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A Guide to Conducting a Systematic Literature Review of Information Systems Research

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Abstract

Levy and Ellis (2006) and Webster and Watson (2002) lament the fact that information systems (IS) scholars tend to be unaware of the need for structure in literature reviews. Even today, the rigorous, standardized methodology for conducting a systematic literature review (SLR) that has developed from the health sciences and other fields is virtually unknown in IS research. In this paper, we adapt Fink's (2005, p. 3) definition of a research literature review as our operative definition of a systematic literature review: "a systematic, explicit, [comprehensive, (p. 17)] and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners." Although there exists an abundance of guides to conducting such reviews in other research fields, none entirely meet the unique needs of IS researchers. In response to this shortage of guides, we present here the features and value of a systematic literature review, and adapt the methodology to the particular context of IS research.

Keywords: Systematic literature reviews, literature reviews, information systems research, research methodology, doctoral studies

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A Guide to Conducting a Systematic Literature Review of Information Systems Research

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Abstract

Levy and Ellis (2006) and Webster and Watson (2002) lament the fact that information systems (IS) scholars tend to be unaware of the need for structure in literature reviews. Even today, the rigorous, standardized methodology for conducting a systematic literature review (SLR) that has developed from the health sciences and other fields is virtually unknown in IS research. In this paper, we adapt Fink's (2005, p. 3) definition of a research literature review as our operative definition of a systematic literature review: "a systematic, explicit, [comprehensive, (p. 17)] and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners." Although there exists an abundance of guides to conducting such reviews in other research fields, none entirely meet the unique needs of IS researchers. In response to this shortage of guides, we present here the features and value of a systematic literature review, and adapt the methodology to the particular context of IS research.

Introduction

Reviews of research literature are conducted for a variety of purposes. They include providing a theoretical background for subsequent research; learning the breadth of research on a topic of interest; or answering practical questions by understanding what existing research has to say on the matter. As such, research reviews are most often published as the introductory section of an article reporting a specific research study, or as one of the early sections of an academic thesis or dissertation. However, there exists another type of literature review that constitutes an original and valuable work of research in and of itself. Rather than providing a base for the researcher's own endeavours, it creates a solid starting point for all other members of the academic community interested in a particular topic.

A rigorous stand-alone literature review, according to Fink's (2005) definition, must be *systematic* in following a methodological approach, *explicit* in explaining the procedures by which it was conducted, *comprehensive* in its scope of including all relevant material, and hence *reproducible* by others who would follow the same approach in reviewing the topic. While Fink's book is itself a guide to producing such reviews, its close focus on the health sciences and rather superficial treatment of qualitative studies significantly limits its applicability for researchers in business and the social sciences. This call for a structured approach is echoed by Rousseau et al. (2008), who argue that literature reviews be "comprehensive accumulation, transparent analysis, and reflective interpretation of all empirical studies pertinent to a specific question" (2008, p. 7). When writing that "reality exists independent of human condition...and that all facts, observations and data are theory laden" (2008, p. 20), they do so to state that

research reviews are no more free from the impact of human subjectivity than other research, and that they require the same amount of conscious objectivity. This perspective is in contrast to the common assumption that literature reviews stand apart from other scientific research, and as such are not bound by the academic rigor required of experiments per se. In fact, the opposite is true. (Levy & Ellis, 2006) and Webster and Watson (2002) lament the fact that information systems (IS) scholars tend to be unaware of the need for structure in reviews.

Systematic Versus Conventional Literature Reviews

A detailed methodological approach is necessary in any kind of literature review. We distinguish three general kinds of literature reviews. The most common we call a "theoretical background": this is the section of a journal article that gives the theoretical foundations and context of the research question, and helps to bring the research question into focus. Within an article, this section is most commonly labeled "literature review," "theoretical background," or something similar. Second is the literature review as a chapter of a graduate thesis. We designate this a "thesis literature review." The third kind is what we call a "stand-alone literature review," a journal-length article whose sole purpose is to review the literature in a field, without any primary data (that is, new or original) collected or analyzed. At most, results from the reviewed studies might be analyzed as the data for the literature review; however, a stand-alone literature review article does not collect or analyze any primary data. When a stand-alone literature review is conducted using a systematic, rigorous standard, it is called a *systematic literature review* (SLR). We discuss these various kinds of literature review here.

Literature Reviews as Theoretical Foundation for Primary Research

The vast majority of literature reviews serve as a section of a primary research article that provides the theoretical foundation for the main study that is the subject of the article. In that capacity, Fink (2005, pp. 2-14) describes multiple purposes for literature reviews. A literature review anchors the rest of a scholarly article. It describes the content and quality of knowledge already available, and readily presents the reader the significance of previous work. Findings are explained to ground subsequent work. Such reviews will ultimately find their place in various roles, including justification for grant and funding applications; to assist practitioners in making informed professional decisions (D. Denyer & Tranfield, 2006; Zorn & Campbell, 2006); identifying significant people, methods or information in the field; and introducing material that is less readily available. As an academic piece, the review cannot simply regurgitate the subject matter, but rather must contribute to the work in its dual approach of synthesizing the available material and offering a scholarly critique of theory. Only in completing both functions can the review join the canon of valuable research as more than an introductory summation.

Literature Reviews for Graduate Student Theses

A special case of the literature review as the introduction to a scholarly work is its use as an anchor for an academic thesis or dissertation. Kwan (2006) asserts that while the outline of the literature review in a student thesis is similar to that in a regular published research article, it structure is not entirely the same. There have been repeated waves of advocates calling for the explicit distinction between student authors and experienced writers as well as more formal

educational programs for doctoral authors (Boote & Beile, 2005; Hüttner, 2008; Maxwell, 2006; Rempel & Davidson, 2008). A variety of guides are available for students pursuing their dissertation (G. B. Davis & Parker, 1997; Rowley & Slack, 2004). Hart (1999) gives a clear explanation of the necessity of the literature review in pursuit of academic degrees. He presents four purposes for the literature review in a thesis: it synthesizes the understanding a student has on their particular subject matter, it stands as a testament to the student's rigorous research dedication, it justifies future research (including the thesis itself), and it welcomes the student into scholarly tradition and etiquette (Bruce, 2001). In a doctoral dissertation, the literature review further increases this demand on the reviewer: authors are expected to present themselves as experts on the subject matter, the review serving as a justification for the novelty of the student's work. Their complete dissertation will summarize, analyze, criticize and build on the literature they are reviewing to facilitate future academic discussion.

Stand-alone Literature Review

The third category of literature review comprises studies that can stand on their own, in themselves a complete research pursuit. There are numerous motivations for this third category of literature review. According to Fink (2005), they can be undertaken to describe available knowledge for professional practice, to identify effective research projects and techniques, to identify experts within a given field, and to identify unpublished sources. Although these motivations are largely shared by the other two categories of literature review, the distinguishing feature of a stand-alone review is its scope and rigour. In its best form, it becomes a much cited-piece of work which researchers would seek out as a first clear outline of the literature when undertaking an investigation. Such free-standing reviews summarize existence evidence, identify gaps in current research and provide a framework for positioning research endeavors. They are valuable in informing policy and supporting practice (Petticrew & Roberts, 2006). Though they are certainly not easy to undertake, the commitment to complete a stand-alone review provides one's academic community a tremendous service: such reviews can, and have in the past been, true "paradigm shifters" (Petticrew & Roberts, 2006).

One notable exception where a doctoral dissertation takes on the characteristics of a stand-alone literature review is when a meta-analysis is conducted. Everything in this article applies to a meta-analysis; the main note being that the meta-analysis is a particular case of stand-alone literature review where the reviewed articles are analyzed primarily quantitatively. While there is always some qualitative analysis as well, there is usually less than in the case of a stand-alone literature review that has no quantitative analysis. In general, the accompanying qualitative analysis ought to be just as thorough as for reviews without quantitative analysis. However, in practice this might not be the case because the set of reviewed articles might be significantly smaller, involving only articles that meet stringent characteristics for the independent and dependent variables. Moreover, pragmatically, reviewers are likely prone to be less demanding on the qualitative analysis of articles "after they've done all that work" on the quantitative meta-analysis.

Systematic Literature Reviews

Stand-alone literature reviews can and are conducted with varying standards of rigor, ranging from little more than an annotated bibliography to scientifically rigorous syntheses of a body of primary research. It is the more rigorous approach to conducting a stand-alone literature review that we refer to as a *systematic literature review* (SLR), which is the subject of this article. We adapt Fink's (2005) definition of a research literature review as our operative definition of a systematic literature review in this article: "a systematic, explicit, [comprehensive, (2007, p. 17)] and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners."

A study of all available literature must be open-minded and transparent in why and how the topic was chosen, how its focus may have changed over the course of development, or in supporting the need for the author's subsequent work (Hart, 1999). It would not suffice to merely compile a simple collection or summary of other articles; there must also be an element of analytical criticism (Hart, 1999). Whereas other two kinds of literature reviews can certainly benefit from many principles that we highlight in this guide, a systematic literature review calls for a level of rigor that is beyond what is normally required even for the typical doctoral dissertation. As an academic piece, the review cannot simply regurgitate the subject matter, but contributes to the work in its dual approach of synthesizing the available material and offering a scholarly critique of theory (Kekäle, Weerd-Nederhof, Cervai, & Borelli, 2009). Only in completing both functions does it meet the requirement of scholarly rigor.

The value of conducting general literature reviews is readily appreciated: a solid literature review is needed to obtain an academic degree, apply for grant funding, or to justify a research article for publication in a journal. It is more difficult to appreciate the value of the longer and more arduous process as the systematic review. Indeed, it would be inappropriate to require or to expect that every literature review must be carried out to the degree of rigor of an SLR. In discussing the purpose of an SLR, Petticrew and Robert (2006, chap. 2) explain that the systematic review is essentially a tool; hence, there is the need to ask whether it is right for a given job. Before ever embarking on the task of conducting an SLR, they recommend first searching for any existing systematic reviews. In particular, they suggest that the review consider the current evolutionary state of the field of research: a systematic review is not very valuable early on, when limited studies might be available, as the few existing studies might not represent the best knowledge that more time might give. They note that the systematic review is no magic bullet, and suggest considering alternatives to systematic review, some of which they describe. Eventually, a reviewer must consider whether the amount of time, energy, and financial cost that the systematic review would require might be justified (see their Table 2.3 in particular for a mean time spent on systematic reviews, based on 27 meta-analyses).

Also highlighting the limits of SLRs, Rousseau et al. (2008) argue that the overuse of some research is as problematic as is its underuse. Evidence in all its forms has political and cultural implications, involving concerns such as the frames of reference and untested assumptions that create invisible biases in research, and the miscast interpretation stemming from the skewed point of the view of the reader who has a particular purpose in mind. They suggest that safeguards against such problems come from establishing professional and scientific

infrastructure, understanding the limits inherent in all studies, and interpreting information as a community project.

Terminology: Systematic as a Qualitative Rather Than a Classifying Adjective

In her guide to SLRs, Kitchenham (2007) uses the term "systematic review," referring to a different type of literature review from what she calls a "traditional" or "conventional" literature review. However, we consider "systematic" in "systematic literature review" to be a qualitative adjective. A qualitative adjective is one that describes the nature of a thing in a way that can be qualified by greater or less; that is, we can speak of a review as being more systematic or less systematic, or very systematic. However, Kitchenham seems to use the term is as a classifying adjective, that is, an adjective that classifies things into a certain category. Thus, she contrasts a systematic review from a traditional or conventional review.

In contrast, Rousseau et al (2008, p. 5): "This chapter's subject, the systematic research synthesis, is not to be confused with a conventional literature review, its *less systematic* [emphasis added], non-representative counterpart. Systematic research syntheses assemble, analyze and interpret a comprehensive body of evidence in a highly reflective fashion according to six evidentiary criteria we describe." Thus, Rousseau et al use the term "less systematic", which is clearly the use of systematic as a qualitative adjective.

The problem with using systematic as a classifying adjective is that this dichotomizes literature reviews into two kinds: systematic and traditional (or conventional). However, we don't see this as a very useful distinction, since it would evoke artificial attempts to set up a cut-off point where a review might be considered systematic or not systematic. Rather, we find it more useful to speak of a review as being more or less systematic. Thus, when we speak of a systematic review, we referred to a review that has the explicit view of being conducted systematically. In contrast to Kitchenham, who seems to imply that conventional reviews hardly merit the designation "systematic", we prefer to consider "systematic" as a spectrum upon which all reviews fall to more or less degree.

The Difference between Stand-alone Reviews and Other Kinds: A Pragmatic Matter

Although we have identified different kinds of literature review, the real difference between the stand-alone review and other kinds (theses and theoretical backgrounds for standard studies) is not in any fundamental difference other than the expected rigor of the review. Although all theses and theoretical backgrounds should purportedly be held to the same standard of rigor, in practice, conducting a study to the degree of rigor that we propose here is not a simple matter. For theoretical background sections, the literature review is a relatively small part of the overall research project, and is not given as much time as the data collection and analysis. In fact, we know of an author of articles in top-level management journals whose routine procedure in developing articles was to develop a hypothesis, collect the data, analyze it, and then at the end seek a theoretical "background" to explain the results he found. (Although this anecdote is an extreme case, it might not be so rare: Boote and Beile (2005, p. 6) observed the same sort of incident among some doctoral students in education.)

Experienced researchers are familiar with a frequent tendency during the research process to quickly finish the theoretical background section, and then "go on to the good stuff," meaning the data collection and analysis. Authors have little motivation to push themselves to higher standards for the theoretical background literature review: we note from our own experience in submitting and revising journal articles that reviewers implicitly accept this relatively lower standard of expectation for a literature review in that they that rarely ask for any explanation of how the relevant articles in the review were identified, screened for quality, or analyzed. Reviewers typically only review the results of the literature review: its breadth in including articles and the resultant analysis (what Levy and Ellis (2006) call "outputs"). They very rarely ask authors to explain their procedure for "inputs" or "processing" of the review. From a pragmatic perspective, we do not criticize this general de-emphasis; rather, we are merely explaining why this practical difference in standards of rigor so drastically differentiates theoretical background literature reviews from the stand-alone reviews that this article describes. Indeed, we encourage writers of theoretical backgrounds and doctoral dissertations to adopt as many principles from this guide as possible, though we realize the practical constraints on their time. However, in the concluding comments of this article, we present some considerations why even in such cases, it is worthwhile expending the extra effort required for a systematic literature review.

An Eight-Step Guide to Conducting a Systematic Literature Review

Although we have described the need and value of systematic literature reviews, the rigorous, standardized methodology that has developed from the health sciences and other fields is virtually unknown in information systems research. Though we found an abundance of sources in other research fields, none entirely meet the unique needs of information systems researchers. In response to this shortage of guides, we have compiled this guide to conducting a systematic literature review, particularly tailored for information systems research.

Our focus here is on stand-alone literature reviews, as opposed to literature reviews that set the theoretical background for a work of primary research, or for a graduate student thesis. While we focus on the needs of information systems researchers, the principles we outline here are readily applicable to a very broad range of domains; this is only natural, considering the broad range of domains from which we draw these principles. Although we have thoroughly studied dozens of articles and books on in the preparation of this guide (the citations are sprinkled throughout the article), the major points in our guide here are drawn primarily from six source guides: Kitchenham's (2007) guide to SLRs in software engineering, Petticrew and Roberts' (2006) book on SLRs in the social sciences, Arlene Fink's (2005) guide on SLRs in health sciences; Rousseau, Manning and Denyer's (2008) article on SLRs in management and organization science; Levy and Ellis' (2006) article on conducting literature reviews in information systems; and Webster and Watson's (2002) article on writing up literature reviews in information systems.

The guideline we present here has eight major steps, each of which is required for a systematic literature review. Indeed, these steps are very valuable for any kind of literature review; however, for a review to be scientifically rigorous, all of the following steps are essential. (Note that, throughout this article, "reviewer" refers to a researcher who is carrying out

a literature review, rather than someone who reviews an article to consider its fitness for publication.)

1. *Purpose of the literature review:* The first step in any review requires the reviewer to clearly identify the purpose and intended goals of the review. This is necessary for the review to be explicit to its readers.
2. *Protocol and training*: For any review that employs more than one reviewer, it is critical that the reviewers be completely clear and in agreement about the detailed procedure to be followed. This requires both a written, detailed protocol document, and training for all reviewers to ensure consistency in the execution of the review.
3. *Searching for the literature*: The reviewer needs to be explicit in describing the details of the literature search, and needs to explain and justify how the comprehensiveness of the search was assured.
4. *Practical screen*: Also known as screening for inclusion, this step requires that the reviewer be explicit about what studies were considered for review, and which ones were eliminated without further examination (a very necessary part of any literature review). For excluded studies, the reviewer must state what the practical reasons were for their non-consideration, and justify how the resulting review can still be comprehensive given the practical exclusion criteria.
5. *Quality appraisal*: Also known as screening for exclusion, the reviewer needs to explicitly spell out the criteria for judging which articles are of insufficient quality to be included in the review synthesis. All included articles need be scored for their quality, depending on the research methodologies employed by the articles.
6. Data extraction: After all the studies that should be included in the review have been identified, the reviewers need to systematically extract the applicable information from each study.
7. *Synthesis of studies*: Also known as analysis, this step involves combining the facts extracted from the studies using appropriate techniques, whether quantitative, qualitative, or both.
8. *Writing the review*: In addition to the standard principles to be followed in writing research articles, the process of a systematic literature review needs to be reported in sufficient detail that the results of the review can be independently reproduced.

A Guide for Information Systems Research

Our guide has a number of unique contributions, compared to other guides to systematic literature reviews. First, this guide is particular to the needs of information systems researchers. Information systems is a combination of social science, business, and computing science, whose research methods are different from those of the health sciences, from which the systematic review methodology has largely been developed. One primary characteristic of information systems research that this guide responds to is the field's balance of quantitative and qualitative methodologies. Some of our reference guides are excellent in treating quantitative research, but only cover qualitative research superficially (Fink, 2005), failing to recognize the fundamental epistemological differences these methodologies. Thus, it is very important to us to treat these approaches in a balanced way with a guide that is equally comfortable with either kind of research; this particularly plays out in the quality appraisal and synthesis sections. By

incorporating Kitchenham's (2007) recommendations from software engineering, this guide incorporates the review of primary studies that use methodologies such as design science, that is not found in social sciences. Moreover, although we could not find any examples of SLRs in information systems, we do reference a number of exemplar IS reviews to illustrate best examples of parts of the review, if not of the whole.

With such a perspective, we bring the methodology of the systematic literature review to the field of information systems and related disciplines. The principles we present here are not new; however, we provide them in one place—a rigorous scientific approach to conducting a literature review, yet in an accessible, step-by-step format. This is similar to the work of Levy and Ellis (2006), who also produced a step-by-step guide for literature reviews in information systems. However, our guide presents much more detail on the input side: we go beyond their treatment to describe a rigorous practical screen, development of a protocol, training of reviewers, and quality appraisal. These elements are critical to have high-quality primary studies as input for the actual analysis of the review. Moreover, our treatment is not only "systematic" in the sense of a step-by-step guide, but also "scientific" in the sense of designed to generate reproducible (that is, scientifically reliable) reviews.

Although this article attempts to be a comprehensive guide to writing a stand-alone literature review, it is impossible for a journal article to be an all-inclusive exhaustive guide. Thus, rather than trying to include every detail of every procedure needed, most of the discussion in this article will focus on items that either have not been adequately discussed in the sources we examined, or exist mainly in bits and pieces so fragmented that it is difficult for review writers to see the big picture. Along the way, there are many aspects of writing a literature review that have been thoroughly and adequately explained by others. In these cases, after explaining each necessary step clearly and discussing its key elements, we refer to important sources that explain and illustrate these steps in more detail in practicable ways. Thus, we hope that this article serves as a gateway to locating various helpful sources.

The final major contribution of this study is that we cite examples of high-quality research (usually in information systems) that illustrates these steps in actual published literature reviews—the sources might not be systematic reviews, but at least certain sections of certain articles provide good examples of certain steps.

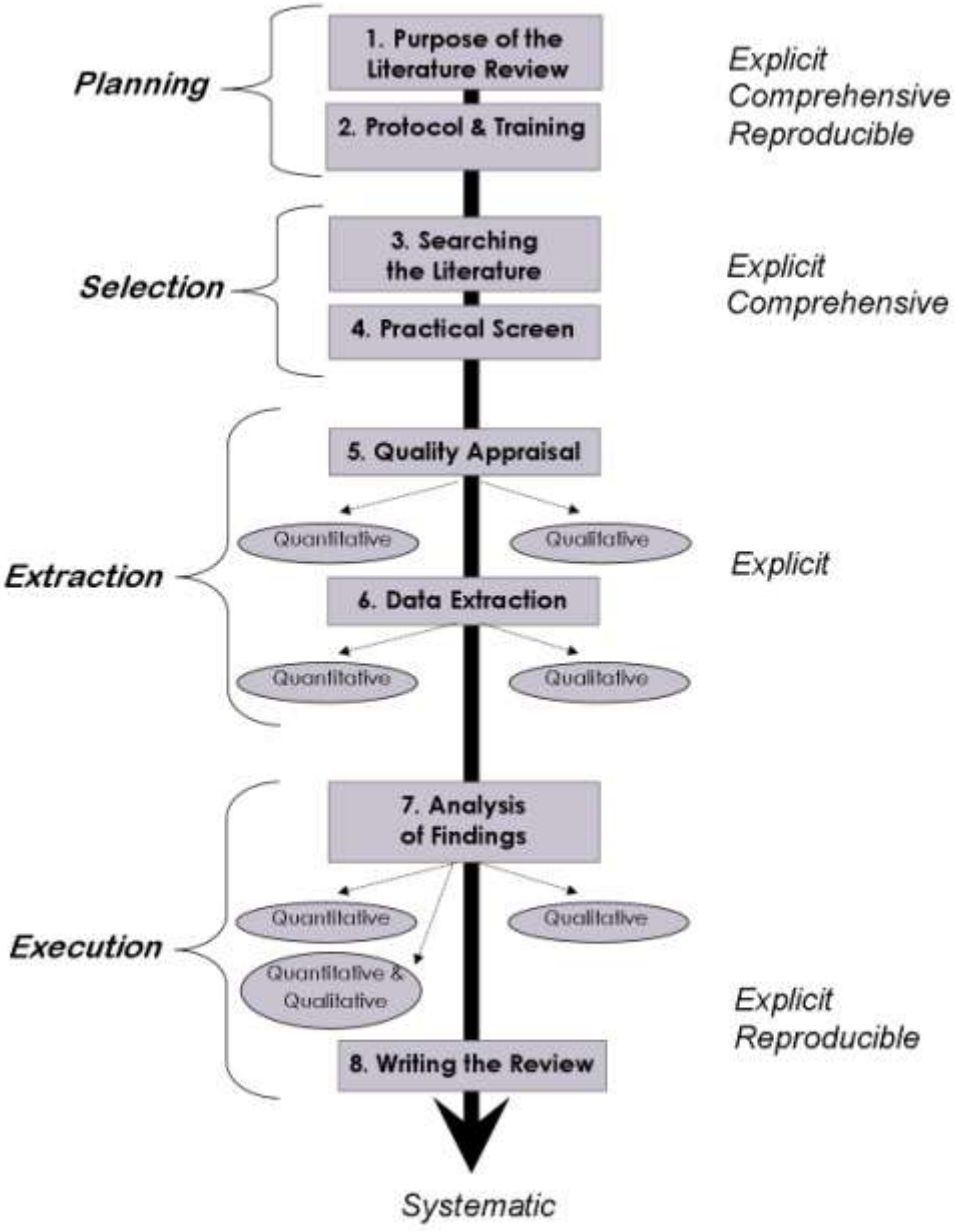

Figure 1: A systematic guide to literature review development

Examples of Model Literature Reviews in Information Systems

In this guide to writing a literature reviews, we will not make a concerted attempt to apply all the items here specifically to the field of information systems. Rather, we will try to

keep the guidelines as general as possible to apply to various fields. However, because our own research background is in information systems and management, we selected SLR guides from social sciences, management, and software engineering, fields that are very pertinent to information systems researchers. Moreover, we draw examples of quality research mostly from information systems publications. With this approach, our guide is general enough to be useful to researchers in many fields, while uniquely helpful to information systems research.

Although we know of no example in information systems research that follows the rigorous methodology of the systematic literature review, we searched a few of the top IS journals for examples of high-quality literature reviews to demonstrate examples of best practice in various aspects of the review process. Specifically, we searched *Information Systems Research*, the *Journal of Management Information Systems*, the *Journal of the Association of Information Systems*, and *MIS Quarterly*. In addition, we searched the *Academy of Management Review*—although it is not an information systems research journal, we believe that the neighboring field of management is sufficiently close for IS researchers to learn from these exemplar reviews. In these journals, we found a total of 24 examples from 1976 to the present (see Table ***). Of these 24, three were meta-analyses, two contained both meta-analytic and narrative components, and the rest employed exclusively qualitative discussion. Articles included detailed construct development of topics such as computer self-efficacy (Marakas, Yi, & Johnson, 1998), negotiation support systems (Lim & Benbasat, 1992), interorganizational systems (Robey, Im, & Wareham, 2008), technology adoption (Venkatesh, F. D. Davis, & Morris, 2007), IT-dependent strategic initiatives (Piccoli & Ives, 2005), and the resource-based view (Wade & Hulland, 2004). They included reviews of existing research on particular phenomena such as employee turnover (Cotton & Tuttle, 1986), shift work (Dunham, 1977), HRM in international joint ventures (Shenkar & Zeira, 1987), and the impact that technological or societal changes have on the future development of organizational structure and strategy (Berthon, Pitt, Ewing, & Carr, 2002; Melville, Kraemer, & Gurbaxani, 2004; Winter & Taylor, 1996).

Notably, there is no uniformity in methodology or structure among these studies, even between articles published in the same journal. 15 of these 24 examples explicitly described how they searched for the literature. These authors generally stated the name of journals and the procedure to retrieve these journals through specific databases. Authors tended to also specify whether they relied heavily on electronic sources and whether articles were always retrieved through computer searches (Alavi & Joachimsthaler, 1992; Alavi & Leidner, 2001; Cotton & Tuttle, 1986; Dubé & Paré, 2003; Griffin, Welsh, & Moorhead, 1981; Joseph, Ng, Koh, & Ang, 2007; Leidner & Kayworth, 2006; Marakas et al., 1998; Petty, McGee, & Cavender, 1984). Piccoli & Ives (2005), only briefly mentioned in the conclusion section that abstracts for 648 articles from IS, strategic management, and the marketing literature were reviewed. Similarly, Jasperson et al. (2001), Shenkar and Zeira (1987) and Wade and Hulland (2004) do not explain how articles were located; each just lists how many articles were found—in Hulland's case, this is done in the appendix. However, such abbreviated reporting makes it impossible to replicate any findings. In fact, only six cited review guides in their references and even those six did not explicitly follow the steps recommended in the cited guides.

In this guide, as we present our eight steps in detail, we will demonstrate from high-quality published research that most of these steps are not new; we will use the existing literature to illustrate the best examples of each step, and hopefully guide reviewers in combining them to produce high-quality reviews themselves.

Citation	Guides[1]	Synthesis type	Purpose	Protocol	Search	Practical Screen	Quality Appraisal	Extraction	Synthesis	Writing
Robey, Im, & Wareham, 2008	• Benbasat, I., & Zmud, R. W. (2003).	Qualitative	◙	◙	◙	◙	◙	◙	◙	
Joseph et al., 2007		Both	◙		◙		◙		◙	◙
Venkatesh, F. D. Davis, & Morris, 2007		Qualitative	◙							◙
Leidner & Kayworth, 2006		Qualitative	◙	◙	◙	◙	◙	◙	◙	◙
Piccoli & Ives, 2005	• Webster, J., and Watson 2002	Qualitative	◙	◙	◙			◙	◙	◙
Hulland & Hulland, 2004		Qualitative	◙		◙					◙
Melville, Kraemer, & Gurbaxani, 2004		Qualitative	◙						◙	◙
Dubé & Paré, 2003		Qualitative	◙	◙	◙	◙	◙	◙	◙	◙
Berthon, Pitt, Ewing, & Carr, 2002	• Chase, J. E. 1970. • Cooper, H. H., R. Rosenthal. 1988.	Qualitative	◙							◙
Jasperson et al., 2002		Qualitative	◙		◙				◙	◙
Alavi & Leidner, 2001		Qualitative	◙							◙
Te'eni, 2001		Qualitative	◙			◙			◙	◙
Marakas, Yi, & Johnson, 1998		Qualitative	◙		◙	◙		◙	◙	◙
Winter & Taylor, 1996		Qualitative	◙							◙
Alavi & Carlson, 1992	• Galliers, R.D., and Land, F.F. (1987)	Qualitative	◙	◙	◙	◙		◙	◙	

[1] The literature review cites at least one guiding piece in its reference section

Alavi & Joachimsthaler, 1992		Meta-Analysis	◙		◙	◙		◙	◙	◙
Lim & Benbasat, 1992		Qualitative	◙							
Morrison & Bies, 1991		Qualitative	◙						◙	◙
Shenkar & Zeira, 1987		Qualitative	◙		◙	◙			◙	◙
Cotton & Tuttle, 1986	• Rosenthal, R. (1978) • Glass, G. V. (1977) • Glass, G. V., McGraw, B. & Smith M. L. (1981) • Hunter, J. E., Schmidt, F. L., & Jackson, G. B. (1982)	Meta-Analysis	◙		◙	◙		◙	◙	◙
Petty, McGee, & Cavender, 1984	•	Meta-Analysis	◙		◙	◙	◙		◙	◙
Griffin, Welsh, & Moorhead, 1981	•	Qualitative	◙		◙	◙			◙	
Dunham, 1977	•		◙							◙
Pierce & Dunham, 1976	•		◙		◙				◙	

1. **Purpose of the Literature Review**

Though there are various ways to classify literature reviews, we can generally categorize them as one of three kinds: an introductory section of most scholarly work used to theoretically support the rest of the article; a major introductory section of an academic thesis or dissertation (which is a special case of the first category); or a free-standing article whose specific and entire focus is to review research on a subject. Although we are specifically looking at only the third category, it is important to discuss the other kinds of literature reviews so that the reader may have an equal understanding of what their purpose is and is not.

The first step of conducting a literature review is to clearly define the purpose of the review. Strictly speaking, this first step is not so much a part of the active procedure as it is a consideration of the technique to be embarked upon. As in all empirical work, the first step of a project should be to consider whether the methodology to be employed is the most appropriate one. In this case, determining the purpose of the literature review should answer the question, "Why do a literature review?" In the introduction, we addressed this question in arguing for the need of systematic literature reviews, which we do not repeat here. Rather, we go directly to discussing the various guides and examples that help in clarifying and defining the purpose of a systematic literature review.

Guides and Examples of Defining the Purpose of the Literature Review

Whereas literature review guides always begin with an explanation of and justification for conducting literature reviews, what is most pertinent to us here is being clear about the purpose of conducting a systematic literature review. As such, we recommend four sources for whom this is the explicit goal. Fink (2005) does not use the term "systematic," but what she calls a "research literature review" is a systematic literature review in every sense. What she presents is the best practice for conducting literature reviews as developed in the health sciences. Three sources are probably more relevant to information systems researchers, directed specifically to its reference fields: Petticrew and Roberts (2006) focus on SLRs in the social sciences in general. In addition to presenting clear arguments and justifications for SLRs, they devote an entire chapter to dispelling myths about SLRs and clarifying what they are not. In their discussion of literature reviews they bring up the notion of bias in traditional reviews, information overload, opportunities lost (and sometimes regained) in such reviews, and the variations in quality of systematic reviews. Of particular help are their appendixes which offer examples of questions to be asked before the review process (appendix 1), a flow diagram from a systematic review, and examples of the variations in quality of systematic reviews. Kitchenham (2007) focuses on SLRs in software engineering, a field which has a lot of overlap with information systems. In particular, she recommends SLRs as a means to assuring reliable software development and application. She describes systematic mapping studies and tertiary reviews as special cases of systematic literature review. Rousseau et al (2008) focus on SLRs in management and organization science; strictly speaking, their study focuses primarily on "research synthesis," that is, the synthesis or analysis of results of studies obtained in an SLR, more than on the rest of the process. Whereas Fink and Kitchenham focus on reviewing quantitative primary studies,

Pettigrews and Roberts and Rousseau et al focus on reviews of both quantitative and qualitative primary studies.

Every one of the 24 examples that we reviewed for this guide specifically addressed this step—indeed, it was the only one of our eight steps that every article followed. Reasons for conducting a literature review generally fell into six categories:

1. To analyze the progress of a specific stream of research (Alavi & Leidner, 2001; Alavi & Joachimsthaler, 1992; Piccoli & Ives, 2005; Venkatesh et al., 2007);
2. To make recommendations for future research (Venkatesh et al., 2007);
3. To review the application of one theoretical model in the IS literature (Alavi & Carlson, 1992; Wade & Hulland, 2004);
4. To review the application of one methodological approach in the IS literature (Dubé & Paré, 2003);
5. To develop a model or framework (Joseph et al., 2007; Melville et al., 2004; Morrison & Bies, 1991; Te'eni, 2001); and
6. To answer a specific research question (Cotton & Tuttle, 1986; Dunham, 1977; Griffin et al., 1981; Jasperson et al., 2002; Petty et al., 1984; Shenkar & Zeira, 1987).

2. Protocol and Training

Once the reviewer is clear about the purpose and scope of a systematic literature review, the review cannot yet actually begin: there is another critical step required in the planning stage before the work of the review can start in earnest. One of Kitchenham's (2007) most important recommendations is that a protocol be developed in advance of actually conducting the study, and that the protocol be externally validated to verify its rigour. A protocol is "a plan that describes the conduct of a proposed systematic literature review (Barbara Kitchenham & Charters, 2007, p. vi). In addition to drafting the protocol, which details the specific steps and procedures to be followed in the particular review being conducted, it is also crucial that this draft be followed by thoroughly training all members of the review team according to this drafted protocol to ensure that everyone is on the same page concerning what is being carried out (Fink, 2005).

The initial protocol can only be called a draft until after training is completed, for the training process will doubtlessly reveal problems that will need to be corrected before the final protocol is completed. Moreover, as with any research endeavor, the process of doing the literature review will certainly bring up limitations and issues with this initial protocol; nonetheless, it is very important that the researchers agree upon and write down their strategy before commencing. The course of action may certainly change (Fink, 2005), but only by documenting the protocol changes can the researchers guarantee the comprehensive, explicit, and reproducible nature of their work and subsequently its high level of quality. The details of carrying out this step involve drafting the research question, creating a research protocol, and training the reviewers.

Drafting the Research Question

As with any research study, the reviewer must have a clear, concise research question. Rousseau et al. (Rousseau et al., 2008) note that the question formulation will require reflection, debate and reformulation. It should basically be a summation of the research completed to understand the purpose of the review in the preceding section. Ultimately it should result in a one to two sentence statement that defines the audience (e.g. scholars, practitioners, policy makers etc.), purpose and end use of the review. The development of an appropriate research question is beyond the scope of this guide, as it is a well-covered topic, particularly in doctoral student training. However, we do note that in the context of conducting an SLR, not all research questions are appropriately answered by this methodology. In particular, since literature reviews are secondary studies that depend on primary research having previously been conducted, an SLR is not applicable when no investigation of the research question has previously occurred. In this vein, the previous discussions in the introduction concerning the need for the SLR methodology, as well as the first step on defining the purpose of the particular literature review, are relevant for drafting the question.

Drafting the Protocol

Once a question has been formulated, the research protocol serves as the road map towards its answer. However, only three of the literature review guides that we identified addressed the issue of defining a research protocol in any way. Some did speak about the information that should be included in a protocol, but did not describe the need for an explicit protocol. Furthermore, only five of the 24 examples we studied mention any form of agreed-upon protocol. It is possible that the others followed protocols, but did not report them in their published studies. However, even if this is the case, we consider the protocol such an important quality assurance step of an SLR that we are surprised that it is referred to so little.

We consider that creating a prior protocol is an absolutely crucial step in the process of conducting and reporting a high-quality literature review. It defines whether the review will be narrow or broad (Petticrew & Roberts, 2006). It defines the locations to be searched for literature, and the various screens each article will need to pass through in being considered for inclusion. Without it, there can be no consensus on work, not just between various researchers but in fact within the work of one research over time. Turner et al (2008) offer an interesting insight into their personal struggles to collect information for their literature review, and their lessons learned through mistakes serves as a good lesson for future reviewers; the need of a prior protocol emerges as one of their top recommendations.

Just as the construction of a house can only begin after an architect has drawn up explicit blueprints and coordinated with the contractor, the protocol blueprint will guide the rest of the review process. Of course, as more subject matter is discovered, the focus of a literature review may change. However, to create strong reliability and consistency throughout the process, it is critical that the actual search procedure be carefully documented so that the reviewer can report in explicit detail how the search was conducted. Moreover, the search needs to be conducted systematically in order to assure that the results obtained are comprehensive, spanning all existing material within the scope of the practical screen (Helmericks, Nelsen, & Unnithan,

1991). The majority of the review checklist should be specific enough on practical screening criteria to remain intact, whereas the commentary section may leave enough breathing room for subjective interpretations. That said, the major keywords should have been established by now and will dictate what material is retrieved (Bacharach, 1989; Thornley & Gibb, 2009).

In practice, the protocol consists of an outline that is organized according to the steps followed for the review. If a protocol were to be written using this guide, it would be organized according to the eight steps of this guide. The details of the protocol would consist of the specific steps that would actually be followed, according to the specific research question being investigated at the end of this section, we give some examples of published protocols for SLRs.

Training the Reviewers

The third step in developing the review protocol is to train the reviewers. Among our major sources, only Fink (2005) truly discusses this issue. Most research literature reviews, because of their broad scope, cannot be conducted by a single researcher. Both in the case of rapidly-expanding fields and of fields that have been in existence for long periods of time, it is impractical to comb through the entire literature single-handedly. Even if it were possible, the long period of time it would take would most certainly lead to changes, and hence, inconsistencies, in the reviewers' interpretation. Finally, collaboration on academic work has often been advocated as leading to more concentrated and prominent work (Figg et al., 2006). For all these reasons, it is essential that all reviewers involved in conduction a literature review be thoroughly trained in both note-taking and reviewing techniques. This is critical for the review to be executed at a consistent level of quality. (Note that although in this article we refer to the person conducting the study as "the reviewer," in practice there will almost always be multiple "reviewers" actually doing the work of the literature review.)

***Note-taking techniques*:** Ridley (2008) offers a detailed explanation of the different reading and note taking techniques currently in use (e.g. SQ3R: Survey, Question, Read, Recall, Review, p. 45) to allow the reviewer to attack large amounts of work, draw connections, and remember content for future inclusion. She notes the necessity of formal note taking strategies that assist in avoiding accidental plagiarism. Reviewers should agree on one method of note-taking. Annotating the printed paper copy is a method once popular that has predominantly been replaced by other methods such as pattern notes, which use visual representations that cluster comments around a main idea; or linear notes, which "use headings and subheadings to distinguish between the main ideas and the subsidiary information" (2008, p. 51). Consensus among reviewers, reading speed, and amount of assigned work will also have an impact on uniformity. Reviewers could, for example, be trained in phenomenological reading techniques that would allow them to share core skills in their ability to integrate theory and method (Hart, 1999). Even the decision whether to take handwritten or computer notes can have significant impact on the amount of information being recorded and the agreement between reviewers (Ridley, 2008) and thus should be discussed.

Reviewing techniques: Because of the vast number of decisions that need to be made, the creation of a training manual or rubric has been applied in the field (R. Green & Bowser, 2006) and continues to be highly recommended (Fink, 2005; Hart, 1999; Ridley, 2008). Beyond basic

rules on how to read and take notes, reviewers would refer to the maual when deciding on what content might warrant note-taking. The guideline would dictate whether reviewers could only make objective decisions (such as, "Is the article in English: yes or no") or whether there is room for personal discretion. Reviewers can summarize entire articles or extract specific, direct sections (Ridley, 2008). The reviewer training session and manual should include a carefully crafted checklist to record the practical screening qualifications of each and every article, and should also set standards for note-taking (Fink, 2005, pp. 166-172).

With trained reviewers, it is meaningful to test a review for reliability. Fink (2005, pp. 176-177) provides guidelines on measuring the validity of reviewers' output. Individuals can re-evaluate a sample of their assigned articles with a time lapse in between reviews in order to establish intra-reviewer (test-retest) reliability. At least some articles should be reviewed by more than one collaborator in order to establish inter-reviewer reliability. Fink also advocates the use of a "gold standard," such as the project leader, to resolve disagreements. While it is always better to have more reviewers, as long as they are properly trained, the number is subject to the budgetary restrictions of a project

As we've already mentioned, the process of training the users will doubtlessly uncover some problems, inconsistencies, and impracticalities of the original protocol, and even of the research questions. Thus, both the development of the protocol and the training of the reviewers are iterative processes: revisions of the protocol require updates in training, which could uncover problems in the protocol that need to be adjusted, which require further refinement of the protocol. The actual work of conducting the literature review is ready to begin only when the final, stable version of the protocol is created and when the reviewers have been trained according to this final version.

Guides and Examples of Protocols and Reviewer Training

As we mentioned, review protocols and reviewer training, although crucial for assuring the quality of a review, are not widely mentioned or practiced. However, there are a couple key sources that provide excellent guidance on this step. Kitchenham (2007) strongly advocates the need for review protocols, and she provides examples of such protocols in some of her own research. In Brereton et al (2007), she and her colleagues give examples from the field that illustrate the value of using a protocol in conducting a review. Regarding training reviewers, Fink (2005) is the only author who went into detail about the procedure and steps to follow, including how to test for inter-rater reliability. However, Ridley (2008) provides practical tips for reviewers' reading of the articles and taking of notes during their review. In addition, Brereton et al (2007) provide field tips on reviewer training related to developing the protocol.

Of the 24 studies we reviewed, 5 explicitly referred to the fact that conducted their study using a protocol that they explicitly defined before the study actually began. Alavi and Carlson (1992) specifically stated the keywords used to retrieve the literature as well as the classification system used to code all journal articles included in their review. Robey et al. (2008) spelled out the procedure through which two authors read and coded the 104 articles they reviewed. Piccoli and Ives (2005) presented a shorter protocol than the other reviews but nonetheless confirmed that 117 relevant articles were reviewed; however, they did not go into much detail beyond this

description. Leidner and Kayworth (1992) described how they found and coded 82 articles. Finally, Dubé and Paré (2003) were most explicit in their protocol description and both describe their procedure and offer an example in their Appendix section.

3. Searching for the Literature

With the *planning stage* of the literature review concluded by the protocol and training, the third step of searching for the literature begins the *selection stage.* Selection involves both searching for and the studies that will be including in the study, and eliminating several studies found that clearly do not meet the requirements. The selection phase is analogous to seine fishing, where a seine (dragnet) is used to capture a large number of fish, such as a school of tuna (searching the literature), but the undesired species, such as dolphins, must be removed from the net (practical screen). In this section, we treat searching the literature, the seine. This should be a fairly straight-forward step that strictly follows the pre-defined protocol. In this article, we focus mostly on locations for source material.

The traditional sources of information are books (including reference books and in some instances textbooks), journal articles, and already published literature reviews. Traditionally, these were accessed mainly by lengthy visits to libraries, but today these sources are widely available on the Internet, with the exception of books, which still not as accessible electronically as articles (Fink, 2005). (However, massive cataloguing operations such as Google Books are changing that.) In addition, "grey literature"(Anonymous, 1998; Petticrew & Roberts, 2006) has become increasingly accessible, mainly through Internet posting: these include non-peer-reviewed sources such as reports, theses and dissertations, conference literature, popular media, monographs or work-in-progress papers, specialist literature, and primary data sources (Ridley, 2008, p. 33).

But where to start? Ridley recommends that the reviewer begin by getting to know their library and librarian. Although this might seem traditionalist, Petticrew and Roberts (2006) argue that the mass volume of information available in today's information society necessitates that a high-quality SLR always involve the consulting of a qualified information scientist such as a librarian. They do note, though, that with today's technological capabilities, systematic reviews can be done without experienced library support as long as a rigorous plan (i.e. the protocol) is followed.

From the librarian, the reviewer may move on to electronic resources, which are now the predominant source of literature collection. Online Public Access Catalogues (OPACs), such as COPAC in the UK, "provide the bibliographical details and locations of all the publications held within a particular library" (Ridley, 2008, p. 34), while publisher and bookseller catalogues offer lists and content information of most of their publications. Today, open access databases (such as Google Scholar and the Directory of Open Access Journals) and specific subject databases (such as ProQuest, Scopus, EBSCO, IEEE Xplore and the ACM Digital Library) offer electronic access to most published literature (Norris, Oppenheim, & Rowland, 2008). It is crucial to understand the correct use of Boolean operators to take particular advantage of these databases (Fink, 2005). Though certainly not yet prominently employed, the academic world should also see an increase in the use of computer assisted data-mining for literature reviews in the coming

years, with potential hazards and glitches (Bragge, Relander, Sunikka, & Mannonen, 2007; Lee, Kang, Mitra, Giles, & On, 2007; Jacsó, 2007). With the Internet's increased dominance, the reviewer should heed Fink's (2005) caution about the need to carefully discern the quality of any information obtained from websites, which, while "published" on the web, have often not passed any sort of quality standards checks.

After completing one's library and online review, it is important to supplement the search further to assure that all sources have been found and exhausted. Studying the reference section of landmark or particularly relevant pieces permits a "backward search" of other pertinent articles (Levy & Ellis, 2006). Certain resources, such as Google Scholar and the ISI Citation Index, will also allow a "forward search" to find all articles that have since cited articles the reviewer may find particularly relevant (Levy & Ellis, 2006). Finally, Petticrew and Roberts (2006) and Fink (2005) mention the importance of contacting experts in the field (after assembling the list of articles) to receive an assessment of the completeness of the search. This step in supplementing electronic searches is particularly crucial when a subject matter is not yet strictly defined, when information may come from various fields, or if the reviewer suspects that much relevant work might not yet be publicly available. Some guides have stressed that researching merely the Internet is insufficient; such searches need to be supplemented by manually thumbing through paper journals. However, we believe that this advice is no longer necessary in today's level of Internet development; we believe that contacting experts (such as referenced authors) to inquire about completeness of a search is sufficient—but necessary—to verify the comprehensiveness of the literature search, especially for identifying materials not readily available through Internet sources.

The big question, then, is, "When is the literature search finally done?" Levy and Ellis (2006) point out that the protocol not only guides the review process but also establishes when the review is completed. For example, without a protocol clearly stating the date range of articles to be included, a reviewer would continuously need to continually review the literature for new additions, or at least remain ambiguous about inclusion periods. Levy and Ellis (2006) suggest that the basic stopping rule is when repeated searches by whatever means result in the same references, with no new results. However, notwithstanding the point at which the reviewer has to go on to the next step, new research is carried out all the time. One reason why it is crucial to record the search string and procedures is so that they can be periodically repeated on the same databases and sources, to see if new materials have shown up since the initial search. This is a common occurrence, as frustrating as it might be; however, despite Levy and Ellis' comments to the contrary, we believe that a comprehensive literature review should include all available evidence as at the time that the article is at least submitted for publication.

Finding the subject matter may be one of the longest and most strenuous parts of the literature review and may often include searching through hundreds of articles; however, a rigorous literature review is impossible without a thorough and careful study of the entire subject matter.

After finding all applicable subject matter, another practical consideration is the management of references. This includes everything from managing information and keeping records to deciding on a reference citation mechanism (Hart, 1999). Fink recommends using

electronic tools such as reference managing software to create a "virtual filing cabinet" (2005, p. 40), while Ridley recommends keeping ongoing records, not only on the reference information of each article but the date of retrieval, keywords that led to retrieval and notes on any other pertinent information. In terms of bibliographical software packages, she gives a brief tutorial of EndNote (http://www.endnote.com) as a reference library which will allow the user to save searches, import references, manually type in data and access all information from any computer. An open source and free equivalent with similar functionality is Zotero (http://www.zotero.org). Levy and Ellis (2006) give guidelines on organizing both electronic- and paper-based reference management systems. Regardless the system used, the important point is to have a systematic means for recording and storing references and abstracts, annotating them, and even storing and organizing electronic versions of articles.

Guides and Examples of Searching the Literature

While all the guides we reviewed mention something about searching the literature, the most detailed guides that we have found are book chapters devoted to this topic. Petticrew and Roberts (2006) answer several practical questions including rules for stopping research, how many databases should be consulted, and when to search "by hand." They also offer an example of their recommendations in action and discuss a comprehensive literature search on experiments in crime reduction. Fink (2005) and Ridley (2008) delineate various types of database sources, and give guides on search rules, including brief tutorial on Boolean search strategies. In addition to these books, Levy and Ellis (2006) give guides specific to information systems research, including identifying citation databases pertinent to information systems researchers. For reference management, some sources with practical guidance are Ridley (2008) and Levy and Ellis (2006).

Among the examples that we have studied, a few excel in demonstrating how to conduct and report the literature search section of a review. Alavi and Carlson (1992), Leidner and Kayworth (1992), and Petty et al (1984) were quite explicit in detailing which journals they searched, and justifying why they chose these ones. They were also fairly clear concerning their keywords and the bounds of their searches.

4. Practical Screen

After searching through the literature, the reviewer will doubtlessly retrieve large numbers of studies. Unfortunately, the vast majority of these will be inapplicable to the research question of the review. Thus, the next step in conducting an SLR is the practical screen (Fink, 2005), that is, deciding which studies should even be considered for the review. The practical screen carried out at this early stage is to weed out articles, not based on their quality (that is quality appraisal, the next), but rather based on two categories of practical criteria: according to whether the study's content is applicable to the research question; and according to explicitly defined, albeit perhaps arbitrary, criteria chosen in order to restrict the total number of articles considered so that the literature review may be practically manageable. At this stage, the reviewer normally reads no more than the abstract of the articles to decide whether, for the purposes of the review, they are worth reading further or not.

The practical screen could be analogous to the role that police officers play in our society. The protocol is the laws they are bound to enforce; the studies retrieved from the search are the suspicious activities that they encounter; the practical screen is their arresting of suspects based on probable cause. The job of the practical screen is to screen articles for inclusion. If the reviewer thinks that an article matches the superficial qualities of the practical screen, it should be included. At this stage, reviewers should err on the side of inclusiveness; if in doubt, the articles should definitely be included: "arrest first, ask questions later." As in law enforcement, it is not the police that ultimately judges and prosecutes offenders; their job is rather to arrest those whom they reasonably suspect of having committed a crime.

Criteria for the Practical Screen

There may be hundreds or even thousands of articles on a topic of interest, and it is not practical to read and analyze all of them in depth. The importance of this step is that the reviewer must explicitly decide and explain on what criteria article judgement will be based. To that extent the reviewer must make several critical decisions about what kind of work should be included or excluded (Sterne, Egger, & Smith, 2001). For example, depending on the field and topic, a reviewer may choose to include only experimental studies, or may extend the scope to include other less stringent work. Uniform data collection for the literature review will only be possible by strictly establishing the reviewer's specific inclusion comfort level in what type of works will be judged as useful and applicable.

Beyond establishing which work to include, the reviewers should at this point also consider *how* they will find such work (the distinct question of *where* to find the work was covered in "Searching for the Literature") (Barbour, 2001). The critical point about the practical screen is not on the suitability of the criteria for including articles for consideration—though the criteria should be reasonably broad if the study is to be comprehensive—but rather on being explicit about these criteria, so that the resulting literature review is reproducible. Fink (2005, pp. 55-56) lists several criteria upon which studies can be reasonably excluded from consideration for practical purposes of limiting the scope of the study:

- Content (topics or variables): The review must always be practically limited to studies that have bearing on its specific research question. (Dawson & Ferdig, 2006)
- Publication language: Reviewers can only review studies written in languages they can read, or for which they have access to scholarly databases.
- Journals: the scope of the review might limit itself to a select set of high quality journals, or include only journals in a particularly field of study (Singh, Haddad, & Chow, 2007).
- Authors: The study might be restricted to works by certain prominent or key authors (potentially including the reviewer). Hyland's (2003) extensive study on self-citation in academic publication points to the prevalence of self-reference in the social sciences to establish authority.
- Setting: Perhaps only studies conducted in certain settings, such as healthcare institutions, or the financial services industry, might be considered.

- Participants or subjects: Studies may be restricted to those that study subjects of a certain gender, work situation (for example, full-time professionals as opposed to students), age, or other pertinent criteria.
- Program or intervention: There might be a distinction made between the nature of the intervention in the studies, such as if data is self-reported versus researcher-measured, or if subjects are self-selected into various groups within the study.
- Research design or sampling methodology: Studies might be excluded based on not using a particular research design. Note that there are significant differences between these judgments between health sciences (Fink, 2005) and management (Rousseau et al., 2008) and computing sciences (Barbara Kitchenham & Charters, 2007), as we discuss later in the quality appraisal section.
- Date of publication or of data collection, or duration of data collection: Studies will often be restricted to certain date ranges.
- Source of financial support: Studies might be restricted to those receiving non-private funds, if perhaps there is a concern that this might be a source of bias in the results, as is sometimes the case in healthcare research (Fink, 2005).

Petticrew and Roberts (2006) and Kitchenham (2007) also offer lists for consideration of the practical. They subdivide considerations according to population, intervention, comparison, outcomes, and context (Kitchenham adds experimental design). Petticrew and Roberts (2006) even address the question of which articles to obtain in hard copy (though we have noted that this consideration may become less fruitful as the Internet continues to revolutionize data retrieval).

The practical screen is a very subjective part of the literature review. There are no absolute rights and wrongs here; however, there are considerations of what is reasonable and justifiable. On one hand, the screen must be broad enough to include a sufficient number of studies that can satisfactorily answer the research question. On the other hand, the review must be practically manageable, considering the reviewers' constraints of time, money, and personnel. To a very large extent, it is the decisions made here that make the difference between a comprehensive and trustworthy literature review, and an unsatisfactory one.

Practical Tips for the Practical Screen

Now that we understand what the practical screen is, how does it actually play out in the execution of a study? Kitchenham (2007) gives much guidance to this question. The key terms in the literature review should leave the reviewers with a large number of articles that meet the search criteria. When using referencing software, we recommend creating individual folders for every literature source (each database, expert recommendations, etc.). Once all articles are collected in the software, distribute the databases randomly among reviewers. Each reviewer will be assigned to through the articles and decide whether each study does or does not meet inclusion criteria based on the set established during the protocol. Be aware that the practical screen does not judge quality or assess information found in the study. Criteria should be simple enough to be determined merely by reviewing the title and, when necessary, the abstract. From past experience, the practical screen determines inclusion based on criteria such as article language (e.g. should non-English articles be filtered out or kept for later translation) (Petticrew

& Roberts, 2006), type of publication (such as whether to include peer-reviewed conference proceedings or only journal (Levy & Ellis, 2006) or date range (e.g., including only articles published after 2002) (Barbara Kitchenham & Charters, 2007).

Articles not meeting these specific inclusion criteria should be set aside and saved, but not deleted. We recommend creating "delete" subfolders in each of the source folders where articles not meeting inclusion criteria should be placed. Better yet, rather than a single "delete" subfolder for each database folder, there could be several "delete subfolders" each specifying the reason for exclusion of the study. While this might seem onerous, it becomes invaluable when each reviewer's work is reassessed. Such reassessment will normally uncover inconsistencies in reviewers' judgments; the original articles should be readily assessable for reinclusion. This procedure permits the reviewers to explicitly document the execution of a uniform methodology. This procedure serves two purposes: First, it maintains the explicitness and replicability of the study, permitting reviewers to backtrack and re-evaluate their inclusion criteria and protocol at any point during the review. Second, it permits the reviewers to assess and establish inter-rater reliability (Fink, 2005).

Because of the subjectivity of the practical screen, we recommend testing for inter-rater reliability during a pilot test of the practical screen. After all literature source folders have been sorted, a portion of folders should be randomly assigned to another reviewer. In the best case scenario, results will establish a case for uniformity and show that both reviewers included or excluded the same articles. In the worst case scenario, both reviewers will have chosen to include very different articles and combing through the "delete" subfolder will clarify whether the discrepancy lies in individual judgment or ambiguity in the search protocol. Most likely, every review, including our own experience, will fall somewhere in the middle and will both give the authors confidence in their work up to that point, and give them an early opportunity to meet and discuss potential changes to the protocol.

Guides and Examples of the Practical Screen

Surprisingly, although the practical screen is an implicit step in every literature review, there are few guides that address it explicitly. The principle ones we have identified are Fink (2005) and Kitchenham (2007), though Petticrew and Roberts (2006) do give some helpful tips on this subject as well. Fink (2005) is particularly helpful for her comments on testing for inter-rater reliability.

Quite a few of the example studies we examined did explicitly report their practical . These studies were notably thorough in their description of decision criteria (Alavi & Carlson, 1992; Alavi & Joachimsthaler, 1992; Robey et al., 2008; Te'eni, 2001) or in their summation of what research methodology would be included (Cotton & Tuttle, 1986; Dubé & Paré, 2003; Griffin et al., 1981; Leidner & Kayworth, 2006; Petty et al., 1984; Pierce & Dunham, 1976). A good example of concise reporting is Marakas et al. (1998), who spell out that all articles needed to "(1) include a material focus on the CSE construct, (2) [develop] a measure or evaluated the construct as an independent variable (IV) or dependent variable (DV) of interest, and (3) [be] published in a recognized academic journal or compendium" (1998, p. 130).

5. Quality Appraisal

The practical screen of articles establishes criteria to decide upon before searching for articles in order to determine what kinds of articles would not even be considered for the literature review, either excluding articles based on non-applicable content, or restricting the articles considered to a manageable number. Once all potentially eligible articles have been collected, the next step is to examine the articles more closely to assess their quality. This quality appraisal serves two purposes: First, in reviews where there is a minimum quality standard for acceptance, the quality appraisal becomes a second "methodological" screen (Fink, 2005) to eliminate articles that do not meet the standard established by the reviewer. Second, in all SLRs, there needs to be some scoring of the methodological quality of the articles included in the study, since the quality of the final review depends very much on the quality of the primary studies.

Not all primary studies are of equal quality; thus, it is important to rate studies according to the extent to which they meet various standards of quality. Although the purpose of article scoring (rating articles according to quality criteria) is distinct from that of methodological screening (eliminating articles for deficiencies in quality), the two steps are obviously related. Thus, practically speaking, it makes sense to rate articles for quality using the same criteria for which they would be considered for methodological exclusion. However, the key difference is that once an article is found to not meet the minimal standards set for methodological screening, there is no need to score it any further. On a cautionary note, the over-zealous exclusion of presumably low-quality articles has led to serious problems in past literature reviews (Rodgers & Hunter, 1994). Not all literature reviews will eliminate studies based on their quality. Regardless, there is the need to appraise or score the quality of articles that remain in the study, as a basis for confidence in the final results. Though we certainly do not advocate keeping dubious articles when in doubt, the reviewer should be aware of the implications of all their choices, and explicitly report them.

Generally, the process of collecting primary articles will have already given the reviewer a basic idea of the quality and type of articles available. Stricter criteria must now be established for which articles should continue to be considered for the literature review. As each systematic review varies, we cannot give a definitive guide to conducting the quality appraisal. In fact, we cannot even define what it means for an article to be of sufficient quality to be included in a specific review. What we will do here is outline the various criteria for quality review recommended by various authors. These can all then be taken into consideration in developing the quality appraisal standards in the literature review protocol.

To carry out quality appraisal, a standard form should be developed and distributed to reviewers to employ in assessing each article. Fink (2005) offers an example of such a grid in which each quality criterion is phrased as a yes or no answer. If an article does not meet one of the pre-determined quality criteria, then the assessment is finished and the article is excluded without further assessment. If such a grid is used, there should also be space for the reviewer to write additional notes and comments both for articles included and excluded. As with the practical screen, we recommend that rather than deleting any article, those that do not meet the standards of the methodological screen should be placed in a separate subfolder, categorized by what specific quality standard they failed to meet. This would permit verification of reviewers'

screening judgments, and permit a test of inter-rater reliability at this stage as well. After clarifying the protocol, the reviewers should pilot-test the appraisal process to work out any problems. This pilot test involves applying the previously-mentioned checklist to several articles to establish whether the format suits itself to the articles in question, or if it needs revision.

Appraisal methods are very different depending on if the primary studies are quantitative that is, they obtain knowledge by measuring) or qualitative (that is, use text with discussion and argumentation to attain understanding of the phenomenon); hence, we treat these categories of studies separately.

Quality Appraisal: Quantitative

In assessing quantitative primary studies for a literature review, the dominant approach has been to develop what is known as a "hierarchy of evidence," which ranks certain kinds of studies as intrinsically providing more valid and reliable results than others. This perspective exalts randomized control trials as the king of all study designs, and ranks others lower in quality, with qualitative studies such as case studies usually placed at the bottom of the hierarchy. The SLR guides that we studied all referred to the hierarchy of evidence in some manner or the other. For example, Petticrew and Roberts (2006) rank studies as follows: of primary quality are studies of effectiveness with randomized controls, followed by quasi-experimental designs, uncontrolled studies, studies assessing etiological relationships such as case control and prospective cohort studies, and finally cohort studies.

To quantitatively assess articles, Fink (2005) stresses in-depth judgment of an article's data collection methodology, interventions, analysis, results and conclusions. Her approach is very much reflective of her background in health sciences research. Fink recommends first establishing the study's reliability. Does the study hold up to test-retest reliability? Did it report inter- or intra-rater reliability, homogeneity of data, and equivalence or alternate forms of reliability? In terms of the article's validity, what is the degree of content, face, criterion, predictive, concurrent, or construct validity? Whenever possible, reviewers should decide whether interventions or programs applied in a particular article are appropriate. Did an article apply acceptable statistical methods? In particular, did it employ reliable and valid independent and dependent variables? What kinds of scales—categorical, ordinal, or continuous—were used, if applicable? Did the statistical analysis correspond to the nature of those scales? What kind of confidence level would the reviewer judge acceptable to qualify a study for inclusion? For most of the above questions there is no hard or fixed answer. Acceptable standards for different methodological tests sometimes vary from discipline to discipline. Moreover, newer and emerging areas of research might call for more lenient methodological standards for inclusion in a literature review in order to not prematurely exclude work in areas that are not yet well understood. Ultimately, it is up to the reviewer to establish their own inclusion and exclusion criteria. Our emphasis is not on what criteria should be used, but rather to stress that the reviewer must thoroughly understand their criteria for inclusion, and make these criteria explicit so that the resulting literature review can be reproducible.

Health science research is more likely to establish strict methodological screens—in that field, only SLRs that consist of nothing but randomized control trials are considered to be of the

highest quality (Fink, 2005). However, social science studies such as those in information systems often do not have the luxury of identical treatments (medications and other health interventions) given to sufficiently large number of peoples as to yield sufficient statistical power (Barbara Kitchenham & Charters, 2007). Thus, it is not surprising that Petticrew and Roberts (2006), writing on SLRs in social science research, advocate a more lenient usage of the hierarchy of evidence. Unlike Fink, they do not advocate strict yes-or-no cutoffs for including studies based on their methodology; they rather recommend ranking studies and generally being aware of the differences in quality. Although they disagree that systematic reviews should include only randomized controlled trials, they do caution against incorporating any articles whose context (implementation decision, treatment integrity, etc.) do not meet a certain standard. They also recommend a more sophisticated assessment of each article that goes beyond information found on the page and assesses subjective influence of authors. Their discussion of author bias and its effects is particularly enlightening and includes a discussion of non-reporting aptly titled, "When no news isn't always good news," and of critical appraisal in "Too much criticism, not enough appraisals."

Other SLR guides outside the health sciences domain are similar to Petticrew and Roberts (2006) in assessing quality without strict methodological cutoffs. Kitchenham (2007) argues that quality instruments must be developed that incorporate the subjective predispositions as well as objective criteria set by researchers. In particular, the development of instruments must consciously consider human bias. She provides two examples of quality checklists, but warns that quality assessment has its limitations. Rousseau et al (2008) identify six general categories of quality assessment criteria: construct validity, internal validity, effect size, generalizability, intervention compliance, and contextualization.

Quality Appraisal: Qualitative

The majority of authors do not distinguish between setting quality standards for quantitative and qualitative studies. For example, Rousseau et al. (2008) do not offer any new information for appraising qualitative reviews but follows the same six criteria as for quantitative reviews. Fink (2005) likewise offers that there is no essential difference between criteria for assessing quantitative or qualitative studies. Petticrew and Roberts (2006), go to the opposite extreme: they question whether systematic reviews are even possible with qualitative work or whether the use of a systematic procedure negates the ability to analyze qualitative work. They worry about the harmful effect of checklists and generalizations. However, we believe that qualitative work lends itself just as much as quantitative work to the rigorous empirical methodology of systematic reviews. Only through this structure can the four mandates of explicit, comprehensive, systematic, and reproducibility be met.

In fact, assessing qualitative studies does require a separate set of procedures. Klein and Myers (1999) provide a detailed guide to the process of conducting and evaluating interpretive field studies (an important category of qualitative studies) in information systems. Furthermore, Myers (2008) provides a guide that spans some of the major categories of qualitative research: action research, case studies, ethnography, and grounded theory. For each kind of study, he includes specific guides to evaluating the quality of such studies. Myers writes generally for

business and management researchers, but his information systems background assures his evaluations' applicability to information systems research.

More generally, there are also guides for evaluating qualitative studies for literature reviews. Although Hart's (1999) and Ridley's (2008) guides are designed for doctoral thesis literature reviews, the quality appraisal sections for qualitative studies are still helpful for SLR reviewers. Analyzing the qualitative merit of an article is the first necessary step when going beyond basic design structure and dissecting the logical arguments of the work. This qualitative scoring is "the difference between critical reading and critical writing" (Ridley, 2008, p. 117). Hart (1999) highlights the importance of argumentation analysis. Reviewers should identify whether argumentation is based on inference, assertion or supposition. How was the argument built? For theoretical articles that exclusively rely on theory or model-building without an empirical component, it is crucial to discover whether such an article relies on deductive or inductive reasoning. Using Fisher's method of critical reading—using structural words such as "thus" and prepositions to understand the logic of a piece (Hart, 1999, p. 93)—and Toulimin's method of argumentation analysis—a mapping device that breaks arguments into basic elements and draws their interrelations (Hart, 1999, p. 88)—every article should be screened for four items: what claims are being made, what evidence is provided to support these claims, if the evidence is warranted, and how it is backed. Fallacies in arguments at this point could lead to seriously downgrading an article's quality score.

Guides and Examples of Quality Appraisal

For the quality appraisal of quantitative primary studies, Fink (2005) presents the rigorous standards used in health sciences research, where research quality is literally a matter of life or death. Whether or not the reviewer chooses to exclude studies based on the hierarchy of evidence presented here, the quality appraisal principles are very helpful. Petticrew and Roberts (2006) also present a hierarchy of research, but one that is more tailored to social science research. Their Table 5.1, "Six tools suitable for use in systematic reviews of quantitative studies," is a well-laid out overview of quality appraisal and caps a section that discusses the use of tools, scales and checklists in the review process. In detail, their review addresses the quality assessors in randomized controlled trials, observational studies, case control studies, interrupted time series studies and cross-sectional surveys. Kitchenham (2007) is valuable in presenting hierarchies of evidence assembled from still other SLR guides.

For qualitative primary studies, information systems researchers are fortunate to have the native studies of Klein and Myers (1999) and Myers (2008). While applicable to many business and social science fields, their assessments take the particularities of information systems research into careful consideration. More generally, Hart (1999) takes a more philosophical approach to quality assessment, emphasizing critical argumentation analysis.

Only five of the examples we reviewed addressed quality appraisal. Dubé and Paré (2003) and Joseph et al. (1996) are extremely thorough in their description of what constitutes quality and why articles were excluded. Robey et al. (2008) explain how they limited the 53 articles from the practical screen to 51 based on methodological quality. Leidner and Kayworth (1992) do state that articles were sorted based on methodology, but do not state how many, if

any, were excluded. Finally, Petty et al. (1984) makes a passing comment that attempts were made to correct measurement error.

6. Data Extraction

Data extraction represents a crucial phase in the systematic review procedure. The reviewers should at this point have gone through the practical screen and quality appraisal, and should be left with a complete list of articles that will comprise the material for the final systematic review. At this point, information will be systematically taken from each article to serve as the raw material for the synthesis stage. The type of data to be removed is based on the research question established during the protocol phase. Unlike the first protocol, we do not consider it necessary to create a detailed extraction form before this stage, as there is so much learning that goes on in prior stages that any initial form would certainly have to be revised several times. Eventually, having gone through the previous steps and pilot-tested each, the reviewers should now be able to develop a clean extraction form to be used to store information about each study. We recommend that this form include spaces to store the details required by the research question, as well as a general comment section. The information from this form will be combined with information collected from the practical screen and from the quality appraisal as a full record for each study, to be used in the data synthesis stage of the review.

Guides and Examples of Data Extraction

The majority of literature review guides do not discuss data extraction at all, but take it for granted that after a certain screening process, extraction will happen before synthesis can be completed. The exception to this is Kitchenham (2007), who devotes an entire section to data extraction. She offers an example of the data extraction form used in Maxwell (2006) systematic review. In this example, the data collection form should include information on cross-company models, within-company models, the measures used to determine statistical significance, measures for prediction accuracy, measures used to compare results, and the results of the tests. Kitchenham covers data extraction procedures, what to do with multiple publications of the same data, how to handle unpublished or missing data, and comments on data manipulation. She also offers insightful "lessons learned" to help reviewers avoid certain pitfalls. Beyond Kitchenham's treatment, Petticrew and Roberts (2006) also offer an example of a data extraction form (their Appendix 4) and briefly discuss the reliability of critical appraisal and data extraction, and the differential effects of interventions.

One limitation of the samples of data extraction in the guides we have mentioned is that they only cover the extraction of quantitative data; we have been unable to locate any focused guide on extracting qualitative data specifically for literature reviews. However, we expect that, depending on the research questions, the common methods for coding qualitative data would also be applicable for literature reviews. Hart (1999), Klein and Myers (1999), Myers (2008) and Ridley (2008) provide some guidance here that could be helpful.

Six of the example studies we reviewed explicitly mentioned their data extraction process. Some very thoroughly dedicated a section of their methodology to touching back upon the initial protocol and its application in the data extraction process (Alavi & Carlson, 1992;

Cotton & Tuttle, 1986; Dubé & Paré, 2003; Robey et al., 2008). Piccoli and Ives (2005) and Leidner and Kayworth (1992) briefly address how the articles in their studies were examined and coded.

7. Synthesis of Studies

When the articles for the review have been screened, selected, and scored, the next requirement is to combine them in order to make comprehensive sense out of a large number of studies. At this stage the reviewers aggregate, discuss, organized and compare. At the end of this stage a completely and polished synthesis of information should be available, and the writing the literature step should be a straightforward process. As with the quality appraisal, the prodeures involved in this step depend on whether the studies to be synthesized are quantitative, qualitative, or contain elements of both. Whereas only quantitative studies can be analyzed quantitatively, both quantitative and qualitative studies need to be analyzed qualitatively.

Rousseau et al. (2008) develop a classification of different kinds of research synthesis, based on the nature of the primary studies, and based on the philosophical approach to analyzing these studies. They call the quantitative, positivist synthesis of quantitative primary studies "synthesis by aggregation"—this is what is commonly called meta-analysis. They call the positivist synthesis of primary studies of different natures (such as qualitative and quantitative) synthesis by "integration"—this is commonly called triangulation. Their other two categories of synthesis apply to qualitative primary studies, based on different philosophical approaches to analyses. When an interpretivist approach is adopted, they call this synthesis by "interpretation"; with a critical realist approach, they call this synthesis by "explanation." In our treatment here, although we consider Rousseau et al's classifications, we consider synthesis approaches based on the quantitative or qualitative natures of the primary studies and of the review itself, rather than on the philosophical approach taken to synthesis.

Quantitative Synthesis of Quantitative Studies: Meta-analysis

A quantitative synthesis of reviewed studies involves considering each study as a case that has certain independent variables that are hypothesized to have an effect or non-effect on a given dependent variable (B. F. Green & Hall, 1984). When each of these cases (individual studies) are quantitatively analyzed to derive a composite result, such a synthesis is called a meta-analysis. Because meta-analysis involves quantitative analysis based on the same quantitative criteria as the primary studies, this can only be conducted on quantitative primary studies—it makes no sense in the context of qualitative primary studies. It is beyond our scope in this guide to explain the procedure for conducting a meta-analysis (however, we do refer to some helpful guides below). Our goal here is to consider meta-analysis as one synthesis approach in the larger context of carrying out systematic literature reviews.

Rousseau et al. (2008) call meta-analysis "synthesis by aggregation." They note that a key limitation of this approach in management and organization science is that primary studies in that field are rarely homogenous—this is also the case with information systems, in contrast to the health sciences (the leading domain where meta-analysis is practiced), where replication of studies is a scientific norm and necessity, thus facilitating meta-analysis. In such fields, meta-

analysis in the context of systematic literature reviews is considered as research of the highest quality—in fact, meta-analytical systematic literature reviews of randomized controlled studies are the top of the top of the hierarchy of evidence. Without disputing the exaltation of one particular research approach far above all others, we mainly note here that in information systems and related social sciences, the lack of circumstances for randomized control trials and other highly replicable studies limits the availability of circumstances for robust meta-analyses to be carried out. Hence, SLRs in non-health-science fields tend to downplay exclusive devotion to meta-analyses.

Rousseau et al (2008) argue that there exists no single consensus regarding the best evidence to be included, and reviewer bias might have seeped into the selected studies. In order to fully synthesize knowledge, they argue that interpretation certainly does not need to stop at meta-analysis but can include other modes of synthesis. Similarly, Petticrew and Roberts' (2006) do not believe that meta-analysis is the end all and be all of synthesis, but instead strongly advocate triangulation (what Rousseau et al call "integration"). They begin their section on quantitative synthesis with a discussion of narrative synthesis, which includes tabulating included studies and explicitly sorting study quality. Their treatment of quantitative synthesis can be equated with the synthesis section of any experimental study where the first discussion of analyzed data offers a broad overview and population description. This also falls in line with Kitchenham (2007), who advocates beginning synthesis with narrative synthesis (regardless of article type) followed by quantitative synthesis. Next, a synthesis of the best evidence should be presented as a conclusion drawn from "vote counting"; only then would meta-analysis follow. Even then, Pettigrew and Roberts' discussion of meta-analysis is cautionary, beginning with the question of whether it even works, followed by criticism of the technique as an academic "sausage machine" (in the sense that junk meat produces junk sausage), and offering concrete ideas for improvement. However, their caution is not to denigrate meta-analysis; they rather clearly define its limits, before they proceed to describe the approach in detail.

Qualitative Synthesis of Quantitative or Quantitative Studies

Although information systems was initially a research field with primarily quantitative analysis, qualitative research has now established equal regard, if not yet equal frequency of application. As Albert Einstein said, "Not everything that can be counted counts, and not everything that counts can be counted." Thus, the importance of qualitative synthesis is well established, not only in information systems, but in other social sciences as well.

Webster and Watson (2002) describe the synthesis stage as transitioning from an author- to a concept-centric focus. They recommend mapping all provided information in order to best evaluate the data, fit it within the theory of one's review, and structuring that review. Synthesis of qualitative literature can be broken into a concrete set of steps (Levy & Ellis, 2006): knowing the literature; understanding it; breaking it down to a cognitive or construct levels (that is, understanding the various variables, models and frameworks); applying the literature; analyzing it; synthesizing it; and finally evaluating it. In essence, this recommendation is a mini-breakdown of our entire systematic review guideline but may enlighten the reader faced by the somewhat complicated synthesis stage. Their "tips from the field" and "when is the review completed' sections may be particularly helpful.

Rousseau et al. (2008) refer to the analysis of qualitative material as synthesis by interpretation and synthesis by explanation. Such interpretative and critical realist approaches are associated with relativist epistemologies such as phenomenology or social construction. They outline the use of meta-ethnography and the development of theoretical models of how interventions work, why and for whom. One can thus derive a preliminary synthesis and explore relationships within and across the data. A final step is then assessing the robustness of the synthesized output. As in their discussion of meta-analysis, they note that there is no consensus about what is the best evidence, and that a systematic review will always be shaped by subjective interpretation. What the systematic review does offer to combat this however is an explicit description of methodological procedure to allow future researchers to replicate or amend the process.

Petticrew and Roberts (2006) offer a simple three-step guide to tabulating included studies in a narrative synthesis. Of particular interest is their Table 6.1 which offers an example of descriptive synthesis. They advocate describing within-study synthesis first, and then using these various threads to begin a qualitative description of mixed-method research.

For guidelines on qualitative analysis of a review, Hart (1999) is particularly helpful. The reviewer should begin by qualitatively classifying all material thus far collected. Is each article judged to match the relative standards previously established? Begin mapping relations (Alias, Maizam, Suradi, Zurinah, Reiska, Åhlberg, & Novak, 2008) between articles according to standards such as the methodological tradition they fall under, or their particular design features. Based on the analysis of each article, how can they be synthesized? What rhetorical devices predominate in an article? (Hart offers a thorough list of such rhetorical devices such as metaphor, tropes, synecdoche, irony, metonymy etc. which could be very helpful to reviewers not very comfortable with the writing process.) Often, the style of an article offers clear insight into its author's voice. The easiest way to proceed to the final writing process is to create a visual map of the ideas and of the review layout. Potentially useful strategies include feature maps, tree constructions, content maps, taxonomic maps or concept maps (Wu & Weld, 2008); Hart offers appropriate visual representations of each form (1999, pp. 146-157). Erduran et al. (2004) are particularly provocative in their promotion of argumentation in scientific thought.

Combined Synthesis of Quantitative and Qualitative Studies

A third, rarer approach to synthesis is that of primary studies comprising where some use quantitative analysis, and others use qualitative. Generally referred to as triangulation, there have been many calls for such reviews, but very few applications of it. Rousseau et al. (2008) recommends approaching these unique articles through a combination of synthesis by integration and synthesis by explanation. Synthesis by integration involves the collection and comparison of evidence from two collection methods and typically employs pre-determined questions and selection criteria. Synthesis by explanation focuses on identifying causal mechanisms and how they operate, with recognition of the hierarchy of evidence. As in the previous sections, both approaches must acknowledge the subjectivity of the reviewers. Although not related to literature reviews, Lee (2007) does provide helpful insight to triangulation of positivist and interpretive analysis in information systems and organizational science research.

Guides and Examples of Synthesis

Rousseau et al (2008) provide an excellent framework for understanding the different approaches to synthesis in a literature review, depending on whether the primary studies are quantitative or qualitative and depending on the philosophical approach of the reviewer. Their framework effectively incorporates quantitative and qualitative approaches, and assess the pros and cons of each. For meta-analysis, Fink (2005) and Petticrew and Roberts (2006) provide clear introductions to the methodology, sufficient for a reviewer to determine whether or not to take that approach. However, for actually implementing meta-analysis, these overviews are insufficient. For details of how to actually carry out a meta-analysis, Borenstein et al (2009) provide a good introduction with state-of-the-art recommendations. Rosenthal (R. Rosenthal, 1995; R. Rosenthal & DiMatteo, 2001; Robert Rosenthal, 1991) also has a number of helpful and authoritative publications on meta-analysis. For qualitative synthesis, Hart (1999) provides very detailed guidance on a variety of synthesis approaches and techniques.

Six of the examples we consulted explained their approach to synthesis. (Marakas et al., 1998) and Dubé and Paré (2003) are particularly thorough in their descriptions, and specifically detail the data extraction procedure used for different study methodology encountered. Robey et al. (2008) are less specific, but mention that the theoretical underpinnings from each guide were assessed in accordance with earlier reviews. This reliance on precedent seems to be a trend in the data extraction stage and is also employed by (Winter & Taylor, 1996). The description of data extraction seemed most pertinent in the included meta-analyses (Alavi & Joachimsthaler, 1992; Cotton & Tuttle, 1986; Petty et al., 1984) as these rely on standard extraction techniques and are expected to produce replicable results.

8. Writing the Review

The final step of developing a research literature review is reporting the findings and actually writing the review. Though it should be clear by now how time- and energy-intensive this process can be, assuming all the previous steps have been followed in order, we are confident that it can be done systematically and smoothly (B. Kitchenham et al., 2009). The most important goal in the reporting of findings is that the process of the literature review be documented in sufficient detail that the entire procedure be reproducible in the scientific sense: other researchers wishing to replicate the results of the review should be able to follow the same steps described and arrive at the same results. Beyond simply reporting the procedures, the literature review should conclude by highlighting any novel findings. Was the literature supportive of particular existing theory, or did the reviewers establish a new model which builds on existing theory and will contribute to future research? Unexpected results, in particular, should be highlighted.

Most literature reviews continue to be poorly conceptualized and written (Boote & Beile, 2005). Though the average reviewer may not have an affinity for this final step, as much effort is needed in this final stage as in the others. Without a clear and understandable write-up of the findings, the chances of the review being widely disseminated decrease. As with any other research, it would be a shame for results to not receive the attention they deserve because of poor presentation.

It is beyond the scope of this article to provide a general guide to writing a paper, but there are various sources and articles that address writing issues that are particularly pertinent to the writing of a literature review. Ridley (2008) and Hart (1999) devote a number of chapters in their books to various writing issues particular to literature reviews, including from pre-writing, being critical, supporting claims with evidence, maintaining legitimacy, verb use, writer's voice, and many other pertinent issues. Other helpful resources help authors to write in a way that prioritizes the ultimate audience (Keen, 2007; Donovan, 2007); laying out the review with consideration for their preconceived expectations for each section (2006); consistency in the structure and grammar of the text (Hartley, Pennebaker, & Fox, 2003); and setting a definite voice for the review, especially in the case of multiple collaborators (Allen, Atkinson, Morgan, Moore, & Snow, 1987).

Webster and Watson (2002) give general guidance about the writing stage of developing a literature review paper, particularly in information systems. They talk about identifying the topic, defining terms and clarifying the scope of the study, and writing the discussion and conclusions. They also offer helpful guidance on the tone and verbal tense to adopt in writing.

Disseminating the Literature Review

Priority in writing the review must also be placed on remembering one's audience. Though the majority of scholars may already feel at ease with this topic, Petticrew and Roberts (2006) offer a helpful guide for disseminating the review. They discuss the possibility of getting research into policy and practice, where the information will be actively used, and they offer pointers for effective dissemination. Among their suggestions are engaging users early, putting the "D" (dissemination) in R&D, disseminating to the media, publishing in academic journals, and the impact of presentation and timing. Kitchenham (2007) also emphasize the development of a dissemination strategy—in fact, she insists that the dissemination strategy should be determined as part of the research protocol, even before the study begins. Beyond academic publications, dissemination targets include practitioner-oriented journals, media releases, short-summary leaflets, posters, websites and direct communication; she offers formatting and design lessons for each type.

Guides and Examples of Writing a Literature Review

Kitchenham (2007) gives a very clear model outline of the structure of a published systematic literature review, indicating what should be reported. For writing style tips particular to literature reviews, Bem (1995) and Webster and Watson (2002) give practical guidance. Hart (1999) and Ridley (2008) also have lengthy treatments of writing reviews, but their guides are targeted to literature reviews in graduate theses.

Of course, the best guide to how to report a literature review is an actual published review. Although none of the 24 examples specifically states how they would engage in the write-up phase, this is expected since the write-up is an implicit step in any publication. The write-ups took a variety of forms, and indicating that there is no one acceptable procedure for outlining one's findings: Marakas et al. (1998) created tables to classify studies and then clearly explained all finding variables. Berthon, Pitt, Ewing, and Carr (2002) framed their discussion

around a set of "meta-assumptions". Winter and Taylor (2002) sort their reviewed articles in chronological order. Venkatesh et al. (2007) chart their expectation for future developments around a historical discussion of the process of technology adoption research over the past two decades. Piccoli and Ives (2005) first explain the three principal contributions of their framework and then organize their literature review around this framework. Hulland (2004) states three research purposes of their review and then answer the respective questions. Melville et al. (2002) build their review around a set of propositions and research questions. Similarly, Leidner and Kayworth (1992) proposed six themes around which to organize articles and build propositions. Jasperson et al. (2001) engage in a lengthy discussion of meta-triangulation. Joseph begins with a narrative review, moves into a meta-analysis and finally tests a proposed model. Cotton and Tuttle (1986) limit themselves to only presenting the quantitative results of the meta-analysis. Other authors, however, presented their discussion through a series of headings and subjects but without any clear framework outlining the structure of their write-up.

Thoughts on Publishability of Systematic Literature Reviews

This guide describes a much more rigorous approach towards writing literature reviews than most researchers are familiar with. Those who have already published literature reviews (whether as students for their theses, as the theoretical background for a piece of primary research, or as a stand-alone publication) might wonder if the systematic approach we advocate is worth all the trouble. We certainly believe it is. Although this approach does require more work than is normally spent in writing a literature review, because we have presented such a detailed step-by-step guide, it does not entail a tremendous amount more work; in fact, the detailed guideline helps researchers to not waste time floundering in wondering what to do, or wondering if they have done enough. The reward of this extra effort is twofold: first, the researcher can readily produce high-quality work that is more valuable for their own and others' research; and second, the researcher can expect their work to result in higher quality publications, with direct career benefits. In this section, we comment on the potential publication outlets that result from adopting this systematic approach.

A reward for the labor of conducting an SLR, other than the intrinsic reward of producing a truly valuable work of research, is that well-executed literature reviews on emerging or perennial areas of interest would likely yield many more citations than would most primary studies. This is because authors of primary studies in the topic area tend to refer to the same base studies; a well-executed literature review does a lot of their work for them, and analyzes the primary studies in ways that help other researchers focus their own work. Obviously, the benefits of high citations are in greater recognition among colleagues, promotion and tenure, research awards, and other related professional benefits.

Publishing the Protocol

Creating a literature review protocol before conducting the review is one element that is rarely practiced, and thus might seem particularly onerous. However, we have argued why this practice greatly enhances the quality of the overall review, mainly in that it forces reviewers to lay out the plan beforehand, and thus to explicitly think through the process before they begin. From the perspective of publication, a review protocol is ideal for presentation at a conference.

Actually, the primary reason for presenting a review protocol at a conference is to obtain external validation by the reviewers of the submission, and hopefully to obtain helpful feedback from the audience; this external input can be very helpful in refining the design of the review. Moreover, it gives the reviewer a publication before the review even begins, which can hardly be considered a waste of time.

Doctoral students, in addition to getting an early conference publication before graduation, can employ the protocol directly in their dissertation proposal as part of the methodology section. However, when the entire dissertation literature review is conducted with the SLR methodology, significant benefits accrue to a doctoral student, as we discuss in the next section.

Systematic Literature Reviews as Part of Doctoral Dissertations

Although thesis literature reviews (especially for doctoral dissertations) ought to be held to high standards of rigor, they typically are not held to the same standards as for stand-alone reviews. The first reason for this is the same as for theoretical background reviews—the literature review is not the main focus of the study; if the student is ever to graduate, their supervisor has to let them "go on to the good stuff," that is, continue to the data collection and analysis of the primary study. The second reason for lower standards is related: student theses are not held to the same standards as scholarly articles in leading journals produced by researchers many years beyond their PhDs. Particularly in the case of master's theses, most supervisors would consider a rigorous literature review such as is proposed here overly onerous for the student. (The notable exception is when the dissertation analysis is a meta-analysis; in such a case, the rigorous SLR methodology would be expected. However, many dissertation supervisors distinctly prefer that students demonstrate their ability to conduct a primary study.) Similarly, doctoral supervisors and committee members would rarely hold their students to a higher standard than that held by reviewers of leading journals.

However, although we do understand these pragmatic considerations, we offer one pragmatic argument for holding doctoral students to the standards of a stand-alone literature review in their dissertation literature review: From the perspective of the student's career, the doctoral dissertation has two purposes: First, the best dissertation is a finished dissertation—its primary goal is for obtaining a PhD. A common though controversial advise is that the best strategy for a doctoral dissertation is to do the minimum required to quickly get the dissertation, and then with a PhD and professorial or post-doc position in hand, begin to work on your scholarly masterpieces. This advice would tend to de-emphasize a highly rigorous literature review. Paradoxically, the second purpose of a dissertation is to provide one or more rapid journal publications after its completion. A minimalist dissertation would result in minimalist publications; thus, this second purpose balances the first, motivating the student to push themselves for higher quality than what their committee might let them get away with. (Of course, for students who aim to work in an industry where research publications are not valued would normally aim for the minimum required to post the letters "PhD" behind their name, with little extrinsic incentive to push themselves for higher quality.)

Following a procedure as outlined here for a literature review could help a doctoral student achieve both ends. Although the standards for a doctoral literature review are not normally as rigorous as presented here, dissertation literature reviews are normally expected to be significantly longer and more comprehensive than theoretical backgrounds to standard journal articles. Dissertation literature reviews normally must demonstrate a broad knowledge of related literature and a thorough understanding of the theory that underlies the dissertation topic. However, Boote and Beile (2005) lament the low standards of doctoral dissertation literature reviews, which they attribute to the low priority assigned to this aspect of doctoral training. Although they speak about doctoral dissertations in the field of education, their arguments are widely applicable to many fields. Without a systematic guide, many doctoral students flounder in creating a quality literature review; for this reason, a number of books are dedicated to this one section of a review. While very helpful, these guides generally lead to dissertation literature reviews that would eventually be chopped to pieces to become the theoretical background of an eventual journal article submission.

In our view, there is an incredible amount of scholarly waste in the academic industry that results from the inefficient way that doctoral literature reviews are typically conducted. Thousands of doctoral students every year spend hundreds of hours on a dissertation literature review. Most of this time is spent aimlessly floundering, since most students don't know what they are doing, and most supervisors don't have a model for guiding them to proceed in a systematic manner. Thus, their hundreds of hours result, inefficiently in literature reviews of perhaps 40 to 80 pages, in their final accepted form. However, very few of these are performed with sufficient rigor that they could be published as stand-alone literature reviews. Thus, when publication time comes, these literature reviews are often reduced to no more than five to ten pages of a journal article. Thus, the lack of a system results in enormous scholarly waste.

The system we present here would help a doctoral student structure their literature review sufficiently rigorously to satisfy the demands of a dissertation proposal, and at the same time be sufficiently rigorous and structured to be published as a stand-alone review, distinct from the main research question of the article. On one hand, adopting a rigorous approach might require more work than is typically involved in creating a dissertation literature review, especially in the planning and article collection stages. On the other hand, by giving students a detailed system, they might actually spend much less time floundering and all the time they spend would be much more efficient and effective. Thus, the student could reap significant benefits towards producing a high-quality dissertation, and at the same time produce an article ready for submission to a journal before the rest of the dissertation is even completed.

Some doctoral programs require a synthesis examination, which is typically a general literature review covering theory and methodology in their general area of interest. The value of this approach is that students are guided towards a specific research question and a specific research methodology for their dissertation. As long as they know their general area of interest, this synthesis exposes them to what research has been done (and what has not been done), and the methods that have been used to conduct research in that area (as well as potentially fruitful methods that might not yet have been employed). The SLR methodology is again helpful in conducting such a study. Specifically, what is involved here is what Kitchenham (2007) describes as a "systematic mapping" or "scoping study." The methodology is the same as that of

the SLR; the difference is that instead of aggregating primary studies' responses to a common research question, a systematic mapping collects and classifies studies that treat a subject of interest, often with different research questions. The SLR methodology gives focus and direction to the preparation for a synthesis examination, and likewise results in a publishable study from an exercise which often is otherwise a throw-away endeavor.

Stand-Alone SLR as the Initiation to a Research Program

In carrying out a research program that involves more than just one study, it is important to first be aware of what studies have been conducted in that area or in related areas. For this purpose, it is helpful for the initial study in the program to be a scoping study that maps out the various areas and questions involved in the program. Such a study is similar to that described in the previous section for a doctoral synthesis examination. Many stand-alone literature reviews are of this nature—rather than investigating the aggregated response to a specific research question, they classify and compare studies that treat the same general subject of interest. The value of such an initial study is that it helps to map out the areas that have been well-treated, and those that lack coverage. Well-treated areas, if overwhelming conclusive, might not need further research. However, if findings are contradictory or otherwise inconclusive despite the presence of a number of empirical primary studies, a regular, formal systematic literature review might be called for. On the other hand, if there is a shortage of studies in an area, the scoping study would highlight this dearth, and would guide the researchers in designing a primary study that fills the identified gap.

Conclusion

This article has presented a detailed guide to developing a systematic literature review. The steps have been delineated so as to assure a rigorous review, one that is valid in its goal of producing a comprehensive summation and discussion of the existing literature on a research question of interest. We have emphasized the need for such a review to be explicit in describing the procedures followed, to the extent that the results could be reproduced by independent researchers carrying out the same review process.

This guide presents a step-by-step approach to carrying out the rigorous, scientific methodology of a systematic literature review. While written generally enough to be applicable to a broad range of fields, this guide has a focus specific to information systems: it incorporates SLR guides from related fields—social sciences, management, and software engineering; it covers synthesis of both quantitative and qualitative primary studies; and it uses exemplar literature reviews from information systems as illustrative examples. Moreover, for each step of the process, it provides references to helpful resources that provide further detail on conducting each step of the SLR.

While reproducibility is an important mark of a rigorous study, the value of the study depends mainly on it being comprehensive in incorporating all relevant literature. To assure this, the practical screen must be careful not to unreasonably exclude studies that could be significant to the general body of knowledge on the topic. In addition, the search for literature must be thorough and far-reaching, so as not to miss any potentially important studies.

While we have been fairly detailed describing each step, it is impossible to elaborate on all the particulars necessary to create a literature review in one article. The cited studies go into more detail on specific procedures, considerations, and judgments that must be made along each step. We hope that in conjunction with these additional sources, this guide may serve its purpose in aiding the development of rigorous and valuable research literature reviews.

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