DISTINGUISHING KNOWLEDGE IMPACT FROM CITATION IMPACT: A METHODOLOGY FOR ANALYSING KNOWLEDGE IMPACT FOR THE LITERATURE REVIEW GENRE

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Abstract. The scientific impact of research papers is multi-dimensional and can be determined quantitatively by means of citation analysis and qualitatively by means of content analysis. Accounting for the widely acknowledged limitations of pure citation analysis, we adopt a knowledge-based perspective on scientific impact to develop a methodology for content-based citation analysis which allows determining how papers have enabled knowledge development in subsequent research (knowledge impact). As knowledge development differs between research genres, we develop a new knowledge-based citation analysis methodology for the genre of standalone literature reviews (LRs). We apply the suggested methodology to the IS business value domain by manually coding 22 LRs and 1,228 citing papers (CPs) and show that the results challenge the assumption that citations indicate knowledge impact. We derive implications for distinguishing knowledge impact from citation impact in the LR genre. Finally, we develop recommendations for authors of LRs, scientific evaluation committees and editorial boards of journals how to apply and benefit from the suggested methodology, and we discuss its efficiency and automatization.

Key words: Scientific impact, knowledge impact, content-based citation analysis, methodology.

1 Introduction

The scientific impact of published research across genres and academic fields is most often measured quantitatively using different metrics at various levels (Hassan and Loebbecke 2017), including the paper level (e.g., number of citations), the author level (e.g., h-index), and the journal level (e.g., the Thomson Reuters Impact Factor). Most of these metrics are based on the number of citations that a paper has attracted. It is appealing to draw on these figures for various reasons: First, citation data is easily accessible by querying literature databases such as Google Scholar. Second, many tools for analysing huge sets of publication data are available, of which the Publish or Perish software is just one example. Third, the field of scientometrics provide rich sets of methods and metrics for the analysis of publication metadata (Hassan and Loebbecke 2017). Fourth, quantitative analyses provide "objective" results (Bavelas 1978; Taubes 1993) and avoid interpreting publication data on subjective grounds, which is often tedious and difficult to defend. Finally, quantitative citations analyses are applicable to all kinds of publications regardless of their genre, paradigm, and methodology, for example. These advantages have created an environment in which quantitative citation analyses are prevalent (Rip 1997) and in which corresponding measures are used for rankings of institutions, journals and authors (Hassan and Loebbecke 2017).

While the opportunities of analysing citations are widely acknowledged, there have also been dissenting voices on the limitations of measuring the scientific impact based on citations exclusively (Hicks et al. 2015). The raised issues are largely related to methodology, data, and interpretation. These issues have been discussed for decades with one of the earliest criticisms being that citations are not all of the same type (MacRoberts and MacRoberts 1989; Smith 1981). For example, some refer to the ideas of the cited paper while others are perfunctory, i.e., superficial and not engaging with the main knowledge contributions of the cited paper (Hassan and Loebbecke 2017; Small 1978). Recognizing this diversity, the assumption that citations imply use of the cited document for further knowledge development has been criticized repeatedly in extant scientometric literature (Smith 1981, p. 87). This popular but questionable assumption can be found in many types of citation analyses that indiscriminately associate citations with knowledge development (cf. Hassan and Loebbecke 2017 and Smith 1981 for reviews).

Adopting the perspective of knowledge impact, we focus on the abovementioned interpretation issues related to citation analysis and scientometric studies by distinguishing between *citation* and *knowledge impact*: while there are plenty of analyses of citation impact, analyses of knowledge impact are rare (Brooks 1985, 1986; Chubin and Garfield 1980; Moravcsik and Murugesan 1975; Stremersch et al. 2015), possibly because they require time-consuming content analyses. Since the identification of knowledge impact requires citations, we argue that analyses of knowledge impact naturally extend analyses of citation impact. A challenge associated with assessing knowledge impact is clarifying what it essentially means (semantic challenge) and how it can be traced (methodological challenge). We address the semantic challenge by adopting a knowledge perspective on papers. From this perspective, we analyse how the knowledge developed in a paper has been used by citing papers to further enhance this knowledge. As an example, when a paper A contributes to knowledge development through the proposition of an explanatory theory, a paper B which cites this work can enhance this knowledge through conducting an empirical study to provide empirical support for the theory. While the proposition of a theory in paper A can be conceived as direct knowledge development of A, its empirical analysis and instantiation in paper B can be conceived as indirect knowledge development of A. Without the proposition of the explanatory theory in paper A, paper B would not have been able to test this theory and, thereby, to achieve subsequent, cumulative knowledge development. Addressing the methodological challenge needs to follow the semantic interpretation of knowledge. A methodology for identifying knowledge impact needs procedures to identify both the direct and indirect knowledge development of an article.

When developing an analysis of knowledge impact, a particular type of content-based citation analysis, the diversity between genres of research needs to be considered. We argue that the conceptualization of direct

and indirect knowledge impacts needs to account for this diversity, which pertains to methodology and epistemology, for example (cf. Banville and Landry 1989). For example, a paper reporting on an exploratory case study is expected to generate knowledge that differs from that of a LR. In this regard, it should be noted that knowledge-based citation analysis, in contrast to pure citation analysis, needs to account for the genre of the paper. In this paper we focus on LRs, which is one of the most important genres for synthesizing, preserving and developing knowledge (Webster and Watson 2002, p. xiii). LRs can thereby develop substantial scientific impact in terms of both direct and indirect knowledge development.

The abovementioned arguments reveal that knowledge impact and citation impact are two types of impact, which need to be distinguished. This perspective is in line with previous research which acknowledges that scientific impact includes not only perfunctory citations but also the dissemination of knowledge and theoretical advancements (Daft et al. 1987; Karuga et al. 2007). In this regard, we address the following research question in this paper:

How can the knowledge impact of literature reviews be determined?

Answers to this question complement citation analyses at different levels: First, at the article level, the extent to which a LR has contributed to knowledge development can be determined. This insight complements citation analyses on LRs and enables qualitative assessments of the knowledge impact of LRs. Second, when the knowledge impact of LRs is aggregated at the author level, this approach allows evaluating a scholar's scientific impact (with regard to LRs). Third, when aggregated at the journal level, the approach allows determining the knowledge impact of LRs published by a particular journal. Finally, at the discipline level, a scholarly community can evaluate the knowledge impact of LRs published in their discipline and identify weaknesses that point to future research needs. In summary, a broad range of academic stakeholders can benefit from a methodology for evaluating the knowledge impact of LRs and thereby gaining insights that a pure citation analyses cannot provide.

We address the above research question by providing three key contributions: First, we propose a new methodology for analysing knowledge impact of LRs that that distinguishes different types of direct and indirect knowledge developments. Second, we apply this methodology to a sample of LRs on "IS business value" to demonstrate how it can be applied, and to derive implications on the distinction between knowledge impact and citation impact. Third, we develop recommendations on how to go beyond pure citation analyses and leverage the suggested methodology for analysing knowledge impact.

The remainder of this article is structured as follows: In the next section, we provide the background on LRs, including the distinction between direct and indirect knowledge development. Then, we suggest the new methodology and demonstrate its application to a sample of LRs in an exploratory literature study and use the results to derive propositions related to the distinction of knowledge impact and citation impact of LRs. Finally, we conclude with a summary and implications for further research.

2 Background

2.1 Literature Reviews

The literature review (LR) is an established research genre in many academic disciplines, including the IS discipline. As Garfield (1987) notes, *"[i]t is not an accident that so many of our greatest scientists have used, created, and contributed to the review literature."* (p. 113) Since 2000, almost 200 LRs have been published in pertinent IS journals (Paré et al. 2015; Schryen et al. 2015). LRs have been approached by researchers from many perspectives, including definitions, purposes, genres, classifications, and

composition guidelines. In the presence of different expectations of what LRs can or should accomplish, there is consensus of scholars across various fields that synthesizing the findings of the literature is a mandatory contribution of a LR (e.g., Cooper 1998; Webster and Watson 2002). We draw upon this shared understanding. Furthermore, in this study we are interested in knowledge development in a particular domain, with domain knowledge being understood as the realm of knowledge that researchers have about their particular field of study. This domain can be as broad as a whole discipline (e.g., IS discipline) but also as narrow as "IT business value" or "business-IT alignment". Based on the two aforementioned properties, we propose the following definition:

A literature review provides a synthesis of the body of knowledge of a specified domain.

We would like to stress that we focus on standalone LRs; i.e., we exclude reviews as sections of papers, for example.

2.2 Knowledge Development Through Literature Reviews

Being interested in analysing the scientific impact of LRs in terms of knowledge development, we adopt the ancient definition of knowledge as *justified true belief*. In this context, *"[b]eliefs refer to the attitude of individuals, 'roughly, whenever [they] take something to be the case or regard it as true'"* (Schwitzgebel 2014) and knowledge is justified when it is gained by rigorously applying scientific methods and no refutation through repeated criticism and attempts of falsification has occurred (Moser 2002, p. 390; Popper 2014). As conceptualized in the introduction, we distinguish *direct* from *indirect knowledge development* and tailor this distinction to the LR genre.

Schryen et al. (2015) use the theory of knowledge to conceptualize six different ways in which LRs can directly contribute to knowledge development: synthesizing, theory building, theory testing, criticizing, identifying research gaps, and developing a research agenda. A definition of each type of knowledge development is provided in Table 1. We refer to these activities as ways in which LRs can perform *direct knowledge development* (see **Figure 1**).

Knowledge development	*Definition*
Synthesizing	Synthesis provides a structured presentation of domain knowledge that has already been made explicit by other researchers in their publications.
Theory building	Theory building speculates on new insights and suggests new approaches to framing domain knowledge that has not yet been validated empirically. New hypotheses represent developments of provisional domain knowledge which requires support by empirical evidence (Weber 2012).
Theory testing	When a substantial body of empirical research has been accumulated, theory testing reviews gather empirical studies, quantify the extent to which existing research supports particular theoretical hypotheses, determine aggregate effect sizes, and identify biases.
Criticizing	Criticizing prior work through, e.g., problematizing assumptions, identifying inadequate knowledge or revealing methodological, logical or conceptual problems makes explicit that past research has failed or at least made mistakes in creating domain knowledge.
Identifying research gaps	The identification of research gaps helps to find unchartered territories of research and informs on missing domain knowledge. Research gaps are thus conceptualized as domain metaknowledge.
Providing a research agenda	Providing a research agenda increases transparency in terms of how research gaps might be closed in future research.

Table 1. Direct Knowledge Development Through LRs (Schryen et al. 2015)

To conceptualize indirect knowledge development of LRs, the ways in which subsequent research can enhance the direct knowledge development have to be determined for each of the aforementioned types of knowledge development. In contrast to the direct knowledge development of LRs, to the best of our knowledge, the current literature does not provide a conceptualization of indirect knowledge development of LRs. Thus, we suggest such a conceptualization based on the analysis of a large random sample of LRs and citing papers that we found in our literature search in the IS business value domain". For each type of knowledge development (as shown in Table 1), we identify how they have been used in subsequent research to create subsequent, cumulative knowledge (see the methodology section). The resulting concept of indirect knowledge development of LRs is shown in Table 2. While we acknowledge that this understanding may be preliminary and may be slightly different in other domains, we argue that, based on the large size of our sample, it covers the most important types of indirect knowledge development.

Direct knowledge development	*Indirect knowledge development*	*Rationale*	*Examples*
Synthesizing	Theory building	Theorists can draw on the evidence synthesized by a review to develop novel explanations or to modify existing theories.	Coltman et al. (2011) use the resource-based view advanced by Melville et al. (2004) as the foundation for their model of CRM performance, which posits human, technological, and architectural resources as antecedents of superior CRM capabilities.
Theory building	Theory building	When authors of a review develop a theory, subsequent research can advance the theory by adapting it to specific contexts, or by integrating it into a unified theory, for example.	In their 10-year update, DeLone and McLean (2003) build on the original IS success model (DeLone and McLean 1992) and propose several refinements.
	Theory testing	Theories developed in a review can be tested by primary empirical studies or by meta-analysis.	Petter et al. (2013) provide a test for the IS success model, which was proposed in review papers (DeLone and McLean 1992, 2003).
	Identifying research gaps	By providing a formalized (theoretical) frame, authors of a review enable other researchers to search for aspects that are not covered by the theory and thereby identify novel research gaps.	Torkzadeh et al. (2011) refer to the link between system usage and individual performance, which was proposed by DeLone and McLean (1992), and suggest that the effect of use of technology on work practices presents a research gap.
Theory testing	Theory testing	When a meta-analysis tests a theory, it can stimulate further theory testing, in particular if the results are inconclusive and uncover partial support for particular hypotheses.	Sabherwal and Jeyaraj (2015) provide a substantial update of Kohli and Devaraj's (2003) meta-analysis and test how information technology impacts firm performance.
	Identifying research gaps	Theory testing reviews, in particular when they yield ambiguous results, provide opportunities for other authors to identify research gaps.	Yen et al. (2015) refer to the review of Petter et al. (2008) and identify a lack of studies focusing on service quality.

Criticizing	Addressing criticized shortcomings	A critique provided by a review may constructively stimulate researchers to address the shortcomings of extant research.	Fairbank et al. (2006) address the critique of a review – Dedrick et al. (2003) argued that extant research has underestimated lag-effects when measuring IT payoff.
Identifying research gaps	Closing research gaps	Research gaps identified by authors of a review can be closed in subsequent research.	Burton-Jones and Straub (2006) follow the call of DeLone and McLean (2003) to examine the usage construct.
	Synthesizing research gaps	To discuss the progress in a domain, authors can synthesize research gaps identified by previous reviews and develop an updated call for research.	Schryen (2013) draws on the research gaps suggested by Brynjolfsson and Yang (1996), Dedrick et al. (2003) and Dehning and Richardson (2002) to develop a comprehensive view of open research challenges.
Providing a research agenda	Following a research agenda	When authors of a review provide specific guidance on how a research gap should be addressed (i.e., a research agenda), this may stimulate other researchers to follow corresponding advice.	Kohli and Devaraj (2003) follow the call of Brynjolfsson and Yang (1996) and conduct a meta-analysis to synthesize IT payoff studies while controlling for methodological artefacts.

Table 2. Indirect Knowledge Development Through LRs

3 A Methodology for Analysing the Knowledge Impact of Literature Reviews

This section presents the methodology for analysing the knowledge impact of LRs, including direct and indirect knowledge development. An overview of the methodology is visualized in **Figure 1**, which shows how the analysis of knowledge impact extends citation analyses.

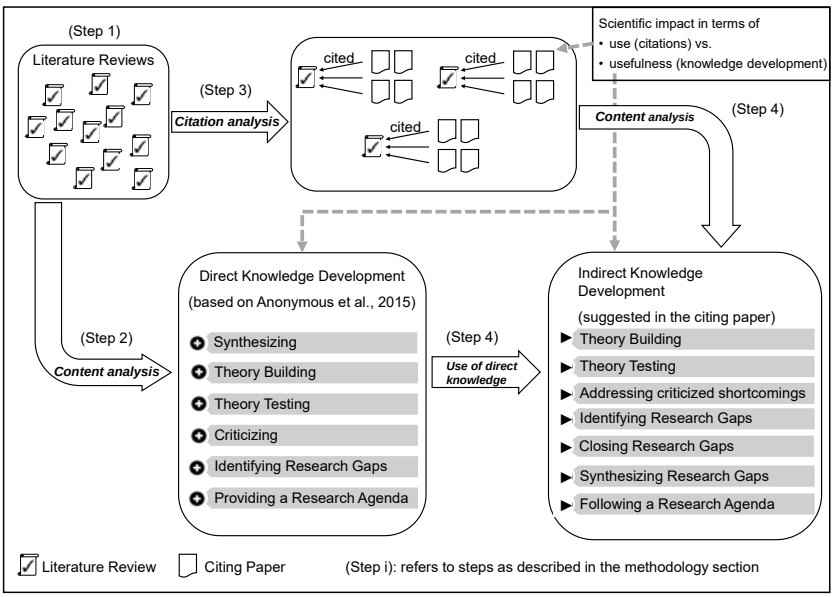


Figure 1. Methodology for Analysing Knowledge Impact of LRs

The proposed methodology proceeds in four steps: 1) identification of LRs, 2) analysis of direct knowledge development of LRs, 3) citation analysis, and 4) analysis of indirect knowledge development of LRs.

3.1 Procedures of the Proposed Methodology

3.1.1 Identification of Literature Reviews

For the researcher, domain or discipline of interest, the LRs that have been published in pertinent (IS) journals, conference proceedings and books, etc. have to be identified. This step involves applying usual literature search procedures. We recommend that a team of researchers conducts this step by firstly developing a shared understanding of LRs and making this understanding explicit, and secondly applying a multi-coder procedure to ensure a high inter-coder reliability when matching a set of potential LRs with their LR definition to finally derive the set of LRs to be analysed.

3.1.2 Analysis of Direct Knowledge Development of Literature Reviews

The identified LRs need to be coded with regard to their type(s) of direct knowledge development (see Table 1 and **Figure 1**): synthesizing, theory building, theory testing, criticizing, identifying research gaps, and providing a research agenda. In Appendix B, we provide several examples for each of the six types of knowledge development. However, as the knowledge development can hardly be described by formal specifications, there remains room for subjective interpretations. For example, while some researchers may require a section dedicated to the identification of research gaps, including a lengthy discussion, other researchers may have less rigorous expectations and consider it sufficient to find the identifications of research gaps integrated in the synthesis of the LR. We recommend that, similar to the identification of LRs, a team of researchers should apply a multi-coder procedure (Neuendorf 2002). This procedure may be based on a coding scheme that specifies guidelines on how to deal with cases in which the occurrence of a type of knowledge development may be unclear. Drawing on the above example, such a guideline could

specify the expectations of the researchers on the existence of a section dedicated to the identification of research gaps.

3.1.3 Citation Analysis

A forward search is conducted for each LR to obtain a list of papers which have cited the respective LR. Some providers of literature databases, including Google Scholar and Web of Science, offer a forward search function. With this step, we explicitly integrate citation analysis in our methodology. When the number of identified articles that cite a LR becomes too large for a manual analysis, researchers may want to select a sample instead. This sample can be determined by a range of procedures, including randomized sampling, quota sampling, or applying a journal filter.

3.1.4 Analysis of Indirect Knowledge Development of Literature Reviews

The last step involves the coding of how knowledge created in a LR is used in citing papers to create new knowledge. For each of the citing papers, it needs to be analysed which type of direct knowledge development of the cited LR are used in which way (indirect knowledge development of a LR). For this analysis, Table 2 provides possible pairs of direct and indirect knowledge development, including examples; further examples are provided in Appendix B. From an operational perspective, the analysis of how a paper enhances knowledge created in a cited LR proceeds at the syntactic and the semantic level, which are the two categories of citation context (Kaplan et al. 2016; Wan and Liu 2014a; Zhang et al. 2013). At the syntactic level, all appearances of citations of the LR need to be located in the body and the appendices of the citing paper; such appearances have been termed “citation mentions” (Wan and Liu 2014b). At the semantic level, the context of each of the citation mentions needs to be analysed with regard to how the citing paper makes use of the (types of) direct knowledge development of the cited LR.
The analysis of how a citing paper enhances knowledge created in a LR needed to be conducted manually as we were not aware of any procedure or tool that is capable of performing this challenging semantic analysis automatically. Similar to step 2, we therefore recommend the application of a multi-coder procedure (Neuendorf 2002) based on a coding scheme that provides guidelines that describe how to identify the type of use of a knowledge development of a LR in a citing paper.

3.2 Relationships Between LRs and Citing Papers

The integration of citation analysis into our methodology for the analysis of knowledge impact requires a discussion of phenomena that may occur when the citation of a LR A by a paper B is considered a necessary precondition for any knowledge impact that paper A has on paper B. These phenomena can be approached by acknowledging that the relationship between a LR and a citing paper can be of any of the following four types:

1. A paper cites a LR and explicitly describes how the knowledge created in the LR is used. The manual content-related analysis of both LRs and citing papers allows us to identify such relationships.
2. A citing paper uses the knowledge created in a LR but does not cite it. If this case occurs (accidentally or deliberately), our citation-based analysis is not capable of identifying the citing papers.
3. A citing paper does not use the knowledge created in a LR although it cites the LR. As in the first case, our manual analysis of both LRs and citing papers allows us to identify such relationships.
4. A citing paper does not use the knowledge created in a LR and does not cite this LR. This does not cause problems as the use of a LR by a citing paper is not assumed.

The discussion of the four cases shows that, from a knowledge perspective, while we might underestimate the impact that a LR has had on subsequent research, we do not overestimate it. Although our approach is based on citation analysis, our qualitative procedure allows us to identify and thereby substantially mitigate the issues of citation analysis as they are described in the introduction.[1]

4 Exploratory Study in the IS Business Value Domain

We apply the methodology to a sample domain in IS to demonstrate its applicability and illustrate differences between knowledge impact and citation impact of LRs. We choose to analyse the IS business value domain, which deals with the economic impact of information systems, for two reasons. First, it is a well-established and one of the most important domains in IS (Dehning et al. 2004; Schryen 2013) and it has matured and attracted a substantial number of LRs, which have received considerable high numbers of citations. This large body of literature is promising with regard to the identification of diverse sets of types of direct and indirect knowledge development. Second, the authors have gained experience with this domain over many years. In the remainder of this section, we describe how we apply the suggested methodology to this domain before we continue to present the results and derive implications regarding the differences between knowledge impact and citation impact. We argue that these implications are not limited to the sample domain but hold for the distinction between the two types of scientific impact in a more general context.

4.1 Application of Methodology

4.1.1 Identification of Literature Reviews

We consider those LRs in the IS business value domain which have been published between 1990 and 2010; we do not consider LRs published more recently because it takes a few years until they will have substantially stimulated subsequent research. Comprehensive lists of LRs on IS business value have been already identified in earlier works of the authors. We refer to these 41 LRs as *candidates* (cf. Table A1 in Appendix A.1). Two of the authors jointly analysed whether the candidates (1) focus on IS business value, (2) are compliant with the LR definition, and (3) are written in English. Applying the third criterion accounts for potential language-based effects on knowledge and citation impact. After the exclusion of 19 candidates (cf. Table A1, Appendix A.1), the final list contains 22 LRs.

4.1.2 Analysis of Direct Knowledge Development of Literature Reviews

Two authors analysed and coded the types of direct knowledge development of each LR. Inter-coder reliability was consistent with kappa statistics above 0.8 (Cohen's Kappa); disagreements were reconciled by the third author. The results of the coding process are summarized in Table A2 in Appendix A.2 and are presented for each of the 22 LRs in more detail in Appendix B.

4.1.3 Citation Analysis

To identify citing papers, we conducted a forward search for each of the LRs based on Google Scholar and Web of Science (between November 15th and 18th , 2016). Our search revealed that the 22 LRs have attracted a high level of citation impact (with 30,000 citations overall).
In the presence of an exceedingly high number of total citations, we needed to select a sample of citing papers since the analyses of indirect knowledge development needed to be conducted manually. We

decided to select papers that have been published in a journal included in the Senior Scholars' Basket of Journals ("BASKET-8"), which is widely acknowledged as a collection of top journals in the IS field and recognizes *topical, methodological, and geographical diversity* (AIS 2011). As Table A3 in Appendix A.2 shows, the distributions of citations over all LRs do not vary substantially when we compare the datasets of Google Scholar and BASKET-8.
The application of the BASKET-8 criterion reduced the number to 1,302 papers. We manually checked each of these papers to verify whether they actually cite at least one of the 22 LRs. We removed 74 erroneously listed papers, resulting in an overall set of 1,228 citing papers published in the BASKET-8. Further details of the citation analysis can be in Appendix A.3.

4.1.4 Analysis of Indirect Knowledge Development of Literature Reviews

At the syntactic level of citation context, we used text mining tools (GROBID, https://github.com/kermitt2/grobid) to automate the identification of those locations in citing papers where LRs are cited (identification of citing mentions); in cases in which an automated analysis failed, we manually searched for the citing mentions. At the semantic level, we used the context of the abovementioned locations to manually analyse each of the 1,228 citing papers with regard to how they enhance knowledge created in the 22 LRs. To ensure reliable results, we implemented a (multiple-phase) coding process (details are provided in Appendix A.4). A description of the direct and indirect knowledge development of each LR is provided in Appendix B.

4.2 Results

We report the findings of the analyses of citation impact and knowledge impact. The two types of results represent the basis for our discussion of the scientific impact of LRs in the sample domain in terms of citation and knowledge impact. We focus particularly on the differences between citation and knowledge impact.

4.2.1 Analysis of Citation Impact

Overall, the 22 LRs have attracted 1,228 citations in the BASKET-8 (cf. Table A3, Appendix A.2). A graphical representation of citation relationships between the most often cited LRs and citing papers is provided in **Figure 2** (displaying LRs with more than ten knowledge-based citations).

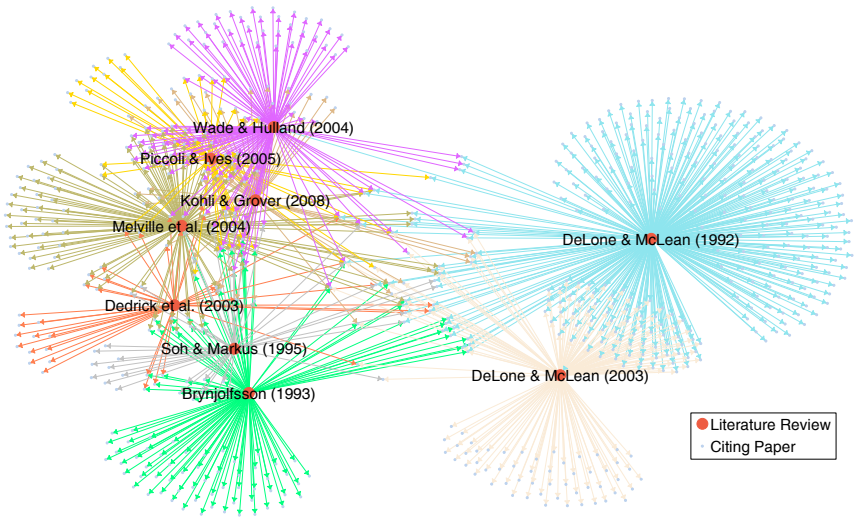


Figure 2. Citation Network: Highly Connected but Without Insights into Knowledge Impact

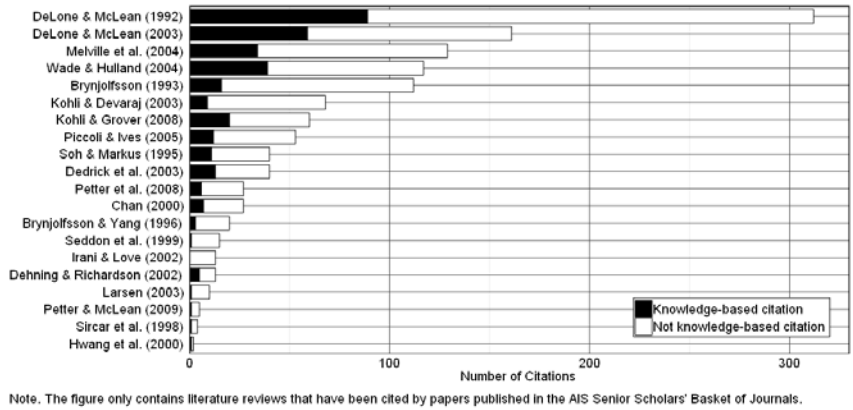
The results of the citation analysis reveal that the numbers of citations LRs have attracted vary substantially. **Figure 2** visualizes these results and shows that the network of citations represents a highly-connected graph which does not have striking clusters of citation relationships. It needs to be stressed that this figure only displays citations to LRs and does not inform us on whether they have been used in terms of knowledge development. In this regard, the connections between LRs and citing papers (as they have been identified through citation analysis) remain black boxes. To turn these black boxes into white boxes, we proceed by analysing the underlying knowledge impact.

4.2.2 Analysis of Knowledge Impact

To illustrate the knowledge impact of LRs in terms of direct and indirect knowledge development, we adopt both qualitative and quantitative perspectives. First, we analyse discuss knowledge impact of LRs across all types of knowledge and compare the results with citation impact (cf. implications 1 and 2). Then, we disaggregate the results along the types of knowledge development and compare citation and knowledge impact at this level (cf. implications 3 and 4).

Figure 3 contrasts the *knowledge-based citations* with those that are *not knowledge-based*. The figure indicates that a substantial fraction of citing paper does not further enhance knowledge of the cited LR. For example, papers refer to LRs (1) as exemplars for their genre (e.g., Grover and Lyytinen 2015), (2) to highlight the relevance of IT business value research (e.g., Bharadwaj 2000), or (3) to justify their methodological approach (e.g., Gerow et al. 2014). Focusing on LRs that have attracted at least 20 citations by BASKET-8 papers, this analysis reveals that the corresponding ratios at the LR level vary between 13% (Kohli and Devaraj 2003) and 37% (DeLone and McLean 2003); i.e., the relative knowledge impact of the more often cited review is three times as high as that of the less cited review. To sum up, we conclude with

Implication 1: Overall citation impact of LRs is not a suitable indicator for the extent to which LRs have stimulated knowledge impact.



Note. The figure only contains literature reviews that have been cited by papers published in the AIS Senior Scholars' Basket of Journals.

Figure 3. Knowledge-based Citations vs. Overall Citations

To identify clusters of knowledge-based citations, we removed all those citations from the citation network that are not knowledge-based. The resulting network of knowledge impact is shown in **Figure 4**. It reveals the existence of knowledge-based citation clusters, which are not evident from the overall citation network. The visualization demonstrates the existence of two clusters related to the reviews of DeLone and McLean (1992, 2003), which are more strongly connected to each other than to other (knowledge-based) citation clusters. From the graphical representation we identify five additional clusters, with one cluster being related to the reviews of Kohli and Grover (2008), Wade and Hulland (2004) and Piccoli and Ives (2005), and four other clusters being related to the reviews of Brynjolfsson (1993), Dedrick et al. (2003), Melville et al. (2004) and Soh and Markus (1995), respectively.

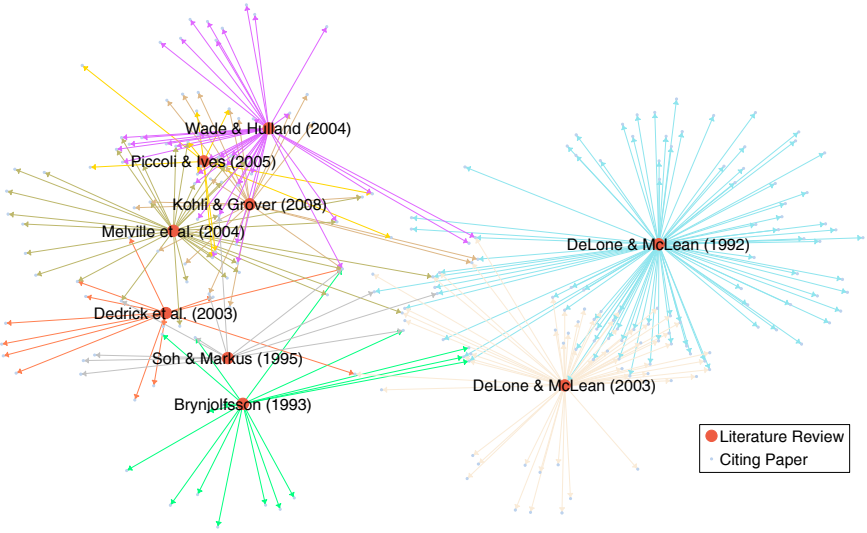


Figure 4. Knowledge-impact Network: Less Connected but showing Knowledge Impact

The identification of knowledge-based citation clusters reveals that, in the IS business value domain, knowledge created through LRs does not spread broadly in the whole body of the domain literature. Instead, the propagation of knowledge created by LRs focuses on parts of the overall citation network. This result shows less connected graph and suggests that the scientific impact of LRs in terms of knowledge impact does not spread in the entire body of the domain literature as broadly as assumed when only citation analysis is conducted. Thus, we derive the following implication:

Implication 2: Knowledge-impact clusters can be hidden in overall-citation networks. Our methodology can uncover such knowledge-based clusters, which can differ from those identified by citation analysis.

After deriving implications at the overall level of LRs, we now conduct an analysis that distinguishes between the granular types knowledge development. In **Figure 5**, the knowledge development of all LRs is disaggregated along the types of direct and indirect knowledge development (see Table 2), with the size of the nodes corresponding to the absolute frequencies of the knowledge types (Table A6, Appendix A.4, provides detailed figures).

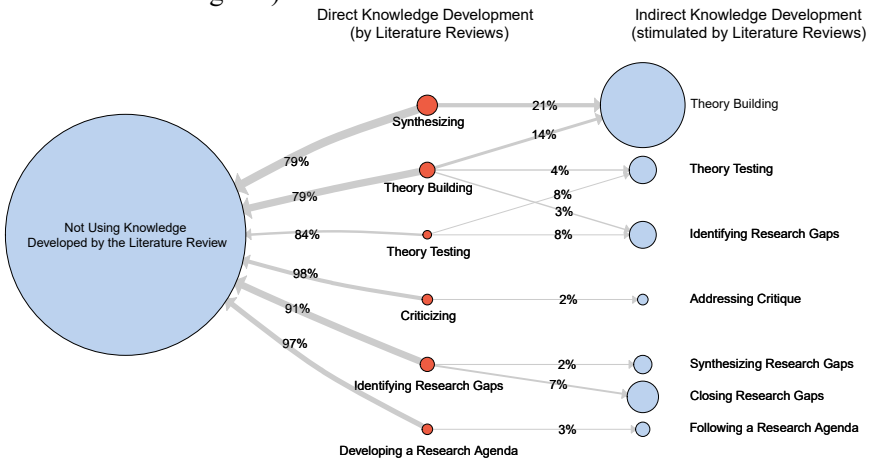


Figure 5. Types of Knowledge Impacts of LRs

The results show that a small fraction of citing papers further enhance the knowledge developed by a review. For example, the results of the syntheses of LRs have been used in only 21% of the citing papers to build theories (e.g., Ravichandran et al. (2009) use the LR of Brynjolfsson (1993) to integrate temporal lag effects in their theoretical contributions) while 79% have not engaged with the direct knowledge contributions of the LR.

Similarly, theories suggested in LRs have been used for enhanced theory building, theory testing, and identifying research gaps in 14%, 4% and 3% of all citation relationships, respectively. For example, DeLone and McLean (2003) build on the original IS success model (DeLone and McLean 1992) and propose several refinements in their 10-year update; and Torkzadeh et al. (2011) refer to the theoretical link between system usage and individual performance, which was proposed by DeLone and McLean (1992), and suggest that trying to understand how the use of technology affects work practices presents a significant research gap.

Insights gained from theory testing have also been hardly used in subsequent research. Two of the few exceptions are the works of Sabherwal and Jeyaraj (2015), who provide a substantial update of Kohli and Devaraj's (2003) meta-analysis and test how information technology impacts firm performance, and Yen et al. (2015), who refer to Petter et al. (2008) when identifying a lack of studies focusing on service quality.

The identification of research gaps in LRs has been used overall in only 9% of all affected citation relationships. For example, Schryen (2013) draws on the research gaps suggested by Brynjolfsson and Yang (1996), and Dedrick et al. (2003) to develop a comprehensive view of open research challenges.

Criticizing and the development of a research agenda has stimulated even lower amounts of follow-up knowledge development: Only 2% of the citing papers have engaged with the critique of the cited LR. For example, Dedrick et al.'s (2003) critique regarding the neglect of lag effects and small-firm samples has been addressed by Fairbank et al. (2006). Similarly, research agendas have been followed by only 3% of

the citing papers. For example, the research guidance provided by Kohli and Grover (2008) has been adopted by Coltman et al. (2015).
In summary, the results shown in **Figure 5** reveal that only a very small fraction of papers that cite LRs enhance the knowledge created in the LRs. Some types of knowledge created by LRs have not been used at all by the citing papers (cf. Table A6). **Figure 5** also suggests a strong emphasis towards theory building, which is based on the synthesis of knowledge and/or theory building of LRs. These insights are opposed to the results related to the highly-connected citation network that results from pure citation analysis, suggesting a much more comprehensive and diverse scientific impact of LRs on subsequent research. As a whole, we derive the following implication:

Implication 3: Citation analysis obscures the extent to which knowledge contributions of LRs have stimulated subsequent research; knowledge-based citation analysis can uncover the prevalence of different types of knowledge impact.

Next, we disaggregate the results to unfold the knowledge impact at the LR level (focusing on LRs that have attracted at least 20 citations by BASKET-8 papers). This disaggregation allows us to compare citation impact with knowledge impact (disaggregated along all types of indirect knowledge development). Interestingly, the results reveal that those LRs which have attracted the highest numbers of citations have been mainly used in subsequent research for activities related to theory building (cf. Table A6). The other types of knowledge created by these LRs have hardly been exploited.
The LRs, which have attracted fewer citations, show a more diverse enhancement of their knowledge developments in terms of which types were used in which way in subsequent research (diversity of indirect knowledge development, cf. Table A5). These exceptions show that, although there seems to be a correlation between the number of overall citations and the level of diversity of indirect knowledge development of LRs, the number of overall citations is not a reliable indicator for the level of this diversity. A content analysis of the LRs that show a low level of diversity if knowledge-based use reveals that three out of the seven reviews focus on the DeLone and McLean model (DeLone and McLean 1992, 2003; Petter and McLean 2009), two reviews adopt the Resource-Based View (Melville et al. 2004; Wade and Hulland 2004), and one review (Soh and Markus 1995) focuses on the suggestion of a process theory. Although all these reviews have been used for knowledge development other than theory building, their focus lies on theoretical artefacts, which may explain why they are mainly used for theory building. Overall, we conclude with

Implication 4: Analyses of knowledge impact can identify a variety of indirect knowledge developments and reveal untapped potential for future research to enhance knowledge developed by LRs.

5 Discussion

The results of our study demonstrate how analyses of citation and knowledge impact can lead to different pictures of the impact of LRs. They show that it is reasonable to challenge the assumption that citations indicate knowledge impact. Thereby, our study does not only illustrate the applicability of the suggested methodology, but it also makes explicit what the conceptual distinction between *citation impact* and *knowledge impact* of published articles means from an empirical perspective. From our empirical findings, we derive general implications for LRs, which are an important genre for condensing and developing knowledge.

We argue that a knowledge perspective on LRs (and on research articles in general) represents an approach which is particularly valuable in science, considering that its overarching goal is to advance knowledge. In our discussion we position analyses of knowledge-impact and our methodology for the genre of LRs in the broader debate on the scientific impact of research articles.

We acknowledge that scientific impact is a multi-dimensional construct (Lowry et al. 2013), which includes citation impact and knowledge impact. Our argument is not that the knowledge-based perspective and the application of our methodology should substitute citation analysis but rather complement it to achieve a more comprehensive picture of scientific impact. This recommendation aligns with the "The Leiden Manifesto for research metrics" (Hicks et al. 2015), which states that *"we have watched with increasing alarm the pervasive misapplication of indicators to the evaluation of scientific performance"* (p. 430) and that *"[r]eading and judging a researcher's work is much more appropriate than relying on one number."* (p. 431) In this regard, one method is not superior to the other, but both should be applied carefully, and their results should be interpreted appropriately.

5.1 Comparison of Citation Impact and Knowledge Impact

Our empirical study and its implications demonstrate that the number of citations of a LR is not a suitable indicator for the extent to which knowledge created in a LR has stimulated or enabled enhancements of this knowledge in subsequent research. At first sight, overall correlations between citations and knowledge impact may suggest that the prior provides an appropriate indicator variable for the latter. When removing highly cited LRs, i.e., influential observations, however, citation impact and knowledge impact, are only moderately or weakly correlated. Consequently, citation scores are not an appropriate indicator of subsequent knowledge development for many rarely cited LRs. This insight – although based on a small sample – suggests that contrary to conventional knowledge, citation impact and knowledge impact may not be related. As a consequence, when being interested in the knowledge impact of a LR, it is necessary to go beyond pure citation analysis. To get such a (knowledge-based) picture of the scientific impact of LRs, we recommend the application of our methodology.

However, when limiting the analysis to particular types of knowledge impact, other types are neglected. For example, the cited authors of the LR may have created an especially useful and succinct definition, identified a powerful motivation, proposed an interesting methodological approach, etc. In general, citations can have various functions (Moravcsik and Murugesan 1975; Small 1978; Voos and Dagaev 1976).

5.2 Recommendations

In line with our analysis of different facets of knowledge development that constitute a critical dimension of scientific impact, we derive recommendations for authors, evaluation committees and editorial boards of journals. Overall, we argue that analyses of knowledge impact and analyses of citation impact should not be seen as competing alternatives but as complementary approaches with different *goals*, *methodologies*, *advantages* and *limitations*. However, current practice shows that this diversity is rarely appreciated when the scientific impact of scholars, organizational units (departments, schools, universities, etc.), journals and scholarly communities are evaluated only in terms of quantitative metrics (Hicks et al. 2015), such as the *h*-index. The results of the (evaluation processes of) scientific impact have far reaching consequences: For example, scholars are evaluated with regard to promotion, salary and research grants; academic institutions with regard to global rankings (e.g., Shanghai Ranking, Times Higher Education World University Rankings), and journals with regard to their impact factors.

In the light of these consequences, our empirical findings provide strong justifications for the need to evaluate the scientific impact of LRs (and research articles in general) not only in terms of citation impact

but also with regard to knowledge impact. While we acknowledge that adhering to quantitative metrics seems to be attractive for a variety of reasons, including the advantage of simple automatization, we advocate the integration of knowledge-based citation analysis in scientific evaluation processes not only for LRs but also for other types of research articles. We therefore provide recommendations and envision some changes in scientific processes that are related to the (evaluation of the) scientific impact of research articles in general and LRs in particular.

Some researchers monitor the impact of their research articles in terms of citations, as they can be retrieved from Google Scholar or Web of Science. Other widely used instruments include measures of visibility in academic social networks, such as Research Gate and Academia.edu. Authors may want to go a step further by identifying and documenting how their work has affected knowledge development in subsequent research by tracing citations of their work, reading the citing paper and classifying the knowledge impact. For example, authors of LRs may find their proposed theory extended, tested or confirmed, the research gaps they identified closed, and their critiques on past literature findings acknowledged in articles of well-known senior scholars. Documenting this impact in academic social networks, in academic CVs or on professional websites allows highlighting an author's research success and increasing an author's reputation beyond pure citation counts.

Evaluation committees consider a scholar's scientific impact as a key component when they make decisions on researchers' career steps and provide recommendations for salary negotiations and research grants. The range of criteria that can be applied by evaluation committees is large and may distinguish a researcher's output from his/her scientific impact, which is multi-dimensional and includes, inter alia, the *numbers of citations* and the degree to which his/her research output serves as a *basis for the research of others* (Lowry et al. 2013). The development and dissemination of knowledge is undoubtedly such a *basis for others' research*. Thus, we recommend that evaluation committees account for this role of knowledge impact as an important type of scientific impact by applying the suggested methodology to determine the knowledge impact of scholars' works when evaluating their research contributions. While our methodology identifies knowledge contributions for LRs, we encourage further discourse on the knowledge contributions of other genres.

Editorial boards of journals may also consider insights from our study and apply the suggested methodology. Identifying and documenting the knowledge impact that articles can inform scientific communities on the knowledge impact of their journal and build up scientific reputation beyond the reputation based on purely quantitative impact factors. In particular, editorial boards of journals open or even dedicated to publishing LRs, such as the *European Journal of Information Systems* in the information systems field, *ACM Computing Surveys* in the computer science field, or the *International Journal of Management Reviews* in the management field can draw on our methodology to evaluate the knowledge impact of LRs published in their journal.

5.3 Efficiency and Automatization

Despite the benefits of evaluating a scholars' scientific impact in terms of knowledge impact, we also acknowledge that the application of the suggested methodology is more time consuming than a purely scientometric evaluation. While step no. 1 is unlikely to be time-consuming as a list of LRs to be evaluated is usually given, and step no. 3 can be largely automated or delegated, the content analyses in steps 2 and 4 are more challenging. We expect that, in the near future, these analyses still require reading and manually coding LRs and citing papers. The analysis of (direct knowledge development through) LRs should be practicable in a reasonable time when the number of LRs is low, as is usually the case when authors evaluate themselves or are evaluated by scientific evaluation committees. However, when the number of LRs becomes large, as may be the case when all LRs published in particular journal need to be evaluated, we expect that a "coding backlog" for already published LRs is created and addressed over time, if

possible. In any case, the publication of future LRs in a journal can be accompanied by enriching the publication record of the LR with (meta) information on knowledge development through the submitted LRs supported by already involved reviewers, who can be asked to explicitly specify (types of) knowledge development in their evaluation sheets.

Considering that large parts of the syntactic level can be automated, the semantic level of step 4, which involves content analysis of citing papers, is the most critical in terms of efficiency. Table A3 in Appendix A.2 demonstrates that the number of citations to LRs can easily amount to several hundreds or thousands of citations, in which case, for practical reasons, a sample needs to be determined. In our empirical analysis, we selected a set of eight prominent journals. We recommend that, similar to our study, evaluators focus on a set of publication outlets which seem of particular relevance in the context of the evaluation. However, we admit that the analysis of LRs and citing papers does not scale well when it has to be done entirely manually. This observation is in line with the conclusion of Swales (1986), who argues that *"[…] a general retreat to the retrospections of individual authors is very much a counsel of despair, in that it will inexorably make the findings of [citation content analysts] both highly labor-intensive and very small scale"*. (p. 44) We envision the application of (semi)automated content analysis based on advances in natural language processing (NLP) (Ding and Stirling 2016; Ding et al. 2014; Larsen and Bong 2016). An NLP-based approach recently proposed by Prester et al. (2018) applies machine learning classifiers to identify and classify knowledge development in research articles that are based on knowledge developments in cited LRs; i.e., these classifiers identify indirect knowledge development of LRs. While this stream of research is still at an early stage, it shows promising avenues for the (semi-)automated knowledge-based citation analysis, which would avoid labor-intensive manual coding and make our suggested methodology more scalable.

5.4 Limitations and Future Research

Our study has some limitations, which provide avenues for further research. The conceptualization of knowledge development does not distinguish different epistemological research paradigms, such as positivism and interpretivism (Chen and Hirschheim 2004). Future epistemological research may adopt these paradigms and develop as well as compare paradigm-specific models of knowledge development.

Furthermore, the proposed methodology considers knowledge developments of the LR genre. Albeit being applicable to other genres in principle, the methodology would need to be customized in terms of knowledge conceptualizations for the targeted genre. The development of knowledge concepts for other genres, such as empirical case studies, formal model developments, and computational experiments, would make the suggested methodology practically applicable to a broader set of research articles that need to be evaluated from a knowledge perspective.

6 Conclusion

Accounting for the widely acknowledged limitations of citation analyses, we suggest a methodology for analysing the knowledge impact for the genre of LRs. Its focus on the LR genre is based on the conceptualization of knowledge development through reviews; however, developing analogous conceptualizations for other genres would make the methodology empirically applicable to these genres as well.

The suggested methodological procedure consists of four steps, the application of which we demonstrate in a sample literature study in the IS business value domain. Our results of this empirical study lead to the derivation of implications for the distinction between knowledge impact and citation impact in the overall

LR genre. The implications underline the challenge of the assumption that citations indicate scientific impact.

To make the suggested methodology practically beneficial for scholars, we develop recommendations for authors of LRs, scientific evaluation committees and editorial boards of journals how to apply and benefit from the suggested methodology. Our discussion of the efficiency and automatization of the suggested methodology shows that recent advances in the field of natural language processing offer promising avenues for making the methodology large-scale applicable.

Notes

1. We acknowledge that our measurement-based approach is limited as it does not include interviews with or observations of authors. In this regard, MacRoberts and MacRoberts (1996) note: „If one wants to know what influence has gone into a particular bit of research, there is only one way to proceed: head for the lab bench, stick close to the scientist as he works and interacts with colleagues, examine his lab notebooks, pay close attention to what he reads, and consider carefully his cultural milieu." (p. 442).

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Appendix A: Methodology

A.1 Identification of Literature Reviews

Literature reviews were identified by Anonymous (2010), who performed a title search in the journal databases *Business Source Premier, MLA International Bibliography, EconLit, ScienceDirect, IEEE Xplore*, the *ACM Digital Library*, and *Web of Science*. The logical search string was *("information technology" OR "information systems") AND ("value" OR "investment" OR "productivity" OR "competitive" OR "performance" OR "measurement" OR "evaluation" OR "profit" OR "efficiency").* Schryen (2010a) further scanned the table of contents of the following journals: *Academy of Management Review, ACM Transactions on Information Systems, American Economic Review, Communications of the ACM, European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of Management Information Systems, Journal of the AIS, Management Science, MIS Quarterly*, and *WIRTSCHAFTSINFORMATIK*. The search period starts with 1989, the end of the period is not provided.

Anonymous (2010) performed a title search with a similar search string: *("IT" OR "information technology" OR "IS" OR "information systems") AND ("value" OR "investment" OR "productivity" OR "competitive" OR "performance" OR "measurement" OR "evaluation" OR "profit" OR "efficiency").* The author applied the search string to the above set of literature databases on 1 June 2008 without limiting the search period. The author also searched the table of contents of the abovementioned journals for the period January 1995 until May 2008 and he scanned the conference proceedings of the *International Conference on Information Systems* (1994-2008) using the *AIS Electronic Library (AISeL).*

Anonymous (2013) updated the search of Anonymous (2010) by applying the same search string to the same set of literature databases (update was conducted on 13 January 2012). The author searched the table of contents of a similar set of journals (*WIRTSCHAFTSINFORMATIK* was removed and *Organization Science* was added) for the period January 1995 until December 2011.

Anonymous (2015) searched the table of contents of the 40 journals included in the list of Lowry et al. (2013). The search period was 2000 until 2014. The search was not limited to a particular domain. From the list of papers that are related to IT business value, we added those to our provisional list which could be considered a LR.

Reference	*Included (reason for exclusion)*
Bannister & Remenyi (2000)	No (no standalone review)
Brynjolfsson (1993)	Yes
Brynjolfsson & Yang (1996)	Yes
Carter (2010)	No (no standalone review)
Chan (2000)	Yes
Chan & Reich (2007)	No (no focus on IS business value)
Chatfield et al. (2014)	No (outside temporal scope)
Chau et al. (2007)	No (no standalone literature review, no focus on domain knowledge)
Dedrick et al. (2003)	Yes
Dehning & Richardson (2002)	Yes
DeLone & McLean (1992)	Yes
DeLone & McLean (2003)	Yes
Demirhan (2004)	No (no focus on IS business value)
Devaraj & Kohli (2000)	No (no standalone review)
Fichman (2004)	No (no focus on IS business value)
Hwang et al. (2000)	Yes
Hwang (2014)	No (outside temporal scope)
Irani & Love (2002)	Yes
Kauffman & Weill (1989)	No (outside temporal scope)
Kauffman & Walden (2001)	No (no focus on IS business value)
Kohli & Devaraj (2003)	Yes
Kohli & Grover (2008)	Yes
Larsen (2003)	Yes
Melville et al. (2004)	Yes
Paré et al. (2008)	No (no focus on IS business value)
Petter et al. (2008)	Yes
Petter & McLean (2009)	Yes
Petter et al. (2013)	No (outside temporal scope)
Piccoli & Ives (2005)	Yes
Potthof (1998)	No (published in German)
Roztocki & Weistroffer (2008)	No (no focus on IS business value)
Schryen (2010)	Yes
Schryen (2013)	No (outside temporal scope)
Seddon et al. (1999)	Yes
Seddon (2014)	No (outside temporal scope)

Sircar et al. (1998)	Yes
Soh & Markus (1995)	Yes
Sylla & Wen (2002)	No (no focus on IS business value)
Wade & Hulland (2004)	Yes
Walter & Spitta (2004)	Yes
Wan et al. (2007)	No (no standalone review, as no focus on domain knowledge)

Table A1. IS literature review candidates (on IS business value)

A.2 Analysis of Direct Knowledge Development of Literature Reviews

Literature review	*SYN*	*TB*	*TT*	*CRI*	*RG*	*RA*
Brynjolfsson (1993)	X	X		X	X	
Brynjolfsson & Yang (1996)	X			X	X	
Chan (2000)	X				X	
Dedrick et al. (2003)	X	X		X	X	X
Dehning & Richardson (2002)	X	X			X	
DeLone & McLean (1992)	X	X				
DeLone & McLean (2003)	X	X			X	
Hwang et al. (2000)	X	X	X			
Irani & Love (2002)	X	X				
Kohli & Devaraj (2003)	X		X			
Kohli & Grover (2008)	X				X	X
Larsen (2003)	X	X			X	X
Melville et al. (2004)	X	X			X	X
Petter et al. (2008)	X		X			
Petter & McLean (2009)	X		X			
Piccoli & Ives (2005)	X	X		X	X	X

Schryen (2010)	X					
Seddon et al. (1999)	X	X		X		
Sircar et al. (1998)	X			X		
Soh & Markus (1995)	X	X				
Wade & Hulland (2004)	X				X	X
Walter & Spitta (2004)	X	X				
SYN: Synthesizing, TB: Theory building, TT: Theory testing, CRI: Criticizing, RG: Identifying research gaps, RA: Providing a research agenda						

Table A2. IS literature reviews (on IS business value) and their types of knowledge development

Literature review	*Google Scholar*	*Web of Science*	*BASKET-8*
Brynjolfsson (1993)	2,891 (9 %)	261 (8 %)	112 (9 %)
Brynjolfsson & Yang (1996)	740 (2 %)	not available	20 (2 %)
Chan (2000)	391 (1 %)	71 (2 %)	27 (2 %)
Dedrick et al. (2003)	956 (3 %)	149 (5 %)	40 (3 %)
Dehning & Richardson (2002)	405 (1 %)	not available	13 (1 %)
DeLone & McLean (1992)	9,473 (30 %)	not available	312 (25 %)
DeLone & McLean (2003)	7,202 (23 %)	1,174 (36 %)	161 (13 %)
Hwang et al. (2000)	40 (0 %)	not available	2 (0 %)
Irani & Love (2002)	274 (1 %)	53 (2 %)	13 (1 %)

Kohli & Devaraj (2003)	614 (2 %)	148 (5 %)	68 (6 %)
Kohli & Grover (2008)	636 (2 %)	143 (4 %)	60 (5 %)
Larsen (2003)	164 (1 %)	30 (1 %)	10 (1 %)
Melville et al. (2004)	2,530 (8 %)	469 (14 %)	129 (11 %)
Petter et al. (2008)	1,007 (3 %)	164 (5 %)	27 (2 %)
Petter & McLean (2009)	367 (1 %)	70 (2 %)	5 (0 %)
Piccoli & Ives (2005)	569 (2 %)	127 (4 %)	53 (4 %)
Schryen (2010)	34 (0 %)	2 (0 %)	0 (0 %)
Seddon et al. (1999)	541 (2 %)	not available	15 (1 %)
Sircar et al. (1998)	33 (0 %)	not available	4 (0 %)
Soh & Markus (1995)	700 (2 %)	not available	40 (3 %)
Wade & Hulland (2004)	2,009 (6 %)	399 (12 %)	117 (10 %)
Walter & Spitta (2004)	88 (0 %)	9 (0 %)	0 (0 %)
Sum	31,664 (100%)	3,269 (100%)	1,228 (100%)

Table A3. IS literature reviews (on IS business value) and their citations

A.3 Citation Analysis

To identify papers which cite one or more of the identified 22 LRs, we conducted a forward search for each of the LRs based on Google Scholar using the software "Harzing's Publish or Perish" (version 5.23.0.6142), and on Web of Science (Core Collection); we searched during the period November 15-18, 2016. The advantage of Google Scholar is the much more comprehensive coverage of citing papers (see Table A3); however, Google Scholar shows more severe issues with data quality than Web of Science (Core Collection) in terms of correctness and completeness of data included in the provided references. We identified an overall number of 31,664 citations (mean = 1,439, median = 591, standard deviation = 2,333, coefficient of variation = 1.62) that the LRs have attracted. The above figures already show the high level of attention that LRs have attracted in terms of *use*. They also show pronounced differences in the number of citations that LRs have attracted.

In the presence of an exceedingly high number of total citations (overall 31,664), we needed to select a sample of citing papers. We decided to select papers that have been published in a journal included in the Senior Scholars' Basket of Journals, which we refer to as "BASKET-8" in this paper. As Table A3 shows, the distributions of received citations over all LRs do not vary substantially when we compare the datasets of Google Scholar and BASKET-8.

We filtered the citing papers identified by Google Scholar and Web of Science (for 15 of the 22 LRs that are available on Web of Science) by applying the BASKET-8 criterion. This allowed us to mitigate data issues related to the coverage of publication outlets and correctness of the entries. We removed duplicates and consolidated both sets, yielding 1,302 papers. We manually checked each of these papers to verify if they actually cite the LRs as indicated by the data of Google Scholar and Web of Science, and we removed 74 erroneously listed papers, resulting in an overall set of 1,228 citing papers that are published in the BASKET-8 and that cite at least one of the 22 LRs.

A.4 Analysis of Indirect Knowledge Development of Literature Reviews

We manually analyzed each of the 1,228 citing papers with regard to how they use cited LRs from a knowledge perspective. To ensure reliable results, we implemented a coding process consisting of (1) a training phase, (2) a reliability assessment phase, and (3) an individual coding phase (Neuendorf 2002). The coding was conducted by one of the authors and a master student. During the training phase, all coders analyzed the same set of ten randomly chosen citing papers, which cite an overall number of seven LRs. The purpose of the training phase was to get familiar with the coding scheme and coding protocol[1], to achieve a consistent understanding between the coders and to modify the coding protocol where necessary. In the reliability assessment phase (phase 2), two coders analyzed the same set of 100 randomly chosen citing papers. Inter-rater reliability was measured and results showed that the coding was sufficiently reliable[2] with kappa values (Cohen 1960) above 0.6 (except for TB→RG, for which the sample size was insufficient). A third coder reconciled remaining disagreements. In the final individual coding phase (phase 3), the remaining papers were assigned to two authors using two disjoint individual sets.

[1] Both the coding scheme and the coding protocol used in the exploratory literature study of this article can be received from the authors upon request.

[2] Kappa values: 0.89 (no use related to knowledge development), 0.84 (SYN→TB), 0.72 (TB→TB), 0.66 (TB→TT), 0.49 (TB→RG), 1.00 (TT→TT), 1.00 (TT→RG), 1.0 (CRI→ADDR), 0.73 (RG→CLOSE), 0.66 (RG→SYN), 1.0 (RA→FOLLOW).

	Pairs of types of direct and indirect knowledge development (as conceptualized in Table 2)[a]									
Literature review	*SYN → TB*	*TB → TB*	*TB → TT*	*TB → RG*	*TT → TT*	*TT → RG*	*CRI → ADDR*	*RG → CLOSE*	*RG → SYN*	*RA → FOLLOW*
Brynjolfsson (1993)	13	9	1	2	0	0	3	0	0	0
Brynjolfsson & Yang (1996)	2	0	0	0	0	0	0	2	1	0
Chan (2000)	5	0	0	0	0	0	0	5	0	0
Dedrick et al. (2003)	6	6	2	0	0	0	2	5	1	1
Dehning & Richardson (2002)	4	2	1	1	0	0	0	0	1	0
DeLone & McLean (1992)	82	37	10	10	0	0	0	0	0	0
DeLone & McLean (2003)	47	44	12	9	0	0	0	12	2	0
Hwang et al. (2000)	0	0	0	1	0	0	0	0	0	0
Irani & Love (2002)	0	0	0	0	0	0	0	0	0	0
Kohli & Devaraj (2003)	6	0	0	0	3	4	0	0	0	0
Kohli & Grover (2008)	7	0	0	0	0	0	0	9	7	3
Larsen (2003)	0	1	0	0	0	0	0	0	0	0

Melville et al. (2004)	26	15	2	3	0	0	0	5	2	0
Petter et al. (2008)	3	0	0	0	4	5	0	0	0	0
Petter & McLean (2009)	0	0	0	0	1	0	0	0	0	0
Piccoli & Ives (2005)	9	9	2	3	0	0	0	3	1	0
Schryen (2010)	0	0	0	0	0	0	0	0	0	0
Seddon et al. (1999)	0	0	0	0	0	0	1	0	0	0
Sircar et al. (1998)	1	0	0	0	0	0	0	0	0	0
Soh & Markus (1995)	11	9	2	1	0	0	0	0	0	0
Wade & Hulland (2004)	33	0	0	0	0	0	0	12	3	7
Walter & Spitta (2004)	0	0	0	0	0	0	0	0	0	0
Total	255	132	32	30	8	9	6	53	18	11
Notes: [a] For example, the synthesis (SYN) in the literature review of Brynjolfsson (1993) has been used in 13 citing papers for the purpose of theory building (→TB).										

Table A4. IS literature reviews (on IS business value) and pairs of types of direct and indirect knowledge development

Literature review	*Types of knowledge development in LR but not used in citing papers*[a]	*Proportion of knowledge-based citations to total citations*[b]	
Brynjolfsson (1993)	RG	14 %	(16/ 112)
Brynjolfsson & Yang (1996)	CRI	15 %	(3/ 20)
Chan (2000)	--	26 %	(7/ 27)
Dedrick et al. (2003)	--	32 %	(13/ 40)
Dehning & Richardson (2002)	--	38 %	(5/ 13)
DeLone & McLean (1992)	--	29 %	(89/ 312)
DeLone & McLean (2003)	--	37 %	(59/ 161)
Hwang et al. (2000)	SYN, TT	50 %	(1/ 2)
Irani & Love (2002)	SYN, TB	0 %	(0/ 13)
Kohli & Devaraj (2003)	--	13 %	(9/ 68)
Kohli & Grover (2008)	--	33 %	(20/ 60)
Larsen (2003)	SYN, RG, RA	10 %	(1/ 10)
Melville et al. (2004)	RA	26 %	(34/ 129)
Petter et al. (2008)	--	22 %	(6/ 27)
Petter & McLean (2009)	SYN	20 %	(1/ 5)
Piccoli & Ives (2005)	CRI, RA	23 %	(12/ 53)
Schryen (2010)	SYN	-	(0/ 0)
Seddon et al. (1999)	SYN, TB	7 %	(1/ 15)

Sircar et al. (1998)	CRI	25 %	(1/4)
Soh & Markus (1995)	--	28 %	(11/40)
Wade & Hulland (2004)	--	33 %	(39/117)
Walter & Spitta (2004)	SYN, TB	-	(0/0)
Total			(328/1228)

Notes: [a] For example, the research gaps identified in the literature review of Brynjolfsson (1993) have not been used in any of the citing papers to develop new knowledge. A hyphen (for example, in the case of the literature review of Chan (2000)) indicates that all of the types of knowledge created in this particular literature review have been used in citing papers to develop new knowledge.
[b] For example, the literature review of Brynjolfsson (1993) has been cited by 112 papers in BASKET-8 while 16 of these papers (14.29%) use knowledge created in the literature review to develop new knowledge.

Table A6. IS literature reviews (on IS business value) and their usefulness based on papers published in a journal included in the Senior Scholars' Basket of Journals (BASKET-8)

Appendix B: Knowledge Development in Literature Reviews

In this part of the Appendix, we describe the (types of) knowledge development provided by each LR and how they have been used in subsequent citing papers that have been published in one of the BASKET-8 journals.

Brynjolfsson (1993): The Productivity Paradox of Information Technology

The LR of Brynjolfsson (1993) has attracted more than 2,800 citations (112 citations in BASKET-8) and is one of the most frequently cited LRs in our field. In his seminal review, the author scrutinizes past research and concludes that the alleged productivity paradox is due mostly to deficiencies in measurement and methodology. Furthermore, he identifies research gaps and contributes to theory building through explaining. Some researchers have drawn on the synthesis of the productivity literature in Brynjolfsson (1993) to develop their own theoretical contributions; for example, Francalanci and Galal (1998) and Ravichandran et al. (2009) integrate temporal lag effects on IS business value in their developments, and Schryen (2013) integrates various levels of examination in his synthesized model on IS business value. Other researchers have addressed the critique of Brynjolfsson (1993) by, e.g., addressing several of the identified measurement problems (Barua et al. 1995) or developing new productivity measures (Tallon and Kraemer 2007). The theoretical explanatory contributions provided by Brynjolfsson (1993) have been used by some researchers to develop their own theoretical contributions. For example, Straub et al. (2004) use the literature review to derive measurement items for their study. In only one case the theoretical contributions of Brynjolfsson (1993) have been tested (Kohli and Devaraj 2003); in two cases research gaps have been developed (Mahmood and Mann 2000; Petter et al. 2013). We have not found papers that use the research gaps identified by Brynjolfsson (1993). Overall, 16 out of 112 citing papers (about 14%) have made use of the knowledge developed in the literature review to develop further knowledge.

Brynjolfsson & Yang (1996): Information Technology and Productivity: A Review of the Literature

The succeeding LR of Brynjolfsson and Yang (1996) on IT productivity has also received a remarkably high number of more than 700 citations (20 citations in BASKET-8). In their LR, the authors synthesize literature findings on the relationship between IT and productivity, criticize extant research, and identify existing research gaps. Specifically, Kohli and Devaraj (2003) use the synthesis of Brynjolfsson and Yang (1996) to substantiate effects on IT payoff. The authors also aggregate empirical evidence on various antecedents of IT payoff and thereby address a research gap identified by Brynjolfsson and Yang (1996). Pavlou et al. (2005) and Schryen (2013) draw on the research gaps identified by Brynjolfsson and Yang (1996) to provide a synthesized overview of extant research gaps. There are no papers that address the critique of Brynjolfsson and Yang (1996). Overall, 3 out of 20 citing papers (15%) have made use of the knowledge developed in the literature review to develop further knowledge.

Chan (2000): IT Value: The Great Divide between Qualitative and Quantitative and Individual and Organizational Measures

The literature review of Chan (2000) has exerted a noteworthy impact with 390 citations (27 citations in BASKET-8). The author synthesizes papers on IT value and reveals schisms (1) between the use of measures on the organizational and individual level, and (2) between qualitative and quantitative measures used in IT value research. In particular, the call for more emphasis on theory generation has been answered by several researchers (e.g., Lee and Bose (2002), Nevo and Wade (2011), Santhanam and Hartono (2003) and Tallon and Kraemer (2007)) who simultaneously use the synthesis provided by Chan (2000) for substantiating their contributions to theory building. Overall, seven out of 27 citing papers (about 26%) have made use of the knowledge developed in the literature review to develop further knowledge.

Dedrick et al. (2003): Information Technology and Economic Performance: A Critical Review of the Empirical Evidence

The LR of Dedrick et al. (2003) has attracted almost 1,000 citations (40 citations in BASKET-8). It develops a framework which is used to review the research on IT productivity (building theory for analysis), in order to identify limitations of existing research (criticizing and identifying research gaps) and to discuss areas for future research (developing a research agenda). The synthesis and the framework of IT and economic performance has stimulated subsequent research to theorize from a business process perspective (Baars et al. 2009), and to further conceptualize spillover effects (Han et al. 2011), for example. The framework suggested by Dedrick et al. (2003) has received limited empirical validation, most notably with regard to spillover effects (Tambe and Hitt 2014). Dedrick et al.'s critique regarding the neglect of lag effects and small-firm samples has been addressed by Fairbank et al. (2006) and Tambe and Hitt (2012), respectively. Further, research gaps identified by the review have been closed (e.g., Goh and Kauffman (2013) and Habjan et al. (2014)) with only one paper (Zhu et al. 2004) following the specific agenda outlined by Dedrick et al. (2003). Finally, the research gaps identified in 2003 have been revisited and synthesized 10 years later by Schryen (2013). Overall, 13 out of 40 citing papers (about 33%) have made use of the knowledge developed in the literature review to develop further knowledge.

Dehning & Richardson (2002): Returns on Investments in Information Technology: A Research Synthesis

The LR of Dehning and Richardson (2002) has received more than 400 citations (13 citations in BASKET-8). It develops an explanatory model (theory building), which is used to synthesize research on return on IT investments and to identify areas in which further research is necessary (identification of research gaps). The model developed by Dehning and Richardson (2002) has been used by Melville et al. (2004) and Schryen (2013) to advance the theory. Empirical support for the model is provided by Ranganathan and Brown (2006). With respect to guiding future research, Schryen (2013) uses the gaps identified by Dehning and Richardson (2002) in his research agenda, and derives additional research gaps from the theoretical model. Overall, five out of 13 citing papers (about 38%) have made use of the knowledge developed in the literature review to develop further knowledge.

DeLone & McLean (1992): Information Systems Success: The Quest for the Dependent Variable

The LR of DeLone and McLean (1992) has triggered a tremendous echo in the literature with almost 10,000 citations (312 citations in BASKET-8). This number is remarkably high when acknowledging that a number of 12,000 citations has been sufficient to get ranked in the top 100 of the most cited papers of all times (Van Noorden et al. 2014). DeLone and McLean (1992) suggest a comprehensive taxonomy of IS success (theory for analyzing), which posits six major dimensions: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. The authors use this taxonomy to organize their literature synthesis.

The LR of DeLone and McLean (1992) has been used extensively for theory building (Cenfetelli and Schwarz 2011; DeLone and McLean 2003; Scott et al. 2016; Weill and Vitale 1999) and theory testing (e.g., Petter et al. (2008, 2013) and Wang (2008)) in subsequent research. For example, regarding theory building, Weill and Vitale (1999) base their model of the IS applications portfolio and its health on the dimensions of DeLone and McLean, and DeLone and McLean (2003) propose enhancements to their original model. Teo et al. (2008) extend the model of DeLone and McLean (1992) to the domain of e-government websites, and Nicolaou and McKnight (2006) propose a model for the role of information quality in the success of inter-organizational data exchange based on dimensions proposed in DeLone and McLean (1992). With regard to theory testing, several studies lend empirical support to the DeLone and McLean model of IS success (e.g., Rai et al. (2002) and Wang (2008)) and subsequent meta-analysis (most notably Petter et al. (2008, 2013)) have aggregated the results of ongoing efforts of theory testing. Several authors have used the model of DeLone and McLean (1992) to identify research gaps (Rainer and Watson 1995; Torkzadeh et al. 2011; Wang et al. 2015). For example, Petter et al. (2008) contend that although the model is appropriate for explaining success of utilitarian information systems, it is relatively unknown to which degree it is useful to explain success of hedonic information systems. Focusing on design science research, Prat et al. (2015) argue

that using antecedents of IS success (as theorized in the model) to evaluate artifacts represents a significant research opportunity. Overall, 89 out of 312 citing papers (about 29%) have made use of the knowledge developed in the literature review to develop further knowledge.

DeLone & McLean (2003): The DeLone and McLean Model of Information Systems Success: A Ten-Year Update

With more than 7,200 citations, the updated model of IS success, published a decade later, is on the trajectory to surpass the impact of the original paper in a few years (161 citations in BASKET-8). At first, there may have been doubts concerning the strength of the contribution to knowledge development compared to the original paper. In hindsight, however, not only does the citation impact support the authors' contribution, but so does the higher relative knowledge development which the updated model has stimulated in subsequent research. Beyond the updated model (theory building), the authors also discuss directions for future research (identifying research gaps).

The updated D&M IS success model has been used by several papers which contribute to theory building. The influence on subsequent theorizing efforts ranges from the adoption of constructs (e.g., Chiu et al. (2007), Cooper and Haines (2008) and Sasidharan et al. (2012)), effects, and hypotheses (e.g., Sykes (2015)), to adaptions of the whole model (e.g., Chang and King (2005) and Kulkarni et al. (2007)). In particular, the suggestion to use the model as a framework for explaining success of e-commerce systems has been useful for subsequent theorizing in this context (e.g., Urbach et al. (2010) and Wang (2008)). A plethora of empirical papers are analyzed and aggregated by Petter et al. (2013), while Petter et al. (2012) adopt a qualitative perspective and synthesize unaddressed research challenges (inter alia, those identified by DeLone and McLean (2003)). Among the directions for further research, the call to consider *system use* as a measure for IS success has stimulated several authors to conceptualize the construct of *IS use*, or *effective use* (e.g., Barki et al. (2007), Burton-Jones and Gallivan (2007) and Burton-Jones and Straub (2006)) and to analyze the use (Chi et al. 2010) and its link to performance (Burton-Jones and Grange 2012) empirically. Overall, 59 out of 161 citing papers (about 37%) have made use of the knowledge developed in the literature review to develop further knowledge.

Hwang et al. (2000): Building a Knowledge Base for MIS Research: A Meta-Analysis of a Systems Success Model

The literature review of Hwang et al. (2000) has been cited 40 times (two citations in BASKET-8). The authors synthesize knowledge on systems success in a theoretical model and provide a meta-analysis (theory testing). Of these three contributions, the model has been used in subsequent research. Specifically, Petter et al. (2013) use the model of Hwang et al. (2000) to identify gaps in the breadth and depth of antecedents of IS success. Overall, one out of two citing papers (50%) has made use of the knowledge developed in the literature review to develop further knowledge.

Irani & Love (2002): Developing a Frame of Reference for ex-ante IT/IS Investment Evaluation

The LR of Irani and Love (2002) has been cited more than 270 times (13 citations in BASKET-8) but hardly by papers published in the IS senior scholars' basket of journals, in which it has received only one citation in MISQ, ISR and JMIS papers. The LR presents IS benefit types and associated natures, discusses the resulting implications of using traditional appraisal techniques during the IS planning and decision-making process, develops a frame of reference that can be used to navigate through the variety of appraisal methods, and suggests taxonomies of appraisal techniques (theory building). We did not find any paper published in one of the BASKET-8 journals that has made use of the knowledge developed in the literature review to develop further knowledge (zero out of 13 citing papers, i.e., 0%).

Kohli & Devaraj (2003): Measuring Information Technology Payoff: A Meta-Analysis of Structural Variables in Firm-Level Empirical Research

The LR of Kohli and Devaraj (2003) has attracted a high number of more than 600 citations (68 citations in BASKET-8). It examines the structural variables that affect IT payoff through a meta-analysis of 66 firm-level empirical studies (theory testing). The LR of Kohli and Devaraj (2003) has been used in subsequent

research for theory building (e.g., Melville et al. (2004) and Rai et al. (2012)) and theory testing (e.g., Altinkemer et al. (2011) and Kohli et al. (2012)). The authors contribution to theory testing has enabled subsequent research to identify and pursue research gaps, pertaining to theoretical clarity (Drnevich and Croson 2013) and the need for perceptual measures (Tallon and Kraemer 2007), for instance. Although the absolute impact may appear to be limited, the importance of the meta-analysis of Kohli and Devaraj (2003) is underlined by the fact that it has been updated prominently (Sabherwal and Jeyaraj 2015). Overall, nine out of 68 citing papers(about 13%) have made use of the knowledge developed in the literature review to develop further knowledge.

Kohli & Grover (2008): Business Value of IT: An Essay on Expanding Research Directions to Keep up with the Times

The review of Kohli and Grover (2008) has been cited more than 600 times (60 citations in BASKET-8). The authors provide a synthesis of "*what we know*" about the business value of IT before they discuss "*what we need to know*". To guide further research, Kohli and Grover identify specific research questions and they expand their research agenda to include issues which should be addressed from a cross-theme perspective. The synthesis of Kohli and Grover has influenced context-specific studies, such as Yeow and Huat Goh (2015), who theorize on value expansion in the context of healthcare IT. Beyond the synthesis the research agenda of Kohli and Grover also has had an influence on the literature. The call for further research on the co-creation of value by IT has been answered by Gnyawali et al. (2010), who have used it as a basis for theorizing the co-creation of value through IT-enabled competitive actions, and Rai et al. (2012), who theorized the influence of interfirm communications on value co-creation, for example. The research gaps identified by Kohli and Grover (2008) have received considerable attention with several papers closing them (Gnyawali et al. 2010; Roberts and Grover 2012; Sykes 2015). The research guidance provided by the authors has also resonated with several authors who consider the gaps identified previously in their updated research agendas (synthesis of research gaps) (e.g., Coltman et al. (2015), Grover and Kohli (2012), Sarker et al. (2012) and Schryen (2013)). Overall, 20 out of 60 citing papers(about 33%) have made use of the knowledge developed in the literature review to develop further knowledge.

Larsen (2003): A Taxonomy Of Antecedents Of Information Systems Success: Variable Analysis Studies

The LR of Larsen (2003) has attracted more than 160 citations (ten in BASKET-8). The author develops a taxonomy comprising several categories of IS success antecedents (building theory for analysis), identifies several areas that warrant further research and provides specific recommendations on how corresponding research could be implemented (identifying research gaps and developing a research agenda). In particular, Larsen emphasizes the lack of research that takes into account organizational level variables. Only one of the papers published in BASKET-8 (Chang and King 2005) has used the knowledge (i.e., a model) created in the review for theory building. Overall, one out of 10 citing papers (10%) has made use of the knowledge developed in the literature review to develop further knowledge.

Melville et al. (2004): Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value

The review of Melville et al. (2004) was cited more than 2,500 times (129 citations in BASKET-8). The authors provide a synthesis and an integrative model of IT business value (theory building) which explains how organizational resources and business processes affect organizational performance. To guide further research, Melville et al. define essential research questions on the levels of the focal firm, the competitive environment and the macro environment (identification of research gaps). In addition, detailed Implications are developed, and guidance on how to design appropriate research studies is provided (development of a research agenda).

The model has been referred to by many papers that advance resource-based models for IT business value (e.g., Coltman et al. (2011), Gregor et al. (2006), Mithas et al. (2012) and Schryen (2013)). Theory testing has been relatively limited with Banker et al. (2006) providing empirical evidence in the specific context of

manufacturing plants and with Oh and Pinsonneault (2007) testing models based on the resource based view and on contingency theory. Notably, the paucity of empirical work is underlined by the absence of meta-analysis.

Research questions identified by Melville et al. have influenced subsequent research. First, Melville et al. suggest that there is a need for a better understanding of how IT resources generate operational efficiencies and competitive advantages. This research question has been addressed by Wang et al. (2012), who theorize and test provision of support to competitive strategies and core competencies as mechanisms through which IT resources enhance firm performance. Similarly, progress has been made on explaining firm performance based on theories for the role of CIO skills (as IT resources) (Chen et al. 2010). In the specific domain of ERP systems, the theory on complementary resource effects on firm performance has been developed and tested (Karim et al. 2007). Overall, 34 out of 129 citing papers (about 26%) have made use of the knowledge developed in the literature review to develop further knowledge.

Petter et al. (2008): Measuring Information Systems Success: Models, Dimensions, Measures, and Interrelationships

The review of Petter et al. (2008) has received 1,000 citations (27 citations in BASKET-8). The authors provide a synthesis and qualitatively aggregate the empirical evidence of different effects included in the DeLone and McLean model of IS success (theory testing). In contrast to a meta-analysis, this approach allows the authors to include the findings of qualitative empirical papers.

Beyond limited theory building efforts, the aggregation of empirical evidence has stimulated researchers to identify and address corresponding research gaps. Most notably, Gorla et al. (2010) analyze antecedents of IS success on the organizational level, which has received insufficient attention according to Petter et al. (2008). Overall, six out of 27 citing papers (about 22%) have made use of the knowledge developed in the literature review to develop further knowledge.

Petter & McLean (2009): A Meta-Analytic Assessment of the DeLone and McLean IS Success Model: An Examination of IS Success at the Individual Level

The literature review of Petter and McLean (2009) has received 360 citations (five citations in BASKET-8). It provides a meta-analysis of the IS success model on the individual level. Because it has been published relatively recently, the review has only been used rarely. Petter et al. (2013) build on the empirical evidence gathered by the review, and examine factors that affect the dimensions of success described in the review. Overall, one out of five citing papers (20%) has made use of the knowledge developed in the literature review to develop further knowledge.

Piccoli & Ives (2005): Review: IT- Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature

The LR of Piccoli and Ives (2005) has attracted more than 550 citations (53 citations in BASKET-8). It reviews the literature on the sustainability of competitive advantage rooted in information systems use. Furthermore, it offers a framework that articulates both the dynamic approach to IT-dependent strategic advantage and the underlying drivers of sustainability and models how and why the characteristics of the IT-dependent strategic initiative enable sustained competitive advantages. Beyond this contribution to theory building, the LR identifies research gaps, offers a critique, and develops an agenda for future research.

The LR of Piccoli and Ives has also been drawn upon in subsequent research for theory building and testing (Gnyawali et al. 2010; Lim et al. 2011; Nevo and Wade 2010). For example, Gnyawali et al. (2010) use the LR to develop and test a conceptual model of competitive moves that social networking services firms undertake and how these moves affect firm performance. In addition, Lim et al. (2011) draw on the findings that IT-dependent strategic initiatives are path dependent. This path dependence can be attributed to, the role of IT capabilities, resource complementarities, and prior knowledge – to develop and test the hypothesis of "temporary resource heterogeneity". While the research gaps have received limited attention, (e.g., Doherty and Terry (2009) and Drnevich and Croson (2013)), the critique and the research agenda have not been used

in subsequent research. Overall, 12 out of 53 citing papers (about 23%) have made use of the knowledge developed in the literature review to develop further knowledge.

Schryen (2010): Preserving Knowledge on IS Business Value: What Literature Reviews Have Done

The LR of Schryen (2010b) is a meta review, which synthesizes 22 literature reviews on IS business value. It has been cited by 34 papers but by none in BASKET-8.

Seddon et al. (1999): Dimensions of Information Systems Success

The LR of Seddon et al. (1999) has also attracted more than 540 citations (15 citations in BASKET-8). It offers a critical account, and further proposes a two-dimensional matrix for classifying IS effectiveness measures (building theory for analysis), with the first dimension being the type of system studied and the second dimension being the stakeholder in whose interests the system is being evaluated. The matrix is used to classify IS effectiveness measures from 186 empirical papers.

While the matrix of IS effectiveness measures has not stimulated theory development, the critique of the confusion which arises from combining process and variance theories has stimulated the scientific discourse. Particularly, it has resonated with DeLone and McLean (2003), who, in their well-known review, discuss whether and how models of IS success should combine process and variance related aspects. Although the absolute impact may appear to be low, the prominent discussion by DeLone and McLean (2003) lends credit to the critique of Seddon et al. (1999). Overall, one out of 15 citing papers (about 7%) has made use of the knowledge developed in the literature review to develop further knowledge.

Sircar et al. (1998): The Impact of Information Technology Investments on Firm Performance: A Review of the Literature

The LR of Sircar et al. (1998) has been cited rarely (33 citations, four citations in BASKET-8). It synthesizes literature findings on IT productivity by critically analyzing the literature from variance and process theory perspectives. We found two studies published in the BASKET-8 which cite this LR. Of these two studies, only Sircar et al. (2000) substantially draw on Sircar et al. (1998) in order to develop a refined model for assessing the relationship between IT investments and firm performance. Overall, one out of four citing papers (25%) has made use of the knowledge developed in the literature review to develop further knowledge.

Soh & Markus (1995): How IT Creates Business Value: A Process Theory Synthesis

The LR of Soh and Markus (1995) is the only one of our identified LRs on IS business value that has been published in conference proceedings, and it has attracted 700 citations (40 citations in BASKET-8). The LR reviews theoretical models of IT investment and business value, and further suggests its own process theory synthesis of these models (building theory for explanation), trying to resolve some of the previous contradictions.

The LR has been used to build theories (Davern and Kauffman 2000), and to build and test theories (Devaraj and Kohli 2000; Wang et al. 2012; Zhu and Kraemer 2005). For example, Davern and Kauffman (2000) use the value of IT investments as a starting point for their model. Wang et al. (2012) use the IT value creation model of Soh and Markus to propose and test that strategic-level IT effects mediate the effects of IT resources on firm performance. Empirical testing has been relatively scarce (Kohli and Devaraj 2003; Wang et al. 2012). Overall, 11 out of 40 citing papers (about 28%) have made use of the knowledge developed in the literature review to develop further knowledge.

Wade & Hulland (2004): Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research

The LR of Wade and Hulland (2004) has had a large echo in the literature through more than 2,000 citations (117 citations in BASKET-8). The LR presents a typology of IS resources and uses this typology to review the literature, emphasizing the importance of looking at both resource complementarity and moderating factors when studying IS resource effects on firm performance. Wade and Hulland suggest several propositions to guide future research (identifying research gaps and developing a research agenda).

The LR of Wade and Hulland has been used in subsequent research for theory building (Silva and Hirschheim 2007; Tallon 2010). In particular, the typology of IS resources has proven to be useful for subsequent research (e.g., Banker et al. (2006), Benitez-Amado and Walczuch (2012), Doherty and Terry (2009), Kettinger et al. (2013) and Tan et al. (2015)). In addition, Dong et al. (2009) use the Resource-based View as applied in the LR to develop a conceptual model that links three IT-related resources (backend integration, managerial skills, and partner support) to firm performance improvement and to test the model empirically. Banker et al. (2006) develop and empirically test a conceptual model to study how U.S. manufacturing plants realize improvements based on advanced manufacturing capabilities.

Several researchers close research gaps by following the research agenda, which has been suggested by the LR (Hulland et al. 2007; Karimi et al. 2007; Kettinger et al. 2013; Mithas et al. 2011, 2012; Nevo and Wade 2010; Wang et al. 2012). For example, Kettinger et al. (2013) draw on the proposition no. 4 and use the construct "integrated information delivery" to explain the effect of resources on competitive positions. Steinfield et al. (2011) use the research gaps identified by Wade and Hulland to substantiate their research agenda on inter-organizational systems. Overall, 39 out of 117 citing papers (about 33%) have made use of the knowledge developed in the literature review to develop further knowledge.

Walter & Spitta (2004): Approaches to the ex-ante Evaluation of Investments into Information Systems

The LR of Walter and Spitta (2004) contributes to theory building by suggesting a classification scheme of evaluation approaches (building theory for analysis). It uses the scheme to classify and review available approaches for the ex-ante evaluation of investments into information systems. The LR has been cited more than 80 times but not by any paper published in BASKET-8.

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