Which Factors Affect the Scientific Impact of Review Papers in IS Research? A Scientometric Study

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[4] http://gepris.dfg.de/gepris/projekt/327130595?language=en

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ABSTRACT

Review papers are essential for knowledge development in IS. While some are cited twice a day, others accumulate single digit citations over a decade. The magnitude of these differences prompts us to analyze what distinguishes those reviews that have proven to be integral to scientific progress from those that might be considered less impactful. Our results highlight differences between reviews aimed at describing, understanding, explaining, and theory testing. Beyond the control variables, they demonstrate the importance of methodological transparency and the development of research agendas. These insights inform all stakeholders involved in the development and publication of review papers.

KEYWORDS

Literature review; review papers; scientometric; scientific impact; citation analysis.

1. Introduction

Review papers, which comprehensively collect, synthesize, and interpret extant research in a domain [1], are a fundamental genre in every scientific discipline. In fact, “many of our greatest scientists have used, created, and contributed to the review literature” [2, p.113]. Especially in recent years, a vibrant discourse on (standalone) review papers and other forms of literature reviews, such as literature review sections of research papers, has started in IS research [3–5]. This renders Information Systems (IS) a pioneer discipline to contribute to this important conversation in the business disciplines and social science research. Review papers in the IS discipline provide a foundation for scientific progress, in particular by contributing to theory [6], and the impact of this genre is apparent. With very few exceptions, every major IS journal accepts review papers, often as a separate genre. In addition, there are editorial initiatives to facilitate the publication of reviews in some of the field’s most renowned journals, including *MIS Quarterly*, the *Journal of the Association for Information Systems*, the *European Journal of Information Systems*, and the *Journal of Information Technology*. Over the last 15 years, more than 220 review papers have been published in IS journals and this genre has achieved a remarkable impact [5,7].

The variance between reviews that achieve an outstanding impact [e.g., 8–10] and those that receive limited attention poses a challenge for effective knowledge development in the IS discipline. Understanding the drivers of scientific impact can provide useful guidance for crafting review papers and making valuable contributions to the scientific discourse and ongoing debates. In this regard, we contend that scientific impact – similar to knowledge creation and scientific progress – should not be confined to a positivist, commensurable perspective, but it should capture all contributions to the scientific discourse, including disagreement with, and refutations of previous ideas. This lack of knowledge also puts prospective authors at risk of investing a lot of time, developing minimal impact and receiving almost no recognition. Furthermore, while prospective authors who aspire to make an impact with their reviews can only draw upon universal metrics such as journal impact factors and h-indices to assess the potential impact of papers in general, there is a lack of empirical insights into which attributes affect the scientific impact of different types of reviews. Consistent with this lack of insights, IS researchers have recently called for a better understanding of paper-level measures associated with scientific impact [11]. We suggest that a systematic analysis contributes to our understanding of the factors driving the scientific impact of IS review papers and therefore we propose to answer the following research question:

What are the main attributes that affect the scientific impact of IS review papers?

To answer this question, we conducted a study of 220 review papers which have been published in 40 IS journals from 2000 to 2014. In developing our model, which explains scientific impact in terms of citations, we focus on content-centric attributes of a review, i.e., methodological transparency and the development of a research agenda. We complement these main variables with common attributes derived from meta-data, such as the journal and the authors. Transparency refers to the "completeness with which a review is presented and whether important methodological aspects about its design and execution are clearly or explicitly reported" [4, p.497]. For instance, review papers are more transparent when they provide details on the search strategy, the inclusion screen, and the data analysis [5]. Review papers that propose a research agenda go beyond the identification of research gaps, "elaborating on how researchers should conduct future research to achieve meaningful progress" [12, p.139]. For example, a research agenda could propose specific empirical settings, methodological approaches, or theoretical foundation worthy of investigation in future research.

Accounting for the heterogeneity observed between review types, we test the model in four subsets restricted to reviews pursuing the goal of describing (narrative and descriptive reviews), understanding (scoping and critical reviews), explaining (theory development and realist reviews), and theory testing (meta-analysis, qualitative systematic reviews and umbrella reviews), respectively [5,13]. Our results corroborate important contingencies depending on the type of review. Overall, we observe positive relationships between scientific impact and factors such as transparency and research agenda, controlling for important journal, author and the topic characteristics of reviews. We further conducted several complementary robustness checks, which corroborate these results.

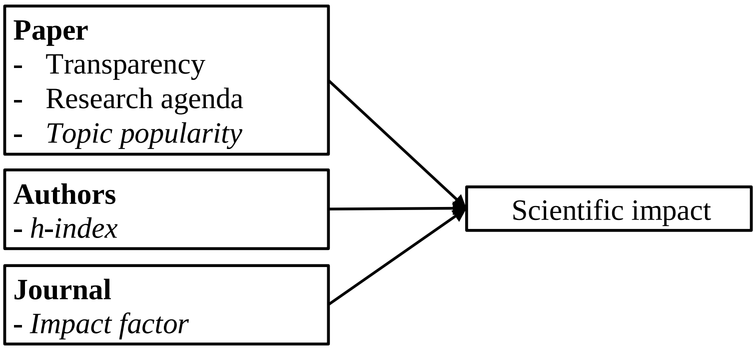
Our findings contribute to the discourse and literature on IS review papers and to the scientometric literature in general. By providing empirical evidence on the antecedents of scientific impact, our work contributes to the debate on the characteristics considered integral to a valuable review paper [e.g., 3,4]. In particular, methodologists and editors have emphasized methodological rigor and the development of a research agenda as important qualities of review papers [e.g., 4,6,14]. To our knowledge, we are the first to address this lack of empirical insight into whether these qualities actually lead to a higher scientific impact, i.e., whether subsequent research values these qualities by building upon these papers. Our insights are useful for substantiating guidelines and methodological recommendations in this regard. Furthermore, our work illustrates the value of scientometric studies by providing insights into the properties of reviews that emerge as highly cited papers, which move the IS field forward [15]. Answering the question of what features of papers, such as standalone reviews, are associated with impact is an important task in itself [16], which has been addressed in many top-tier journals in other business and management disciplines [e.g., 17–19], but neglected in our field.

The remainder of this paper is organized as follows. Based on extant work from the methodological literature on reviews and the established research stream of Scientometrics, in Section 2 we develop a model consisting of attributes relating to the paper, the author, and the journal that can be expected to affect scientific impact. In Section 3, we present the dataset. Next, in Section 4 we evaluate the attributes empirically and show that their effects on scientific impact are robust. We discuss the implications of our results for authors of review papers who strive to maximize their impact on subsequent research in Section 5 and conclude with an outlook on how the IS discipline could foster the impact of reviews in Section 6.

2. Model development

There are different attributes on the paper, author, and journal level that can be expected to affect the scientific impact of different types of review papers. In reviewing these attributes, we primarily focus on models designed for the purpose of explaining scientific impact (see Tahamtan et al. [20] for a comprehensive cross-disciplinary review) and corresponding measures that are well-known to researchers and authors. Our focus is not on reviewing research intended to change current practices, most notably with the purpose of improving fairness of research evaluation [21,22]. New measures for evaluating research, authors, journals and institutions are an important contribution of scientometric research in any discipline. Their validity as predictors of citation impact, however, is limited, especially when they are not readily available to citing authors and require complex calculations. To justify the development of the model, which is structured according to these levels, we draw on both the scientometric literature, which analyses the impact and diffusion of knowledge contributions within the academic discourse [e.g., 23–26], and the literature on literature reviews, which includes methodological and editorial papers discussing qualities of impactful review papers [e.g., 4–6,13,14].

While there are multiple possible attributes on each level (an overview is provided in Tables A.1 – A.3, Appendix A), we deliberately develop a parsimonious model[1] by selecting one control variable for each level, and two main variables specific to review papers. The main variables, i.e., transparency and the development of a research agenda, correspond to those attributes of a review paper that can be shaped throughout the manuscript development process. They are specific to the genre of review papers, related to the content of the review, and not to its meta-data, such as the length of the title and the number of keywords. In developing the model, we focused on selecting the variables that have commonly agreed definitions as opposed to variables for which competing perspectives have been proposed (e.g., practical significance or quality of presentation). At the same time, control variables need to be included at each level in order to avoid confounding effects related to differences in visibility and reputation. Furthermore, we consider attributes that are not limited to particular types of review papers to enable comparisons between types. The most relevant alternative attributes will be revisited in the results section as part of the robustness checks. Figure 1 provides an overview of the research model, which is structured according to the paper, the author, and the journal level, respectively. This model applies to reviews pursuing different goals with regard to theory [13]. With this model in mind, we explore empirical dependencies between the attributes and the different types of reviews in Section 4.



Note. The same model applies to reviews pursuing different goals (describing, understanding, explaining and theory testing). Control variables are in italics.

Figure 1. Model: Scientific impact of review papers

2.1. Attributes at the paper level

At the paper level, methodological transparency and the development of a research agenda can be expected to lead to higher scientific impact [5,6]. As the scientometric literature is remarkably silent with regard to these content-related attributes of review papers that predict the impact of review papers, they are primarily based on the discourse on literature reviews. As a further attribute, we include the popularity of the topic to control for general variations in potential readership since papers on more popular research topics have been found to receive more citations [20].
We consider methodological rigor as one of the most important attributes affecting the scientific impact of review papers. Assessing the reliability of the knowledge contributions when citing a review, authors' decisions to cite are influenced by the degree to which the transparency of the review's reporting practices signals a systematic methodological approach. A systematic methodology, which depends on the specific review type[2], is considered as the basis of reliability, validity and trustworthiness of a paper

[1] The number of published review papers does not yet provide sufficient test power for models with more variables. Further details on our analytical approach and dealing with the low sample sizes are provided in the analyses section.
[2] Note that systematicity is a concept applicable to all types of reviews, not only the qualitative systematic review [5], which has been discussed critically [3].

[5,16,23,27]. Although transparency and systematicity are twin concepts [4], systematicity – referring to the "disposition towards organized methodic, and orderly inquiry" [4, p.496] – cannot be assessed directly. Instead, readers may perceive high transparency as signaling high systematicity. For example, they may implicitly or explicitly consider detailed methodological guidelines [5] or more general recommendations on reviews [e.g., 6,13] and recognize familiar methodological items that have been reported or, similarly important, those that have been omitted. For reviews that are not transparent, readers may be unable to evaluate their systematicity. Transparent reviews, on the other hand, can only be unsystematic if reviewers and editors have failed to require corresponding changes. In extant scientometric research, transparent reporting and methodological rigor, which are perceived by the readers, have been found to be associated with the number of citations a paper attracts [16,17,23,28].

Developing a research agenda has been suggested as an important contribution of review papers [e.g., 6,13]. However, this attribute can rarely be found in scientometric analyses. In fact, the only scientometric study we are aware of is a survey dating back more than two decades and its results on providing value for future research by developing a research agenda have largely been ignored in subsequent scientometric research [29]. In this paper, the authors have surveyed researchers to identify attributes that make papers influential, one of these attributes being value for future research. Except for theoretical significance, this attribute outranked all other factors in terms of importance, including substantive interest, methodological interest, practical significance and quality of presentation. Drawing on a comprehensive overview of extant research, literature reviews are in a position to make well-grounded recommendations on promising research gaps, thereby helping others to avoid reinventing the wheel [30]. Authors who identify research gaps can either highlight white spots in the research landscape, challenge existing knowledge and its underlying assumptions [31,32], or outline which gaps are unlikely to be addressed successfully [33]. Authors of review papers can even go one step further and develop a structured research agenda describing how research gaps should be closed. By including recommendations for further research as an attribute in our main model, our study provides empirical insights into whether efforts to pave the path for future researchers actually translate into scientific impact. Specifically, citations may indicate whether review papers identifying research gaps in the literature and developing research agendas have been successful in stimulating subsequent research that has followed these roadmaps.

The topic of a review paper represents another scientometric attribute likely to correlate with its scientific impact. Taking into consideration that decisions to cite tend to be premised on an appropriate thematic fit with the manuscripts of citing authors, reviews addressing popular topics have more opportunities to be cited. This has been confirmed by scientometric research, which has not only uncovered that citation practices differ between disciplines [34,35] but also that citation rates vary between different topics within a given discipline [36].

2.2. Attributes at the author level

At the author level, there are several attributes which have been suggested to influence the impact of a scientific paper. While some author attributes should be unrelated to the contribution of a paper (e.g., gender and nationality), other attributes may be considered indicators of the authors' impact, or a reputation for strong contributions to research. Citing a paper due to author-related attributes is commonly associated with particularistic citing behavior, while citing a paper for its scientific merits is associated with universalistic citing behavior [16,37,38]. A further dimension refers to teamwork between and beyond the authors, with author teams increasingly outperforming individual authors in terms of productivity and impact while sharing the credit for their work [39]. Furthermore, authors' interactions with the research community, such as presenting early work and soliciting feedback, have been found to impact the visibility of their research [40].

The category of author attributes most commonly used in the scientometric literature comprises indicators of an author's reputation, centrality in academic networks, and visibility [16,41]. Several indices have been developed to measure the impact of an author's publication record, such as the h, g, hc, and h(2) indices [23,42]. Some of these indices are aimed at facilitating fair evaluation, which may differ from the current reputation and impact of authors. Other attributes, such as academic reputation and an author's affiliation, appear to be less trivial predictors of a paper's impact, but they tend to be correlated with an author's impact. This is due to the consideration of publication records and citation impact when academic reputation is evaluated and when tenure and promotion decisions for top-tier institutions are made. Our main rationale for including the h-index (also referred to as the Hirsch index) is that it is readily available to citing authors (e.g., on Google Scholar), it has shaped the public perception of prominent authors in academia and it is based on both, productivity and impact. Furthermore, a comprehensive meta-analysis has demonstrated high correlation rates between the h-index and variants of the h-index that have been proposed in extant literature [43].

2.3. Attributes at the journal level

Scientometric studies have found the publication outlet to be among the strongest predictors of the number of citations a paper receives [16,41,44,45], regardless of its genre. At the same time, the impact of papers published in the same journal still varies considerably [e.g., 11], suggesting that the journal can neither be considered as a proxy for paper quality [11,46] nor as the only predictor of scientific impact of individual papers [20]. Overall, attributes at the journal level, such as their prestige, quality, network centrality, access and circulation [47–49], are significantly correlated with the scientific impact of their papers in IS [23], management [16], economics [50], operations research [45], psychology [51], and the health sciences [52]. As many of these attributes are interrelated, we follow a common practice in scientific impact models by adopting the journal impact factor as a proxy variable.

3. Data collection

3.1. Sample of review papers

The scope of our sample is restricted to papers published from 2000 to 2014[3]. In contrast to other scientometric studies [e.g., 23,53,54], we go beyond a few top-tier journals and focus on a broad set of 40 IS journals, which was identified by Lowry et al. [55]. These journals were identified based on expert judgment and impact factors. They include the AIS senior scholars' basket of journals; in addition, the set primarily comprises journals from the IS discipline. To eliminate language-related effects, we exclusively focus on reviews published in English[4]. We did not include conference papers because they would add substantial heterogeneity to our sample (e.g., regarding the length of papers and the lack of conference-level indicators that correspond to the Journal Impact Factor). It would also raise problems of double-counting when conference papers are eventually published in journals.

Reviews were identified by scanning the tables of contents from each journal (approx. 2,200 tables and 17,500 papers). The first screen was as inclusive as possible and not restricted to particular types of reviews. If in doubt, abstracts were checked and papers were deliberately retained for the second screen (for example when the methodology was apparent from the title and abstract). We then compiled a preliminary list of 470 candidates. From this list, we excluded papers which do not comply with our definition of review papers. In agreement with extant definitions of literature reviews [e.g., 56–59], we define review papers as *providing a synthesis of the body of knowledge of a specified domain*. As outlined in the following, we thereby exclude papers collecting primary data, or focusing on questions of research methodology, as opposed to domain knowledge, for example. Specifically, we excluded papers according to the following eight criteria, which are consistent with Schryen et al. [12] and Templier and Paré [5]: 70 candidates which do not provide a synthesis, i.e., the result of "summarizing and organizing published knowledge" [12, p.138], 24 candidates which are short research commentaries, 28 candidates which collect primary data, 93 candidates which do not focus on domain knowledge, as opposed to knowledge of research methodology or scientometric meta-data, 8 candidates

[3] By selecting the year 2000 as a starting point, our sample includes all reviews published in the prominent *Theory and Review* category of *MIS Quarterly*. For the most recent reviews published after 2015, three-year citation rates were not yet available.

[4] We acknowledge that this is likely to increase homogeneity related to author nationalities and regions in our sample. At the same time, English is the established language for authors and readers of research, allowing us to cover the predominant share of research output in IS.

which do not focus on the academic literature, 9 candidates that focus on the history of a journal, 2 editorials, and 1 paper developing an artifact. Inter-coder agreement for the inclusion as a review paper was substantial with Cohen's Kappa exceeding 0.9 in an overlapping sample of 69 candidate papers. In addition, three of the authors coded the type of review based on Rowe [13], resulting in 74 reviews aimed at describing, 48 reviews aimed at understanding, 65 reviews aimed at explaining, and 33 reviews aimed at theory testing. After this coding process, we dropped 15 hybrid reviews [5] that could not be assigned to a unique goal, resulting in a final sample size of 220. Similar to Colquitt and Zapata-Phelan [18], the goal of excluding hybrids was to test the impact of archetypes that exemplify the types of (review) papers we are interested in. Disagreements were discussed and reconciled during team meetings. A list of all review papers included in our sample is provided in Appendix B and a profile of the papers is provided in Table C.1 and C.2 (Appendix C).

3.2. Measures

Table 1 provides an overview of the measures used to operationalize the attributes of review papers, proceeding from attributes at the paper level to the author and journal level and concluding with the dependent variable (i.e., citation rates). Consistent with extant scientometric impact models [20], the operationalization of our research model relies on observed variables as opposed to abstract constructs. Descriptive statistics, including correlations, are provided in Appendix C (Tables C.3 – C.12).

Quality attributes of review papers include transparency and the development of a research agenda. Concerning transparency, we calculated a score measuring the percentage of items that were reported relative to the items required for each type of review. This approach is similar to previous studies [e.g., 17,60]. We coded items pertaining on six methodological steps as presented by Templier and Paré [5]. These methodological steps are: (1) developing the review plan, (2) searching the literature, (3) selecting studies, (4) assessing the quality of included studies, (5) extracting data, and (6) synthesizing. For each step, we coded a set of items required for the specific type of review. A detailed overview of the items for each type of review is provided in Appendix D. The first author extended the transparency coding of Templier and Paré [5] to the whole set of reviews included in this study. To become familiar with the coding procedures, a random sample of 30 reviews was coded. A high agreement was achieved[5], and disagreements were resolved in a discussion between the authors. The remaining review papers were coded by the first author, and borderline cases were discussed by the authors until consensus was reached.

Concerning the development of a research agenda, we coded three possible levels. If the review briefly mentions topics that would benefit from future research, we coded *none*. If the review provides more specific starting points for subsequent studies by identifying research gaps [12], we coded the level *partial*. Exhaustive research agendas that are consistent with the recommendations of well-known editorials [e.g., 6,13] were coded as *complete*. As Schryen and colleagues [12] summarize, this way of "elaborating on how researchers should conduct future research" should involve "specific [suggestions] regarding "research designs, empirical settings, or […] strategic recommendations" (p.139). This highest level was only coded when the guidance for subsequent research were specific and actionable, e.g., including a description of methodological approaches, or unambiguous recommendations on how to address the research gaps. Although these semantic criteria were given precedence in our evaluation, we also considered the space dedicated to describing the research agenda (e.g., number of pages, table summaries), and the relative importance in the review (e.g., a 1st level "Research Agenda" section, or a 2nd level section that is part of the "Discussion" section, mentions in the abstract, mentions as a key contribution of the review).

[5] Dependencies between review types and steps explained in Appendix D and corresponding scarcity of observations prevent us to report meaningful inter-rater agreement statistics. For instance, parallel independent quality assessment is only required for qualitative systematic reviews or meta-analyses and reported by very few papers.

Table 1. Measurement: Attributes of review papers

Attribute	Measurement	Key references
Paper level		
Transparency	A score indicating the percentage of items reported transparently (relative to the items required to be reported by the review type). The items are structured according to six methodological steps: (1) developing the review plan, (2) searching the literature, (3) selecting studies, (4) assessing the quality of included studies, (5) extracting data, and (6) synthesizing. Details are provided in Appendix D.	[4,5,17,61]
Research agenda	Dummy variables representing three levels: *ResearchAgenda_None=1* if no guidance for future research is provided, *ResearchAgenda_Partial=1* if the review identifies research gaps[a], *ResearchAgenda_Complete=1* if the review additionally provides specific and actionable recommendations on closing the gaps (a research agenda)	[6,12,13,29,62]
Topic popularity	Average impact of papers addressing similar research topics[b], i.e., papers addressing the same topic were identified based on overlapping keywords. Data was extracted on August, 9th 2017.	[17,36]
Author level		
h-index	Average of the h-indices of authors at the time when the review was published. Calculated based on publication lists provided by Scopus. Data was extracted from Scopus on September, 19th 2016.	[63]
Journal level		
Journal impact Factor	Journal impact factor provided by Clarivate (previously Thomson Reuters)[c]. Data was extracted on June, 26th 2016.	[16,45]
Dependent variable		
Scientific impact	Number of citations after three years, corrected proportionally for the month of publication, and corrected for self-citations. Data was extracted from Google Scholar on February, 20th 2018.	[16,19,23]

Notes. Control variables are in italics.
[a] Note that the reference group *partial* corresponds to *Research_Agenda_None=0* and R*esearch_Agenda_Complete=0*.
[b] The count of papers in the research area would be an alternative measure for topic popularity. Such a measure would be most accurate if we could examine all papers associated with a similar topic, regardless of whether they are published in IS, in one of the sister disciplines, in an indexed journal, a conference, workshop, or a practitioner magazine.
[c] Imputation of missing values based on the average impact factor of same-tier journals according to VHB-JOURQUAL3 (available at https://vhbonline.org/en/vhb4you/vhb-jourqual/vhb-jourqual-3).

We specify control variables for the popularity of the topic, the reputation of the review's authors, and the journal. Topic popularity refers to the average number of citations of other papers addressing the same topic as the review paper, allowing us to include a metric variable instead of many dummy variables representing individual research topics. Following Bergh et al. [17], we measured topic popularity as the average citation rate of other IS papers which examine similar research topics. Research topics were considered similar between a focal review and other papers (using the same scope regarding journals and time, i.e., the Top-40 Journals from 2000 to 2014) if they share at least one keyword[6]. The citation rates per research topic were then averaged using Scopus citation data (excluding the citations of the focal review)[7].

We measured author impact as the average h-index of the author team. An author with an index *h* has published *h* papers each of which has been cited at least *h* times [63]. We therefore controlled for the

[6] Taking the review of Bélanger and Crossler [103] on privacy in the digital age as an example, we identified 48 papers indexed in Web of Science and sharing at least one of the keywords with the review paper. The mean annual citation rate of these papers is determined by dividing the total number of citations for each paper by the age of the respective paper calculating their arithmetic mean value (i.e., 8.8 citations per year).
[7] We used Scopus for this analysis since the keyword indexing of Google Scholar is incomplete.

average of the h-indices of the authors at the time when the review was published. The indices were determined based on the lists of publications of each author, as provided by Scopus[8]. Recognizing recommendations to use profiles of h-indices for measuring author contributions [21], we considered further indices in the robustness checks.

As we cover a broad scope of journals, controlling for effects related to differences in visibility or circulation of journals was essential. Consistent with other scientometric studies covering many journals, we did not control for single journals but measures of journal impact [16,45]. This allowed us to control journal-related effects while at the same time avoiding model overfitting. We used the journal impact factors provided by Clarivate as a measure to control journal-related effects. Although the JIF has been criticized in a number of ways, including its instability, bias toward recent citations, difficulty to compare across disciplines and susceptibility to manipulation [e.g., 11,64], we contend that its prominence and wide availability makes it a suitable variable to control for journal related effects.

We measure the dependent variable using citation rates as commonly suggested in the extant literature [16,23,54]. By focusing on overall citation rates, we do not distinguish different types of citations, such as confirmative vs. negational [65], ideational vs. perfunctory citations [66] or plagiaristic citations [67]. In line with previous scientometric research, we therefore assume that there is no systemic problem with plagiaristic citations and that such errors would be randomly distributed and not systematically bias our results. Citation data was extracted from Google Scholar[9] on February 20th, 2018. Self-citations, i.e., papers sharing at least one identical author with the review paper, were excluded because they do not represent real knowledge flow [68]. We measure scientific impact in terms of three-year citation rates and implement robustness checks to analyze the degree to which they correlate with long-term impact. To avoid possible measurement biases, we have to ensure that the dependent variable is measured after the same amount of time has elapsed since the publication of the reviews, i.e., we have to distinguish whether a review was published early or late in a certain year. Although databases such as Google Scholar and Web of Science only provide citation data on an annual, as opposed to a monthly or daily basis, we correct for the month of publication by adjusting the dependent variable proportionally. For instance, if a review was published in June 2004, we corrected the citation count by adding the citations received in 2004, 2005, 2006, and 6/12 of the citations of 2007. One alternative to the date of publication would be the date of (advanced) online publication. This date, however, is not available for more than 30% of the reviews, and for 40% of the reviews aimed at which the date of online publication is available, it is after the actual/official date of publication (in print, if applicable). Since our dataset contains some reviews published in the early 2000s, availability of a website for the journals might introduce further confounding effects. We therefore consistently measured citations starting with the year of publication and we excluded citations in the years before the review was published in print.

4. Analyses and empirical results

4.1. Analyses

Consistent with previous scientometric research in IS [69], we observe that it is only a small number of reviews, which drive the aggregated impact while many reviews receive low single-digit or no citations with three-year citation rates varying between 0 and 319 citations per year (median: 25, mean: 42, std. error: 51). We examined the attributes that explain the differences in citations of review papers by drawing on a generalized linear model (GLM) with a Poisson link function, which is appropriate for dependent variables that are in count data form and skewedly distributed. To analyze the different effects of the variables, we initially ran regressions using the following equation as the control model:

$$Citations = \beta_0 + \beta_1 JournalImpactFactor + \beta_2 hindex + \beta_3 TopicPopularity + \epsilon.$$

[8] We use Scopus data for author publication lists since author-related data is more accurate on Scopus compared to Google Scholar (e.g., regarding name variants, and corrections).

[9] We did not extract citation data from Web of Science, which covers only 23 journals from our scope of 40 journals, e.g., it does not provide citation data for at least 39 review papers (not counting embargo years, such as for the Journal of the Association for Information Systems).

Table 1 shows how the variables were measured and Appendix C (Tables C.3 – C.12) provides descriptive statistics. By standardizing regression coefficients, we removed different units of measurement and determined the effects of standard deviation changes of the attributes on the dependent variable.

In the next step, we included dummy variables for the four types of review to capture differences in impact between reviews aimed at describing, understanding, explaining, and theory testing. However, the new variable for the type of review significantly correlates with the other variables of our model (see Appendix C, Table C.4), prohibiting us from pooling the different types of reviews and testing the effects of our main variables for the whole sample of reviews. For example, reviews aimed at theory testing are naturally published on popular topics as opposed to emergent ones for which there is no established theory and a paucity of empirical research. Furthermore, these reviews tend to score highly with regard to transparency [5], but they rarely identify research gaps and develop research agendas. Concerning the same attributes, reviews aimed at understanding tend to be located at the opposite sides of the distributions (see Appendix C, Tables C.3-C.12). On the one hand, this indicates that the attributes explaining the impact of the four types of reviews are different. On the other hand, this issue needs to be addressed in our empirical strategy because these dependencies could potentially bias the confidence intervals of our estimates or even reverse the directionality of the main effects.

As these dependencies between variables prohibit us from estimating a single model for all review types, we split our sample according to the review type and conducted separate analyses on each subset of review papers[10]. This step reduced our sample sizes considerably (see Table 2), resulting in lower test-power, in particular for theory testing reviews. As we analyzed all reviews in a broad scope of journals spanning 15 years, our options to extend the sample and increase test-power accordingly were limited. While low test-power poses the problem of a higher probability of missing effects that are actually significant, it can be acceptable when effects are found to be significant and other threats to validity are addressed [70]. Most importantly, low test power makes it necessary to check whether the observed effects are purely spurious, as higher deviations from true effects are more likely in small samples. In the second part of the results section, we checked whether the results are robust regarding outliers and other variations in the sample. For the control model, the estimation results for each subset are provided in Table 2.

In the next step, we included the main variables, which represent paper level variables that can be shaped more directly by authors of review papers. We specified the following main model:

$$Citations = \beta_0 + \beta_1 JournalImpactFactor + \beta_2 hindex + \beta_3 TopicPopularity + \beta_4 Transparency + \beta_5 ResearchAgenda\_None + \beta_6 ResearchAgenda\_Complete + \epsilon.$$

Transparency is the score of methodological items reported in a review paper. *ResearchAgenda_Complete* and *ResearchAgenda_None* are dummy variables indicating whether the review includes a complete research agenda or not. Reviews providing a *partial* research agenda serve as a natural reference group because they represent the common case of brief discussions of implications for future research, which is expected from most papers, including reviews. The formula therefore does not include *partial* as an additional dummy variable. In two subsets, the research agenda variable did not have enough variance (not enough or too many observations) to be included in the analyses. For example, there are too few reviews aimed at theory testing that propose a research agenda and there are too few reviews aimed at understanding that omit a research agenda. These variables are not included in the corresponding result tables.

[10] Another option would be to address this issue using interaction effects. As Table 2 suggests, however, this would result in a complex model in which most variables interact with the type of review.

Table 2. Results of a GLM predicting citations to different types of reviews after 3 years

	Describing (I) (n=74)		Understanding (II) (n=48)		Explaining (III) (n=65)		Testing (IV) (n=33)	
Effect[a]	Control	Main	Control	Main	Control	Main	Control	Main
Journal Impact Factor	0.57**	0.57**	0.38**	0.35**	0.28**	0.19**	0.22**	0.01
H-index (average)	0.27**	0.27**	0.39**	0.45**	0.04	-0.05	0.15**	0.13**
Topic popularity	0.01	-0.07	0.08*	0.00	0.28**	0.22**	0.14**	0.18**
Transparency score		0.10**		0.23**		0.26**		0.53**
Research agenda[c] (none)		-0.27**		[b]		-0.55**		[b]
Research agenda[c] (complete)		0.30**		0.51**		0.13*		[b]
AIC	2149	1983	1720	1532	2859	2410	1150	1009
d.f.	73	73	47	47	65	64	32	32
R^2 (Nagelkerke)	0.29	0.32	0.46	0.48	0.30	0.41	0.37	0.47
ΔR^2		0.03		0.02		0.11		0.10

Notes. * significant at 1%, ** significant at 0.1%.
[a] Effects are reported as standardized regression coefficients. [b] Not enough observations available to include the variable. [c] The dummy variable *partial research agenda* is used as the reference group (*Research_Agenda_None=0* and *Research_Agenda_Complete=0)* and therefore does not have its own coefficient. Wald tests are provided in Appendix E (Table E.1).

The estimation results for the main model are displayed in Table 2. Overall, different attributes explain the variance in the scientific impact of review papers. In fact, the single best predictors vary throughout the subsets, reflecting substantial differences across the review types. This suggests the way in which subsequent research perceives, evaluates, and cites reviews may be contingent on the nature of the review. While some reviews may be primarily valued for their rigorous application and reporting of methodologies, other reviews appear to be valued for the usefulness of their research agendas. Our discussion of the results considers these differences in how other researchers evaluate the review types both directly and indirectly, i.e., by assessing other aspects of a review, which may indicate qualities harder to assess. We discuss each variable in turn.

The journal impact factor is both a control variable and a possible, though crude, indicator of the quality of papers. Although its measurement is similar to the topic popularity variable, the observed correlations between these variables are only moderate and multicollinearity is not an issue with variance inflation factors (VIF) below a threshold of 2. The results show that the journal impact factor is the most important attribute for reviews aimed at describing. This suggests that citing authors may consider the journals' reputation when selecting high quality reviews to build on. The contributions of reviews aimed at understanding, for which objective quality criteria are rare, are similarly difficult to evaluate, thus possibly explaining the high effect of the journal impact factor. For reviews aimed at explaining phenomena, the journal still has an impact, though it is not the predominant driver. Concerning reviews aimed at testing a theory, there is no evidence that citing decisions are associated with a journals' reputation. For this type of review, one can expect citations are largely based on criteria applied to the reporting practices suggested by methodologists. This low and insignificant effect of the journal impact factor contrasts with many other scientometric studies, which generally report strong effects of journal-related variables [20]. Although there are moderate correlations between transparent reporting practices and the journal impact, the change in the journal impact factor's coefficient from the control model to the main model suggests that the variance is explained by transparency and not by the journal impact. This was confirmed by further analyses[11] of partial R^2, which indicate that for theory testing reviews, 1.8% (n.s.) of the variance can be explained by the journal impact factor while 10.0% ($p < 0.001$) of the variance can be explained by the transparency variable.

Our model also controls for the authors' reputation. Taking into account the results of the robustness checks presented in the following subsections, author reputation has a positive impact on citation scores of reviews aimed at describing, understanding, and theory testing. For reviews aimed at explaining, we observe no or slightly negative effects. The question of "Who has published the review?" and a corresponding recognition of the ownership of ideas presented in the review is obviously important for reviews aimed at describing and understanding, whose quality is difficult to assess objectively [25]. For reviews aimed at theory testing, author impact correlates with the impact of the review. In this case, we are careful to speculate on underlying causalities associated with this coefficient, because the challenging methodologies associated with theory testing (e.g., meta-analysis) may be applied more often by experienced author teams (not necessarily captured by the h-indices of authors).

The topic variable controls for the popularity of different topics addressed by the reviews. This variable suggests that different types of reviews may have a higher impact when their timing with the popularity of the topic provides a good fit. While reviews aimed at describing tend to exert a higher impact when published on emerging topics, theory testing reviews evidently are more impactful when more empirical research is available. In this regard, our results complement Hwang [71], who argues that meta-analyses may nevertheless be useful to the field when research topics are still in exploratory phases. Reviews aimed at understanding are not dependent on the popularity of the topic and may be published in its emergent or latter stages. Interestingly, reviews aimed at explaining have the highest impact when published on established as opposed to emergent topics. This indicates that premature theorizing may not be valued by subsequent research.

The transparency variable measures the degree of transparent reporting practices with regard to methodological procedures; this is a quality considered critical by methodologists [5]. Complementing methodological guidelines describing the levels of transparency associated with different types of reviews [4], our study shows to which extent subsequent research considers transparency when using and citing different types of reviews. Above all, we show that transparency is the attribute that appears to have the strongest association with scientific impact of theory testing reviews. Throughout our analyses, it is the single best predictor of impact with an effect size twice as high as the second-best predictor. For descriptive reviews, the effect of transparency is slightly lower but still highly significant. This underlines the importance of transparent reporting and suggests that these practices are valued by subsequent research. Interestingly, reviews aimed at understanding and explaining are cited more often when the methodology is reported in a transparent manner. This suggests that contributions to understanding and explaining phenomena, which often result in theoretical models, benefit from a rigorous methodology supporting the proposed explanation by grounding it in extant literature.

Finally, developing a research agenda has been considered important by several editors [e.g., 6]. Reviews aimed at theory testing are the only exception in our analysis as our sample does not contain enough observations to estimate the effect of this variable for this particular subset. Although this should not discourage authors of theory testing reviews to provide fruitful paths for future research, developing a speculative and conceptual research agenda may be seen as inconsistent with this type of review, which emphasizes empirical evidence. For reviews aimed at understanding, in contrast, the development of a comprehensive research agenda is the single best predictor of citation impact. These reviews seem to be more useful for subsequent research when the constructive problem shifts achieved by the understanding process are complemented by a research agenda specifying the implications for future research. For reviews aimed at describing and explaining, presenting the review without any implications for future research is associated with a significant decrease in terms of impact. In contrast,

[11] Dropping the journal variable from the main model (reviews for theory testing) leads to a 1.8 % reduction in R^2 (not significant). Conversely, dropping the transparency variable from the main model (reviews for theory testing) leads to a 10.0% reduction in R^2 (p<0.001). For both partial R^2, chi-square tests were implemented.

going beyond the presentation of a few open questions and developing a comprehensive agenda leads to higher impact.

In summary, our results provide a parsimonious and powerful explanation (in terms of ΔR^2) for the impact of four types of reviews. In contrast to previous scientometric research, in which a majority of the studies have identified journal impact as the single best predictor [20], we demonstrate the importance of including a transparent methodology as well as a research agenda. Although requiring considerable coding efforts, omitting these variables with strong and significant effects on scientific impact poses a threat to the validity of scientometric models. The results also provide evidence that the explanatory power of certain attributes depends on the type of review. As such, we unveil important heterogeneity in the genre of literature reviews. The robustness checks presented in the following subsection provide further support for our model, which puts forward a robust and holistic explanation for the scientific impact of IS review papers. With its relatively high explanatory power, which exceeds many scientometric studies, it also provides a basis for tentative predictions of the impact of review papers.

4.2. Robustness checks

There are several alternative attributes and explanations suggested in prior research (see Appendix A) that may bias our results (Table 2). Although our sample limits our ability to include further variables in the main model, we can check the robustness of the selected variables with regard to alternative effects[12]. To do so, we estimated seven models, which include various alternative variables and analyzed changes in effect size and significance of the main variables. Table 3 provides an overview of the robustness checks, their underlying rationale, and the corresponding models. Detailed results of the robustness checks, which are structured according to the journal, the authors, and the paper level, are reported in Tables 4 and 5. We discuss each robustness check in turn.

Table 3. Summary of robustness checks

No.	Robustness check	Rationale	Model
1	Include average Journal Impact Factor.	Short-term variation of the Journal Impact Factor may be driven by individual papers, i.e., outliers [72].	(1)
2	Include special issue indicator.	Reviews published in special issues have a higher visibility [17,45].	(2)
3	Include accessibility.	Subscription access control (open access) could bias other coefficients [73,74].	-
4	Include different measures of author reputation.	The average h-index of authors might not be a perfect measure for the reputation of the author team [16,54].	(3)
5	Include the number of authors.	Results might be biased due to the effects of teamwork [75,76].	(4)
6	Include acknowledgment of conceptual feedback.	Results might be biased due to the effects of external feedback on paper impact [40].	(5)
7	Include novelty of the review.	Results might be biased because novel reviews receive more attention [77,78].	(6)
8	Check the effects of correcting citation data for month of publication.	Different results with uncorrected citation data provide evidence for the necessity of our corrections.	(7)
9	Compare short-term and long-term impact.	Short-term impact might be weakly associated with long-term impact.	-

[12] Note that the main purpose of the robustness checks is to evaluate whether the main results presented in Table 2 are robust with regard to alternative explanations and variables. Variables introduced in the models implemented for the robustness checks may correlate with variables of the main models.

Regarding the journal level, the variation of the Journal Impact Factor over time may not represent changes in the overall journal impact and potentially interfere with our results. In particular, the possibility that short-term variation in Journal Impact Factors may be driven by "blockbuster papers" has been discussed in previous research [72]. To evaluate the robustness of our main findings with regard to these short-term variations, we estimated a model using the average Journal Impact Factor between 2000 and 2014. Data sources and imputation procedures were equivalent to the Journal Impact Factor, as reported in Table 1. Standard deviations ranged from 0.11 (Journal of Organizational and End User Computing) to 1.31 (MIS Quarterly). The results show that the other model coefficients are not affected, except for changes in effect sizes for reviews aimed at theory testing.

Another potential concern is that reviews published in special issues may have a higher visibility and receive more attention in the field [17,45]. To assess whether this affects the results of our main model, we include a variable indicating whether the review was published as part of a special issue or not (model 1). We checked all full-texts (i.e., PDFs) and identified 10 reviews that were part of a special issue (4 reviews aimed at describing, 3 reviews aimed at understanding, 3 reviews aimed at explaining). The results are robust with minor changes in the significance of the *complete research agenda* variable (reviews aimed at explaining) and the topic popularity control variable (reviews aimed at understanding and explaining).

Accessibility is another variable that may explain differences in citations as papers published in open access journals are available to more researchers who could access, use, and cite them [73,74]. Since our sample does not include open access journals, this variable could not bias our results. Similarly, we checked for individual papers published openly and not under subscription access control, and found none.

We further evaluated robustness regarding different measures of author reputation. In particular, decisions to cite a review paper might be influenced by the reputation of the most prolific author. Considering the review of Xiao and Benbasat [79], for instance, a value of 24.5 (as an average of the h-indices 1 and 48 at the time of publication) may not capture the reputation and visibility of Izak Benbasat, who authored the review paper with his former PhD student, Bo Xiao. To check how the h-index of the most prolific author affects the model, model 3 includes the highest h-index of the authors. While the coefficients for the highest h-index differ from the coefficients for the average h-index, the effect sizes and significance of the other variables remain robust except for the effect of transparency for reviews aimed at describing. Citing decisions could therefore be influenced by both, the average visibility of the author team and the visibility of the most prolific author. Similarly, controlling for the concatenated h-index, i.e., the h-index calculated for the bibliographies of whole author team [80], shows the robustness of the other coefficients.

Since the size of the author team has been identified as a significant predictor of high impact research output [75,76], we checked whether this variable biases our results. In model 4, we include the number of authors as a variable, which was log-transformed due to its skewed distribution. We also checked robustness regarding other functional transformations. The number of authors is a significant positive predictor of scientific impact in the case of reviews aimed at describing and theory testing; however, it has a negative effect for reviews aimed at understanding and explaining. This indicates teamwork may have favorable effects if the review type is associated with a structured application of prescribed methodological procedures. For reviews requiring creative thought and innovative problem shifts, such as reviews aimed at understanding and explaining, teamwork seems to have a negative effect. This may be explained by disagreements in a team's convergence towards a common storyline and subsequent stagnation in developing the manuscript. Furthermore, there is a lack of methods for discovering novel insights [81] and coordinating individual efforts that could guide an author team in developing reviews aimed at understanding and explaining. Generally, the other coefficients do not change substantially, except for transparency (reviews aimed at describing), underlining the robustness of our main results.

Soliciting external feedback might be associated with a higher scientific impact and thereby complement the effects of collaboration within the author team. Helpful scientists who provide conceptual feedback have been shown to affect the performance of their collaborators [40,75]. Furthermore, the importance of soliciting feedback during the development of a review paper has been emphasized repeatedly [6,82,83]. In model 5, we therefore included a dummy variable indicating whether the authors acknowledge conceptual feedback. In accordance with Oettl [40], this measure was coded manually from the acknowledgments section of the review papers, considering keywords such as ”comments”, ”suggestion”, ”review”, ”discussion”, and ”criticism”, provided by other scholars. For descriptive reviews, the results show that acknowledging feedback has negative effects. This is consistent with the nature of these reviews, which may be perceived as being more neutral and objective. Reviews aimed at understanding, which can be more opinionated, seem to benefit from the solicitation and acknowledgment of external feedback. While feedback has mixed effects on the impact of review papers, the results of the other variables do not change substantially. Complementing prior research on the effects of helpful researchers who provide feedback, our results suggest that effects might not only pertain to the productivity of their colleagues but also to the impact of their research.

Novelty of a paper has been shown to affect its impact [20,75,77,78]. The requirement to give credit to original works by appropriate citations directly contributes to the impact of papers introducing new ideas in a certain domain. This “first-mover advantage” could explain the high impact of the first review on a particular topic, or reviews introducing new ideas and refer to unexplored literatures (e.g., the resource-based view from the management disciplines), for example. Beyond the (qualitative) coding of novelty [e.g., 16,23], Uzzi et al. [78] implement a measure for novelty that does not require (subjective) judgment. The measure is based on novel, or a-typical combinations of references used in a given paper. We followed this approach and measured novelty of review papers as the percentage of cited works that have not previously been covered by a review paper. Reference data was extracted from the full-texts and matched with reference data from the other review papers. The suggested measure does not cover cases in which a review uses the same references included in a previous review but uses them in a distinct, novel way. It may also be questioned whether the percentage of novel references captures novelty in an equal way for reviews that cite few (potentially high-quality journal) papers and reviews that cite extensively (e.g., journal papers, conference papers, etc.). Nevertheless, the values of the novelty variable attest to the validity of this measure. While the early reviews have novelty-scores close to unity, the more recent reviews, in particular those on popular research topics that have been reviewed frequently, have lower novelty-scores. Evidently, descriptive reviews in particular benefit from including papers that have not been considered by previous reviews in IS. The results of model 6 suggest our main model is robust to the effects of novelty, or “first-mover advantages”.

As our procedure of correcting citation data for the month of publication (instead of using citation data aggregated on an annual level) is novel, we analyze its effect on the coefficients (model 7). While several coefficients changed slightly, the most substantial changes can be observed in the subset for descriptive reviews: the standardized coefficient for the topic popularity and transparency variables changed twofold with a strong increase in significance for the topic popularity variable. This suggests procedure is necessary and short-term citation scores need to be crafted carefully when used as a dependent variable. This methodological detail is critical to avoiding biases in scientometric studies that intend to explain short-term impact.

Finally, review papers with a high short-term impact might not necessarily be on a trajectory to become high-impact in the long-term. Figure 2 shows the development of citation scores of the top-10%, the bottom-10% and a random selection of 10% of the review papers. As Figure 2 indicates, high-impact reviews can be distinguished after very few years. Furthermore, the three-year citation rates correlate significantly with citation rates after four ($r=0.99$, $p < 0.01$), five ($r=0.98$, $p < 0.01$) and six ($r=0.967$, $p < 0.01$) years, respectively. The correlations suggest that short and long-term impact are strongly related. Explaining long-term impact would raise three empirical problems. First, self-reinforcing mechanisms, i.e., the Matthew effect [13] [84], may result in impactful review papers biasing the coefficients. Second, with an increasing time-lag the reputation and visibility of authors may increase due to an impactful review, thereby aggravating problems of reverse causality associated with correlational analyses. Third, an appropriate functional form for the development of citations over time would be necessary to analyze recent as well as dated papers.

[13] This effect, which was named after the biblical Gospel of Matthew, describes the phenomenon that prominent authors are cited more often than less well-known authors, even if they publish similar work.

In summary, the results of the robustness checks are qualitatively similar to the main results, as shown in Tables 4 and 5. The only caveat is that the effect of transparency is not robust for reviews aimed at describing. Due to our sample size, test power might not be sufficient to reliably detect lower effect sizes. In the case of reviews aimed at describing, a low and non-robust effect indicates that citing decisions are influenced by other (proxy) variables such as the journal impact factor, rather than methodological transparency. Overall, our main results are not substantially affected by alternative explanations, suggesting that our model provides a robust and parsimonious explanation for the scientific impact of review papers in our field.

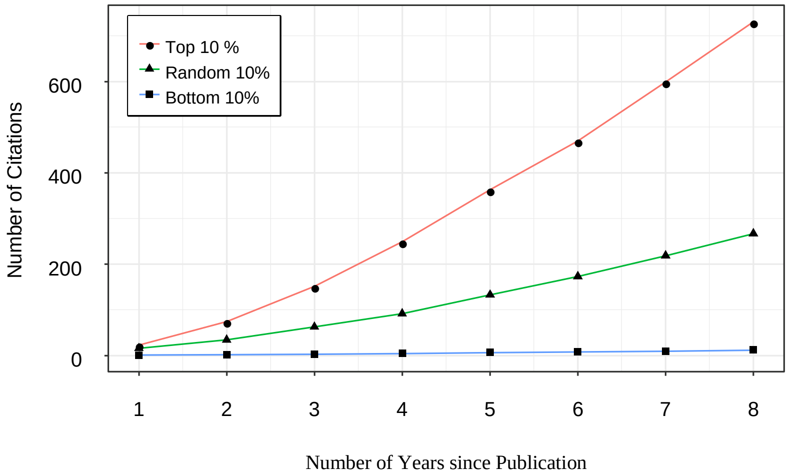


Figure 2. Cumulative scientific impact over time

Table 4. Robustness checks: Reviews aimed at describing and understanding

	Review aimed at describing (I)								Review aimed at understanding (II)							
Effect	Main	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Main	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Journal Impact Factor	0.57**		0.61**	0.58**	0.57**	0.57**	0.55**	0.64**	0.35**		0.35**	0.34**	0.33**	0.29**	0.35**	0.40**
Average Journal Impact Factor		0.60**								0.28**						
Special issue			0.70**								-0.93**					
h-index (average)	0.27**	0.26**	0.29**		0.27**	0.26**	0.31**	0.31**	0.45**	0.41**	0.41**		0.53**	0.46**	0.46**	0.37**
h-index (highest)				0.16**								0.30**				
Team size (log)					0.22**								-0.43**			
Feedback						-0.16**								0.36**		
Topic popularity	-0.07	0.01	-0.09*	-0.04	-0.04	-0.05	-0.01	-0.14**	0.00	0.06	0.10*	0.04	-0.03	0.03	-0.01	-0.09
Novelty							0.25**								0.07	
Transparency score	0.10**	0.12**	0.09**	0.00	0.05	0.12**	0.18**	0.20**	0.23**	0.22**	0.17**	0.13**	0.26**	0.19**	0.24**	0.18**
Research agenda (none)	-0.27**	-0.23**	-0.34**	-0.34**	-0.34**	-0.24**	-0.26**	-0.16*	[a]		[a]	[a]	[a]	[a]	[a]	
Research agenda (complete)	0.30**	0.25**	0.19**	0.34**	0.25**	0.33**	0.24**	0.32**	0.51**	0.51**	0.55**	0.69**	0.49**	0.51**	0.49**	0.48**
R^2	0.32	0.34	0.34	0.28	0.34	0.32	0.35	0.30	0.48	0.43	0.49	0.46	0.51	0.48	0.48	0.44

Notes. DV: citations. Model includes an intercept. Standardized beta coefficients are reported. [a] Not enough observations available to include the variable.
* significant at 1%, ** significant at 0.1%.

Table 5. Robustness checks: Reviews aimed at explaining and testing

	Review aimed at explaining (III)								Review aimed at theory testing (IV)							
Effect	Main	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Main	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Journal Impact Factor	0.19**		0.21**	0.18**	0.18**	0.19**	0.19**	0.19**	0.01		0.01	0.02	-0.03	0.01	0.00	0.05
Average Journal Impact Factor		0.16**								-0.24**						
Special issue			0.45**								[a]					
h-index (average)	-0.05	-0.05	-0.04		0.06*	-0.05	-0.04	-0.06	0.13**	0.28**	0.13**		0.14**	0.13**	0.13**	0.08
h-index (highest)				0.14**								0.07				
Team size (log)					-0.16**								0.30**			
Feedback						0.04								-0.02		
Topic popularity	0.22**	0.23**	0.24**	0.24**	0.23**	0.22**	0.23**	0.22**	0.18**	0.26**	0.18**	0.17**	0.20**	0.19**	0.16**	0.21**
Novelty							0.08**								-0.11*	
Transparency score	0.26**	0.25**	0.25**	0.31**	0.28**	0.25**	0.28**	0.22**	0.53**	0.72**	0.53**	0.54**	0.52**	0.53**	0.46**	0.42**
Research agenda (none)	-0.55**	-0.53**	-0.56**	-0.53**	-0.52**	-0.54**	-0.48**	-0.55**	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Research agenda (complete)	0.13*	0.11*	0.10	0.18**	0.14*	0.13*	0.12*	0.20**	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
R^2	0.41	0.38	0.42	0.40	0.41	0.41	0.41	0.40	0.48	0.48	0.49	0.46	0.47	0.48	0.47	0.44

Notes. DV: citations. Model includes an intercept. Standardized beta coefficients are reported. [a] Not enough observations available to include the variable.
* significant at 1%, ** significant at 0.1%.

5. Discussion

Our study contributes to the vibrant discourse on literature reviews in IS, which is informed by other disciplines and offers many facets ranging from editorials, debates, methodological guidelines and opinion pieces to panels, tutorials and teaching material. This discourse, however, is largely based on anecdotal evidence and illustrative examples as opposed to reliable evidence that would support competing views on the attributes distinguishing impactful reviews. Our paper reports on the first study that provides evidence on the attributes predicting scientific impact of IS review papers. Our insights contribute to the discourse on literature reviews and inform the different stakeholders involved in the development and publication of review papers in the IS field, including authors, reviewers, and editors.

5.1. Contributions

Our model provides a powerful, parsimonious and robust explanation of impactful review papers and advances current scientometric analyses in several regards. We assessed review papers published in a very large number of journals and carefully developed a range of variables, including *transparency* and *research agenda*, which in turn are based on the content of the paper as opposed to meta-data. As a result, we answer our research question by showing that transparency and research agenda are the main attributes that affect the scientific impact of different types of IS review papers after controlling for the journal impact factor, the h-index and the topic popularity.

While our study offers many detailed insights, we emphasize its broader contributions to both the literature on review papers and scientometric research in general. One contribution of our study is to provide substantial empirical evidence on attributes of different types of reviews that are successful in terms of scientific impact. The underlying notion that the value and success of review papers are reflected by their citation impact resonates with prominent editorial views [e.g., 13,85]. The main results thereby suggest that it is necessary to consider nuances between types of reviews rather than conceiving the review genre as a monolithic block. These results are specific to IS review papers. We also think they may be unique to our discipline due to the differences in the discourse in the broader social sciences and information systems, as reflected by the role of theoretical contributions of review papers [6,86].

The presented study also makes contributions beyond IS research by demonstrating that developing a research agenda is significantly associated with higher scientific impact. Developing a research agenda, as a scientometric variable, has received scant attention. To the best of our knowledge, the only scientometric study analyzing this variable was conducted by Sternberg and Gordeeva [29], who show that researchers expect papers providing value for future research, inter alia, to exert higher scientific impact. Despite its significance in the literature, especially in the literature on review papers [e.g., 6,13], the effect of this variable has not yet been analyzed in a scientometric impact model before. By including the development of a research agenda in our model and estimating its effect, we confirm its importance for IS review papers, and thus introduce a new variable to the arsenal of scientometric models [20] and show it has a significant, high, and robust effect on scientific impact.

Our insights further contribute to recent debates on the role of transparency in review papers [e.g., 3,4]. They empirically show that the association between citations and transparency varies between different types of reviews. While this association is strong for reviews systematically summarizing evidence from prior research (theory testing reviews), it is slightly weaker for traditional narrative reviews (reviews aimed at describing). Surprisingly, reviews requiring original, imaginative, or critical engagement (reviews aimed at understanding and explaining) also achieve a higher impact when they are more transparent. This contrasts with the view that the original idea communicated through these types of reviews does not need to be complemented by a transparent methodology [85].

Another scientometric insight is that the effects of transparency and the journal impact factor are inversely related. This general tendency suggests citing decisions rely either on the journal impact factor, which serves as a proxy variable for the quality of papers, or on the transparency of the paper itself. The result that the journal impact factor, one of the best predictors of scientific impact in many scientometric studies, can even become non-significant after including transparency suggests future scientometric research should not avoid the efforts required for coding and including the transparency variable.

Our contribution to research is exploratory, especially regarding the main variables, but our model also builds on extant theories of citation behavior. The two prominent theories contend that authors use citations for normative purposes, i.e., aligned with the scientific merit of the cited papers [38], or for the purpose of persuading the scientific community of the value of a paper and its arguments [87, pp.115-116]. In developing impact models, these theories are very helpful in directing our attention to aspects that could reflect sociological forces potentially in line with the purpose of persuasion (e.g., citing authoritative senior scholars), or the merit of a paper (e.g., rigor). To clarify the connection between impact models and theories of citing behavior, we consider it instructive to reflect on research agendas as our latest addition to impact models. It is easy to imagine that corresponding citations could be a question of sociological persuasion (e.g., "others have prominently promoted the need for this research") or a question of merit (e.g., "we can only address the research gap because previous work has uncovered it"). This ambiguity in the association between theories and factors affecting scientific impact reflects the fact that impact models are not designed to confirm or refute theories of citing behavior, a question that would require different research designs.

Overall, we believe our study contributes to addressing the latent skepticism towards scientometric papers in IS[14]. Scientometric papers are often regarded as purely descriptive in nature and preoccupied with meta-data. In this regard, we are confident that a stronger focus on content-related aspects will raise the interest of a broad audience and provide more actionable implications for prospective authors compared to the meta-data and structural characteristics prevailing in many impact models [20]. This requires extensive efforts in content analysis, such as manually coding a large number of transparency items or categorizing the development of a research agenda.

5.2. Implications

We outline the implications of our work following the framework displayed in Figure 3, which builds on previous works [53,88], and illustrates how different stakeholders shape a discipline's key concerns. For us, this key concern is the impact of literature reviews and their associated value for the discipline [e.g., 13,85]. Review papers are shaped through disciplinary processes of practice and negotiation involving several institutional and principal stakeholders [53,88]. We derive our implications from the main results, which show that the factors contributing to scientific impact of review papers differ between review types and that the two main variables affecting scientific impact are transparency and the development of a research agenda. We believe our work is relevant to practice in two regards. Managers from the industry could refer to our comprehensive collection of review papers to identify decision areas in which consulting IS research and review papers could be beneficial. Moreover, academically interested practitioners could rely on the selection of impactful review papers (Table C.2, Appendix C) to inform themselves about those reviews that had the greatest impact on the advancement of scientific knowledge in IS. With regard to implications for

[14] See https://misq.org/not-published, for instance.

research, we discuss the two groups of principal and institutional stakeholders, their main considerations and contributions in turn.

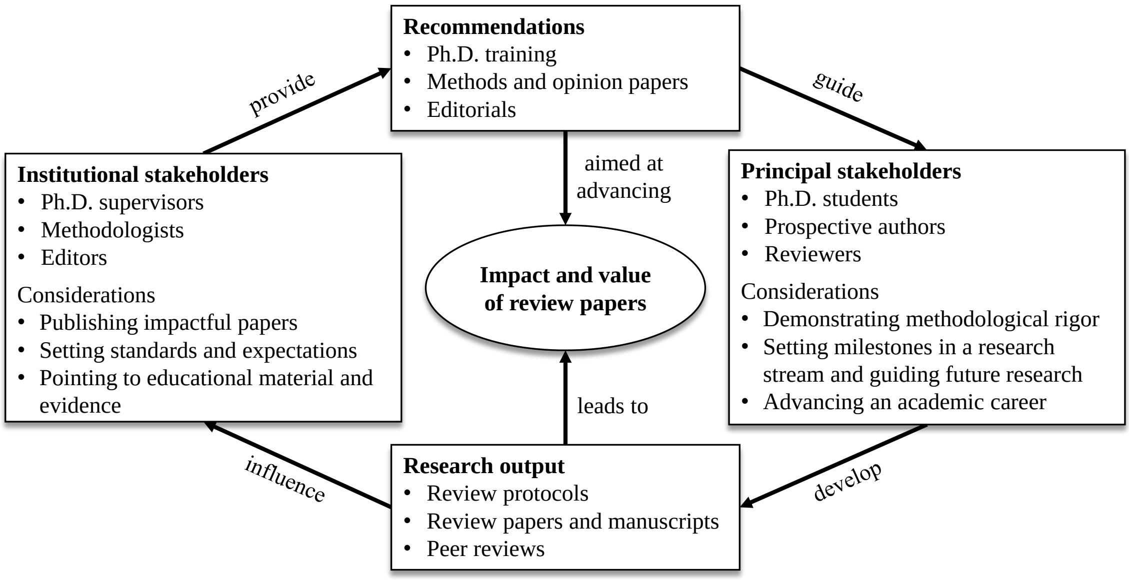


Figure 3. Stakeholder perspectives for the impact and value of review papers (based on [53,88])

Institutional stakeholders, including Ph.D. supervisors, methodologists, and editors, provide different forms of recommendations aimed at guiding principal stakeholders and advancing the valuable and impact of review papers. This involves setting corresponding standards and expectations and backing them up with appropriate educational material and evidence. These recommendations serve as guidelines for principal stakeholders, including Ph.D. students, prospective authors of review papers, and reviewers, who develop protocols, publish review papers, and provide peer reviews. Ultimately, the output of review papers can lead to impact and value for the field and influence the considerations of institutional stakeholders.

Our work has implications for three forms of recommendations: (1) training of Ph.D. students, (2) methods and opinion papers, and (3) editorials. First, we turn to the training of Ph.D. students with regard to writing and reviewing review papers. The need to strengthen doctoral training on literature reviews has been acknowledged in many disciplines [e.g., 57,89] and is increasingly drawing attention in IS [5,90]. As Hart [57] suggests, Ph.D. students cannot do original research without a thorough understanding of previous work. While a reference to the editorial comments of Webster and Watson [6] appears to have satisfied reviewers' expectations in many early review papers, standards are rising at top IS journals [e.g., 91] and other publication outlets. With recent developments in the methodological discourse on literature reviews, Ph.D. students need to be equipped with a more nuanced understanding of the different review types [7], as well as the coherent methodological characteristics [5] and knowledge contributions [12]. Our results further point to the importance of developing research agendas. Corresponding efforts may not only pay off in terms of citations, but also in terms of a clearer understanding of further research efforts required in a research stream.

Second, our work has implications for methods and opinion papers on literature reviews. This discourse has been dominated by recommendations and experiences of senior scholars. As in any other area of a scientific discipline, there is a need to go beyond these valuable but initial pieces [e.g., 6] by providing quantitative evidence of actual research practices. An important quality across the different types of review papers is the transparent reporting of the methodological process. Our insights, representing substantial evidence of citing decisions of more than 50,000 papers (which cite the 220 review papers), is useful to inform recent contradictory debates. In these debates, the role of methodology in reviews aimed at explaining, and theoretical reviews in particular, has been contested [3,4,85]. Contributing to these opinionated debates, we provide initial empirical evidence showing that – despite not representing the only aspect of quality – transparency represents an important driver for stimulating follow-up research, as evidenced by subsequent citation impact.

Third, we think that our work can inform editorial policies and recommendations on publishing review papers[15]. Our main take-away is that such recommendations should emphasize transparent methodology sections and well-grounded research agendas. In addition, editors need to be aware that scientific impact should not be the only consideration when thinking about the value and quality of review papers. On the contrary, editors should be aware of how citing behavior of subsequent research incentivizes authors of review papers. In cases in which authors may be less attentive to particular attributes (e.g., transparency for descriptive reviews, which is not a robust predictor of citation counts), requiring corresponding changes seems advisable. Although it may not immediately pay off in terms of citations, it is necessary for reliable knowledge contributions. Furthermore, there is no evidence of theoretical review papers exerting a higher scientific impact than reviews aimed at describing, understanding, or theory testing[16]. This suggests that editors should be more open towards publishing all types of review papers. Instead, in particular for theoretical review papers, a lack of follow-up research may lead to the proliferation of uncontested knowledge, a tendency which journal editors should be aware of. In this regard, we suggest that the likelihood of stimulating subsequent research and empirical validation needs to be considered as a criterion for accepting and publishing review papers.

The principal stakeholders of our research are Ph.D. students, prospective authors, and peer reviewers. The stakeholders may take several aspects into consideration when developing and reviewing papers and protocols. Beyond the goal of showing an in-depth understanding of the field and contributing to knowledge development, this increasingly pertains to demonstrating methodological rigor [4,5]. For principal stakeholders, publishing review papers can also be a way to set a milestone in a research stream and to achieve a progressive problem shift [92]. Ultimately, authoring impactful review papers can represent a significant step in academic careers. Prospective authors may see it as an opportunity to shape thought leadership in their research streams and to follow the path of many great scholars who have published review papers [2].

Our study aims at informing the decisions of principal stakeholders when drafting review protocols, developing review papers, and conducting peer reviews. We suggest our results (see Table 2) should not be considered as a recipe for developing the structural characteristics of a review paper, but as an indicator of the importance of transparent reporting and a deeper engagement with the future of research in the given domain, i.e., by developing a research agenda. Our results enable prospective authors to focus their review on attributes, including methodological characteristics that are coherent with the specific type of review and likely to stimulate scientific impact. This should be particularly useful when facing page and time restrictions. We think that the preference for transparent reviews prevalent in subsequent research supports the argument that transparency is a necessary aspect for the trustworthiness of a review [4]. If authors of a review do not report their methodological process, they deprive subsequent research of the ability to establish confidence in the reliability of the review's claims regarding what we know and do not yet know on a certain topic. Keeping in mind

[15] Several scientometric papers consider editorial initiatives aimed at publishing more review papers as a means of pushing journal impact factors up [64,102]. In our sample, we do not observe obvious attempts to manipulate journal impact factors in this way. Furthermore, our results and the increasing volume of low-impact review papers suggest that this might not be an effective strategy.

[16] A one-way ANOVA and pairwise t-tests did not yield significant differences between the types of reviews.

that transparency is an important antecedent of scientific impact but not an indicator of contribution and quality, we encourage authors to refer to guidelines outlining transparency, systematicity and corresponding reporting standards [4,5].

Our results further suggest that review papers should not be developed as a purely backward-oriented account of previous research but that they should include forward-oriented knowledge contributions [12] to make an impact. In this regard, our study provides empirical evidence that is consistent with editorials promoting the development of research agendas [e.g., 6,13]. Authors should therefore consider providing additional value by going beyond cursory gap spotting and instead provide more comprehensive guidance for future research. Reviews aimed at theory testing are an exception in this regard since developing a research agenda may not be coherent with this particular type of review.

5.3. Limitations and avenues for future research

Although scientific impact is an important aspect of high-quality reviews, we are cautious to present citations as the sole criterion guiding the discourse on review papers. For example, our results suggest that transparency may not be a highly robust predictor of impact for reviews aimed at describing. However, this should not lead to a neglect of this criterion as transparent reporting is critical for the reliability and trustworthiness of these types of reviews [5]. If transparency is not a high priority for authors who aim at increasing the impact of their reviews, reviewers and editors should require authors to adopt a systematic and transparent approach (i.e., to adhere to methodological reporting guidelines). Otherwise, striving for maximum scientific impact exclusively may have adverse effects on the reliability of knowledge development in our field. Similarly, the effects of authors' reputation require careful consideration. We do not consider them to suggest that junior scholars should reach out to senior scholars and to indiscriminately add any well-known author to the paper who does not immediately decline the request. Instead, we consider these effects to point to the role of experience and knowledge in the topic and the review methodology as an ingredient of high-quality reviews [93]. This is also consistent with the results on teamwork and soliciting external feedback. We therefore encourage a more nuanced debate on how the field can draw on the experience of senior scholars. In this regard, we encourage further research on the process of developing high quality review papers. For example, surveys may offer insights into teamwork, solicitation of feedback, the use of methodological expertise and experience with the review methodology. Further tutorials and seminars on how to conduct various types of reviews should be integrated into PhD courses and mainstream IS conferences to raise awareness of and proficiency in applying appropriate methodologies.

Methodological limitations are related to our sample, which presents us with less than perfect conditions. The nature of our object of analysis prohibits us from implementing experimental research designs that are more appropriate for identifying causality. There could be selection into particular review types, e.g., based on authors or topics, and omitted variable bias. In a correlational, non-interventional design, we can only implement robustness checks to control for alternative explanations, but we cannot intervene and manipulate the research output (e.g., by removing the transparent reporting from review papers) to assess causal effects. Dependencies between variables, particularly between those on the same level, necessitate a delicate selection of a few main variables. The low sample size limits the generalizability of our results although our scope covers 40 journals and spans over 15 years. It also prohibits us from controlling for systematic trends over time. In line with extant scientometric research, our research model also focuses on manifest variables as opposed to the development of abstract constructs. Furthermore, differences in focus on theory vs. practice and a general appreciation of methodological reporting standards suggest that there is no reason to expect our results to be representative beyond the IS discipline. Finally, citations are one possible measure of scientific impact and may not fully reflect scientific progress, knowledge development, or impact on research practice. These facets could be analyzed using other dependent variables [94]. For example, citation impact could be distinguished qualitatively, differentiating perfunctory impact, i.e., citations not engaging with the content of the review, from ideational impact, i.e., citations expanding the knowledge developed in the review [15,95]. Further, indicators for early diffusion into research practice such as reads, tweets, altmetrics or downloads [96,97] could be analyzed.

Despite the volume of papers published on literature reviews, there are further avenues for future research and methodological advances. Concerning research agendas, procedural frameworks for their development and criteria for assessing the value of the output are a literal blind-spot in the literature. We therefore encourage a more comprehensive debate on the components required in a high-quality research agenda that can be considered a standalone contribution of a review paper. Examples include the following: (1) Is it helpful to provide a long list of relatively unconnected research questions? (2) Which aspects of research designs should be clarified to stimulate and enable subsequent author teams to follow up on the suggestions? (3) When and in which way should the proposed research agenda be exposed to feedback from domain experts from the industry and academia? We hope methodologists finally acknowledge the repeated calls for agenda development that can be found in editorials and, combined with our evidence, act upon these calls by developing corresponding methodological guidelines.

Furthermore, while scientific impact primarily reflects relevance to an academic audience, reviews should also be positioned for practical relevance and impact. Disciplines like the health sciences have been successful in positioning review papers as a channel for communicating knowledge and informing practice based on evidence. With less than 10 % of the reviews in our sample outlining implications for practice and design-oriented research, review papers in IS do not yet fulfill their potential. By providing a methodology to identify topics that are relevant to practitioners but lack attention from researchers, Marrone and Hammerle [98] take a valuable first step in this direction. We think reviews are an appropriate genre to provide an overview of the current state of research from which practitioners can pull their topics of interest and inform their decisions. Building on the work of Oates [99], the IS field has much to learn from the evidence-based practice methodologies that have proven to be useful in other disciplines [e.g., 100].

Finally, future impact models can derive inspiration from our approach, which is distinct from previous work. Specifically, we deliberately focused on a small set of content-based variables in our main model to avoid problems related to large models, including correlation between independent variables and model overfitting. In addition, we emphasize the need to assess and control possible biases, by conducting comprehensive robustness checks and implementing corrections of the dependent variable.

6. Conclusion

At the outset of this study we noted that some of the prominent reviews in IS are cited more than twice a day on average, while others take years to accumulate single digit citations. Considering the magnitude of these differences and the proliferation of review papers in recent years, we conducted empirical analyses to understand what distinguishes those reviews driving scientific progress from those reviews that might not be considered impactful. Overall, our scientometric analyses of four types of review papers offer nuanced empirical insights into the content-related attributes affecting the scientific impact of review papers. Based on a parsimonious and powerful model, we show that on the paper level, the degree of methodological transparency and the development of a detailed research agenda distinguish high-impact reviews in IS. These attributes, which can be shaped by prospective authors, have a significant effect on the citation impact of review papers after controlling for the journal impact factor, the average h-index of the author team and the topic of the review. Although some of these control variables have strong effects, they can rarely be influenced by prospective authors. We demonstrate the robustness of these effects by contrasting them with several alternative explanations. In short, our results show which characteristics are integral to IS review papers that are highly cited and valued by subsequent research. This paper thereby makes a significant contribution to an informed debate on how we can leverage the power of review papers to drive scientific impact and knowledge development in IS. The IS research community in turn should continue its efforts to effectively build on the foundation provided by review papers.

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Appendix A. Attributes included in previous scientometric studies

To provide an overview of the various attributes considered in scientometric studies, we searched literature reviews on scientometrics [e.g., 1], background sections [e.g., 2] and major studies of scientometric impact [e.g., 3–5].
The summary in Tables 1 to 3 provides a representative overview of these attributes rather than an exhaustive list. To provide a condensed table, attributes are summarized using the same label if they are measured similarly (e.g., article length and number of pages) or equivalent after transformations (e.g., age of the paper and year of publication). The last column indicates how the attribute is considered in our analyses and the underlying rationale.

Table A.1. Paper level attributes included in previous scientometric studies

Attribute	Exemplary references	Inclusion (rationale)
Methodology	[3,6]	Included in the main model
Research agenda	[7]	Included in the main model
Paper type	[2,3,5,6]	Subset analyses are reported for each type of review, i.e., reviews aimed at describing, explaining, understanding, and testing (cf. Table 2)
Goal	[2,6]	Used for the subsets (since the typology of reviews proposed by Rowe (2014), which is used in this paper, is based on research goals)
Topic popularity/Field size	[3,5]	Included in the control and main model
Novelty	[5,8]	Included in the robustness checks
Strength of theoretical contribution	[6,9,10]	Not included (requires subjective judgment and therefore is difficult to assess reliably; it also does not apply to all types of reviews (e.g., meta-analyses))
Attention grabbers (e.g., length of title, number of keywords)	[5,11]	Not included (not content-related)
Number of references (i.e., the in-degree centrality in the citation network)	[2,5]	Not included (not content-related)
Quality of presentation	[5,6]	Not included (measurement is subjective)
Article length	[2,3,5,6,12]	Not included (not content-related)
Awards	[5]	Not included (due to potential of reverse causality)
Year of publication	[3,6]	Dependent variable measured after 3 years for every review paper
Language	[12]	Not relevant for our sample (includes only reviews published in English)

Table A.2. Author level attributes included in previous scientometric studies

Attribute	Exemplary references	Inclusion (rationale)
Publication record, e.g., h-index, top-tier publications (correspond to measures of centrality in academic networks)	[3,5,6,12]	Included in the control and main model
Number of authors	[2,3,5,13,14]	Included in the robustness checks
Soliciting feedback	[15]	Included in the robustness checks
Affiliation	[3,5,6,12]	Not included (no IS-specific ranking for the time-frame available)
Academic rank	[1,11]	Not included (related to publication record)
Nationality	[12]	Not included (requires many dummy variables)
Gender	[6,12]	Not included (small and non-significant effect in the exemplary studies)
Age	[3,11]	Not considered (related to publication record)
Editorial board membership	[5]	Not included (differences in visibility between boards of different journals)
Self-citations	[5]	The dependent variable is corrected for self-citations

Table A.3. Journal level attributes included in previous scientometric studies

Attribute	Exemplary references	Inclusion (rationale)
Journal impact (i.e., out-degree centrality in the citation network)	[6]	Included in the control and main model
Special issue	[2,3]	Included in the robustness checks
Position in the journal	[5,6]	Not include (The order of papers in a journal only matters when readers use the print version or the table of content. It is irrelevant in database searches, reference searchers, or on academic social networks)
Accessibility	[2,16,17]	Not relevant in our sample (No open access papers included)

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Appendix B. Sample of review papers

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Appendix C. Descriptive statistics and correlations

Table C.1. Frequency table

Journal	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Sum
ACM SIGMIS Database	0	0	0	0	2	0	0	1	1	0	1	1	0	1	0	7
ACM Transactions on Management Information Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
AIS Transactions on Human-Computer Interaction	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
Australasian Journal of Information Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Business & Information Systems Engineering	0	0	0	0	0	0	0	0	0	1	1	2	0	5	1	10
Communications of the Association for Information Systems	0	0	1	1	0	1	1	0	0	0	2	0	2	1	10	19
Decision Support Systems	0	0	1	0	0	0	0	1	2	1	1	1	3	2	3	15
e-Service Journal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
Electronic Commerce Research and Applications	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
Electronic Markets	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
European Journal of Information Systems	1	0	2	0	1	0	0	0	2	0	0	1	1	1	0	9
Information & Management	0	0	0	0	0	1	2	2	0	1	0	0	2	0	1	9
Information and Organization	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	3
Information Resources Management Journal	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3
Information Systems Frontiers	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Information Systems Journal	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	3
Information Systems Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Information Systems Research	0	1	0	1	1	0	0	0	0	0	2	0	1	0	0	6
Information Technology & People	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
International Journal of Electronic Commerce	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Journal of Computer Information Systems	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Journal of Database Management	1	0	1	0	0	1	0	0	1	0	1	2	0	0	0	7
Journal of Global Information Management	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2

Journal of Global Information Technology Management	0	1	0	1	0	0	1	0	0	0	1	1	1	1	0	7
Journal of Information Systems Education	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	3
Journal of Information Technology	0	2	0	0	0	1	1	2	1	1	3	1	0	2	1	15
Journal of Information Technology Case and Application Research	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Journal of Information Technology Management	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Journal of Information Technology Theory and Application	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	5
Journal of International Technology & Information Management	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Journal of Management Information Systems	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0	5
Journal of Organizational and End User Computing	1	0	0	1	2	0	0	0	0	0	0	0	1	0	0	5
Journal of Organizational Computing and Electronic Commerce	3	1	1	0	0	0	1	0	0	0	0	1	0	0	0	7
Journal of the Association for Information Systems	0	0	0	0	1	2	2	2	3	0	2	0	3	3	1	19
MIS Quarterly	0	2	2	0	2	1	1	2	3	1	0	3	2	2	2	23
The Journal of Strategic Information Systems	0	0	2	0	3	0	0	1	0	0	1	3	4	0	2	16
Sum	8	9	11	7	17	8	10	15	17	6	18	19	22	23	30	220

Table C.2. Most impactful review papers (Top 40)

	Review paper [a]	Topic	Citations [b]
1	Alavi and Leidner (2001)	Knowledge management (systems)	9,021
2	DeLone and McLean (2004)	IS success	7,047
3	Melville et al. (2004)	IT business value	2,485
4	Wade and Hulland (2004)	IT business value	1,964
5	Dibbern et al. (2004)	IT outsourcing	1,343
6	Powell et al. (2004)	Virtual teams	1,217
7	King and He (2006)	Technology acceptance, and use	1,167
8	Shim et al. (2002)	Decision support systems	1,145
9	Leidner and Kayworth (2006)	Culture in IS	1,014
10	Petter et al. (2008)	IS success	952
11	Schepers and Wetzels (2007)	Technology acceptance, and use	799
12	Chan and Reich (2007)	IT alignment	784
13	Jeyaraj et al. (2006)	IT innovation adoption	723
14	Schultze and Leidner (2002)	Knowledge management	662
15	Shankar et al. (2002)	E-commerce	613
16	Kohli and Devaraj (2003)	IT business value	598
17	Kohli and Grover (2008)	IT business value	596
18	Piccoli and Ives (2005)	IT business value	561
19	Dhillon and Backhouse (2001)	IS security	531
20	Xiao and Benbasat (2007)	E-commerce	513
21	Ma and Liu (2004)	Technology acceptance, and use	498
22	Jones and Karsten (2008)	Structuration Theory	479
23	Smith et al. (2011)	IS security	467
24	Dahlberg et al. (2008)	E-commerce	462
25	Te’eni (2001)	Software Development	448
26	Chang et al. (2005)	Technology acceptance, and use	425
27	Kauffman and Walden (2001)	E-commerce	399
28	Avgerou (2008)	IS in developing countries	393
29	Aloini et al. (2007)	ERP risk management	387
30	Chan (2000)	IT business value	377
31	Fichman (2004)	IT platform adoption and real options	375
32	Brown and Grant (2005)	IT governance research	360
33	Dewan and Riggins (2005)	E-commerce	360
34	Jasperson et al. (2002)	Power and IT	350
35	Petter and McLean (2009)	IS success	350
36	Ahuja (2002)	Women in IT	349
37	Bélanger and Crossler (2011)	IS security	343
38	Ba et al. (2001)	Software Development	319
39	Pateli and Giaglis (2004)	E-commerce	315
40	Sidorova et al. (2008)	Intellectual core of IS	293

Notes. [a] References based on Appendix B. [b] Citation data extracted from Google Scholar on February, 20th 2018.

Table C.3. All reviews: Descriptive statistics

	Factor	Mean	SD	Min/Max
1	Impact	42.17	51.29	0/318.6
2	Journal Impact Factor	2.09	1.51	0.18/5.31
3	h-index (average)	9.77	6.83	0/38
4	Topic popularity	4.86	3.37	0/24.07
5	Transparency (score)	0.43	0.25	0/1

Table C.4. All reviews: Correlations

	Factor	1	2	3	4	5	6	7-10
1	Impact	1						
2	Journal Impact Factor	0.44**	1					
3	h-index (average)	0.25**	0.21**	1				
4	Topic popularity	0.28**	0.43**	0.07**	1			
5	Transparency (score)	0.20**	0.14**	-0.03**	0.20**	1		
6	Research agenda	-0.21**	-0.22**	-0.15**	0.02**	-0.08**	1	
7	Type: Describing	-0.11**	-0.19**	-0.05**	-0.17**	0.3**	0.10**	a
8	Type: Understanding	-0.07**	-0.06**	-0.10**	-0.10**	-0.15**	-0.38**	
9	Type: Explaining	0.12**	0.23**	0.04**	-0.02**	-0.34**	0.15**	
10	Type: Testing	0.06**	-0.01**	0.13**	0.32**	0.24**	0.13**	

Notes. *significant at 1%, ** significant at 0.1%. N=220. No correlations reported between the levels of the type of review variable.

[a] Since we analyze types of reviews which are mutually exclusive, there are no within-type correlations.

Table C.5. Reviews aimed at describing: Descriptive statistics

	Factor	Mean	SD	Min/Max
1	Impact	36.17	48.67	0.7/318.6
2	Journal Impact Factor	1.80	1.21	0.18/5.31
3	h-index (average)	9.41	7.86	0/34.5
4	Topic popularity	4.31	2.80	0.34/11.38
5	Transparency (score)	0.51	0.23	0.12/1

Table C.6. Reviews aimed at describing: Correlations

	Factor	1	2	3	4	5	6
1	Impact	1					
2	Journal Impact Factor	0.49**	1				
3	h-index (average)	0.35**	0.23**	1			
4	Topic popularity	0.22**	0.50**	0.04**	1		
5	Transparency (score)	0.02**	0.02**	-0.23**	0.24**	1	
6	Research agenda	-0.26**	-0.26**	-0.19**	-0.05**	0.15**	1

Notes. *significant at 1%, ** significant at 0.1%. N=47.

Table C.7. Reviews aimed at understanding: Descriptive statistics

	Factor	Mean	SD	Min/Max
1	Impact	37.86	48.09	0/216.2
2	Journal Impact Factor	1.97	1.43	0.18/5.31
3	h-index (average)	8.94	5.39	0.5/26
4	Topic popularity	4.43	3.06	0/15.29
5	Transparency (score)	0.38	0.25	0.06/1

Table C.8. Reviews aimed at understanding: Correlations

	Factor	1	2	3	4	5	6
1	Impact	1					
2	Journal Impact Factor	0.42**	1				
3	h-index (average)	0.33*	0.16	1			
4	Topic popularity	0.23*	0.42	0.08	1		
5	Transparency (score)	0.20	0.21	-0.26	0.28	1	
6	Research agenda	-0.41*	-0.10	-0.25	-0.14	-0.17	1

Notes. *significant at 1%, ** significant at 0.1%. N=48.

Table C.9. Reviews aimed at explaining: Descriptive statistics

	Factor	Mean	SD	Min/Max
1	Impact	49.58	58.68	2/288.6
2	Journal Impact Factor	2.53	1.77	0.18/5.31
3	h-index (average)	10.07	6.77	0/38
4	Topic popularity	4.79	2.95	0/12.47
5	Transparency (score)	0.32	0.26	0/1

Table C.10. Reviews aimed at explaining: Correlations

	Factor	1	2	3	4	5	6
1	Impact	1					
2	Journal Impact Factor	0.40**	1				
3	h-index (average)	0.13**	0.17**	1			
4	Topic popularity	0.35*	0.49	0.29	1		
5	Transparency (score)	0.38**	0.24**	0.27**	0.14**	1	
6	Research agenda	-0.25**	-0.36**	-0.19**	-0.15**	-0.29**	1

Notes. *significant at 1%, ** significant at 0.1%. N=65.

Table C.11. Reviews aimed at testing: Descriptive statistics

	Factor	Mean	SD	Min/Max
1	Impact	47.29	45.47	0/202.6
2	Journal Impact Factor	2.05	1.54	0.18/5.31
3	h-index (average)	11.19	6.37	1.5/25
4	Topic popularity	6.85	4.87	0.65/24.07
5	Transparency (score)	0.52	0.20	0.05/0.9

Table C.12. Reviews aimed at testing: Correlations

	Factor	1	2	3	4	5
1	Impact	1				
2	Journal Impact Factor	0.42	1			
3	h-index (average)	0.16	0.32	1		
4	Topic popularity	0.34*	0.38	-0.28	1	
5	Transparency (score)	0.45	0.56	0.14	0.20	1

Notes. *significant at 1%, ** significant at 0.1%. N=33.

Appendix D. Measure of methodological transparency

Methodological transparency is measured as the percentage of items relevant to the specific review type that were reported transparently:

Transparency score =

$$\frac{1}{|I_R|}\sum_{i \in I_R} i\ ,$$

with $i = 1$ if the item is reported ($i = 0$ otherwise) and I_R:= set of items required for the type of review R = {Narrative review, descriptive review, scoping review, critical review, theory development review, qualitative systematic review, meta-analysis} [18]. Based on the classification of reviews according to their goals (describing, understanding, explaining, and testing), each review paper was classified according to R by two authors (borderline cases were reconciled in a team meeting). The size of the set of required items $|I_R|$ corresponds to the denominator of the transparency score. These types of reviews are aligned with the categories of reviews aimed at describing, understanding, explaining, and theory testing. A mapping of the items required for the steps and the different types of reviews is provided in Table 4. In the following, we briefly describe the steps, which are based on Templier and Paré [19].

Problem formulation (Step 1): We coded whether the review transparently states the problem it addresses by specifying the primary goals/research questions. We further noted whether the key concepts or theories that are investigated are clearly defined.

Literature search (Step 2): We read the methodology sections to understand the literature search process. Specifically, we noted whether the authors describe how the literature search was performed, whether the application of multiple search strategies is outlined, and whether multiple publication types (such as journal papers, conference papers and books) are considered. Coding decisions capture whether the authors make the comprehensiveness of the search and its restrictions transparent. Furthermore, we analyzed whether the authors describe how the reputation of the sources is considered and whether strategies for minimizing publication bias are applied (if applicable).

Screening for inclusion (Step 3): To analyze the reporting of paper inclusion, we extracted data on the screening and selection of primary studies, and results of parallel independent study selection (such as inter-coder reliability coefficients). In addition, we noted whether it is made transparent how studies using the same dataset are treated and whether the screening process is illustrated by providing a corresponding flow diagram or description.

Quality assessment (Step 4): For those review types that are required to assess the methodological quality of the primary studies in their respective samples (such as meta-analyses, which rely on risk-of-bias assessment), we coded whether the quality assessment procedures are described and whether results on parallel independent coding is provided.

Data extraction (Step 5): We captured reporting of data extraction by coding whether a data extraction plan is provided, by looking for descriptions of tools or methods used to extract the data and by searching for parallel independent coding processes.

Data analysis and interpretation (Step 6): Finally, we coded items on the data analysis and interpretation phase. These include a description of how the data analysis is performed, how study quality is considered in the interpretation of the findings and whether a profile of the studies is included (providing a distribution of the included papers over journals and time, for example). In addition, we analyzed whether the data analysis methods or techniques are justified and whether methodological limitations are made transparent.

Table B.1. Mapping of review types and required items (adapted from Templier & Paré [19])

	Describing		Understanding		Explaining	Testing	
	Narrative	Descriptive	Scoping	Critical	Theory development	Qualitative Systematic	Meta-Analysis
Step 1: Problem formulation							
Primary goals or research questions	required	required	required	required	required	required	required
Key concepts or theories being investigated	required	required	required	required	required	required	required
Step 2: Literature search							
How the literature search is performed	required	required	required	required	required	required	required
Multiple search strategies			required	required	required	required	required
Multiple publication types			required	required	required	required	required
Comprehensiveness of search & restrictions if applicable		required	required	required	required	required	required
How reputation of sources is considered	required			required	required		required
Strategies used to minimize publication bias						required	required
Step 3: Screening for inclusion							
How primary studies are screened or selected	required	required	required		required	required	required
Results of parallel independent study selection		required	required			required	required
How studies using the same dataset are treated						required	required
Flow diagram or description of screening process			required			required	required
Step 4: Quality assessment							
How quality assessment is performed						required	required
Results of parallel independent assessment						required	required
Step 5: Data extraction							
Data extraction plan		required	required			required	required
Tools or methods used to extract data		required	required		required	required	required
Results of parallel independent coding process		required	required			required	required
Step 6: Data analysis and interpretation							
How data analysis is performed			required		required	required	required
How study quality is considered in interpretation of findings						required	required
Profile of the included studies		required	required			required	required

Justification of data analysis methods or techniques			required			required	required
Methodological limitations	required	required	required	required	required	required	required

Appendix E. Wald test

Table E.1. Wald tests

	Describing (I) (n=74)			Understanding (II) (n=48)			Explaining (III) (n=65)			Testing (IV) (n=33)		
Effect	Wald χ^2	d.f.	Sig.	Wald χ^2	d.f.	Sig.	Wald χ^2	d.f.	Sig.	Wald χ^2	d.f.	Sig.
Journal Impact Factor	918.29	1	0.00***	425.70	1	0.00***	651.83	1	0.00***	222.65	1	0.00***
H-index (average)	317.00	1	0.00***	197.64	1	0.00***	22.93	1	0.00***	1.13	1	0.29
Topic popularity	0.18	1	0.67	8.92	1	0.00**	143.56	1	0.00***	64.07	1	0.00***
Transparency score	31.50	1	0.00***	104.93	1	0.00***	269.67	1	0.00***	143.10	1	0.00***
Research agenda[a]	141.37	1	0.00***	87.02	1	0.00***	185.34	1	0.00***	[b]		

Notes. * significant at 1%, ** significant at 0.1%, *** significant at 0.01%.
[a] *Research agenda* is tested as a single categorical variable (with three levels). [b] Not enough observations available to include the variable.

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