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Communications of the Association for Information Systems

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What Affects Citation Counts in MIS Research Articles? An Empirical Investigation

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Abstract:

In academe, the scientific impact of a given research article is measured by the number of citations that article has garnered. More citations for an article mean that more researchers have read and used the contents of that article in aiding research. Because of this, some research institutions consider the scientific impact of the works of a researcher in promotion and tenure decisions. Moreover, evaluating the causes of citations can help the community of researchers in a field gain insight into the values and direction of the field. Therefore, an investigation into the causes of citations is valuable to both individual researchers seeking to further their careers and also to the community of researchers at large. This study looks at two types of independent variables in determining the causes of IS article citations: universalistic variables (specific to the scientific contribution of the article) and particularistic variables (specific to the author and/or structure of the paper). Regression analysis finds that while both universalistic and particularistic variables influence the degree to which a paper is cited, particularistic variables are more influential in the IS field.

Keywords: citation, citation counts, MIS research, IS research articles, research impact, universalism, particularism, universalistic attributes, particularistic attributes

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I. INTRODUCTION

In academic research, citations have been used to assess the impact of an article [Tams and Grover, 2008], the degree of success of an author [Judge, Cable, Colbert, and Rynes, 2007], as well as the status of a journal [Lewis, Templeton, and Luo, 2007]. Studies in marketing [Bettencourt and Houston, 2001], management [Judge et al., 2007; Stremersch, Verniers, and Verhoef, 2007], psychology [Campion, 1993; Gottfredson, 1978], sociology [Cole and Cole, 1967; Merton, 1957], and information systems [Clark and Warren, 2006; Sidorova, Evangelopoulos, Valacich, and Ramakrishnan, 2008; Straub and Anderson, 2010] have measured the impact of articles using the articles' citation counts, i.e., the number of citations an article has accrued from other research articles [Monasterky, 2005]. When an author cites another article, the article that is cited is thought to impact the research of the citing article [Starbuck, 2005]. Articles that are more heavily cited can be said to have more of an impact on the theoretical body in an academic field and sometimes even in multiple academic fields [Bergh, Perry, and Hanke, 2006; Judge et al., 2007]. Citations are, in effect, a measure of the acceptance and utility of an idea presented in a paper and are thus used as an indicator of the impact of a given research article [Judge et al., 2007; Sidorova et al., 2008; Tams and Grover, 2008].

Regarding individual authors, the continual accrual of citations is an indication that scientific field(s) that cite the researcher's work highly regard the researcher's findings [Sidorova et al., 2008]. Researchers who have their work recognized by their peers may be more likely to enjoy tenure and further promotion, while researchers who are not referenced may not be as successful [Dean, Lowry, and Humpherys, 2011]. In fact, research has suggested that several universities consider an author's citation frequency as one of the factors in decisions regarding that author's tenure, funding, promotions, and salary [Hargens and Schuman, 1990]. Some academic departments may compete for prestige through citation counts of their faculty; in turn, individual scholars compete for positions at prestigious departments via citation counts [Dean et al., 2011; Katerattanukul and Hong, 2003].

Citation analysis has also been used to evaluate the scientific contribution of the discipline and of journals by giving substantive expression to the use and diffusion of knowledge[1] [Jackson and Rushton, 1987]. Scholars have used citation counts to assess the knowledge contributions and the normality of IS journals [Katerattanukul and Hong, 2003; Straub and Anderson, 2010]. Citation analysis can also be used to assess the state of the field in general. Some IS studies have used citation analysis to identify themes and intellectual subfields [Culnan, 1986], to examine the structure of the IS field [Holsapple, Johnson, Manakyan, and Tanner, 1994, 1993], to track the development and evolution of the field [Farhoomand, 1987], and even to examine whether or not IS contributes back to its reference disciplines [Grover, Ayyagari, Gokhale, and Lim, 2006; Wade, Biehl, and Kim, 2006].

However, despite the use of citation analysis, we still do not have very good answers to fundamental questions in our field: *What factors cause a paper to be cited*? and, *What attributes of a paper lead to more citations?* [Sidorova et al., 2008; Tams and Grover, 2008]. Is it the quality of the paper? Is it the prominence of the author(s)? Or is it the pioneering nature of the theory? Considering the four levels of analysis identified in the preceding paragraphs (the article, the researcher, the journal, and the field), we would like to answer these questions at the level of the individual article. It is important for researchers to understand broader attributes of a research paper that are related to the accrual of citations—giving ideas, as well as individual careers, the best chance for success. Additionally, these questions are important to the IS field as a whole in that they provide an empirical metric for introspection (how we assess our value) and, if necessary, an impetus for change. Therefore, in an effort to assist the community of IS researchers to keep a finger on its own pulse, this research will endeavor to determine the attributes of an IS article that lead to a greater citation count.

In order to do so, we will examine a set of IS research papers published in major journals over the past twenty years. We identify a set of thirteen variables—some unique to papers' authors, some relevant for research quality, and

[1] We acknowledge the limitations associated with the use of citation analysis to evaluate scientific contribution at the level of the discipline and of journals. At the journal level, although citation counts have been used to determine journal prestige and quality (such as when journals publish highly cited articles), other factors (such as consensus of senior scholars in a particular discipline) often trump citation-based measures of journal reputation. Across disciplines, citation counts may vary considerably in how competitive they are to acquire, making them problematic as a consistent measure of relative quality and prestige across departments. For example, simply the size of a discipline or subfield may affect how impressive the accumulation of citation counts is likely to be in that field; larger fields, which have more researchers who can potentially cite a particular article, may find a given citation count to be less impressive than a smaller field.

others for control. We classify 278 research articles based on these variables and analyze them for relationship with the number of citations for each paper. Results and implications for the field are then presented. We start with a review of the literature to identify two main classifications of research article attributes: universalistic attributes and particularistic attributes. From there, we enumerate the dimensions of these broad predictor types and use those dimensions to identify individual variables, which we then use to test our hypotheses.

II. UNIVERSALISM AND PARTICULARISM

Prior research has described two classifications of research article attributes that might predict papers' citation counts: universalistic and particularistic attributes [Judge et al., 2007; Newman and Cooper, 1993; Wan, Hua, and Rousseau, 2007]. Universalistic attributes are those that indicate whether the paper is making a contribution to scientific knowledge [Bornmann and Daniel, 2009; Kaplan, 1965; Newman and Cooper, 1993]. Research that does this explores new theoretical avenues, uses rigorous data collection methods, and systematically grafts its findings into the extant body of IS knowledge. Particularistic attributes, on the other hand, are those that might give the *illusion* of a knowledge contribution through superficial means [Baldi, 1998; Judge et al., 2007]. For example, when a research paper lists an above-average number of references, it appears to make an impressive contribution to knowledge. The ability of the paper to produce new knowledge that appears to be embedded in such a vast body of prior research, as reflected in the larger number of cited references, suggests a depth of integration and synthesis, at least on a cursory level, which is impressive. However, the paper may not have actually synthesized the body of work apparent in these large numbers of cited references. Actual knowledge contribution is not there unless a compelling and salient story is woven from those references. While universalistic attributes of a research paper are a direct measurement of its quality, which refers to such attributes as the extent of scholarly contribution, the rigor of research design, and the strength of writing, particularistic attributes *might be* an indirect assessment of the paper's quality [Ynalvez and Shrum, 2008].

Universalistic attributes are indicative of a paper's contribution to knowledge [Judge et al., 2007; Long and Fox, 1995; Stremersch et al., 2007]. Therefore, journals that follow this modality should value articles on a normative or "meritocratic" basis [Long and Fox, 1995; Merton, 1957]. According to universalistic ideals, papers should be judged strictly by the quality of the research that they contain, such as the extent to which they make a true scholarly contribution to their respective fields, the quality of the research design, and the quality of writing [Bergh et al., 2006; Shadish, Tolliver, Gray, and Gupta, 1995; Sinzek, Oehler, and Mullins, 1991]. In other words, research should be judged "in a vacuum," ignoring perfunctory factors such as the prestige of the author, research institution, and journal [Long and Fox, 1995; Stremersch et al., 2007].

Conversely, for some time, researchers have formally noted that their colleagues use more of a "social constructivist" approach in deciding which articles to cite [Allen, Jones, Dolby, Lynn, and Walport, 2009; Judge et al., 2007; Stremersch et al., 2007]. Proponents of this idea claim that researchers may take into account factors such as the prestige of the author, the prestige of the university with which the publishing author is affiliated, and the prestige of the journal in which an article is published [Straub and Anderson, 2010; Stremersch et al., 2007]. For example, Judge et al. [2007] found that the prestige of the journal in which an article is published is a significant predictor of future citations—even more so than the nature of the research design or the degree to which the article explores previously unexplored regions of theory. In fields such as IS, which accept a number of methodological and theoretical approaches, a researcher may choose to cite a more prominent author to give his or her particular approach more credibility in the review process as well as to future readers [Katerattanukul and Hong, 2003; Palvia, Pinjani, and Sibley, 2009]. Some studies have even discussed how, during the review process leading to a paper's publication in a journal, members of the review team could unethically push for self-citation of articles from the same journal [Gray, 2009; Straub and Anderson, 2009], although, on the whole, the peer review system is largely recognized as being conducted on universalistic principles [Gottfredson, 1978; Wan et al., 2007]. As such, decisions to cite that are made on judgments not directly related to the paper's knowledge are based on particularistic attributes.

Under our peer review system, certain particularistic attributes of a research paper (the author, the number of authors, and the research institution) are invisible to the reviewers; in fact, the only particularistic variables (used in this study) that the reviewers can see are structural characteristics, such as the number of references. The expert (and, hopefully, open-minded) reviewers can, nevertheless, judge universalistic attributes, such as whether the research is relevant, opens new avenues in theory, uses a rigorous methodology, and successfully integrates the past research in the field [Gottfredson, 1978; Sternberg and Gordeeva, 1996]. Moreover, research has shown that the universalistic attributes of a paper largely determine whether or not that paper is accepted for journal publication [Gottfredson, 1978; Wan et al., 2007]. Therefore, the peer review process is conducted according to universalistic ideals. Notwithstanding this assertion, a *published* article, where both universalistic and particularistic attributes are visible, can be subject to widespread acceptance based on factors that are perfunctory to the knowledge contribution of the paper [Baldi, 1998; Stremersch et al., 2007].

III. SPECIFYING THE ATTRIBUTES

After delineating the boundary between universalism and particularism in scientific literature, the task becomes understanding just what attributes of a refereed article lend it particularistic and universalistic merit. In the subsequent sections, we discuss how previous literature has determined the universalistic and particularistic attributes of research articles and provide a rationale for the selection of variables for this study.

IV. UNIVERSALISTIC ATTRIBUTES

The universalistic attributes of a research paper are those that determine the scientific worth of the paper [Bornmann and Daniel, 2009; Rodriguez-Ruiz and Fernandez-Menendez, 2009]. They reflect the relevance, the theoretical innovation of the paper, the methodological rigor of the paper, and how well the paper integrates its findings and theoretical base into the extant theoretical field [Baldi, 1998; Gottfredson, 1978]. Merton's [1957] original conceptualization of universalism in academic publishing holds that two factors give an article universalistic merit: (a) an original contribution to theory, and (b) a proper execution with a high level of methodological rigor. Subsequent research has understood the universalistic merit of a paper to be comprised of the impact of its idea(s) [Cole and Cole, 1967; Hubbard, Norman, and Parsa, 2010], the novelty of its ideas [Bornmann and Daniel, 2009; Judge et al., 2007; Stremersch et al., 2007], the rigor of the data collection [Baldi, 1998; Gottfredson, 1978; Judge et al., 2007], the appropriateness of the sampling frame and data analysis [Campion, 1993; Judge et al., 2007], the length of the paper [Judge et al., 2007; Peters and van Raan, 1994; Stremersch et al., 2007], and the quality of the writing and presentation of the article [Beyer, Chanove, and Fox, 1995; Judge et al., 2007].

We can categorize the universalistic attributes into four main attribute classes: those evaluating the idea (impact of idea, novelty of idea), those evaluating the method (rigor of data collection and data analysis), those evaluating the writing (quality of writing, quality of presentation), and those informed by the review process (number of pages). In the following sections, we expound on these attribute classes, focusing on the constructs in our study (see Table 1).

Idea

While prior research has judged the idea of a given article by assessing the impact and novelty of that idea, the former (impact) may not be fully recognized for many years, leaving any judgment as to the relative impact of an idea subject to an inherent risk that the status of the judgment will change with the environment. The novelty of the idea, however, is a more objective measure that remains stable, as it is determined at the time of publication; therefore, we evaluate the universalistic merit of a given article, in part, through an appraisal of the novelty of its idea.

The main thrust of evaluating a research article from a universalistic perspective is to determine the degree to which the paper contributes to the body of scientific knowledge in its field [Long and Fox, 1995; Merton, 1957]. A paper that successfully explores previously unexplored theoretical areas is thought to be more of a contributor to scientific knowledge than a paper that extends previously existing theory or further refines already existing propositional connections [Judge et al., 2007; Newman and Cooper, 1993]. Because papers that are exploratory in nature become the founding pillars of further theoretical debate, it is expected that such papers would be cited more than those papers that further analyze previously described relationships [Newman and Cooper, 1993]. *We define novelty of idea as the degree to which a research paper opens new theoretical avenues, enumerating unexplained theoretical constructs and the connections between those constructs.*

Methodology

Some research has shown that the level of methodological rigor affects the validity of the results of a given paper and, thus, the future citation count of that paper (e.g., Judge et al., 2007). Because universalistic judgments on research articles are meant to reflect the quality of the scientific contribution generated by that paper, the methodology employed by the paper should be scrutinized [Pinsonneault and Kraemer, 1993]. Thus, if research articles were cited according to universalistic ideals, we would expect to see studies that utilize rigorous methodologies to be cited more frequently than papers that use less rigorous methods. While there could be many ways to assess methodological rigor, we select two characteristics below that are not only important, but can be objectively evaluated through observation.

One important element of methodological rigor, particularly relevant to fields like IS that propose causal relationships, is the temporal richness of data collection. Temporal richness reflects rigor of the methodological design in that longitudinal studies require more points of data collection (giving more points of analysis) than do cross-sectional studies, which fall victim to more types of bias than do longitudinal studies [Pinsonneault and Kraemer, 1993]. *Temporal richness is defined as the degree to which a research article uses multipoint data collection methods (as opposed to cross-sectional data collection).*

Similar to temporal richness, the number of studies evaluated as part of an empirical piece can bolster claims of generalizability, provide more complete testing of a model, and increase the robustness of findings [Judge et al., 2007]. Therefore, we consider the number of studies included in an empirical research article to reflect the methodological rigor of that article. *Number of studies is defined as the number of separate studies carried out as part of a single empirical research article.*

Writing

Assessing the quality of writing in a given article presents tremendous challenges, with the primary challenge being that assessments of writing quality are inherently subjective—what one person finds well written, another may find disorganized. Judge et al. [2007] experienced reliability problems when rating writing quality on a 5-point Likert scale and, subsequently, made the measure dichotomous, in that it simply indicated whether or not the article was well written. This hardly seems to capture an attribute as important and multifaceted as the quality with which an article is written. As a result, following precedent set in prior research, we do not explicitly consider this attribute [Judge et al., 2007; Stremersch et al., 2007].

Review Process-informed Attributes

This class of universalistic variables deserves special mention as it relies specifically on the assumption that the review process is conducted according to universalistic principles. Because reviews are blind, journal space is granted by editors based solely on the universalistic quality of the article [Baldi, 1998; Gottfredson, 1978; Judge et al., 2007; Sternberg and Gordeeva, 1996; Stremersch et al., 2007]. Moreover, several studies have relied on outcomes of the peer review process, such as the journal space granted to a given article, as proxies for the quality of a research article [LaBand and Piette, 1994; Stremersch et al., 2007] and quality of writing [Beyer et al., 1995; Judge et al., 2007].

LaBand and Piette [1994] have argued that the number of pages granted to an article can be a measure of universalistic quality [Judge et al., 2007; Stremersch et al., 2007]. Journal editors must dole out a limited number of pages in each issue to submitted articles. The competition for this journal space is fierce, especially in the top journals. Also, prior research has surmised that more impactful papers (ones that make greater scientific contributions) require more explanation [LaBand and Piette, 1994]. We do acknowledge that the page limits imposed by some journals (or the lack thereof in the case of online journals) and the subjectivity of different review processes may reduce the efficacy of this variable. Nonetheless, we would argue that there is fairly substantial variability in pages assigned to research articles within the same journal. Even when page limits exist, (a) they can effectively be skirted by using appendices that are not included in page limits, (b) they are often more general guidelines than hard rules, (c) reviewers often ask an author to augment the length of a paper for reasons of readability, and (d) there is still significant variation in the length of research articles in the same journal. Recently, Tams and Grover [2008] assessed the effect of the macro structure of an IS article on its citation count. In doing so, they argued that the number of pages are meaningful because "a) every page in a journal is precious, b) the number of pages devoted to an article is reflective of a review process that results in the minimum number of pages required to communicate the study, c) this parsimony holds for each section of the article, and d) the number of pages devoted to a section of an article is reflective of the importance of that section to the article (i.e., intra-article importance of a section)" [Tams and Grover, 2008, p. 151]. So, if we can assume that the peer-review process evaluates the scientific contribution of a paper and that greater scientific contributions require more explanation, then we can infer in a manner consistent with precedent in IS literature that the more pages granted to an article, the more universalistic merit that paper carries with it [Judge et al., 2007; LaBand and Piette, 1994; Stremersch et al., 2007]. Therefore, we employ page length in this study as a variable that indicates the degree to which the author of a given paper elucidates the ideas in the paper. *Page length, for the purposes of this study, is defined as the number of pages the article occupies in its journal issue.*

V. PARTICULARISTIC ATTRIBUTES

The particularistic attributes of a paper are merely proxies for scientific contribution [Cole and Cole, 1967]. They give the illusion of a real knowledge contribution, but these attributes are actually functionally irrelevant to the paper and include such attributes as the previous success of the author, the number of references cited, the prestige of the publishing institution, and the number of authors [Baldi, 1998]. While they may engender confidence in the findings of a paper, they do not actually determine any of the worth of a paper's scientific contribution. Below, we list and explain four attributes that reflect the particularistic quality of a research paper: author recognition, author affiliation, the number of references, and the number of authors.

Author Characteristics

The characteristics of the author of a research article qualify as particularistic because they are thought to influence citation counts, yet do not directly contribute to the scientific contribution of the article. In this study, we wish to understand how two specific author characteristics—author recognition and author affiliation—may affect the impact of a given article.

Author recognition is constitutionally defined as the degree to which a scientific community regards a given researcher as a publisher of quality work [Bornmann and Daniel, 2005; Egghe, 2006a]. Due to the relatively low paradigm level in the IS field [Pinsonneault and Kraemer, 1993], views espoused by the more popular authors are more likely to be cited than those by less popular authors. Therefore, we expect to see papers authored by individuals with a higher author-impact to be more frequently cited than those papers authored by individuals with a low author-impact. While the impact of any particular author to a scientific field is difficult to quantify, there are measures that help us do just this [Bornmann and Daniel, 2007]; these measures will be discussed in the methodology section. The inclusion of author-impact as a particularistic variable is meant to determine whether authors who were successful in the past, in terms of their author-impact, garner citations simply because of that fact. If so, then the community of IS researchers may be seen as valuing prior scientific success over current scientific contribution, or, at a minimum, allowing prior success to shade their perceptions of a current scientific work. *Author recognition is to be constitutionally defined as the past success of a scientific researcher's body of work.*

Author affiliation refers to the research institution from which the lead author hails [Martins, 2005]. From the particularistic point of view, the papers authored by researchers from more prestigious universities are expected to see higher citation counts than are those from less prestigious universities [Endler, Rushton, and Roediger, 1978; Martins, 2005]. *Author affiliation is to be defined as the prestige of the research institution with which the author is affiliated.*

Structural Characteristics

Structural characteristics are considered to be particularistic in the context of this study in that they engender confidence in the paper, yet do not directly contribute to its scientific worth. We have broken down structural characteristics into two dimensions: number of references and number of authors.

Papers that reference many other works may be cited simply as a favor (quid pro quo) and not because of the scientific quality of the paper [Judge et al., 2007]. For instance, an article that cites the work of an author may garner a future citation from that author because it is in that author's self-interest to propagate his or her own ideas. Thus, we define number of references as a particularistic attribute. Additionally, the number of references used by a paper is a proxy for the number of inputs into that paper, whether or not the references were woven into a salient story for the research. In this manner, the number of references is functionally irrelevant to the knowledge contribution of the paper and is considered as a particularistic variable. *Number of references is the numerical count of the "References" section of a research paper.*

A paper that has many co-authors appears to be the product of multiple viewpoints and knowledge bases, giving the surface impression of increased comprehensiveness and depth of theoretical and methodological development. However, the number of authors is only a perfunctory approximation for these qualities and is distinct from the actual knowledge contribution of the research. Further, multiple authors may even convolute the clarity and continuity with which a single author conducts research. So, we have classified the number of authors as a particularistic variable on the basis that this attribute is quite noticeably associated with a research article but "functionally irrelevant" to the paper itself [Long and Fox, 1995, p. 53]. *The number of authors is the numerical count of the authors of a particular research paper.*

We use the above four attributes to determine the particularistic merit of a research paper. If we assume IS to be a low-paradigm field, we would expect to see papers with a high degree of particularistic attributes to be more highly cited than those with lower levels. Therefore, we expect to see papers that (a) are written by prominent researchers, (b) are published from prominent institutions, (c) are highly collaborative, and (d) cite many other research articles, to be cited more often than those articles that are less so.

Table 1: Universalistic and Particularistic Attributes	
Universalistic Attributes	Particularistic Attributes

• Idea
  ○ Novelty of Idea
• Methodology
  ○ Temporal Richness
  ○ Number of Studies
• Review-Process Informed
  ○ Page Length
	• Author Characteristics
	  ○ Author Recognition
	  ○ Author Affiliation
	• Structural Characteristics
	  ○ Number of References
	  ○ Number of Authors

VI. THE DEPENDENT VARIABLE: SCIENTIFIC IMPACT

The construct of interest in this study is the scientific impact of an individual research article as assessed by citation count. We argue that an article is more impactful if it contributes more to other researchers' ideas in order to help support their research projects [Sidorova et al., 2008]. Individual authors, university departments, and academic journals can all gain attention by publishing highly impactful work. Therefore, understanding the characteristics of an article that can lead to higher impact can be beneficial to each of these stakeholders [Judge et al., 2007]. *The scientific impact of a research article is conceived of as the degree to which that research article influences the work of other researchers—and is assessed by citation count.*

VII. CONTROL VARIABLES

In order to better understand the effects of the particularistic and universalistic variables, we control for several variables that may also affect citation counts. First, because older articles have more time to be cited, we control for year of publication. Second, papers in special journal issues may be cited more than regular journal articles. This is because special journal issues are often dedicated to a single theoretical or methodological approach, meaning that the articles within have greater visibility in their particular niche. In order to account for this bias, we control for the type of journal issue. Third, full-length articles are more likely to be cited than research commentaries due to the lack of originality in the research commentaries; therefore, we control for the designation of the article.

We also control for three attributes related to the construction of the research articles. First, different research methods (e.g. experiment, survey, modeling, etc.) are better suited to different types of problems, some of which may, by nature, carry more citations. Modeling papers, for example, are neither referenced nor cited as much as empirical research, but this has no bearing on the quality of the paper [Grover et al., 2006]. Second, because the IS field has several sub-disciplines, some of which are more highly cited due to popularity, we control for the reference discipline of the article. And last, we control for the unit of analysis (individual or organizational) used by the article.

VIII. METHODOLOGY

The unit of analysis in this study is the individual article. To assess both the universalistic and particularistic predictors that would influence citation count, a large number of representative articles should be studied [Judge et al., 2007]. Also, sufficient time should be given to each of the articles surveyed for analysis [Tams and Grover, 2008]. We collected data from 278 articles, published from 1990 to 2008, selected from three of the top journals in the IS field. The analysis that underlies this research is based on the careful coding of each article in our sample according to the variables discussed in the following "Measures" subsection. Although we are assessing the universalistic merit of a paper based partly on the quality of that paper's methodology, we do understand that many papers (and influential papers at that) are not empirical and, thus, do not have quantifiable methodologies. Therefore, as part of the coding process, we classified each article as either "empirical" or "not empirical." The universalistic attributes that assess the methodological rigor of the article were not coded for non-empirical articles, and those articles were analyzed separately.

Sample

Because our ultimate dependent variable is the scientific impact of an individual research article, we wish to choose a sample that represents the mainstream of IS research. Further, because journal quality, as indicated by the prestige and ranking of journals, has been shown to influence the impact of an individual article, we also wish to select articles from a sample that can mitigate the influence of journal quality. In order to accomplish these goals, we framed our sample in three journals that have consistently ranked in the top six IS journals for more than a decade: *MIS Quarterly, Information Systems Research (ISR),* and *Journal of Management Information Systems (JMIS)* [Tams and Grover, 2008]. Such a sampling frame can mitigate the influence of journal quality on citation counts because all of these journals are considered to be prestigious outlets for research. We would also like to note that these are not the only prestigious journals in the IS field; in fact, the *European Journal of Information Systems (EJIS), Information Systems Journal (ISJ),* and the *Journal of the Association for Information Systems (JAIS)* are

some of the other prestigious journals devoted to the field [Sidorova et al., 2008]. We do not wish to ignore the articles published in other prestigious journals in the IS field, such as *EJIS, ISJ,* and *JAIS;* in fact, an auxiliary sample of ninety-seven articles from these journals bore similar results to those from our initial sample. Nonetheless, we consider our sample of articles from *MIS Quarterly*, *JMIS*, and *ISR* to be representative of IS articles in general in that the sample (a) represents the mainstream of IS research and (b) effectively controls for the effect of journal quality on our main dependent variable. Further, this sampling frame is consistent with other introspective IS research that examines the characteristics of individual articles, such as Sidorova et al. [2008] and Tams and Grover [2008]. For each of the three journals, we selected the first and last articles of alternating issues (issues 1 and 3) for the years 1990 through 2008. This gives us a subtotal of twelve articles per year (four from each of the three journals) for a total sample size of 278 articles.

Measures

Dependent Variable: Citation Count

Consistent with scientometric works in the IS field [Bornmann and Daniel, 2007; Sidorova et al., 2008; Tams and Grover, 2008] and in other fields [Jin, Liang, Rousseau, and Egghe, 2007; Judge et al., 2007], we measured the scientific impact of an article by a count of the number of citations that article has accrued. We would like to note that, although highly cited articles usually have one or more high quality elements, high quality does not always translate into more citations. Here, we do not wish to measure such a subjective abstract idea as "article quality"; rather, we are interested in the elements that may lead to greater citations of that article, or the *scientific impact* of that article. When we collected the citation counts of these papers though, the distribution of citation counts was far from normal, with a skewness measure of 4.093. In order to normalize the distribution so that linear regression analysis (the analytic methodology employed by this research) is meaningful, we have taken the square root of the citation count for each article, as is consistent with the practice of both statisticians and scientometrists[2] [Cohen and Cohen, 1983; Judge et al., 2007]. The distribution for the square roots of the citation counts shows a much more normal curve with a skewness of 1.416. The resulting transformation resulted in a variable that has a mean of 10.12 (std. dev. = 8.1), indicating that the average article in our sample has about 100 citations.

Universalistic Variables: Idea

The method outlined by Newman and Cooper [1993] calls for the categorization of each article as having an exploration, extension, or refinement research plot. Exploratory plots explore new connections between constructs or "the change in a fundamental part of an existing theory or network" [Judge et al., 2007, p. 496]. Extension plots study the connections between already enumerated variables, including moderating and mediating connections, and refinement plots seek to more granularly explain previously tested connections between variables [Newman and Cooper, 1993]. Making this distinction, however, is replete with subjectivity. Therefore, we rationalize this construct as a binary variable, coding "1" for papers that exhibit an exploratory research plot and "0" for articles that do not. In cases where there was uncertainty facing the coding of a particular paper, the authors met and discussed the paper in question, reaching a decision as to the novelty of the idea based on our shared understanding. For our sample, 26 percent of articles were coded as having exploratory research plots, leaving 74 percent of our sample as not having an exploratory research plot.

Universalistic Variables: Temporal Richness

This variable reflects methodological rigor by categorizing each article according to the nature of its data collection method. The breakdown of articles in the IS field by temporal richness is possible into one of four categories: cross-sectional with single snapshot, cross-sectional with multiple snapshots, longitudinal, and process traces [Orlikowski and Baroudi, 1991]. Each article was designated and coded as having one of the following time periods in the research design: cross-sectional with single snapshot = 1, cross-sectional with multiple snapshots = 2, longitudinal = 3, and process traces = 4.[3]

Universalistic Variables: Number of Studies

This will be operationalized by a count of the number of separate studies reported in an empirical research article; each event of data collection is considered to be an individual study (range: 1–7).

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[2] The distributions of many measures operationalized by counts are Poisson distributions. Past research involving citation counts [Judge et al., 2007] has taken the square root of each measurement in a Poisson distribution in order to normalize the distribution of the dependent variable so that statistical analysis outputs are meaningful. We undertook the same transformation [Cohen and Cohen, 1983].

[3] We note that temporal richness is an artifact of an empirical study; therefore, we classified each article as either empirical or non-empirical. We include only this variable in the analysis of empirical studies. When the analysis includes non-empirical research articles, we exclude this variable.

Universalistic Variables: Page Length

This is coded as a simple count of the number of pages an article occupies.

Particularistic Variables: Author Recognition

Because there are many ways an author may impact an academic field, operationalizing *author recognition* proved to be a complex task. Reflecting this complexity is the variety of instruments that have been developed to measure the productivity of a given author. These metrics include the *h* index, the *g* index, the *h(2)* index, the *a* index, the *m* index, the *r* index, the *ar* index, and the h_w index. The differences between these indices are reflected in Table 2. It should also be noted that Table 2 does not represent an exhaustive list of productivity indices; in fact, Bornmann, Mutz, Hug, and Daniel [2011] compare and contrast thirty-seven variants of the *h* index in a Scientometric meta-analysis, finding that there is a large amount of redundancy between many of the variants of the *h* index and the *h* index itself. Earlier work by Bornmann and Daniel [2007] that examined the productivity indices listed in Table 2 reported evidence that there are two dimensions of author productivity: (1) the quantity of the productive core of an author and (2) the impact of the productive core of the author. Further, their work found that, while the *h* index best reflects the quantity of the author's productive core, the *ar* index best reflects the impact of the author's productive core [Bornmann and Daniel, 2007].

Table 2: Author Productivity Indices and Their Definitions

Productivity Index	Definition
h	"A scientist has index *h* if *h* of his or her N_p papers have *h* citations each and the other (N_p-*h*) papers have fewer than (≤) *h* citations each" [Hirsch, 2005, p. 16569]. This is to say that for an author to have an *h* index of 25, that author must have 25 publications with at least 25 citations each. This is a measure of the quantity of the productive core of a researcher [Bornmann and Daniel, 2007; Judge et al., 2007]. The set of papers taken from the whole of an author's publications for consideration in the *h* index is called that author's *H* core [Bornmann and Daniel, 2009].
g	The *g* index is the greatest number of *g* papers that have received a sum total of g^2 citations [Egghe, 2006b]. The *g* index gives greater consideration to highly cited papers in an author's name, allowing the index to reflect a paper that continues to gain citations after being included in the set of papers that informs an author's *h* index [Jin et al., 2007].
h(2)	The *h(2)* index is the highest natural number such that a researcher's *h(2)* most-cited papers gained a minimum of $[h(2)]^2$ citations each [Kosmulski, 2006]. Like the *g* index, the *h(2)* index gives a higher weight to highly cited publications [Jin et al., 2007]. The advantage it has over the *g* index is that, for a given set of publications, fewer measurements are needed to calculate the *h(2)* index, which reduces the error attributed to calculating these values using the Publish or Perish Software [Bornmann, Mutz, Hug, and Daniel, 2011].
a	The *a* index is $\sum_{j=1}^{h} \frac{cit_j}{h}$; h = *h* index, cit = citation count [Bornmann and Daniel, 2007]. The *a* index reflects the average number of citations that are in an author's *H* core. Thus, it gives more weight to the highly cited works of an author than it does to the number of publications that break some minimum threshold for citations [Jin, 2006; Rousseau, 2006].
m	The *m* index is the median number of citations in an author's *H* core [Bornmann and Daniel, 2007]. Because there is usually skewness present in the distribution of citations for the papers in an author's *H* core, the mean number of citations may not be a very meaningful statistic. In such cases, the median score of citations can allow scientometrists to make judgments based on the central tendency of the *H* core [Bornmann and Daniel, 2009].
r	The *r* index is $\sqrt{\sum_{j=1}^{h} cit_j}$; h = *h* index, cit = citation count [Bornmann and Daniel, 2009]. Whereas the *a* index could be seen as punishing an author for having a high *h* index (by dividing by *h*), the *r* index attempts to correct this issue by taking the square root of the sum of citations gained by all of the papers in an author's *H* core [Jin et al., 2007].
ar	The *ar* index is $\sqrt{\sum_{j=1}^{h} \frac{cit_j}{a_i}}$; h = *h* index, cit = citation count, a = number of years since publishing [Bornmann and Daniel, 2007]. Similar to the *r* index, the *ar* index also takes into account the age of the publications in an author's *H* core by consisting of the square root of the sum of citations per article by the age of the article [Bornmann and Daniel, 2009; Jin et al., 2007]. Thus, the *ar* index decreases over time once an author quits publishing.

Considering that we are interested in author recognition as a particularistic variable that may influence the scientific

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impact of a given article, we wish to exclude as much of the impact dimension of author productivity as possible so as to avoid tautological results. Rather, we see a greater fit between the concept of author recognition and the quantity of that author's *H* core, a concept that Bornmann et al. [2007, 2011] found is best reflected in the *h* index of that author. Thus, we measure *author recognition* using the *h* index,[4] which was extracted using the Publish or Perish© software. The returned indices were coded as follows: *h* index from 0–10 = 1, 11–20 = 2, 21–30 = 3, 31–40 = 4, and larger than 40 = 5. These variables are coded as such to reduce the reliance on small changes in the *h* index measure because there is a certain degree of variability in the results returned by the Publish or Perish© software.[5] In IS, the percentage of authors with a particularly high h index is relatively small; thus, we coded h index larger than 40 together as 5. In the case of multiple authors, we recorded the average of the *h* indices.[6]

Particularistic Variables: Author Affiliation

Using the protocol established in prior literature [Judge et al., 2007] to operationalize *author affiliation*, the institution from which the first author conducts research was taken and ranked according to the tier in which that institution appears in *U.S. News & World Report*'s National 2009 Ranking of Universities[7] (tier 1 = 1, tier 2 = 2, tier 3 = 3, tier 4 = 4, tier 5 = 5). Foreign and nonacademic institutions were all given a ranking of three, the midpoint of the range, because data were unavailable from the *U.S. News & World Report*'s National Ranking [Judge et al., 2007]. Domestic institutions that did not appear in the rankings were coded as a 5 [Judge et al., 2007].

Particularistic Variables: Number of References

This is also coded as a simple count of the number of references in a paper's bibliography/works cited section. As a continuous interval having a skewness of .581, no transformation is needed.

Particularistic Variables: Number of Authors

To operationalize the *number of authors*, we simply took the number of authors listed at the beginning of each research article. Authors more than 4 appear rarely; therefore, authors of 4 or more is coded as 4.

Control Variables

The coding for *year of publication* is simply the year in which the article was published. The *type of issue* was coded as "1" for a regular issue and as "0" for a special issue. *Article designation* was coded as "1" for a full research article and as "0" for a research note or research commentary. For *research design*, each paper was coded according to the type of methodology used in the paper; likewise, *reference discipline* was coded according to the subfield within IS most cited by each article. *Unit of analysis* was coded as "1" for the organizational level and as "0" for the individual level. The control variables, their coding, and their references are listed in Table 3 below.

IX. ANALYSIS

Prior to regression analysis, the variables were tested for normality. The dependent variable, citation count, displayed a Poisson distribution; therefore, we transformed that variable by taking the square root of the citation count. This greatly reduced skewness (from 4.093 to 1.146) and gave a more normalized histogram distribution. No other continuous variables displayed non-normal distributions, so no more transformations were necessary. In order to examine the relationships between the variables of interest, we employed OLS linear regression. Since our dependent variable is continuous and normalized, OLS is the preferred statistical technique.

Table 3: Attributes, Variables, and Coding

Attribute	Construct	Variable	Coding	Reference

[4] There is a possible tautological relationship between the author recognition index, or H-index, and the citation count of an article by that author. In other words, we do realize that there may be an inherent, or necessary, relationship between one of our independent variables and our dependent variable. While we do realize that a researcher's H-index may increase as the citation count of a single article increases; however, this increase is minimal and is limited to an increase of 1 among typically very large numbers.

[5] The variability in the results of Publish or Perish© is an artifact of the mechanism by which the software obtains its query results. Publish or Perish© performs a search of Google Scholar for all publications as well as the citation count for each publication. Therefore, because there are occasional errors in entrants in Google Scholar's databases and because the program may confuse some authors with similar names, we coded for this variable in bins of 10.

[6] It is possible that the visibility of a senior scholar on a team of authors is the primary driver of recognition. However, we would argue that there is a difference between a single senior author and one among many authors. Our averaging is reflective of the visibility of a "team of authors."

[7] The *U.S. News & World Report* rankings are widely accepted. The top schools in this ranking tend to be top research schools as well, even though the basis for ranking itself has only a minor weight on research per se. The *U.S. News & World Report* ranking, therefore, provides one of the best visible measures of the reputation of a school.

Universalistic	Idea	Novelty of Idea	1: Exploratory research 0: Non-exploratory research	Judge et al., 2007; Newman and Cooper, 1993
	Methodological Rigor	Temporal Richness	1: Cross-Sectional Research 2: Cross Sectional with Multiple Snapshots 3: Longitudinal 4: Process Traces	Orlikowski and Baroudi, 1991; Pinsonneault and Kraemer, 1993
		Number of Studies	Simple count of number of studies employed by research	Gottfredson, 1978; Shadish et al., 1995
	Review-process Informed	Page Length	Simple Page Count	Judge et al., 2007; LaBand and Piette, 1994
Particularistic	Author Characteristics	Author Recognition	1: h index 0–10 2: h index 11–20 3: h index 21–30 4: h index 31–40 5: h index 41 and above	Bornmann and Daniel, 2007; Egghe, 2006a; Judge et al., 2007
		Author Affiliation	1: Tier 1 2: Tier 2 3: Tier 3 (also foreign and nonacademic institutions) 4: Tier 4 5: Tier 5	Judge et al., 2007; Martins, 2005; *U.S. News & World Report*
	Structural Characteristics	Number of References	Simple references count	Judge et al., 2007
		Number of Authors	Simple author count	–
Control		Year of Publication	Coded as the year of publication (e.g., 1990)	Judge et al., 2007; Orlikowski and Baroudi, 1991
		Research Design	1: Survey 2: Experiment 3: Case Study 4: Mixed-Method 5: Instrument Development 6: Modeling 7: Theoretical/Introspective	Alavi and Carlson, 1992; Jenkins, 1985; Orlikowski and Baroudi, 1991
		Reference Discipline	1: Management 2: Economics 3: Cognitive Psychology 4: Social and Behavioral Science 5: Computer Science 6: IS	Kanga et al., 2007; Katerattanukul and Hong, 2003; Wade et al., 2006
		Type of Issue	1: Regular Issue 0: Special Issue	Judge et al., 2007
		Journal	0: JMIS, 1: ISR, 2: MISQ	–
		Level of Analysis	1: Individual 0: Group and Organizational	–

Because different types of research (e.g., theoretical work and empirical work) are judged differently, we felt it necessary to run three separate models. The first model takes into account both empirical and non-empirical articles and considers only the independent variables that are common to both sets of articles (novelty of idea, page length, author recognition, author affiliation, number of authors, and number of references). The second model considers empirical articles only, and, while the independent variable set does have some overlap with that of the previous model, it includes certain variables that are specific to evaluating empirical research (temporal richness and number of studies). The third and final model solely considers non-empirical research articles and also includes an independent variable set that has been modified to pertain specifically to non-empirical research by excluding those independent variables that are specific to empirical research. Each regression model is broken down into three regression steps. The first step in each model shows the effect of the control variables, while the second and third

steps show the contribution of the particularistic and universalistic variables (respectively) over and above the control variables.

X. RESULTS

Table 4 presents the descriptive statistics for all the attributes in the model; Appendix A contains the correlations among these attributes. Table 5 shows the results of our first model when both the empirical and non-empirical studies are taken into account. Multi-collinearity does not appear to be an issue, as there are no tolerances below 0.7 and no variance inflation factors (VIFs) above .5, both of which indicate that the independent variables are mostly unrelated. Further, power analysis reveals that a sample of 228 with a maximum of ten independent variables has the power to detect effect sizes as small as .08 with 95 percent confidence. We can see that both particularistic and universalistic variables significantly explained variance in the model above and beyond the control variables. For the universalistic attributes, novelty of idea is significantly related to citation count, meaning that exploratory research will be more likely to be cited than non-exploratory research. Further, page length is significantly related to citation count as well, meaning that longer papers tend to be cited more. In terms of particularistic variables, author recognition, and number of references show significant impacts on citations. We can conclude that the higher the authors' impact, the more likely that the paper will be cited. Accordingly, scholars who have been prominent in the IS field tend to have more highly cited papers in the future. Also, as an article cites more references, that article is more likely to be cited.

Table 4: Descriptive Statistics

	n	Range	Min	Max	Mean	Std. Deviation
Author Affiliation	228	4.00	1.00	5.00	n/a	n/a
Citation Count	228	3426	0	3426	168.46	362.89
√Citation Count	228	58.53	.00	58.53	10.118	8.147
Novelty of Idea	228	1	0	1	n/a	n/a
Page Length	228	71.00	2.00	73.00	24.092	8.872
Temporal Richness	173	7	0	7	n/a	n/a
Author Recognition	228	5	1	6	n/a	n/a
Number of Authors	228	5	1	6	2.38	.959
Number of References	228	160	0	160	50.32	32.911
Number of Studies	173	3	1	4	1.13	.536
Level of Analysis	228	2	0	2	n/a	n/a
Year of Publication	228	18	1990	2008	1999	5.489
Journal	228	2.00	.00	2.00	n/a	n/a
Reference Discipline	228	5	1	6	n/a	n/a
Research Approach	228	1.00	.00	1.00	n/a	n/a
Research Design	228	6	1	7	n/a	n/a
Type of Issue	228	1	0	1	n/a	n/a

Table 5: Slopes, Standard Errors, and Explained Variance (All Articles)

Regression Step	Variable	R^2	ΔR^2	Std. B	Std. Error	t-value
1. Control Variables	Model	.104	–	–	–	2.06**
	Year of Publication			-.205	.096	-3.194**
	Reference Discipline			.099	.287	1.499
	Level of Analysis			-.078	1.050	-1.207
	Type of Issue			.074	1.410	1.104
	Journal			.171	.704	2.429**
	Research Design Type			.098	.244	1.461
2. Particularistic Variables	Model	.343	.139	–	–	3.36**
	Author Recognition			.322	.434	5.562**
	Author Affiliation			-.054	.466	-.971
	Number of References			.335	.015	5.696**
	Number of Authors			-.003	.494	-.058
3. Universalistic Variables	Model	.194	.090	–	–	2.73**
	Novelty of Idea			.225	1.168	3.572**
	Page Length			.206	.059	3.186**
N = 228, * indicates alpha = .1, ** indicates alpha = .05						

In the second model, which analyzes only empirical research (Table 6), both the universalistic and particularistic sets

of variables significantly affect citation counts above and beyond the control variables. Power analysis reveals that a sample of 173 with ten independent variables can detect an effect size as small as 0.10 with 95 percent confidence. The results are remarkably consistent. Among the universalistic variables, both idea novelty and page length have significant effects on citation counts. As for the particularistic variables, author recognition and number of references are significantly related to citation counts. Inferring from the results, we can see that among empirical IS articles, those with prominent researchers and many references are more likely to be cited than those that are without. However, neither of the methodological variables of empirical study (temporal richness and number of studies) significantly affects citation counts. Thus, we can infer that using multipoint data collection methods will not necessarily improve an article's citation count.

Table 6: Slopes, Standard Errors, and Explained Variance (Empirical Articles)

Regression Step	Variable	R2	ΔR2	Std. B	Std. Error	t-value
1. Control Variables	Model	.124	-	–	–	1.98**
	Year of Publication			-.209	.106	-2.842**
	Reference Discipline			.075	.325	.980
	Level of Analysis			-.137	1.183	-1.857
	Type of Issue			.072	1.550	.965
	Journal			.186	.718	2.364**
	Research Design Type			.104	.348	1.363
2. Particularistic Variables	Model	.332	.288	–	–	2.83**
	Author Recognition			.333	.508	4.780**
	Author Affiliation			-.057	.524	-.876
	Number of References			.295	.017	4.147**
	Number of Authors			-.013	.572	-.191
3. Universalistic Variables	Model	.207	.083	–	–	2.03**
	Novelty of Idea			.241	1.461	3.271**
	Temporal Richness			-.082	.490	-.951
	Number of Studies			-.059	1.393	-.678
	Page Length			.181	.070	2.321**
N = 173, * indicates alpha = .1, ** indicates alpha = .05						

Table 7: Slopes, Standard Errors, and Explained Variance (Non-empirical Articles)

Regression Step	Variable	R2	ΔR2	Std. B	Std. Error	t-value
1. Control Variables	Model	.132	–	–	–	1.11
	Year of Publication			-.194	.238	-1.32
	Reference Discipline			.174	.661	1.209
	Level of Analysis			.062	2.417	.434
	Journal			.027	2.711	.157
	Research Design			.226	.756	1.602
	Type of Issue			.167	3.928	.959
2. Particularistic Variables	Model	.469	.337	–	–	1.97**
	Author Recognition			.308	.944	2.606**
	Author Affiliation			-.091	1.111	-.772
	Number of References			.430	.036	3.438**
	Number of Authors			-.069	1.177	-.575
3. Universalistic Variables	Model	.309	.177	–	–	1.60**
	Novelty of Idea			.192	2.374	1.464
	Page Length			.359	.138	2.542**
N = 55, * indicates alpha = .1, ** indicates alpha = .05						

Our third model includes only the non-empirical research (those that are theoretical, review, introspective, etc. pieces) from our sample; thus, methodology variables are excluded in the model (Table 7). The results for non-empirical articles are consistent with the comprehensive model except for one universalistic variable—novelty of idea. A power analysis reveals that a sample of fifty-five with a maximum of ten predictors should be able to detect an effect size of at least .35 with 95 percent confidence. The low degree of power in this regression analysis likely contributes to the lack of an observed (by expected) effect of novelty of idea on citation counts. The other significant particularistic variable, author recognition, illustrates significant effect on citation with a stronger positive coefficient. These findings indicate that, among non-empirical research in the IS field, prominent authors tend to have higher

citation counts than do less renowned scholars. In terms of universalistic attributes, page length significantly relates to citation count, whereas, contrary to our expectations, the novelty of the idea does not.

Table 8: Integrated Results Table

		All Articles	Empirical Articles	Non-Empirical Articles
Attributes Type	Variable	*Std. B*	*Std. B*	*Std. B*
Universalistic	Novelty of Idea	.225**	.241**	.192
	Temporal Richness	–	-.082	–
	Number of Studies	–	-.059	–
	Page Length	.206**	.181**	.359**
Particularistic	Author Recognition	.322**	.333**	.308**
	Author Affiliation	-.504	-.057	-.091
	Number of References	.335**	.295**	.430**
	Number of Authors	-.003	-.013	-.069
Control	Year of Publication	-.205**	-.209**	-.194
	Reference Discipline	.099	.075	.174
	Level of Analysis	-.078	-.137	.434
	Type of Issue	.074	.072	.959
	Research Design	.098	.104	.226
	Journal	.171**	.186**	-0.284

*indicates alpha = .1, ** indicates alpha = .05

In Table 8, we show our results integrated across all three of our studies: all articles considered together, empirical articles considered alone, and non-empirical articles considered alone. The results bear out that while author recognition, number of references, and page length are significant predictors of citations across empirical and non-empirical articles alike, novelty of idea falls out of significance in non-empirical articles. Of the control variables, year of publication and journal are significantly related to citation counts when we consider all articles together.

XI. DISCUSSION AND IMPLICATIONS

The main implications of the findings of this research are listed in Table 9. The finding that author recognition is the most significant predictor of citation counts, both in all articles and when we examined empirical articles and non-empirical articles separately, has important implications. This finding indicates that IS researchers judge a paper, in part, by who penned it. Particularistic reasons for citing a research article indicate that citing authors are employing heuristics to judge a paper rather than expending the cognitive resources needed to judge each article strictly on its universalistic merits [Judge et al., 2007]. While such heuristics may lead to errors of exclusion (in that some worthwhile research may go unnoticed because it is not written by prominent authors), they do imply that the field of IS is developing a maturing set of norms from which these heuristics can be derived [Merton, 1957]. Despite the possibility of errors of exclusion, such heuristics serve to reduce the cognitive burden felt by researchers and, as a result, increase their productivity. In a contrarian view, some research alludes to the notion that particularistic citing could be higher in high paradigm fields, such as physics, where large research grants and endowed chairs are awarded to prominent researchers, both of which allow these prominent researchers more access to resources (e.g., Beyer and Snipper, 1974). The emergence of such prominent researchers in our field might be an indication of growing consensus on who produces quality work. It could also indicate that such consensus raises the strategic dependence of the field on key anchors, arguably reflecting the field's growing maturity.

If we assume IS as a low paradigm field [Grover et al., 2006; Katerattanukul and Hong, 2003], then particularistic attributes of articles should determine citations more than universalistic attributes [Baldi, 1998; Bedeian and Feild, 1980; Boyd, Finkelstein, and Gove, 2005]. This is because low paradigm fields have a low level of consensus regarding appropriate research methods and theoretical approaches [Glick, Miller, and Cardinal, 2008; Kuhn, 1962]. In such situations, when an author must choose between referencing papers, s/he is more likely to choose the paper from a more prestigious author/institution/journal [Baldi, 1998; Boyd et al., 2005; Katerattanukul and Hong, 2003]. This is in contrast to a "high paradigm" field where an unknown author (one who has very few publications) can produce a highly cited piece because there is great consensus on the structure of the field as well as what is considered quality research [Bergh et al., 2006; Cole and Cole, 1967; Katerattanukul and Hong, 2003]. Prior research has shown that while both attribute types influence the number of times a paper is cited, particularistic

attributes are more influential than universalistic ones in low paradigm fields [Baldi, 1998; Bedeian and Feild, 1980; Judge et al., 2007; Stremersch et al., 2007].[8]

Another finding is that the number of references significantly predicts the citations of an article. This suggests that, particularly in the case of empirical articles, researchers may implicitly make a citation decision based on the reference-base or its ability to synthesize knowledge rather than its unique contribution to the knowledge base. Again, this finding implies that authors in the IS field might be employing certain heuristics in their citation decisions. Non-empirical articles, which often serve as review pieces and theoretical frameworks, often rely heavily on the assimilation and presentation of a large body of referent literature without attempting to advance a new idea.[9] Moreover, this inference is backed by our failure to identify novelty of idea as a significant predictor of citation counts in non-empirical articles.

The finding that page length significantly predicts the scientific impact of both empirical and non-empirical articles implies that the peer review process does indeed work largely according to universalistic ideals, with precious journal space being granted to high-quality research. This finding backs Tams and Grover's [2008] efficient frontiers argument that a greater amount of journal space is required to explain more complex ideas. Taken in combination with our finding that more references lead to more citations, we can infer that authors prefer to cite papers that synthesize the works of many other authors.

The finding that the novelty of the idea presented in an IS article significantly predicts citation counts speaks to the value the IS research community places on the knowledge contribution of the article. The idea that good IS research produces new theoretical contributions has been a central tenet of the field since its inception (e.g., the work of Gregor, 2006; Murray, 1981; Weber, 2006; Whetten, 1989; and Zmud, 1995]. However, the finding that this predictor lost significance for non-empirical articles, but remained a significant predictor for empirical articles, could suggest the following: First, this is an artifact of the lower power of our test for non-empirical articles; second, it is more useful for empirical works to advance theory than to test it and; third, non-empirical pieces, including reviews, typologies, and frameworks, may accrue citations by organizing a large referent literature in lieu of advancing new ideas.

If we are to summarize the type of IS paper that will be cited, it would be empirical pieces from prominent authors that invest space in developing (and advancing) theory and synthesizing literature. Alternatively, non-empirical pieces from prominent authors that provide reviews of large literature bases also get citations. Universalistic methodological considerations, such as longitudinal samples and triangulation of studies, while contributing to the rigor of the work published, do not (as per our results) facilitate citations.

Most articles in the IS field follow a positivistic orientation. Journal reviewers demand clear operationalization of variables as well as a high degree of methodological rigor so that relationships enumerated in one research article can be linked to those in others. One could argue that this encourages incremental research and discourages speculative research. However, it does seem that if the authors of such speculative pieces are already highly esteemed in the IS field, the field does pay attention. This may be a self-regulating mechanism of the IS field—one that ensures speculation comes from experienced and established researchers. While this could lead to Type II errors (good ideas being rejected from non-prominent researchers), such regulation is fine as long as it comes post-hoc to the review process.

XII. LIMITATIONS

A major limitation of our research is that we sampled only articles from three journals in the IS field: *Information Systems Research, MIS Quarterly, and Journal of Management Information Systems.*[10] Although these journals are among the top in the field, we do understand that the factors that cause articles in these journals to be cited may not be the same as those that drive citations in other journals, including less prestigious ones. Therefore, those that interpret our research should be careful as to the generalizations they may make. Further research should take a more comprehensive sample of articles in the IS field.

[8] In blind review processes, universalistic attributes determine journal acceptance. However, once a paper is published, research indicates that particularistic attributes influence citations more so than universalistic attributes.

[9] In such cases, this particularistic variable may actually reflect universalistic attributes, as references are important in review pieces.

[10] We would like to note that, in order to bolster the validity of our results, we collected an auxiliary data source of ninety-seven random articles from *EJIS, ISJ,* and *JAIS.* Results of OLS regression with that data set show that author recognition and page length were significant predictors of citation counts of articles. These results are consistent with our sample of *MISQ*, *ISR,* and *JMIS* papers.

Another limitation to our research is that we did not directly take some important variables. Implicitly, there could be particularistic variables like academic politics at work. On the universalistic side, the writing style of the article influences accessibility of its ideas. This certainly can have an effect on the citation count of the article in that the easier an article is to read, the more the article will be read, and the more the article will be cited (ceteris paribus). While writing style may not overcome trivial findings or low methodological rigor, the accessibility of content should influence citations.

Future research into the causes of citations in IS articles might consider using a broader sample of journals and articles and account for elements of writing style, such as whether the article has a clearly stated results section, clearly defined tables, and a detailed description of the methodology. While the results of this research are indicative of papers in top journals, they may not be applicable to any highly cited articles in second tier journals, or specifically those journals that may include more qualitative research methodologies.

Table 9: Implications

Significant Result	Implication
• Novelty of Idea predicts citation counts in all articles considered together. • When empirical and non-empirical articles are considered separately, novelty of idea is a significant predictor of citation counts only in empirical articles.	• The field values new theoretical contributions. • This is especially salient for empirical pieces that must contribute unique knowledge rather than summarize others' findings. • Non-empirical articles include publications such as review pieces and frameworks, which do not necessarily need new or exploratory ideas to garner citations.
• Number of References is a significant predictor of citation counts in all articles considered together, as well as in separate considerations of empirical and non-empirical articles.	• The field values a research article's connection to an extant theory base. • This variable's significance in empirical articles indicates that the degree to which an empirical article is connected to the theory base is an important consideration of citing authors.
• Author Recognition is a significant predictor of citation counts in all articles considered together, as well as in separate considerations of empirical and non-empirical articles.	• The finding that author recognition is a significant predictor of citation counts indicates that referencing authors are employing the author of a paper as a proxy for paper quality. While the use of such heuristics can lead to errors of exclusion, it does allow for a more efficient search for quality articles and, as such, is an indicator of a maturing scientific field.
• Page Length is a significant predictor of citation counts in all articles considered together, as well as in separate considerations of empirical and non-empirical articles.	• The finding that Page Length is a significant predictor of citation counts indicates that authors tend to cite longer articles more than shorter ones. From this, we can infer that authors use the journal space granted to them to effectively explain complex and interesting ideas. • When taken in conjunction with the finding that the number of references significantly affects citation counts, we can infer that authors prefer to cite papers that condense and synthesize a large body of literature.

XIII. CONCLUSION

In summary, this study examines the basic question, "What causes an IS paper to be cited?" We tested a range of universalistic and particularistic variables via regression analysis for their effect on citation counts, finding significant influence for four variables: Page Length, Author Recognition, Number of References, and Novelty of Idea. These were studied across subsamples of empirical and non-empirical articles. While page length, author recognition, and number of references are significant across sample subsets, novelty of idea is a significant predictor of citation counts in empirical articles.

From this, we can draw a few conclusions geared toward authors in the IS field regarding citability of their work, not necessarily publication success. First, there are different strategies that could pay off in writing different types of articles. Empirical articles appear to be judged on how well they connect to and extend the theory base, expending space in developing ideas as well as tying them to the larger literature base. Non-empirical articles, on the other hand, appear to be cited because they are long and because they reference many other articles. This indicates that non-empirical pieces may accrue citations when they effectively coalesce a large extant theory base for easier interpretation by a reader.

We can also draw conclusions for the IS field at large. First, while we do see evidence of particularism in IS research, the degree to which it is present is hardly at the exaggerated level claimed by some [Long and Fox, 1995]. While particularism indicates that researchers are using heuristics to evaluate the work of their peers, which can lead to errors of exclusion, these heuristics might suggest (a) the low paradigm nature of the field where particularistic factors prominently influence impact over universalistic factors. There is no compelling evidence that this is the case, as novel ideas and reviews do get cited in IS research, and (b) that there is an overarching value proposition emerging in the field as it builds on a growing literature base (cumulative tradition), recognizes novelty, and has a strategic dependence on experienced and prominent researchers. This could be taken as a positive indicator of a maturing field.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. The author(s) of the Web pages, not AIS, is (are) responsible for the accuracy of their content.
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APPENDIX A: BIVARIATE CORRELATIONS TABLE

Table A1: Bivariate Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1															
2	-.059	1														
3	.135*	-.032	1													
4	-.164*	-.056	.027	1												
5	.126	-.048	.174**	-.034	1											
6	.059	.084	-.181*	.046	.130	1										
7	-.086	.083	.309**	-.020	.057	-.391**	1									
8	.009	.134*	.417**	-.019	.023	-.104	.182*	1								
9	-.104	-.014	-.157*	.039	-.084	.069	.066	.047	1							
10	.081	.011	-.016	-.075	.022	-.150*	.021	-.026	.069	1						
11	-.013	.036	-.002	.065	-.252**	-.045	.033	.041	.037	.023	1					
12	.008	-.064	.042	.151*	.240**	.220**	.016	-.068	-.013	-.108	-.637**	1				
13	.089	.028	-.159*	-.256**	-.061	.324**	-.490**	-.105	-.054	.277**	.176**	-.273**	1			
14	.070	-.032	.006	-.032	-.025	.171*	-.221**	.048	.071	.049	.048	-.118	.235**	1		
15	-.118	.004	.199**	.030	-.007	-.098	.196**	.277**	-.037	.010	.052	.077	.000	-.084	1	
16	.422**	-.084	.299**	-.098	.240**	.061	-.145	.111	-.070	.111	.027	.017	.195**	.143*	-.201**	1

1. Author Recognition
2. Author Affiliation
3. # References
4. # Authors
5. Novelty of Idea
6. Temporal Richness
7. Number of Studies
8. Page Length
9. Level of Analysis
10. Type of Issue
11. Research Approach
12. Research Design
13. Journal
14. Reference Discipline
15. Year of Publication
16. √Citation Count

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

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