Contribution of Information Science to Other Disciplines as Reflected in Citation Contexts of Highly Cited JASIST Papers

Nahid Tabatabaei

School of Information Studies, Faculty of Education

McGill University, Montreal

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To my forever beloved angel
&
To the most precious treasure of my life

Table of Contents

List of Tables

List of Figures

Abstract

Information Science is an interdisciplinary field that interacts with other disciplines through its intellectual borders. While there is much research into the interdisciplinary nature of Information Science, little research exists that identifies the nature, extent, and quality of these extra-disciplinary interactions. The purpose of the present study is to provide in-depth analyses of the implicit and explicit contexts of citations as a means of exploring the nature of citations that Information Science literature receives from the literature published in other disciplines. This sort of analysis reveals the level of citation impact that Information Science literature contributes to the advancement of knowledge in other disciplines.

The present research is led by one main research question: What is the "nature" of citations that highly cited papers appearing in the *Journal of the American Society for Information Science and Technology (JASIST)* receive from citing papers published outside the Information Science field? The present study uses two citation contextual measures to define and determine the nature of citations: citation functions and citation textual properties, including citation location, citation frequency, and co-citation frequency. Citation context analysis was selected as the research method. Highly cited JASIST papers were assumed to represent Information Science literature for the purpose of the present research. Citation contexts of highly cited papers were used as a "radioactive tracer" to investigate the contributions of Information Science literature to other disciplines. A detailed citation classification scheme was constructed to identify functions and roles of citations.

Results of implicit and explicit analyses of citation contexts showed that citations convey different meanings, serve different purposes, and all citation functions are not of equal significance. It was also demonstrated that the nature of citations may vary across a wide spectrum of different functions and roles, with different impact levels on the theme of citing papers. Citation functions showed a

significant association with all three textual properties, including citation location, frequency of citation occasion and co-citation frequency.

The high rate of citations within Information Science journals (74.7 percent) indicates that highly cited JASIST papers are cited extensively in other Information Science journals. This rate drops to 25.3 percent for publications outside of Information Science. An investigation of the nature of the contributions of highly cited papers to other disciplines shows that the vast majority of citations (80 percent) convey "reviewed" or "perfunctory" functions. Furthermore, for 51 percent of citing papers, the impact level of highly cited JASIST papers was ranked "low" or "relatively low". The disciplines to which Information Science mainly contributes include Computer Science, Psychology, Education, Business, and Communication. The present research concludes that Information Science literature is yet to have a major theoretical or methodological impact on other disciplines.

At the conceptual level, the Citation Pyramid Model was suggested to provide a common ground for both normative and constructivist theories. This model shows that both theories can be intertwined and act complementarily rather than as mutually exclusive theories to explain such an internal and complex phenomenon as citation motivations.

Résumé

La science de l'information est un domaine interdisciplinaire qui interagit avec d'autres à travers ses frontières intellectuelles. Bien qu'il y ait beaucoup de recherches sur la nature interdisciplinaire des sciences de l'information, peu de recherches identifient la nature, l'étendue et la qualité de ces interactions extradisciplinaires. Le but de l'étude est de fournir une analyse approfondie des contextes implicites et explicites de citations pour explorer la nature de citations que la littérature des sciences de l'information reçoit d'autres disciplines. Cette analyse approfondie révèle le niveau de l'impact des citations auquel la littérature des sciences de l'information contribue pour l'avancement des connaissances dans d'autres disciplines.

La présente recherche a été menée par une principale question de recherche: Quelle est la «nature» que les citations des articles les plus cités figurant dans le Journal of the American Society for Information Science and Technology(JASIST) reçoit lorsque les articles qui sont cités sont publiés dans d'autres disciplines? La présente étude utilise deux mesures contextuelles de citations pour définir et déterminer la nature des citations: les fonctions de citation et les propriétés textuelles de citation, y compris l'emplacement des citations, la fréquence de citation et la fréquence de co-citation. L'analyse du contexte des citations a été choisie comme méthode de recherche. Les articles les plus cités de JASIST étaient supposés représenter la littérature des sciences de l'information dans le but de la présente recherche. Les contextes de citation des articles les plus cités ont été utilisés comme «traceur radioactif» pour enquêter sur les contributions de la littérature des sciences de l'information à d'autres disciplines. Un système de classification de citation détaillé a été construit pour identifier les fonctions et les rôles des citations.

Les résultats des analyses implicites et explicites des contextes de citation montrent que les citations véhiculent des significations différentes, servent à des fins différentes, et toutes les fonctions de citations ne sont pas d'égale importance. Il a également été démontré que la nature des citations peut varier dans un large

éventail de fonctions et de rôles différents, avec différents niveaux d'impact sur le thème des articles cités. Les fonctions de citations ont montré une corrélation significative avec les trois propriétés textuelles, y compris l'emplacement de citation, la fréquence de citation et la fréquence d'occasion de citation et la fréquence de co-citation.

Le taux élevé de citations dans des revues sciences de l'information (74,7 pour cent) indique que les articles les plus cités de JASIST sont cités abondamment dans d'autres revues des sciences de l'information. Ce taux tombe à 25,3 pour cent pour les publications en dehors des sciences de l'information. Une enquête sur la nature de la contribution des articles les plus cités à d'autres disciplines montre que la grande majorité des citations (80 pour cent) véhiculent des fonctions «examinées» ou «superficielles». En outre, pour 51 pour cent des articles cités, le niveau d'impact des articles les plus cités de JASIST a été classé «faible» ou «relativement faible». Les disciplines auxquelles les sciences de l'information contribuent comprennent principalement l'informatique, la psychologie, l'éducation, les affaires et la communication. La présente étude conclut que la littérature des sciences de l'information reste proche d'avoir un impact majeur théorique ou méthodologique sur d'autres disciplines.

Sur le plan conceptuel, le modèle «Citation Pyramid» a été suggéré afin de fournir une base commune pour à la fois les théories normatives et constructivistes. Il montre que les deux théories peuvent être imbriqués et agir en complémentarité au lieu de théories qui s'excluent mutuellement pour expliquer un tel phénomène interne et complexe que les motivations de citation.

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Chapter 1: Statement of the Problem

1.1. Introduction

Information Science (IS) has been characterized as an interdisciplinary field that absorbs, through its intellectual borders, parts of other disciplines (Borko, 1968; Holmes, 2002; Saracevic, 1999; Tang, 2004). The main reason for this interdisciplinary nature relates to the complexity of research problems that IS needs to address that cannot be resolved with approaches from any single field (Saracevic, 1999, p. 1059; Chua & Yang, 2008, p. 2163). This interdisciplinary nature presents some opportunities and some challenges; it requires IS to interact constantly with other disciplines to integrate assumptions and approaches across disciplinary boundaries. Due to technological innovations and rapid shifts in information needs of users, research problems are changing and, accordingly, the nature of these interactions and the relations that IS enjoys with other disciplines are also changing (Borgman & Rice, 1992; Borko, 1968; Cronin & Pearson, 1990; Harmon, 1971; Peritz, 1977; Saracevic, 1999). However, "the interdisciplinary evolution is far from over" (Saracevic, 1999, p. 1052).

Recently there has been a rise in the number of studies on the interdisciplinary nature of IS and its communication with other disciplines (Holmes, 2002; Afsharpanah, 1984; Al-Sabbagh, 1987). Some studies have empirically tested the interdisciplinary nature of IS (Holmes, 2002). Others have explored the interdisciplinary structure of IS (Afsharpanah, 1984) and have investigated the evolution of interdisciplinarity in IS (Al-Sabbagh, 1987). Another group of studies have aimed to investigate whether IS interaction is a balanced import-export interaction of ideas or whether it is mainly importing ideas from other fields and barely contributing to the advancement of knowledge in other disciplines (Cronin & Meho, 2008; Sugimoto, Pratt and Hauser, 2008).

Since the 1970s, increasing concern has been reflected in the literature that IS has had little interaction with other fields and has appeared to be somewhat of an isolated field (Peritz, 1977; Small, 1981). Cronin and Pearson (1990) claimed that IS is "a net importer of ideas from other disciplines" (p. 381). Furthermore, it

was reported in the literature that while IS absorbs knowledge created in diverse fields, most of IS-generated ideas have not had enough scientific impact to break through the intellectual border of IS and were cited infrequently or not at all in the literature of other disciplines (Cronin & Pearson, 1990, pp. 381, 385; Large & Koshman, 1993, p. 298).

This situation remained more or less the same until 1996, when Meyer and Spencer (1996) reported a higher rate of citations from other fields than previous studies had indicated (p. 23). Eight years later, a more promising and stable situation was reported; the number of citations showed that IS had started interacting actively with a wide variety of disciplines and was attracting "learned interests" from them (Tang, 2004, p. 61). Cronin and Meho (2008) showed that "exports from IS to other fields has increased significantly over time… [and the field] has become a more successful exporter of ideas as well as a less introverted than was previously the case" (pp. 551, 560). More recently, Levitt, Thelwall and Oppenheim (2011) have investigated whether or not research in Social Science has become more interdisciplinary and "compared the extent to which the interdisciplinarity of different Social Science subjects has changed" since 1980 (p. 1118). The results of this study suggested that Information Science and Library Science (IS&LS) had the largest increase in interdisciplinarity between 1990 and 2000 in the Social Science Citation Index (SSCI) (compared to thirteen other social science subject categories). In another recent study, Larivière, Sugimoto, and Cronin (2012) analyzed citations of Library and Information Science (LIS) and showed that there was an increase in the interdisciplinary aspect of LIS during the last fifteen years, an increase from 20 percent in 1995 to 60 percent in 2010. This study concluded that LIS has gained the status of a permeable field instead of an insular field in terms of exchanged references and citations.

There is much research into the interdisciplinary nature of IS from different perspectives. Nevertheless, little research exists on the nature, extent, and quality of extra-disciplinary interactions. There is little evidence to show whether IS is contributing insights, paradigms, theories, models, techniques or just peripheral information. Also, a gap still exists in the literature regarding

whether the contribution of IS to other disciplines is fundamental or marginal to the advancement of knowledge in those disciplines. In their study, Cronin and Pearson (1990) deduced: that "for meaningful conclusions, this kind of study must be extended to include…sharper content classification (do we count as exports citations which are dismissive or negational?)" (p. 385). In response to the above knowledge gap, the current research provides in-depth analyses of the contexts of citations as a means of exploring the nature of citations that appear in the literature of other disciplines. This sort of analysis will reveal the level of citation impact that IS contributes to the advancement of knowledge in other disciplines. Understanding the significance of IS contributions to other disciplines will provide a common ground between researchers so as to achieve shared advances in methodologies, tools and theories and to better address research problems and interests (Sugimoto et al., 2008).

1.2. Purpose of the Study

The main purpose of the present study is to provide in-depth analyses of implicit and explicit citation contexts of IS literature so as to understand the "nature" of citations that appear in the literature of other disciplines.

Citation analysis, defined as the quantitative analysis of the characteristics of documents, has proved to be a valid research method for assessing interactions and citation flows between disciplines. However, previous studies have utilized citation analysis using different techniques, units of analysis and levels of precision. Co-citation analysis (Small, 1973), author co-citation analysis (ACA) (White & Griffith, 1981; White & McCain, 1998), field citation analysis (Sugimoto et al., 2008), and journal citation analysis (Levitt et al., 2011) represent some techniques used in earlier research. Other studies have focused on the context of citations to extract meanings that are attached to each citation occasion[1]. The present research extends previous studies that have focused on interactions of IS with other disciplines (Cronin & Pearson, 1990; Peritz, 1977; Small, 1981; Meyer & Spencer, 1996; Tang, 2004; Cronin & Meho, 2008), but

[1] For more details, see the "Literature Review" chapter.

uses citation context analysis to conduct in-depth analyses of citations to understand the nature of interactions that IS enjoys with other disciplines.

Citation context analysis is used as a research method to explore the extent and quality of extra-disciplinary citations and to understand the nature of IS contribution to other disciplines. Highly cited papers from *Journal of the American Society for Information Science and Technology (JASIST)* will represent IS literature in the present research. Citation contexts of these papers, cited in the literature of other disciplines, will be used as a "radioactive tracer" to see where IS research eventually informs research in other disciplines.

Highly cited papers are interesting for two reasons. First, there is "a potential association between high citation counts and high quality research" (Levitt & Thelwall, 2009, p. 45), and second, they provide enough citation context occasions to explore the research questions of the present study. JASIST is selected as the source of data primarily based on a consensus that is shared in IS literature regarding it being representative of IS field (Sawyer & Huang, 2007, p. 1440; Tsay, 2008, p. 125). In related studies, JASIST has been referred to as prominent, highly regarded, well-respected quality journal (Yang, 2009; Smith, 1999), a "probable legitimate sole surrogate for Information Science" (Koehler, 2001, p. 117) and a premier journal (Nisonger, 1999; Kraft, 1999) that has accumulated numerous citations over the years. Previous researchers have emphasized its broad subject coverage along with its large pool of authors (Hooten, 1991, p. 398)[2].

1.3. Research Questions

The present research is led by one main research question: What is the "nature" of citations of highly cited JASIST papers when citing papers are published in other disciplines? The present research takes the citation context in the citing paper as evidence of the nature of citation (McCain & Turner, 1989) and uses citation functions as well as citation textual properties, including citation

[2] For more information regarding the rationale behind selecting JASIST as the source of data for the present research, see the "Methodology" chapter, section 4.3.1.1. "JASIST as the Source of Data and its Selection Rationale"

location, citation frequency, and co-citation frequency as variables to express and define the nature of citations.

The nature of citations is operationally defined by implicit and explicit in-depth analyses of the citation contexts. Implicit citation context analysis infers the "function" of each citation occasion from the citation context and identifies relationships that citing authors perceive between their papers and highly cited JASIST papers. Explicit citation analysis records textual properties of each citation occasion: including citation location, citation occasion frequency, and co-citation frequency, and explores any possible association between implicit functions of citations and explicit textual properties.

The following three research questions shed more light on the nature of citations:

1. What are the functions of citations?

   To explore this research question, the text surrounding each embedded citation in the citing paper will be identified and the main idea intended by the citing author, or the links the citing author perceived between his/her citing paper and the cited paper, will be characterized. This procedure represents the main research methodology applied in the present research, citation context analysis. This analysis detects citation function categories and, ultimately, results in the construction of a citation classification scheme. Each main category of this scheme reflects a citation function to interpret the relationship between the citing and cited paper, and eventually illuminates the "nature" of citations.

2. What are the textual properties of citations?

   To investigate this research question, for each citation occasion of highly cited JASIST papers, the following textual properties are recorded:

   a. Citation location: Defined as the exact section of the citing paper in which a citation occasion occurs. The rationale for recording citation location is that citations occurring in some sections of citing papers may imply a more significant contribution of the cited paper than other citations, e.g.,

citations in the "methodology" or "results" section compared to citations located in the introductory sections (McCain & Turner, 1989).

b. Citation occasion frequency: Defined as the frequency of each citation occasion in the citing paper. Here the underlying assumption is that multiple citation occasions are associated with more relevance, importance, or even a more significant contribution of the cited paper to the theme of the citing paper, an assumption that rests on the results of previous studies (Voos & Dagaev, 1976; Bonzi, 1982; McCain & Turner, 1989).

c. Co-citation counts: Defined as the total number of citation occasions that occur in the same citation context (usually in the same parenthesis). Here it is assumed that if a citation occasion of a cited paper is a unique citation in the citation context, without any other accompanying citation occasion, it may indicate a significant contribution of the cited paper to the theme of the citing paper.

3. What is the level of citation impact of highly cited JASIST papers on their corresponding citing papers?

This question calculates an impact score for each highly cited JASIST paper by combining explicit and implicit context-related citation properties to show how far various textual properties converge and support each other (McCain & Turner, 1989). This question also shows how meaningful the contribution of each cited paper is to the theme of citing papers.

1.4. Assumptions

The following assumptions are made in the present study:

1. In the present study, it is assumed that IS is an interdisciplinary field of knowledge that interacts with other disciplines to address and solve its research problems.

2. In the present research, no effort is made to provide a conceptual definition of Information Science. Instead, it is assumed that IS literature reflects the content of the IS and can be used as a proxy for this discipline. Specifically, papers published in the *Journal of the American Society for Information Science and Technology (JASIST)* are representative of IS literature.
3. It is also assumed that citations convey an intellectual or a subject relationship between cited and citing papers and reflect the fact that authors have consulted the source. Therefore, citation patterns can be used as a "radioactive tracer" to identify interdisciplinary relations that occur between IS and other disciplines (Afsharpanah, 1984).
4. The designation of journals according to Journal Citation Reports (JCR) subject categories that have been established by the editors of Thomson Reuters over time in 172 subject categories is an adequate classification system to represent and delineate the disciplines.

1.5. Definition of Terms

1.5.1. Contribution

"While citation counts can be conceived as manifestations of intellectual influence" (Moed, 2005, p. 4), in the present research the notion of "contribution" has been limited to "citation impact" to avoid any misinterpretation and possible biases (Moed, 2005, p. 14). This concept will be investigated through the exploration of the "nature" of citations that appear in surrounding disciplines.

Other researchers have showed similar interest in the concept of "citation impact". Kostoff (1998) referred to a "radioactive tracer" role of citations in revealing research impacts. Hanney, Frame, Grant, Buxton, Young and Lewison (2005) traced the impact of health research literature through two generations of papers (cited and citing papers). Baldi (1998) also tested whether "citations reflect the worth and content of contributions, by including measures of a potentially cited article's theoretical, empirical, and topical content, the extent to which it builds upon recent literature, and its perceived quality" (p. 835).

1.5.2. Information Science

As earlier mentioned, in the present research, no effort is made to provide a conceptual definition of Information Science. Instead, it is assumed that IS scholarly journals, specifically JASIST, reflects the content of the IS discipline and can be used as a proxy for this discipline. Nevertheless, the assumption that IS is an interdisciplinary field that interacts with other disciplines to address and solve its research problems is backed up and supported by several well-known definitions that have been suggested to characterize IS.

I. The classic definition of IS, suggested by Borko (1968), is one of the earliest definition that emphasizes on the interdisciplinary nature of IS and the relationships between IS and other disciplines, including "Library Science" and "Computer Technology":

> Information science is a discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with that body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, transformation, and utilization of information. This includes the investigation of information representations in both natural and artificial systems, the use of codes for efficient message transmission, and the study of information processing devices and techniques such as computers and their programming systems. It is an interdisciplinary science derived from and related to such fields as mathematics, logic, linguistics, psychology, computer technology, operations research, the graphic arts, communications, library science, management, and other similar fields. It has both a pure science component, which inquires into the subject without regard to its application, and an applied science component, which develops services and products (p. 3)

Bates (1999c) defined Information science as "the study of the gathering, organizing, storing, retrieving, and dissemination of information". Bates further remarked that this definition is timeless (Holmes, 2002) and "has been quite stable and unvarying over at least

the last 30 years", since Borko (1968) suggested his definition (p. 1044).

II. Rayward (1996) in his paper on the history of information science focused on "what constitutes information science" and reflected:

> The interdisciplinarity of information science is a continuing theme in attempts to define it…This suggests that the history of information science may be considered as much a historical interdiscipline as information science itself may be considered an interdiscipline more generally. The raison d'dtre for a history of information science then becomes not only the illumination from an historical point of view of important disciplinary developments but the new light it can cast on fundamental aspects of human society (pp. 4,15)

III. Saracevic (1999) elaborated on the interdisciplinary nature of Information Science:

> First, information science is interdisciplinary in nature; however, the relations with various disciplines are changing. The interdisciplinary evolution is far from over…Two things introduced interdisciplinarity in information science. First and foremost, the problems addressed cannot be resolved with approaches and constructs from any single discipline-this, interdisciplinarity is predetermined, as it is in many modern fields. Second, interdisciplinarity in information science was introduced and is being perpetuated to the present by the very differences in background of people addressing the described problems (pp. 1052, 1059)

IV. Bawden (2007) in an attempt to reach to a unified view on information for information science suggests that information science is:

> a multidisciplinary field of study, involving several forms of knowledge, given coherence by two foci: first on the central concept of human, recorded information, …and second on the interaction between Popper's worlds and with an intellectual core of information science"… This way of understanding the discipline seems to bridge the gap between the fundamental issues outlined above, with their potential for highly interdisciplinary research, and the practical needs of those who

> plan courses and contemplate the future of the information professions (p. 320)

1.5.3. Disciplines

In the present research, the concept of "discipline" is based on JCR subject categories that have been established by Thomson Reuters' editors over time in 172 subject categories. According to Pudovkin and Garfield (2002), the process started forty years ago and categories have developed manually. The whole process is ongoing and categories are evolving. Once a category was established, "new journals were assigned one at a time. Each decision was based upon a visual examination of all relevant citation data" (p.1113) and each category reflect the overall content of journals. Thomson Reuters' editors use topical relevance and citation relevance as the main indicators in determining each journal's subject category (Nick Andrews Consultancy, 2007).

A number of previous studies have used JCR subject categories as representative of scientific disciplines and "citations outside category as an indicator of cross-disciplinary research activity" (Porter & Chubin, 1985, p.161), for example, Gu (2004), Rinia, Van Leeuwen and Van Raan (2002b), Rinia, Van Leeuwen, Bruins, Van Vuren and Van Raan (2002a), Pettigrew and McKechnie (2001), or for evaluating scientific achievements (Guerrero-Bote, Zapico-Alonso, Espinosa-Calvo, Gomez-Crisostomo and De Moya-Anegon, 2007; Van Leeuwen, Visser, Moed, Nederhof and Van Raan, 2003; Van Leeuwen & Moed, 2002; Moya-Anegon, Vargas-Quesada, Herrero-Solana, Chinchilla-Rodriguez, Corera-Alvarez and Munoz-Fernandez, 2004; Podlubny, 2005; Sombatsompop & Markpin, 2005; Pettigrew & McKechnie, 2001), or for constructing maps of science (Moya-Anegon et al. 2004). This classification system is one of the few systems that span all disciplines. It may not be a perfect means of attributing publications to a discipline (Rinia, Van Leeuwen, Bruins, Van Vuren, and Van Raan, 2001) and there may be "lots of discussion about the details, but when you look at the whole thing, …ISI categories are pretty good" (Boyack, 2007).

It should also be noted here that for simplicity's sake, the terms "field" and "discipline" have been used interchangeably throughout the present research, however, there is a nuanced difference between these two terms[3].

1.5.4. Other Disciplines

Other disciplines include all disciplines (excluding IS), whether they are cognate with IS (e.g., Computer Science) or not (e.g., Art, Religious Studies…). Nevertheless, Library Science is an exception here and citations appearing in Library Science literature are not included in the data for the present research. The reason for this exclusion is that Library Science accompanies IS in JCR's subject category (this subject category reads as: "Information Science and Library Science" and, practically, it is not feasible to divide Library Science from IS. Consequently, all citations appearing in Library Science literature are excluded from the data (similar to IS itself).

1.5.5. Cited and Citing Papers

Here two groups of papers should be distinguished in order to avoid any confusion: cited papers or references (papers that have been cited) and citing papers or citations (those that cited other papers). Sometimes cited papers have been referred to as the "first generation" and citing papers as the "second generation" (Hanney et al., 2005). In related literature, references are usually examined as the unit of analysis, although a few studies have analyzed citations (McCain & Salvucci, 2006; Oppenheim & Renn, 1978) or both citations and references as the unit of analysis (Frost, 1979; Shadish, Tolliver, Gray and Sengupta, 1995).

[3] In academic usage, discipline refers to an indisputable and established branch of knowledge studied at the higher education level, while field refers to a particular branch of study or sphere of activity or interest still not formally recognized as such by other disciplines (Discipline, 2012; Field, 2012).

Chapter 2: Literature Review

2.1. Introduction

The main purpose of this chapter is to provide a background to the present research and to illustrate how current research relates to previous studies. The literature reviewed for the present study is divided into two sections. In the first section, a selective review of research relevant to citation motivations and citation context analysis will be presented. These studies have gone beyond the initial impression of citation counts and have attempted to yield deeper insight into the nature of citations, mostly through devising or using a citation classification scheme or a list of citation motivations. The first section provides the present study with a basis upon which the classification scheme specific to the present research can be constructed.

The second section reviews bibliometric studies that have investigated the interaction of Information Science (IS) with other disciplines. This section includes three sub-sections: 1) a summary of studies that have addressed the contributions of other disciplines to IS; 2) a review of those studies that have focused on the contribution of IS to other disciplines; and 3) a summary of studies that have addressed the reciprocal interaction of IS with other disciplines. In sum, this section tries to understand the degree to which IS as a discipline has been open to receive intellectual input from other disciplines and the degree to which it has influenced other fields. Obviously, the main focus is on studies that have investigated the scientific merit of IS and its contribution to other disciplines. The current research draws upon the results of these empirical studies and tries to shed some light on what might motivate scholars in other disciplines to cite IS literature.

2.2. Citation Context Analysis and Citation Motivation Studies

Recently, citation analysis, defined as the quantitative analysis of the characteristics of documents, has been increasingly used to indicate citation

practices of individual authors, disciplines, and interactions between disciplines. The two main assumptions of these citation analyses are:

1) High quality publication will trigger more citations from the scientific community than low quality publication (Van Raan, Visser, Van Leeuwen and Van Wijk 2003; Cawkell, 1968).

2) The number of citations to scientific publications correlates with other assessments of scientific achievement, such as awards and honors (Myers, 1970; Inhaber & Przednowek, 1976).

However, these fundamental assumptions have been criticized within the scientific community. Critics have argued that citation counts are a function of many factors besides scientific merit. These factors include, for example, time dependent factors (citations accumulate over years), field dependent factors (in some fields authors cite literature more frequently than others), journal dependent factors (publication frequency of journals and even the position and order of articles in journals), article dependent factors (review articles may receive more citations), author/reader dependent factors (language of the articles and cultural barriers may play a role), and availability of publications (physical accessibility may have an effect on citation counts). Many of these factors have little to do with scholarly acceptance of cited work (Bornmann & Daniel, 2008). So, two significant questions have so far remained unanswered: whether citation counts can truly reflect the research impact of scientific activity; and whether citation counts can reveal the actual motives of citing authors? Further, what meaning can be attached to citations, and thus to citation scores, and are publications that receive more citations than others truly more influential? (Hanney et al., 2005, p. 358)

Beginning in the 1970s and with the advent of the use of citations as a measure of scientific accomplishment, the debate on the quality and function of citations evoked some insightful citation behavior studies. These studies were triggered by increasing concerns that citation counts may not "yield insight into the authors' motives or their citing behavior" (Bornmann & Daniel, 2008, p. 48) and may not reflect the actual use and merit of cited documents.

These studies addressed the issue for two different purposes: first, to identify citer motivations and to extract meanings that authors attached to citations (Brooks, 1985; Brooks, 1986; Bonzi & Snyder, 1991; Vinkler, 1987; Cano, 1989); and second, to validate and assess the adequacy of citation counts for research evaluation purposes (Bornmann & Daniel, 2008; Moravcsik & Murugesan, 1975; Maricic, Spaventi, Pavicic and Pifat-Mrzljak, 1998). However, as will be discussed later, most of the first group of studies (citation motivation studies) was ultimately targeting citation counts as a research evaluation tool.

Previous studies into the identification of citation motivations or citation functions used two different approaches. In the first approach, researchers approached citing authors and asked them to state their citation motivations either through questionnaires, interviews, or sometimes with a combination of both instruments. In the second method, researchers preferred to analyze the citation context to extract meanings attached to each citation occasion.

According to the first approach, authors are asked to express their citation motivations and to explain the meanings they have attached to each citation occasion. However, there is always a chance that authors forget their motivations and provide the study with inaccurate responses. In addition, positive characteristics of references are usually better remembered than negative attributes and memory biases are always expected. Another disadvantage of this approach concerns research instruments such as questionnaires. Usually questionnaires are designed at the beginning of the study and respondents are asked to rate their citation motivations along pre-identified categories. Before posting their questionnaires, researchers may conduct some in-depth interviews with some colleagues or authors in order to capture all possible citation motivations. But since this process has to be closed off at one point, researchers are always exposed to criticism: Why did they not interview more diverse people in different contexts and disciplines to discover more citation motivations in preparatory stage of questionnaires? Or, why did they not encourage respondents to go beyond the questionnaire items? Or, why did they not use discovery oriented and open-ended questionnaires? (though some studies could not uncover more

citation motivations in the open-ended questions) (Shadish et al., 1995; Case & Higgins, 2000). Lack of care and consistency in responses has always been another issue raised in the literature; long checklists to complete in questionnaires sometimes lead respondents to simply go down the list and check a random response, resulting in some unreliable and inconsistent responses (Case & Higgins, 2000).

Conducting intensive interviews with authors to understand why they cited a specific document is an alternative way to compensate some questionnaire shortcomings. As White and Wang (1997) suggest, in-depth interviews can reveal motivations that neither context analyses nor surveys can address. Harwood (2008) accounts the advantages of semi-structured interviews and suggests that "the interviewer can seek fuller explanations and question authors closely about citing practices that questionnaire respondents may not have thought worth bringing to the researcher's attention or may not have thought about very much (or at all) themselves" (p. 1011). While promising as a means to understand citation behavior, face-to-face interviews have their own limits; respondents may suffer from recall problems and may provide researchers with false or socially desirable responses. Harwood (2008), who conducted several interview-based citation behavior studies, reported that in one of his interviews, one of his cases "found himself at a loss to explain" his citation behavior (p. 1011). In addition, some respondents may be more capable of introspection than others. Finally, conducting interviews requires a considerable time span (Case & Higgins, 2000).

Those studies that have analyzed the context surrounding each citation occasion and have extracted the meanings intended by the citing authors from the citation context, have been criticized for being "unobtrusive and speculative - dealing with the investigators' interpretation of why a citation was made rather than with the citers' own claims in this matter" (Prabha, 1983, p. 202), and also for their low degree of confidence and accuracy (Harwood, 2008). Critics have based their arguments on the fact that this method uses researcher or coder intuition to attribute citation motivation to each citation occasion rather than asking citing authors to state their citation motivations. It has also been raised in

the literature that this approach is tightly defined to a small number of citation types, which imposes some preconceived assumptions about what citation counts might measure (Shadish et al., 1995; Case & Higgins, 2000, p. 644). Harwood (2008) comments that this approach "interprets citation motivation from an etic (i.e., through the eyes of the analyst) perspective" (p. 1007). This kind of interpretation exposes the method to some reliability concerns, especially when researchers decide about the impact of each citation, e.g., whether a citation is perfunctory or essential to the theme of citing paper. These reliability concerns are more relevant when researchers fail to provide any operational definition for their categorization decisions (Case & Higgins, 2000). As a response to these concerns, Harwood (2008) believes that any citation behavior study "must include input and explanations from authors" (p. 1010).

While citation context analysis produces rich descriptions of citation context, another line of criticism taps a different aspect of this methodology. Shadish et al. (1995) remark that citation context analyses "are unlikely to uncover at least some motivation or citations that would not typically be acknowledged in print, such as citing a work because a reviewer asked that it be included" (p. 495). On the other hand, Glaser and Laudel (2001) believe that "research into establishing a typology of citations has ceased, and today we simply do not know how affirmative, rejective, perfunctory citations and the like are distributed" (p. 429). Hanney et al. (2005) disagree with this argument and point out that "[t]here is, nevertheless, continued interest in the topic and a substantial body of existing work" (p. 359).

The following section presents a literature review of both conceptual and empirical studies related to citation motivation and citation context analyses. This review provides the needed background to identify citation functions that have been captured in previous studies. This background will help the present research to build its own citation scheme in order to answer the first research question of the present study. Citation schemes and lists of citation motivations as essential elements of all citation behavior and citation context studies will be summarized in a unified table in another section of this literature review. Bornmann and

Daniel's (2008) scheme will act as a template upon which the final citation scheme of the present research will be built. In addition, those studies that focused on citation occasion textual properties, including citation location and multiple citation occasions, are also reviewed to provide the present research with a background to address the second research question.

2.2.1. Citation Motivation Studies

Citation motivation studies survey or interview citing authors to express citation motivations in order to explore why citers made references. However, as earlier discussed, most of these studies ultimately target the use and validity of citation counts for research evaluation purposes and investigate whether citing motivations are so diverse and complicated that citation counting loses its rationale as a reliable measure of scientific impact (Bornmann & Daniel, 2008).

In an attempt to investigate whether citation indexing can be automated, Garfield (1962) challenged the ability of intelligent machines to deal with implicit citations (where authors neglect to provide the necessary citations) as opposed to explicit citations. He further provided a list of author reasons for citing a document and used this list to justify machine indexing failure to extract implicit citations. Garfield list of citation reasons was not supported by any empirical study, nevertheless, his contribution was interpreted as a reference to both normative and constructivist views by later researchers, for example, Bornmann & Daniel (2008). Case and Higgins also commented on the Garfield list and noted that 20 percent of the reasons that were provided in this list were negational in nature (p. 641). This study triggered a number of subsequent studies on citer motivations. Table 1 shows Garfield list of citation reasons.

Table 1: Garfield (1962) List of Citation Reasons (p. 85)

1. Paying homage to pioneers
2. Giving credit for related work (homage to peers)
3. Identifying methodology, equipment, etc.
4. Providing background reading
5. Correcting one's own work
6. Correcting the work of others
7. Criticizing previous work
8. Substantiating claims
9. Alerting to forthcoming work
10. Providing leads to poorly disseminated, poorly indexed, or uncited work
11. Authenticating data and classes of fact (physical constants, etc.)
12. Identifying original publications in which an idea or concept was discussed
13. Identifying original publication or other work describing an eponymic concept or term
14. Disclaiming work or ideas of others (negative claims)
15. Disputing priority claims of others (negative homage)"

Small (1982), in his review of citation context analysis studies, mistakenly attributed the Garfield list to Weinstock and criticized the list for not being "intended as the basis for a systematic classification effort" (p. 300). Nevertheless, he identified some similarities between Garfield list and Lipetz list of citation relationships (Lipetz list will be discussed later in this review) (Lipetz, 1965).

As one of the earliest empirical studies, Prabha (1983) investigated the citation behavior of 19 faculty members from the Department of Business Administration, University of Illinois, to find out if they had consulted what they had cited in their papers, to what extent the authors had drawn upon the cited source for the preparation of their own papers, and whether they had considered those citations essential to the development of their own papers. This study was one of the first studies that used a questionnaire to gather information from citing authors. This questionnaire enabled Prabha to investigate the strength of the impact of cited documents on developing the themes of citing articles (Hanney, Frame, Grant, Green and Buxton, 2003). Table 2 shows the questionnaire that Prabha used to gather citation practices data.

Table 2: Questionnaire about Citation Practices of Business Administration Faculty as Developed by Prabha (1983, p. 203)

1. In the preparation of this article
    a. I consulted these sources in the past, but did not consult specifically for writing this article…
    b. I consulted these sources specifically for writing this article…
    c. I did not see these sources, but found them cited elsewhere…
    d. I didn't remember…
2. In writing this article,
    a. I drew heavily on these sources…
    b. I drew moderately on these sources…
    c. I drew peripherally on these sources…
3. At the time I wrote this article, these sources were located in
    a. My personal collection…
    b. Coauthor's collection…
    c. A colleague's collection…
    d. University of Illinois library collection …
    e. Other libraries…
    f. I don't remember…
4. I could not have written this article without consulting these sources…

Results of this study suggested that surveyed faculty members claimed to have consulted 96 percent of their cited references, but only 63 percent of these references were consulted specifically for the preparation of the paper in which the citation appeared. Also, the data indicated that authors used half the citations in a peripheral way and considered only one-third of their citations critical to the preparation of their own papers. Heavily used items were consulted in the preparatory stage of authoring articles (pp. 203,205). Throughout this study, the notions of "heavy use" and "critical use" remained subjective to the interpretations of authors and no attempt was made to define these concepts.

Brooks (1985) was the first scholar who systematically interviewed a sample of academic authors to explore their citation motivations for citing a specific reference (Bornmann & Daniel, 2008). As a motivation for his study, he referred to existing ignorance about citer motivations, arising from the small number of empirical studies on this topic. Inspired by previous theories of citer motivations, he extracted seven of the most significant citer motivations arbitrarily from previous theories and models of citer motivations (see Table 3 for details). Brooks further presented these citer motivations to 26 University of Iowa faculty members who had recently published an academic article and asked them

to identify their motivations for citing each reference along these seven motivational scales.

Table 3: Brooks (1985) List of Citer Motives (p. 226)

1. **Currency scal**e: Reviewing the current state of knowledge in a field; Referring to the latest output of author's contemporaries to show how up-to-date the author is
2. **Negative credi**t: Negating, disputing, correcting and criticizing other works
3. **Operational informatio**n: Borrowing techniques, tools, equipments or results from the cited paper
4. **Persuasiveness**: Convincing author's peers of the legitimacy of his method and results
5. **Positive credit:** Paying homage to pioneers, substantiating claims and justifying the data
6. **Reader alert:** Alerting the readers to new and future works
7. **Social consensus:** Having a vague perception of a consensus in a field and trying to show the author knows that

The data showed that among the seven citer motivations, persuasiveness was the highest frequently-referenced motivation and social consensus and negative credit had the lowest mean score among citation motivations. This study concluded that science and non-science authors are motivated by different motivations and citer motivations may differ by subject area. Results also revealed that authors usually cite other studies to advocate their own point of view and use previous literature to justify their own positions. Brooks concluded that although many citer motivation models have been improved, no perfect model has yet been articulated (p. 228).

Brooks (1986) published the results of another study in which he provided some evidence for complexity of citer motivations. Similar to the previous study, he interviewed 20 scholars and asked them to identify their motivations along the same seven motivational scales used in his previous study. Results of this study established three clusters as the parameters of motivation: persuasiveness, positive credit, currency, and social consensus as the first cluster, negative credit as the second cluster, and reader alert and operational information as the third cluster. As in his previous study (Brooks, 1985), persuasiveness was identified as the most significant motive by the surveyed scholars. Some of the interviewed authors expressed some contradictory motivations, e.g., moderately negative and at the same time positive credit; these statements were later interpreted and reported as empirical evidence to prove that citer motivations are often

contradictory. Also, Brooks used this evidence to show that authors usually try to diffuse the impact of negative references by "attributing some simultaneous positive credit" (p. 36). In addition, 70.7 percent of scholars named a combination of motivations, leading to the conclusion that citers are prompted by a "complex interplay of multiple citer motives" (p. 36).

Vinkler (1987) was the first scholar who made a clear distinction between two groups of motivations: professional motivations, related to the theoretical and practical connection between citing and cited documents; and non-professional or connectional motivations that prompt authors to cite other authors for personal incentives. While the primary aim of this study was to measure "the strength of cognitive pressure toward citing a given paper" (p. 50), this study also sought to find out why some papers are not cited. Vinkler surveyed 20 authors affiliated with the Central Research Institute for Chemistry of the Hungarian Academy of Sciences (CRIC), who had published at least one paper annually, to identify their motivations for citing references appeared in one of their papers. Table 4 summarizes professional and connectional motivations as suggested by Vinkler in his questionnaire. The strength of motivation was measured on a three-point scale: absolutely necessary (scored 3), important (scored 2), and less important (scored 1).

Table 4: Professional and Connectional List of Citer Motivation as Suggested by Vinkler (1987, pp. 54, 55)

Professional motivation:
The particular paper was cited in your paper because . . .

- … in the introduction of your paper or later a review of literature is given due to "completeness", "preliminaries"
- …your work is based entirely on the cited work
- …a significant part of the cited work (theory, preparation of substance, measuring methods) is utilized
- …a minor part of the cited work (preparation of one substance of secondary importance, application of part of a methodology, application of a statement) is utilized
- …the cited work confirms, supports the results published in the citing paper
- …the cited work is fully refused, criticized
- …the cited work is refused, criticized in one important question
- …the cited work is criticized in some minor point
- Professional reason other than above. Please, specify.

Connectional motivation:

- …professional connection is maintained with the cited author or you wish to build such a connection
- …you expect professional or private benefit from citing
- …honor, respect toward the authors caused you to cite the work
- …the cited paper was written by persons on whom you depend in some way (professionally, financially, etc.)
- …you needed more references (citation was, in fact, unnecessary)
- …the paper is your own, and you want to make publicity to it by citing
- …you want to make publicity to the cited paper in this way
- …the cited paper was published in an important (respected) journal
- …the cited paper was written by widely known, respected author(s) with absolute professional credit (reputation)
- …the paper was cited by other, too
- Connectional reason other than above. Please, specify.

The data of this study showed that in 81 percent of citations, professional motivation played the main role. A further 17 percent of citations were prompted by both professional and connectional reasons, and only 2 percent of citations were motivated by connectional incentives. This conclusion confirmed the reliability of citation counts for scientific evaluation purposes (Bornmann & Daniel, 2008).

Regarding the reasons why some papers are not cited, Vinkler showed that 42 percent of actually cited references were potentially citable works that were missed or omitted from the reference list. Respondents to this study stated that neglected citable publications were not relevant enough to the topic of their papers to be cited. None of the surveyed authors admitted lack of care or oversight as a reason for their neglect (p. 67). This study also revealed that only 3

percent of all professionally motivated citations were actually refuting or criticizing the original document.

Cano (1989) was the first scholar who empirically tested the applicability of citation behavior model of Moravcsik and Murugesan (1975)[4]. Twenty-one elite scientists in the Structural Engineering field were surveyed to examine the relationship between citation type, utility level, and location variables. Scientists were asked to classify the references they had made in two of their recent articles along the Moravcsik and Murugesan model, and to rate the utility level of each reference on a four-point scale. The utility level variable was defined as what "makes a reference indispensable in the production of novel information" (p. 285). Results showed that perfunctory and negational citations were the most frequent categories (26 percent), though they obtained a low utility rank from the scientists. Cano later interpreted this result "as a sign that the research subjects were not unduly affected by any presumed value-ladenness in the labeling of the categories of the model" (p. 286). Cano also found some discrepancies between the results of her study and the Moravcsik and Murugesan (1975) study. She attributed these discrepancies to the different methods that they had used; Moravcsik and Murugesan classified theoretical references of 30 physics articles, but Cano asked 21 scientists to classify their citations themselves. She also noticed that her research subjects were inclined to classify citations in more than one category that did not conform to the dichotomous categories included in the original model suggested by Moravcsik and Murugesan (p. 285). Cano concluded:

> Moravcsik and Murugesan model could not accommodate the nature of the information use reported and did not reflect the research subjects' perception of their use of information. However, the citation behavior of scientists in other fields or non-elite scientists in the same field may show a different information use pattern. (p. 289)

Bonzi and Snyder (1991) investigated citation motivations among 51 natural science faculty members. This research was the first study that surveyed self-citing authors about both self-citations and citations to others, and tried to

[4] See Table 14 for the description of this model

capture any discrepancy between these motivations. Table 5 shows a sample of the survey instrument.

Table 5: A Sample of the Survey Instrument (Bonzi & Snyder, 1991, p.253)

Reasons for citing (self-citations vs. citations to others)
1. There were no other sources of data
2. Identify a related body of work for the reader.
3. Establish the writer's authority in the field.
4. Substantiate claims/establish precedence for work.
5. Critically analyze/correct earlier work.
6. Given a variety of equally valid sources, chose this one.
7. Best/most relevant work on the subject.
8. Demonstrate knowledge of important work in the field.
9. Inclusion of earlier work on which the current work builds:
10. Political pressure.
11. Raise citation count.
12. Ease of access to the cited work
13. Don't remember.
-Besides those listed above, are there any other reasons why you have cited yourself?
-Besides those listed above, are there any other reasons why you have cited the works of others?

The most substantial difference between citation motivations for self-citations and citation of others was observed in reason 3 - "establishing the writers' authority in the field". Authors tend to establish their own authority rather than to acknowledge other scholars' reputations. Reason 8 - "demonstrating knowledge of important work in the field" - was given more credit in citations to others than self-citations, as there is a large body of literature written by other authors in each discipline. The other difference was observed in reason 9 - "inclusion of earlier work on which the current work builds" - that was checked more often for self-citations than for citations to others. Normally, people build on their previous research and usually remain in the same research area. The results of the Bonzi and Snyder study confirmed the hypothesis of their research that, in general, there were few differences in factors that motivated self-citations versus citations to other authors. This study also concluded that "citation behavior is consistent across scientific disciplines" (p. 252).

Shadish et al. (1995) explored the judgments of authors of 283 sample papers to yield deeper insight into the meanings and nature of citations. They designed three consequent empirical studies of citations in Psychology journals to extract author judgments and to relate them to citation counts. This study was also

designed to explore differences between old and new citations in order to predict citation patterns of new articles over the next five years. Surveyed authors were asked to characterize one of the previously identified references along a 5-point Likert scale and were also asked to identify if they were socially connected to the cited author in any way (see Table 7 for details) which, presumably, had an effect on their citations. Table 6 illustrates 28 items reflecting citer motivation, categorized by six different subscales, and Table 7 lists proximity items. These items were all included in the research questionnaire. Shadish et al. also conducted some sessions with their colleagues so as to include their stated citation reasons in the initial draft of the questionnaire.

Table 6: Subscales for Author Judgments of Citations (Shadish et al., 1995, pp. 482-483)

Subscale 1: Negative Citation
1. This reference has deficiencies that contrast to the strengths of your article.
2. This reference illustrates a perspective or finding that contradicts a perspective or finding in your article.
3. This reference reported unique or anomalous findings.

Subscale 2: Personally Influential Citation
1. This reference strongly influenced your thinking on the topic of your article.
2. This reference was a major source of the idea for your article.
3. This reference is crucial because it helps justify your central argument.
4. This reference reports an article that is similar to your own article.
5. This reference reviews prior work in this area.

Subscale 3: Creative Citations
1. This study used a method or theoretical perspective that you think is currently unusual or especially innovative.
2. This reference bridges a gap between two subfields.
3. This reference helps to reconcile contrasting viewpoints or findings in the field.
4. This reference illustrates possible avenues for future research.
5. This reference solves an important conceptual or practical problem in the field.
6. More so than most, this reference advances our ability to address an important social or human problem.

Subscale 4: Classic
1. This is a classic reference in the field.
2. This reference is authored by a recognized authority in the field.
3. This reference has generated much novel and successful research or scholarship.
4. This reference has withstood many efforts to show that it was wrong.
5. This reference is a 'concept marker' - it represents a genre of studies, or a particular concept in the field.
6. This is one of the earliest works in the field.

Subscale 5: Citations for Social Reasons
1. This reference was published in a prestigious journal or handbook in the field.
2. This reference was authored by someone who might have been influential in the review process.
3. This reference presents an orientation that is congruent with that of the readers or reviewers for the journal in which your article appeared.
4. This reference shows the reader that you are familiar with the important literature in this field.

Subscale 6: Supportive Citation
1. This reference supports an assertion in the sentence in which it occurred.
2. This reference helps establish the legitimacy of the topic of your article.

Items Scored Separately:
1. This reference reports what you consider to be an exceptionally high-quality piece of science.
2. This reference documents the sources of a method or design feature used in your study.

Table 7: Proximity Items (Shadish et al., 1995, p. 483)

1. Have you ever spoken directly or by phone with the author of this citation?
2. Would you consider the author a personal friend?
3. Is the author a colleague at your institution?
4. Did the author work at an institution where you were trained?
5. Did a journal referee/reviewer ask you to include this particular reference during the review process?
6. Have you ever read this reference? 95 percent If so, how many months ago?
7. Did this reference appear in the journal in which your article appeared?
8. Do you subscribe to the journal in which this reference appeared?
9. Do you currently possess a copy of this reference?

In the opinion of surveyed authors, they cite a source when it supports their own assertion, when it documents a source of method, and when it represents a genre of studies. Also, from authors' points of view, highly cited papers are high quality papers that are usually seen as exemplars (p. 485). Shadish et al. further defined "an exemplar" as a document where the "author was a recognized authority; and which was thought to be a classic, [an] early reference that presented a genre of studies" (p. 492). Following this conclusion, Shadish et al. investigated whether high citation counts meant different things for older versus newer publications and how the concept of creativity may affect citation counts. They further warned against the misuse of citation counts and pointed out that quality of work is not the only factor that citation counts measure; there are some other aspects, such as exemplar status of the work. In addition, since there are a lot of creative works that still receive low citation counts years after their publication, "not all high quality works are highly cited" (p. 492). Citation counts are not interchangeable with quality, though they are positively related to peers' quality ratings of the publications. Shadish et al. also found that 9 percent of citations were motivated by at least partially negative reasons but they could not find any significant relationship between citation counts and negative citations (p. 492). This study emphasized that citation context analyses "are unlikely to uncover at least some motivation or citations that would not typically be acknowledged in print, such as citing a work because a reviewer asked that it be included" (p. 495).

The pressure from journal editors to include some citations was also raised and discussed by Franck (1999). He labeled this issue as "citation cartels", when editors or referees suppress submitted papers worthy of publication until the authors understand that they need to cite what referees or editors want them to include in their citations.

Case and Higgins (2000) investigated citer motivations in the discipline of Communication. These two researchers replicated Shadish et al (1995) study in Psychology, identified two highly cited authors in Communication, and surveyed all citing authors who had cited their publications from 1995-1996. Case and Higgins reported that questionnaire items were taken from Shadish et al. (1995):

133 citing authors were asked to answer 32 questions about why they cited a certain document, and there were also some "proximity" questions about the relationship between citing author and cited author or document. Case and Higgins failed to provide readers with a sample of their questionnaire, though they criticized their own instrument as being lengthy, time-consuming, and containing some redundant items (p. 644).

Table 8: List of the Most Important Citation Reasons Stated by Respondents, Given in their own Words (Case & Higgins, 2000, p. 640)

1. this reference reviews prior work in this area
2. this reference is a "concept maker"- it represents a genre of studies, or a particular concept in the field
3. this reference documents the source of a method or design feature
4. this reference helps establish the legitimacy of the topic of your article
5. this reference is authored by a recognized authority in the field
6. this reference supports an assertion in the sentence in which it occurred (not used in present study)

Results of this study were similar to what Shadish et al. (1995) found in their study. Table 8 lists the most important citation reasons stated by respondents. Twenty-four percent of references were made to review the related literature, 20 percent of authors were inspired by previous "concept marker" works, and 11 percent of references were the source of a method or design feature for citing documents. Partially negational citations were fairly rare and formed only 5 percent of all most significant citation motivations (p. 640). A tendency to cite exemplars representing a genre of work was also observed in Communication authors. However, proximity questions revealed that authors in Communication tended to have an interpersonal connection to cited authors, as 16 percent of authors reported that they had previously coauthored with the cited author. Researchers explained this finding by the smaller size of the Communication discipline, with smaller numbers of universities and journals, compared to the Psychology discipline investigated by Shadish et al. (1995).

Based on the results of their multivariate analysis, Case and Higgins elaborated on some of the significant factors in predicting citation behavior of Communication scholars:

> First the perception that the cited work is novel, well known, and presents a genre of studies; second, the citing author's judgment that citing a prestigious work will promote the cognitive authority of his or her own work; and third, the perception that a cited item deserves criticism-which can also serve to establish the citer as an authoritative, critical thinker. (p. 643)

The strong influence of these three factors led the authors to suggest that citing authors cite other documents to promote their own authority and legitimacy through either attacking or praising those documents (p. 643)[5]. This theory was later called "the persuasive hypothesis" in the literature (White, 2004a, p. 108).

Almost a decade after Shadish et al. (1995) and Case and Higgins (2000), Tang and Safer (2008) criticized both studies for similar reasons: first, in both studies, only one reference was randomly selected from the citing paper and authors were asked to state their citation reason(s) for that specific reference. Tang and Safer remarked that author decisions to cite a specific reference "depends in part on all the references in the citing document" and thus limiting a study to only one reference in the citing article limits the contextual impact of other references in the citing document (p. 250). Tang and Safer also criticized both studies for not evaluating the essentiality or significance of references in the citing paper.

White and Wang (1997) reported citing motivations of twelve agricultural economists that emerged from a qualitative study. Agricultural economists were interviewed both at an early stage, when they were reviewing the literature, and at the final stage of their project, when they were completing their written reports. The participants were asked to verbalize their thoughts in structured interviews and the focus of the study was on the analysis of this content. Based on participants' comments, White and Wang generated a model that explained the citation motivations of the participants. This model identified three different factors that citing authors consider when making citation decisions: "contributions of [cited] documents to their research, the criteria they apply to the documents and

[5] The theoretical implication of this suggestion will be discussed later in the "conceptual framework" chapter

meta-level documentation concerns" (p. 122). Table 9 illustrates the model that White and Wang generated for citation motivations.

Table 9: White and Wang (1997) Model for Citation Motivations (pp. 130, 134, 144)

1. **Contributions of cited documents to participants research**
    a. Analogies, contrasts, comparisons
    b. Corroboration
    c. Data, example, case
    d. Identification of originator
    e. Justification
    f. Methodology
    g. Tangential, ceremonial
    h. Theory, concept, definition, argument
    i. Verification
2. **Criteria used in decision making**
    a. **Internal criteria**
        i. Actual quality
        ii. Audience
        iii. Authority
        iv. Classic
        v. Content
        vi. Depth
        vii. Discipline
        viii. Expected quality
        ix. Journal spectrum
        x. Orientation 1
        xi. Orientation 2
        xii. Peer reviewer
        xiii. Prolific author
        xiv. Publicity
        xv. Regency
        xvi. Relation
        xvii. Reputation
        xviii. Standard reference
        xix. Topicality
    b. **Self-related criteria**
        i. Availability
        ii. Cognitive requisite
        iii. Novelty
        iv. Time, effort
    c. **External criteria**
        i. Credential
        ii. Judge
        iii. Norm
        iv. Relation
        v. Target journal
3. **Meta level documentation concerns**
    a. Completeness
    b. Researcher vs. researcher/teacher role
    c. Secondary citing
    d. Self-citing
    e. Judge's expectations
    f. Synthesizing sources
    g. Journal coreness

White and Wang study was unique in the sense that they looked at the reasons that motivated citing authors to initially recognize cited documents as relevant. This study also examined both positive and negative citation decisions and concluded that "citing behavior is complex [and] a multidimensional behavior. They also concluded that a cited "document's contribution to the research seemed to be a major factor in the decision to cite a document" (p. 147).

To build a citation theory, White (2001) explored the notions of "citation identity". He selected eight prominent scholars from within the IS field and extracted their citation identity, defined as "the set of authors that an author cites" (p. 88). Based on the data gathered in this study, White proposed two macro-motivations for citations. First, "to project one's writing" (p. 102) by linking earlier work to later works within the same context. White asserted that this is the motivation behind all self-citations. White described the second motivation as "to project one's reading as a signal of the intellectual context in which one writes" (p. 102). White further explained that both of these macro citation motivations have one common ground, which is the citation motivation in general, and that common ground is "perceived relevance", when a citing author decides that a cited document is related to the theme of the citing document or perceives that a cited document satisfies a specific need. White even suggested that "the history of citedness is the history of perceived relevance in given areas of research" (p. 103).

Hanney et al. (2005) traced the impact of health research literature through two generations of papers, cited and citing papers: 623 papers (second generation papers) citing 29 cited papers (first generation papers) were analyzed to identify the motives or reasons behind each citation occasion. Based on previous research and existing lists of citation motivation, Hanney et al. adopted a list of citation motivations and applied it to their pilot and main studies. They also adopted Cano (1989) scale to assess the importance of cited papers to citing papers. Table 10 lists the citation motivation and importance assessment scale used in the Hanney et al. study.

Table 10: Citation Motivation and Importance Assessment Scale Used in Hanney et al. (2005) Study (p. 366)

Citation motivation:
Develop: The citing article is developing a concept or method previously described in the cited article.
Support: The citing article is supporting a concept or method previously described in the cited article.
Apply: The citing article uses a method (or methods) described in the cited article.
Refute: The citing article either claims that the cited article is incorrect or disputes the cited article but is unable to come to a firm conclusion.
Note/Review Only: The citing article refers to the cited article as part of the relevant literature but it either serves no explicit role in the analysis (note) or is compared to other relevant literature (review).

Overall assessment of the importance of the cited paper to the citing Paper:
Peripheral: The work described in the cited article is of little importance to the citing article. Citation is simply background, an aside, for completeness or indeed irrelevant.
Limited: The work described in the cited article is of some limited importance to the citing article. It would be inappropriate to omit it, but it is not an important part of a central argument.
Considerable: The work described in the article is of considerable importance to the citing article. The work is one of a number central to the argument.
Essential: The work described in the cited article is of critical importance to the citing article, and central to the argument presented, and a key foundation for the paper.

Results of this study suggested that cited papers were significant for only a small number of citing papers and no association was found between the number of times a paper was cited and the importance of that paper to the papers that cited it. The "develop" category turned out to be problematic, prompting the authors to suggest the revision or omission of this category along with a better definition of other categories.

Tang and Safer (2008) examined how textual properties, such as citation location, citation length, and citation frequency, as well as any possible personal or professional relationship between citing and cited authors, and, also, citation reasons (as three separate independent variables) may predict the importance of citations (as the dependent variable), rated by citing authors (p. 246). The general purpose of this study was to identify efficient predictors of citation importance to improve "citation-based information retrieval systems" (p. 247). Research participants were asked to identify their citation reasons for each specific reference along a citation reasons list. The authors explained that they developed this list based on previous research (e.g., Garfield, 1965; Shadish et al., 1995) and

also “based on the input of pretest participants” (p. 252). Table 11 lists citation reasons generated in Tang and Safer study:

Table 11: List of Citation Reasons Generated in Tang and Safer (2008) Study (p. 253)

Please indicate the primary reason why you cited this reference. Choose the one best reason from following list:

- Provides general background (including classic works) that is broadly applicable to my study
- Identifies a publication which presented a conceptual idea that is specifically relevant to my study
- Identifies a publication which developed methodology or quantitative techniques/data used in the study
- Provides evidence for the correctness of my methods or results
- Cited in order to dispute it or correct it
- Cited in order to suggest a limitation of the present study
- Identifies a publication that suggests future research for application of my research to other areas

The results of this study suggested that textual properties as well as citation reasons stated by citing authors can predict the importance of citations. Nevertheless, the strength of the impact of textual properties on citation significance depends on “citation features in the article as a whole” and citation context of other references in the article (p. 246). This research concluded that giving high importance to multi-occurrence citations or to citations motivated by “conceptual” or “data and methodology” reasons may help to improve the rankings of citation-based retrieval systems (p. 270).

In a recent review paper, Bornmann and Daniel (2008) summarized a number of citation behavior studies. As a concluding remark, they commented on previous classification schemes and pointed out that “in addition to acknowledging intellectual and cognitive debts to colleagues, there are a number of other factors that can determine citing behavior” (p. 66). Following this comment, they provided a list of the most important citation motivations “within a unified typology” (p. 66). In addition, the approximate or range of percentages for each citation motivation found in previous citing behavior studies was provided beside each category. This unified typology is shown in Table 12.

Table 12: Unified Typology Developed by Bornmann and Daniel (2008, pp. 66-67)

- **Citations of the affirmational type** (citing work confirms cited work; citing work is supported by cited work; citing work depends on cited work; citing work agrees with ideas or findings of cited work; citing work is strongly influenced by cited work). In the citing behavior studies, the percentages for this type of citations range from about 10 percent to 90 percent.
- **Citations of the assumptive type** (citing work refers to assumed knowledge that is general/specific background; citing work refers to assumed knowledge in an historical account; citing work acknowledges cited work pioneers). In the citing behavior studies, the percentages for this type of citations range from about 5 percent to 50 percent.
- **Citations of the conceptual type** (use of definitions, concepts, or theories of cited work). In the citing behavior studies, the percentages for this type of citations range from about 1 percent to 50 percent.
- **Citations of the contrastive type** (citing work contrasts between the current work and cited work; citing work contrasts other works with each other; citing work is an alternative to cited work). In the citing behavior studies, the percentages for this type of citations range from about 5 percent to 40 percent.
- **Citations of the methodological type** (use of materials, equipment, practical techniques, or tools of cited work; use of analysis methods, procedures, and design of cited work). In the citing behavior studies, the percentages for this type of citations range from about 5 percent to 45 percent.
- **Citations of the negational type** (citing work disputes some aspects of cited work; citing work corrects/questions cited work; citing work negatively evaluates cited work). In the citing behavior studies, the percentages for this type of citations range from about 1 percent to 15 percent.
- **Citations of the perfunctory type** (citing work makes a perfunctory reference to cited work; cited work is cited without additional comment; citing work makes a redundant reference to cited work; cited work is not apparently strictly relevant to the author's immediate concerns). In the citing behavior studies, the percentages for this type of citations range from about 10 percent to 50 percent.
- **Citations of the persuasive type** (cited work is cited in a "ceremonial fashion"; the cited work is authored by a recognized authority in the field). In the citing behavior studies, the percentages for this type of citations range from about 5 percent to 40 percent.

2.2.2. Citation Context Analyses Studies

As discussed earlier, citation context studies analyze the context of citations to yield a better understanding of the relationship between cited and citing documents (Bornmann & Daniel, 2008). As one of the earliest examples, Lipetz (1965) proposed inclusion of citation relationship indicators in citation indexes to improve citation index selectivity and to provide users with citations most relevant to their information needs. According to Lipetz, citation relationship indicators can describe the precise continuity relationship of the citing reference to the cited reference, but their implementation in science citation indexes requires costly human labor and skills.[6]

[6] Small (1982) later criticized this requirement and stressed that compilation of a citation index should be largely mechanized

Lipetz further analyzed relationships between 60 different citing papers and 750 references in the journals *Physical Review* (vol. 128) and *Soviet Physics* (vol. 15). This analysis produced an evolved descriptive scheme that comprised four different categories, each containing several meaningful citation relationships (see Table 13 for details). These categories were devised to help users select citations most pertinent to their information needs. This scheme was inspired by the documentary system used in *Shepard's Citations,* a citation index that documents every instance in which a past court decision was used in later cases (Small, 1982). Lipetz himself emphasized that his scheme was experimental and was "subject to further change" (p. 83). Lipetz failed to provide any statistics on the frequencies of different categories and gave only some examples of the application of his scheme in actual articles, though his conceptual contribution (Bornmann & Daniel, 2008) and his devised scheme was later appreciated in the literature as "the earliest citation scheme for general scholarly literature" (Small, 1982, p. 290). Cronin (1994) also praised his scheme as "a pioneering list" and "a rich mixture of the general and specific" citation categories (p. 537).

Table 13: Citation Relationship in Science Literature as Described by Lipetz (1965, p. 83)

Group one: original scientific contribution or intent of citing paper

1. description of observed phenomena
2. data transformation
3. explanation
4. hypothesis or theory
5. calculation from theory
6. prediction
7. definition or notation
8. statement of experimental technique

Group two: contribution of citing paper other than original scientific contribution

9. review article
10. bibliography
11. data accumulation

Group three: identity or continuity relationship of citing paper to cited paper

12. one or more authors in common
13. same text
14. abstract or condensation
15. Erratum
16. continuation
17. precursor
18. inclusion

Group four: disposition of the scientific contribution of the cited paper in the citing paper

19. noted only
20. distinguished
21. reviewed or compared
22. applied
23. improved or modified
24. replaced
25. changed the precision (plus or minus)
26. change the scope of applicability (plus or minus)
27. questioned
28. affirmed
29. refuted

Ten years after the publication of the Lipetz paper, Moravcsik and Murugesan (1975) planned a series of in-depth studies on the quality and functions of citations. While their initial purpose was to explore the organic nature of citation counts and to evaluate if citation counts can be used in scientific evaluation policies, their ultimate goal in conducting these studies was to understand the structure of scientific research (p. 87). Moravcsik and Murugesan asked several questions about references made in thirty theoretical high energy physics articles published in the journal *Physical Review* from 1968 to 1972.

These questions formed the basis of their citation scheme, which later attracted a lot of interest[7].

Table 14: List of Questions Asked by Moravcsik and Murugesan (1975, p. 88)

1. "**Conceptual** or **operational**? Is the reference made in connection with a concept or theory that is used in the referring paper, or is it made in connection with a tool or physical technique used in the referring paper?
2. **Organic** or **perfunctory**? Is the reference truly needed for the understanding of the referring paper or is it mainly an acknowledgment that some other work in the same general area has been performed?
3. **Evolutionary** or **juxtapositional**? Is the referring paper built on the foundations provided by the reference, or is it an alternative to it?
4. **Confirmative** or **negational**? Is it claimed by the referring paper that the reference is correct, or is its correctness disputed?"

Moravcsik and Murugesan emphasized that the first and the third questions were intended to yield some insights into the nature of the citations; however, the second and the fourth questions were posed to evaluate the quality of citations. Each reference was classified under one of the four questions and was categorized within one or the other option of the dichotomy or neither of them (e.g., conceptual or operational or none of the two). Table 14 lists four questions asked by Moravcsik and Murugesan that formed the basis of their citation scheme.

Partway through their study, Moravcsik and Murugesan introduced the concept of "redundant references". They defined this concept as "when a reference is made to several papers and each of them makes the same point, …all but one of the papers referred to was in this sense judged redundant" (p. 90). Based on the results of this study, "redundant references" comprised about one third of references. Also, 40 percent of references proved to be "juxtapositional", 60 percent appeared "evolutionary", two-fifths belonged to the "perfunctory" category, and one-seventh (14 percent) were "negational" references (p. 91).

The large proportion of perfunctory references and the role of "disputed references" led the authors to cast doubt on the validity of citation counts in scientific evaluations. This was the first time that the quality of citation counts was empirically challenged and this controversial remark triggered a number of

[7] This paper has been cited 196 times up to this date (August 2008)

further interesting studies (Moravcsik & Murugesan, 1975). However, this scheme was later challenged in the literature, e.g., White (2004a) remarked that the Moravcsik and Murugesan categories are not easy to work with, especially when "large numbers of citations are involved" (p. 102).

Chubin and Moitra (1975) also criticized Moravcsik and Murugesan for not validating their typology "in light of evidence" (p. 425). Moravcsik and Murugesan's emphasis on the generalizability of their typology also seemed a premature claim to Chubin and Moitra. As an effort to improve this typology, Chubin and Moitra redefined the Moravcsik and Murugesan typology "as a set of mutually exclusive categories", refashioned all the categories "into a kind of scale" (White, 2004a, p. 102), and applied the revised version to references made in 33 letters and 10 full-length articles published in high energy Physics journals between 1968 and 1969. They also revised the definition of perfunctory from "dispensable" to "cited without additional comment" (White, 2004a, p. 102). Table 15 shows the categorization devised by Chubin and Moitra in their study.

Table 15: Categorization Devised by Chubin and Moitra (1975, pp. 426-427)

1. **Affirmative citations**
    - **a. Essential**
        - i. **Basic** ("the referenced paper is declared central to the reported research, a reference on which its findings depend")
        - ii. **Subsidiary** (a specific method, tool, or mathematical result is not directly connected to the subject of the paper")
    - **b. Supplementary**
        - i. **Additional information** ("when the referenced paper contains an independent supportive observation with which the citer agrees")
        - ii. **Perfunctory** ("papers referred to as related to the reported research without additional comment")
2. **Negational citations**
    - a. **Partial** ("if a citer suggests that the paper is erroneous in part and then offers a correction")
    - b. **Total** ("when the citer refers to the paper as being completely wrong and offers an independent interpretation or solution")

Results revealed that the "affirmative essential subsidiary" citation category was the most frequently cited category (34 percent) for full-length papers. Most of the citations made in letters belonged to the "affirmative supplementary additional information" category (32 percent). "Affirmative supplementary perfunctory" citations comprised about one-fifth (20 percent) of

the citations; however, only 4 to 6 percent of citations belonged to the negational category.

Spiegel-Rosing (1977) analyzed the context of 2309 references in 66 citing articles published in the journal *Science Studies* between 1971 and 1974. Spiegel-Rosing investigated the "kinds of uses of previous research" to see if the citing article praised or criticized the cited source and if the citing article used the cited reference to substantiate an argument or to acknowledge a significant finding. Spiegel-Rosing developed a list of "kinds of uses of previous research" (see Table 16 for details), but did not provide any further information about how this list was created.

Table 16: List of Kinds of Uses of Previous Research as Suggested by Spiegel-Rosing (1977, p. 105)

1. Cited source is mentioned in the introduction or discussion as part of the history and state of the art of the research question under investigation
2. Cited source is the specific point of departure for the research question investigated
3. Cited source contains the concepts, definitions, interpretations used (and pertaining to the discipline of the citing article)
4. Cited source contains the data (pertaining to the discipline of the citing article) which are used sporadically in the citing text
5. Cited source contains the data (pertaining to the discipline of the citing article) which are used for comparative purposes, in tables and statistics
6. Cited source contains data and material (from other disciplines than citing article) which is used sporadically in the citing text, in tables or statistics
7. Cited source contains the method used
8. Cited source substantiates a statement or assumption, or points to further information
9. Cited source is positively evaluated
10. Cited source is negatively evaluated
11. Results of citing article prove, verify, substantiate the data or interpretation of cited source
12. Results of citing article disprove, put into question the data as interpretation of cited source
13. Results of citing article furnish a new interpretation/ explanation of the data of the cited source

According to Spiegel-Rosing, substantiation of a statement or an assumption made in the citing article was found to be the most frequent use of references (80 percent). Only six percent of references had an acknowledgement use and eight percent were given for comparative purposes. The very low percentage of negational or disproval references (0.8 percent) prompted the author to challenge those studies that use negational citation rates as a serious argument against the use of citation counts for scientific evaluation purposes.

Three years after their first study, Murugesan and Moravcsik (1978) applied their previously devised classification scheme to 230 articles to test the reproducibility and universality of their scheme. These papers were published in high energy, nuclear, and solid state Physics journals and included 3501 references. The publication locations of journals were also geographically diverse, including Europe, US, Japan, and Soviet Union. Murugesan and Moravcsik stressed the importance of the reproducibility feature of classification schemes across different specialties and provided a detailed definition of all four dichotomies used in their classification scheme. No significant difference in "conceptual" and "negational" citations between three specialties was reported. However, high energy Physics papers appeared to contain more "organic" and "evolutionary" citations. "Perfunctory" citations were a relatively high percentage in Soviet journals, a result that was explained by the hierarchical structure of the scientific community in the Soviet Union, which encouraged authors to include more references to their own scientific papers (p. 146).

In a third study and with a slightly different purpose, Moravcsik and Murugesan (1979) used their citation typology to study scientific revolutions. Since some of the four typology indicators appeared sensitive to the paradigm changes of scientific revolutions, the authors concluded that citation patterns can effectively be used in the study of the structure of science.

Frost (1979) examined previous schemes developed in earlier studies and proposed a preliminary typology for literary research and then applied this typology to the references of sixty articles in German literary research and to the references of approximately forty monographs published between 1935-37, 1955-57, and 1970-72. Table 17 shows the classification scheme developed by Frost.

Table 17: Classification Scheme Developed by Frost (1979, pp. 405-409)

A. Documentation of primary sources-references to literary texts, letters, etc.
    a. To support an opinion or factual statement on the specific literary author(s) or work (s) discussed in the citing work
    b. To support an opinion outside the central topic of the citing work; or
    c. To support a factual statement outside the central topic of the citing work
B. Documentation of secondary sources- references to previous scholarship
    a. Independent of approval or disapproval of the citing author
        i. To acknowledge the pioneering work of other scholars
        ii. To indicate the state of present research, a range of opinions, or prevailing views on a topic; or
        iii. To discuss the meaning of a term or refer to a work in which a given term or symbol first appears
    b. Representing the approval of the cited scholar
        i. To support an opinion of the citing author
        ii. To support a factual statement of the citing author
        iii. To take an idea a step further; or
        iv. To acknowledge intellectual indebtedness
    c. Presenting the disapproval of the citing author
        i. To disagree with an opinion of the citing author
        ii. To disagree with a factual statement of the cited scholar, or
        iii. By expressing a mixed opinion
C. Documentation of sources either primary or secondary
    a. To refer to further reading; or
    b. To provide bibliographic information on a specific edition

Results of this study revealed that citations were mostly provided to support the opinions or interpretations made by the citing author or to provide readers with additional references, rather than refuting other authors' opinions. Frost concluded that citations serve positive purposes more than negational purposes.

Oppenheim and Renn (1978) examined 978 papers that cited 23 highly cited old papers in Physics and Physical Chemistry to understand why these papers are still highly cited many years after their publications. They devised a new typology to classify citation reasons and claimed that their typology is more convenient to use and understand than previously developed schemes (see Table 18 for details). This study concluded that the historical background of old papers provoked 40 percent of citations to these documents. The remaining 60 percent of citations were motivated by substantive reasons, implying valuable and relevant contributions of cited documents to the citing papers (pp. 225, 230). Oppenheim and Renn also found that less than 2 percent of citations to the old papers were partially negational.

Table 18: Classification Scheme Developed by Oppenheim and Renn (1978, p. 226)

1. Historical background
2. Description of other relevant work
3. Supplying information or data, other than for comparison
4. Supplying information or data for comparison
5. Use of theoretical equation
6. Use of methodology
7. Theory or method not applicable or not the best one

Peritz (1983) devised a classification scheme to investigate the roles of citations in empirical studies conducted in the social sciences and related fields. The primary purpose of this study was to propose a classification scheme that required the least subjective judgment. This classification had eight sub-categories and was later applied to 106 research papers published in five leading journals in five different social science fields. Table 19 provides a description of this scheme.

Table 19: Peritz Classification Scheme (1983, pp. 304-305)

1) "Setting the stage for the present study. Under this heading appear all the citations to previous work which leads up to the research questions asked in the present investigation.
2) Background information. This group includes all citations which document basic data on the setting of the investigation
3) Methodological. These are the citations of works describing some aspect of the methods used in the citing study.

a) Citations referring to the design of the study (including those referring to the instruments used in the research)
b) Citations referring to methods of analysis. Occasionally one had to include in this group citations referring to a method whose use had been considered and rejected for some stated reason.

4) Comparative. This category contains the citations to other studies with which the present one is being compared.
5)Argumental, speculative, hypothetical: This category contains all citations made in supporting the formulation of new hypotheses and conjectures, suggestions for further research, speculations and other arguments.
6) Documentary. These are the citations which refer to the sources of raw data (e.g. official statistical publications) used in the study, to more complete descriptions of the body of data used or (more rarely) to data which are submitted to secondary analysis.
7) Historical: These are citations made while retracing the history of the subject, or acknowledging the work of pioneers.
8) Casual: This category refers to citations not directly tied to the issue at hand; mentions of related work in other areas, of different approaches- yet without any attempt at comparison or analysis- fall into this category.

Distribution of citations over the eight categories showed that “setting the stage” was the most frequent citation motivation within all social science sub-

fields. Peritz evaluated his classification as being straightforward and easy to use, though emphasized the need for a reliability study.

MacRoberts and MacRoberts (1984) examined behavioral sciences literature to count the frequency of negational citations (where the author disagrees with the given reference). They rarely found any negational or critical citations in the literature and where such criticism occurred, it was "toned down, disguised or redirected away from important people" (p. 91). Three frequent ways of avoiding or dissembling criticism were found: to praise the work criticized, to cite it perfunctorily, and to "avoid confronting anyone of importance who holds the view being questioned" (p. 92). This avoidance led the authors to conclude that "there is little purpose served in determining the relative frequency of negational and affirmative references in papers" (p. 93).

Hooten (1991) examined the functional use and nature of cited documents in Information Science. Two samples of frequently and infrequently cited articles published in the *Journal of the American Society for Information Science (JASIS)* in 1972, 1973, 1974 were selected (63 cited articles, 148 citing papers that had cited infrequently cited JASIS articles and 170 citing papers that had cited frequently cited JASIS articles). Four classification schemes, developed by Murugesan and Moravcsik (1978), Chubin and Moitra (1975), Peritz (1983), and Spiegel-Rosing (1977) were merged to explore "whether sample groups of frequently and infrequently cited papers were used for different functions by authors who cited them?" (p. 397). Table 20 shows the classification scheme used in the Hooten study.

Table 20: Classification Scheme Used in Hooten Study (1991, p. 402)

1. Confirmative (MM)"
2. Organic (MM)
3. Evolutionary (MM)
4. Operational (MM)
5. Conceptual (MM)
6. Essential-Basic (CM)
7. Documentary (P)
8. Juxtapositional (MM)
9. Setting the Stage (P)
10. Essential-Subsidiary (CM)
11. Part of History/State of Art
12. Concepts, Def., Interpret. (SR)
13. Perfunctory (MM)
14. Substantiates Statement (SR)
15. Within Discipline Data Used comparatively (SR)
16. Casual (P)
17. Supplementary-More Info. (CM)
18. Supplementary-Perfunctory (CM)
19. Comparative (P)
20. Background (P)
21. Negational (MM)
22. Historical (P)
23. Negational-Partial (CM)
24. Negatively Evaluated (SR)
25. Within Discipline Data Used sporadically (SR)
26. Specific Point of Departure (SR)
27. Methodological (P)
28. Methods Used (SR)
29. Argumental/Specula/Hypo. (P)
30. Negational-Total (CM)
31. Source's Data/Inter/Quest. (SR)
32. Source's Data Newly Interpreted (SR)
33. Other Discipline Materials used Sporadically (SR)
34. Positively Evaluated (SR)
35. Source's Data or Interpretation Substantiated (SR**)**

(MM) = Murugesan and Moravcsik, (CM) = Chubin and Moitra, (P) = Peritz, (SR) = Spiegel-Rosing.

Results of this study showed that infrequently and frequently cited articles were not cited for "significantly different functions" (p. 397). However, frequently cited articles appeared more essential to the theme of citing documents than infrequently cited articles. Also, a greater consistency was found in the use of infrequently cited articles compared to frequently cited articles that were used for various functions. Hooten did not provide any further explanation about how she dealt with similar categories in the four classification schemes. At the end, Hooten concluded that "a difference in use [of frequently and infrequently cited

documents] may exist but could not be measured by the taxonomies used in this study" (p. 401).

Maricic et al. (1998) traced and analyzed some of the citations made to 219 cited source papers published by a multidisciplinary institute during a 21-year period following their publications. This study focused on a structural factor defined by the location of citations within the citing paper (introduction, methods, results, and discussion) and an intensity factor defined by the citing level for each citation (low to high levels). If a cited document was essential, central, or organic to the theme of the citing paper, it was recorded as a high intensity citation and if the cited document had a non-essential, peripheral, or perfunctory role in the citing document, it was ranked as a low intensity citation. The main purpose of this study was to assess whether citation counts really do reflect the impact of cited documents within the scientific communication process. Maricic et al. could not find any congruency between citation counts and context analysis based on structural and intensity scales. These findings prompted the authors to conclude that "our result may be taken as yet another warning against indiscriminate use of citation counts for evaluative purposes" (p. 538).

Ahmed, Johnson, Oppenheim, and Peck (2004) conducted a citation analysis on Watson and Crick's highly cited old paper reporting their discovery of the double helix structure of DNA. One of the main purposes of this study was to identify the reasons why this paper has been cited more than 2000 times since its publication in 1953. The Ahmed et al. (2004) paper was the second part of the previous paper, "Highly Cited Old Papers and the Reasons Why They Continue to be Cited", authored by Oppenheim & Renn (1978). This study used a similar typology of reasons, developed in the first part of the article, to categorize citation reasons. Ahmed et al. justified their choice of typology on the grounds that this classification "is the only one specifically developed to analyze reasons for citing very old papers" (Ahmed et al., 2004, p. 153). Table 21 shows the classification scheme used in the Ahmed et al. study.

Table 21: Classification Scheme Adopted from Oppenheim and Renn Study (with small revisions) (Ahmed et al., 2004, p. 154)

1. Historical background
2. Description of other relevant work, e.g. describing or discussing the work in some detail or quoting from its results, or saying how the theory could be used
3. Made specific use (other than for comparison) of information contained in the cited paper
4. Made use of data for comparison purposes
5. Use of theoretical equation for calculation purposes
6. Use of practical or theoretical methods in the cited paper to solve a problem
7. Criticism of the cited paper

Results of this study demonstrated that 75 percent of citations were made for historical or background acknowledgment of Watson and Crick's article. Compared to the 58 percent rate in their previous study (Oppenheim & Renn, 1978), the rate of negational references was almost the same (1.5 percent to 2 percent). However, in the second study, only 13 percent of citations referred to the method or results sections of the original old paper. In the first article, this active citation rate was 40.4 percent. Also not surprisingly, Watson and Crick's article was mostly cited in the "introduction" or "historical background" sections of citing articles.

Krampen, Becker, Wahner, and Montada (2007) analyzed random text samples from encyclopedias, textbooks, journals, and manuals published in various Psychology sub-fields to count the frequency of high-quality positive citations, negational citations, and perfunctory citations. Results revealed that high quality positive citations (referring to theories, methods, results, or word-to-word citations) constituted more than 70 percent of all citations, leading the authors to confirm the validity of citation counting to a certain extent. However, due to the 25 percent volume of perfunctory citations (where authors just indicate the reference with little information utility), they tended to limit this validity to Psychology publications.

2.2.3. Citation Schemes

Citation schemes and citation motivation lists have usually been developed as one of the essential elements of citation motivation and citation context studies, however, each researcher "has regarded his or her problem or

approach as unique, and has gone on to construct a scheme with little attention given to comparing it with earlier work" (Small, 1982, p. 300). Scholars in this research area have been criticized for their "virtual isolation of one another in an ad-hoc fashion" (Baldi, 1998, p. 831) and this whole non-cumulative endeavor (Small, 1982) has been degraded as a "cottage industry" (Baldi, 1998, p. 831; White, 2004a). A lot of "striking parallels" (Small, 1982, p. 300) between different citation schemes have been noted. In addition, most schemes have been developed independently and have used different terminology to convey almost the same citation categories and meanings (Small, 1982; Cano, 1989). On the other hand, White (2004a) argues that the "idiosyncratic" nature of citation schemes accounts for their "unique nuances" and scarce replications of their use. Nevertheless, there are a lot of similarities underlying categories (p. 100). Cronin (1994) also commented on the general trend of citation schemes and criticized that different levels of citation aggregation or granularity have not been reflected in the citation schemes. He further elaborated that citation acts may happen in different layers and citers may cite an entire work (the highest level) or may choose to be very specific and cite a specific dimension of a work, e.g., a few words or phrases. Cronin added that very few citation schemes have taken this factor into consideration and have addressed these different citation layers (White, 2004a). White (2004a) emphasized the subjectivity of citation schemes and stressed that "recovery of implicit meaning" requires "close reading, domain knowledge and expert judgment", tasks which cannot be normally expected from a computer (p. 103). He further remarked that unless category assignment to a scheme is automated, the wide popularity of any of the existing citation schemes seems unlikely. White also compared information scientists active in the citation scheme research area to literary critics and criticized them for "thinking hermeneutically", pondering "shades of meaning in the citation classification tradition" (p. 103).

2.2.3.1. The Purpose of Citation Schemes

The analysis of citation contexts and citer motivations has been carried out for many reasons and, accordingly, citation motivation lists and citation schemes

have served different purposes. Some studies explored citer motivations and tried to extract meanings that authors attached to their citations through questionnaires or conducting interviews (Brooks, 1986; Bonzi & Snyder, 1991; Vinkler, 1987; Cano, 1989). As a result, citation motivation lists or schemes developed in these studies reflect citer motivations more prominently than other aspects. Other streams of work attempted to examine the significance and essentiality of cited works for citing documents through tracking their citation contexts. Accordingly, citation schemes developed in these studies reflect the relationship between cited and citing works more prominently and convey the notions of research contribution and research impact more significantly (Hanney et al., 2003; Hanney et al., 2005; McCain & Turner, 1989). Hanney et al. (2005) distinguished between these two types of citation schemes and stressed the significance of the main focus of the scheme: "whether the focus is on motivation/reasons for citing, or on strength of impact the cited work has made on the paper citing it, or on a combination [and] whether single or multiple motivation are linked to each citation" (p. 362). Nevertheless, Peritz (1983) emphasized that a citation scheme should bear a "heuristic value" to answer interesting research questions (p. 310).

2.2.3.2. Different Approaches to Devising Citation Schemes

A review of citation schemes and citation motivation lists devised in previous studies was conducted to provide the necessary background to construct the citation scheme specific to the present research. This section briefly summarizes different approaches used to devise citation schemes. In the first approach, researchers reviewed previous literature, analyzed citations, and ultimately presented their scheme in a conceptual paper, just based on their own knowledge and experience with no support from empirical evidence (Lipetz, 1965; Garfield, 1962). In the second approach, researchers found it unnecessary to devise another citation scheme or list of citation motivations; they just adopted other researchers' citation schemes and used them in their own empirical studies, sometimes with very little modification (Chubin & Moitra, 1975; Cano, 1989; Hooten, 1991; Case & Higgins, 2000; Hanney et al., 2003; Ahmed et al., 2004). Case and Higgins (2000) reported that they decided to build on the citation

scheme previously devised by Shadish et al (1995), since no other citation motivation was identified in the open-ended responses stated in their research instrument. In the third approach, researchers devised a list of citation motivations based on a review of previous literature and then asked citing authors to state their motivations along a pre-prepared list of motivations (Vinkler, 1998; Brooks, 1985). Bonzi and Snyder (1991) attempted to modify previously devised schemes to fit their specific research questions, and then generated a specific scheme for their own study. In the fourth approach, classification schemes and citation motivation lists emerged from in-depth interviews with colleagues or authors and then these lists were polished based on the specific purposes of the study (Shadish et al., 1995). White and Wang (1997) allowed the author citation motivations to emerge from their interviews with authors. Maricic et al. (1998) preferred to avoid undue complications and opted for a simple distinction between two different levels of citations. Based on the previous literature, they labeled all nonessential, peripheral, or perfunctory citations as "cursory", marked as lower- (L) level citations, and all essential, central, or organic citations as "meaningful", marked as higher- (H) level citations (p. 531).

Table 65 (appendix A) draws together 21 citation schemes discussed in this literature review section. The most up-to-date and unified scheme, suggested by Bornmann and Daniel (2008), was used as a framework to which the main categories of other schemes were related. For each scheme, description of its sub-categories was examined to make sure that all sub-categories fit their assigned main categories. Nevertheless, it should be noted that correspondences are not definite; some sub-categories were assigned to more than one category and some sub-categories were collapsed into one category. The practical implication of this table (Table 66) will be discussed later in the "Methodology" chapter.

2.2.4. Textual Properties

The following section summarizes related literature that addressed explicit contexts of citations. This literature is presented according to two text-based

properties of citation contexts: 1) citation location; and 2) frequency of citation occasions.

2.2.4.1. Citation Location

Scientific articles reporting original research results "tend to have a definite, rather formulaic structure – "introduction", "methods", "results", and "discussion" - an organizational format recommended by many style manuals and required by most scientific journals" (McCain & Turner, 1989, p. 133) . This structure enables readers to rapidly scan and retrieve information from the article. Therefore, it sounds reasonable to assume that the location of a citation occasion within this structured text would reflect the level of usefulness of the cited paper and the information that it contains (McCain & Turner, 1989, p. 133-134). Here, it is assumed that a citation occasion located in methodology, results, discussion, or conclusion sections may play a more significant or meaningful role than one located in introductory sections. In other words, usually less significant citations tend toward the introductory sections (Bonzi, 1982; Tang & Safer, 2008). A few previous studies focused on citation location as a variable that may yield more insight into the nature of citations. The following section summarizes their approaches and some of their findings.

The first study in which citation location was examined as a variable and hypothesized a relationship between this variable and citation level was conducted by Bertram (1972). Citation level in Bertram study was defined as the amount of text cited (full-text, partial text, or word(s) citation), and citation location was identified and coded according to the four sections of the article in which the citation was mentioned: a) "title" b) "introduction" c) "experiment" and d) "results/discussion" section. Study results suggested a significant relationship between citation locations and citation level and, accordingly, Bertram concluded that citation level is predictable through the identification of the section of the article in which a citation occurs (as cited in Cano, 1990).

Similar to Bertram (1972), Voos and Dagaev (1976) divided citing articles into four different sections and defined citation location parameter based on the

following areas: a) “introduction” b) “methodology” c) “discussion” and d) “conclusion”. This study demonstrated that exploring citation location would add some value to citation counts and concluded that, on average, most citations were concentrated mainly in “introduction” and then in “conclusion” sections of citing papers.

Finney (1979) was the first researcher to relate the location of citations to citation types. In this research, a classification scheme with seven categories was devised and used to define citation types. Finney categorized citation occasions according to three different sections of citing papers: a) “introduction” b) “methodology” and c) “conclusion/discussion” (Finney, 1979).

Later, Cano (1990) adopted Finney classification scheme in her Ph.D. dissertation and explored the relationship between this scheme and the macrostructure of citing papers. Cano classified 375 citation occasions according to the macrostructure suggested by Gopnik (1972). According to this macrostructure, each citation occasion could appear in one of the following sections of citing papers: a) current approach; b) demonstration of inadequacies; c) statement of problem or hypothesis; d) testing of hypothesis (techniques and methods); e) solution (results); and f) discussion. This study confirmed Finney assumption and supported the hypothetical relationship between citation location and citation. In addition, part of the results of this study suggested that methodological citation types (related to citation classics) were mostly exhibited in techniques and methods sections; however, citations to non-classics were mostly populated in the presentation of previous literature or discussion sections (pp. 87, 93).

Bonzi (1982) examined “placement of citation in text” as one of the 13 characteristics of citing papers to indicate the extent to which a cited paper contributes to a citing paper. She divided the citing paper into four quarters and looked into the distribution of citations in these four quarters. Results showed a wide scatter of citations in the texts of citing papers with no strong statistical significance for the “citation placement” variable. However, little used citations tend to concentrate more in introductory sections.

In another study, Cano (1989) introduced a "citation location parameter as a novel bibliometric variable" (p. 284), to be used in conjunction with a theoretical model of citation behavior, and the frequency and utility level of citations, to improve the quality of citation counts for evaluative purposes. Citation location parameter was defined as the "distance from the beginning of the paper to the location of each citation within the paper" (p. 285). Thus, the location parameter was "expressed relatively, as a fraction of the total paper length" (p. 285). Cano identified three areas for citation locations: a) beginning section (located up to the 15th percentile); b) middle section (from the 20th to the 75th percentile); and c) the end area (from 80th percentile). Results of this study revealed the heaviest concentration of citations in the first 15 percent of the paper and, specifically, a high concentration of perfunctory citations in this area (over one third of the citations), roughly corresponding to introductory sections; however, organic citations were scattered mostly in middle and end sections.

The concept of citation location in molecular genetics was further explored by McCain and Turner (1989). Based on the definite structure of scientific papers that report original research outcomes and usually tend to have four different sections ("introduction", "methods", "results", and "discussion"), authors assumed that the placement of a specific citation occurrence within a scientific paper can be an indication of the "perceived usefulness" of cited papers and represent the significance of the information that cited papers contain (p. 133). In this study, citation location, along with citation occurrence counts and citation context, were taken into account for calculating a Utility Index to represent the relationship between cited and citing papers. McCain and Turner produced four different indices based on two different types of the scientific papers, research articles and reviews. Within research articles, they identified three different sections: a) "introduction"; b) "methodology"; and c) "results" and "discussion". These three sections were quite similar to what was suggested in Finney (1979) study. McCain and Turner treated review articles as a fourth type of citation location, due to the communication function of a review article, which the authors assumed to be similar to the introductory section of a research paper,

both informing the reader about the general background of the topic and describing selected previous research in the same area (p. 136). In calculating the Utility Index, McCain and Turner used "four sets of values for location weights and calculated a separate Utility Index based on each set", but due to their similar "background-related information" content, they assigned "introduction" and "review" citations the same utility level (p. 139). Table 22 presents four sets of location weight values that were used to calculate "a separate Utility Index based on each set" (p. 139).

Table 22: "Utility Index Location Weights" Adopted from (McCain & Turner, 1989, p. 139)

	Wt introduction	**Wt methodology**	**Wt discussion**	**Wt review**
Utility Index #1	1	2	1	1
Utility Index #2	1	3	2	1
Utility Index #3	0.5	1	1	0.5
Utility Index #4	1	1	1	1

The specific purpose and method of this study did not allow the authors to evaluate application of the citation location parameter in their Utility Index; nevertheless, they admitted that the Utility Index as a whole proved to have "a partial measure of long-term utility" for evaluative purposes (P. 151). Hanney et al. (2003) later criticized McCain and Turner's approach as being "rather mechanistic" and relying on "predetermined ratings for different locations rather than judging each individual citation" (p. 29).

Maricic et al. (1998) traced and analyzed some of the citations made to 219 cited source papers, published by a multidisciplinary institute during a 21 year period following their publications. This study focused on a "structural factor" defined by the location of references within citing paper ("introduction", "methodology", "results", and "discussion or conclusion"). In selecting specific sections of citing papers, Maricic et al. admitted that their approach is a "pragmatic approach" and these sections may represent a reflection of "accepted

publishing practices" that are obeyed by authors, though this metastructure was later supported by the results of their study (pp. 531, 535). Maricic et al. also explained that their location ranking was devised based on the best of their "knowledge and judgment" (p. 532).

Hanney et al. (2005) traced the impact of health research literature through two generations of papers, cited and citing papers. In this study, 623 (second generation) papers, citing 29 cited (first generation) papers, were analyzed to identify the motives or reasons behind each citation occasion. The location of each citation occasion was defined based on the types of citing papers; if citing paper was an article, the location factor was divided into four sections: "introduction", "materials and methods", "results", and "discussion". For review articles, "introduction", "discussion", and "elsewhere" sections were identified and recorded. Hanney et al. examined the relationship between the location of citation occasions and the importance of cited papers to citing papers. No significant difference was found in terms of citation location for all four "importance" categories (peripheral, limited, considerable, and essential). For all four categories, most citation occasions occurred in the "discussion" section, followed by "introduction, then "materials & methods", then, "results" (p. 375).

Whether some citation textual properties, such as length and location of citations can predict the importance of citation occurrences was one of the research questions of Tang and Safer (2008). They coded citation locations based on the following sections of citing papers: a) "abstract"; b) "introduction"; c) "literature review"; d) "method"; e) "results"; f) "discussion"; g) "conclusion/summary/future research"; h) "results and discussion"; j) "discussion and summary"; k) "figure and table"; and l) "appendix/endnote/footnote". Results of this study suggested some significant disciplinary effects in citation locations for citing documents published in the fields of Psychology and Biology. Biology authors tended to cite almost the same proportion of citations in the "introduction" and "discussion" sections, whereas most of the references that appeared in Psychology papers were mostly populated in the "introduction" section (p. 259). When relationship between citation location and citation reason was explored,

data revealed that citations inspired by "general background" and "conceptual" reasons were mostly located in "introduction" and "discussion" sections. Most of the citations motivated by "conceptual" reasons were populated in "results" section (28.3 percent). "Method" section mostly contained citations related to "methodology and data" reasons (47.6 percent) (p. 259). In terms of the importance and relevance of citations, references appeared solely in the "introduction" section, especially if they occurred only once, were judged less important, of low relevance, and were more likely to be "general background" citations than citations mentioned in other sections of the article (pp. 263, 269). In sum, this study concluded that textual properties such as citation location and citation frequency can significantly predict citation relevance and importance (p. 267).

2.2.4.2. Multiple Citation Occasions

When an author cites a reference more than once in the same citing document, a "multiple citation occasions" variable is added to textual properties of citations. White (2001) calls this reoccurrence "synchronic recitation" (p. 88). A few previous studies have focused on multiple citation occasions as an indicator that may have an impact on the value of citation counts. The following section summarizes these studies along with their approaches and their findings.

Chubin and Moitra (1975) counted the frequency of citation occasions in citing papers. When a cited paper was cited more than once in a citing article or letter, the contribution of cited paper was coded at the most affirmative level. Voos and Dagaev (1976) also examined the impact of multiple citation occasions on the value of citations to the users, trying to challenge the main implicit assumption of citation analysis that ignores multiple citations and counts all citations to the same cited paper not more than once. This study concluded that multiple citations are associated with more relevance or more importance of a cited article and even proposed that the frequency of citation occasions for the same cited article could be an integral part of evaluating the value of a citation (p. 21).

Herlach (1978) tested the hypothesis that multiple citation occasions of the same cited paper indicates a close relationship between cited and citing papers. In this study, 66 citing research articles were assigned to two groups of samples, those containing multiple citation occasions for a single cited document, and those exhibiting only one citation occasion for the same cited document. Experts were asked to judge the topical relevance of articles appearing in each group. The results showed that while 31.6 percent of references were cited in the text more than once, articles that belonged to the "multiple citation occasions" group were judged 27.7 to 33.6 percent more topically relevant by the experts. However, as Cano (1990) notes, no definition of topical relevance was provided in this study.

In a similar study, Bonzi (1982) assumed that some characteristics of citing papers indicate the extent to which cited paper contributes to citing paper. As one of these characteristics, she looked into multiple citation occurrences and verified that multiple occurrences is an appropriate indicator of the use of cited paper. She further confirmed the results of Herlach (1978) and Voos and Dagaev (1976) and emphasized that as the frequency of citation occasions for a cited paper increases in the citing paper, so does the information contribution of the cited paper to the citing paper.

Oppenheim and Renn (1978) also noted the number of times a citing article referred to a cited article. They found that in Physics and Physical Chemistry, each cited paper was cited 1.13 times on average. Then they compared their findings with the frequency that was reported in Chubin and Moitra (1975) (1.05 citation occurrences for each cited paper) and concluded that "there is a rule that states that each cited paper is referred to on average 1.05-1.15 times in every paper that cites it which may be valid over much of science" (p. 230).

McCain and Turner (1989) also incorporated multiple citation occasions as a parameter in their Utility Index. This incorporation was based on the premise that citation occurrence counts correlate with the relevance or significance of the cited papers, however, they warned against the use of citation occasion counts (or as they called it, multiple references or the "op. cits" problem) as a sole parameter to characterize the usefulness of cited papers to subsequent research. This justified

their decision to combine expository context, citation location, and authorship with a citation occasion counts parameter to extract a single overall measure (Utility Index) to explore the "perceived usefulness" of cited papers (pp. 136, 137).

Hooten (1991) also identified multiple occurrences of each cited reference within citing articles. Total number of citation contexts examined as the unit of analysis in this study was 178 for infrequently cited articles and 239 for frequently cited articles. Results of this study showed that frequently cited articles were more likely to be repeatedly referenced in the texts of citing articles compared to infrequently cited articles (pp. 400, 401). This study also indicated a tendency for infrequently cited articles to be cited multiple times in citing articles in the immediate years (0-4 years) following their publications. On the other hand, frequently cited articles were more often cited from 5 to 13 years following their publications. This finding inspired the author to conclude that the repeated use of frequently cited articles tends to accumulate with time, while multiple mentions of infrequently cited articles in citing articles tends to diminish with time (pp. 403, 404).

Maricic et al. (1998) also noted the frequency of citation occurrences for each cited paper. If a cited paper was cited more than once in the citing article, the appropriate values of 1 or 2 were added up to rank the research topics (p. 533).

Hanney et al. (2005) also recorded the number of citation occasions. This study showed that "quite a few of…the first generation papers involved the paper being cited on more than one occasion in the same second generation paper" (p. 368). This study also reported that for one percent of citing papers for which the cited papers were assumed to be "essential", the cited papers were cited seven times on average (p. 373).

To explore whether citation frequency can predict the importance of a citation, Tang and Safer (2008) recorded the frequency of citation occasions in each citing document. The data strongly supported their hypothesis that more occurrences of a citation correlates with a higher rank in citation importance scale, as rated by citing authors (p. 260). Nevertheless, they emphasized that the

impact of the frequency of citations on citation significance is related to "the context of the frequency of citation for other references in the article" and is comparable to the "pond effect":

> Multi-cited references in an article with relatively few multi-cited references stand out in importance, hence the relationship between citation frequency and importance is stronger in a "small pond". They would not stand out as much in an article with many other multi-cited references; the relationship between citation frequency and importance is weaker in such a "large pond" (p. 262)

This study also found that the relationship between citing and cited authors could have an impact on citation frequencies; more frequent citations belonged to cited authors with whom the citing author had worked before, or had known him/her personally or professionally, or it was a self-citation (p. 266). In conclusion, this study found citation frequency to be a strong indicator of citation importance (pp. 262, 267, 269). However, the authors again stressed the "pond effect" and emphasized that multiple occurrences of citations would be especially important if "there are very few multi-cited references" in the citing document (p. 269).

2.2.5. Citation Impact of Cited Papers on Citing Papers

A number of previous studies combined several indicators to obtain an overall assessment of the impact of cited papers on their corresponding citing papers to explain whether the reference to the cited paper was indispensable to the theme of the citing paper. The following section summarizes some of the studies related to this notion.

Prabha (1983) explored the notion of "essentiality" or "importance" of cited references as part of a citation behavior study. Prabha selected nineteen faculty members from the Department of Business Administration, University of Illinois, who had published at least one article in the preceding two years, and surveyed them about the essentiality of cited sources to the development of the theme of their articles. Results of this study suggested that less than one-third of the cited sources were evaluated "critical references" in the sense that authors perceived that they could not write their articles without consulting those cited

references (p. 203). This study defined three levels of "amount of use" of cited sources: "heavy use", "moderate use", and "peripheral use", but could not find a strong relationship between perceived "critical references" and three levels of "amount of use". Out of 120 critical cited sources, only 43 percent were labeled as heavily used, 29 percent were used moderately, and 28 percent were used peripherally (p. 205). In other words, this study could not find any evidence that "essential" cited references were also "heavily used" by citing authors (p. 205). At the end, Prabha admitted that the notion of "heavy use" was open to a wide spectrum of interpretations and no attempt was made to precisely define this notion (p. 203).

In an attempt to determine the usefulness degree of cited papers as perceived by citing authors, McCain and Turner (1989) adopted a dichotomous usefulness level. If a cited paper was referenced in a detailed and specific way, its usefulness was assumed to be "central", but if it was cited in a general and broad context, among other references, the degree of usefulness was considered "peripheral". This dichotomous usefulness level was later used to calculate the "Utility Index" developed in this study (p. 136). This "Utility Index" was developed as a single measure of "perceived usefulness", to examine if the effects of different citation variables, including the frequency of citation occurrences, citation locations, citation expository context, and self-citations, may interrelate. This index was constructed to combine all citation variables and to differentiate the relative significance of specific variables to represent their citation impact and value. McCain and Turner admitted that their choice of numerical values for weights in the Utility Index formula were quite arbitrary and prone to be criticized. However, they clarified that they had tried to remain consistent with earlier research and had assigned values that seemed more capable of highlighting citation patterns. Nevertheless, they admitted that their Utility Index as a whole proved to have "a partial measure of long-term utility" for evaluative purposes (pp. 138, 151).

Cano (1989) surveyed twenty one elite scientists in the Structural Engineering field to examine the relationship between citation type, utility level,

and location variables. Scientists were asked to "judge the utility content of each reference they had cited". They were asked to rate, on a four point scale, "the level to which each reference had contributed to the production of the technical paper" (p. 285). Scientists were asked to rate the utility level of each reference on a four point scale: peripheral, moderate, heavy, and essential utility levels. The utility level variable was defined as what "makes a reference indispensable in the production of novel information" (p. 285). Results suggested that perfunctory and negational citations appeared to be the most frequent categories (26 percent), though scientists ranked them as low utility (mostly peripheral or moderate). On the other hand, in the second group, operational, conceptual, organic, and evolutionary categories were ranked as high utility-content (mostly heavy or essential) by scientists (pp. 286-7). In the third group, "juxtapositional and confirmative categories were given values fairly uniformly over the four utility levels and also exhibit similar distribution shapes" (p. 287).

Maricic et al. (1998) constructed a compound scale, based on a combination of their location ranking and level ranking scales, as well as document types (article, review paper, or book), and the number of citation occasion(s) for each cited paper. This upward scale was a relative ordinal scale of citation impact, conveying the importance or primacy of cited papers to citing papers. Maricic et al. emphasized that in developing their combined scale, they "refrained from applying a metric scale such as the one developed by McCain and Turner (1989)" (pp. 533-534). In order to assess whether citation counts really reflect the citation impact or rank of cited sources, Maricic et al. distinguished between two levels of citations: 1) cursory or nonessential citations, denoted as lower level citations; and 2) meaningful or essential citations, denoted as higher level citations, thus, defining a dichotomous scheme of high and low level citations. High level citations were quantified by 2 and low level citations were quantified by 1. Maricic et al. assumed that the level or intensity of citations was of significant importance and a step forward from commonplace purely quantitative citation count studies, helping to demonstrate the scientific merit and citation impact of cited papers more accurately (p. 532).

White (2001) proposed a fourfold classification scheme based on two criteria: first, whether the cited document is indispensable to the theme of the citing document; and second, whether the cited paper has been treated positively or negatively in the citing document. Based on the combination of these variables, four citation types were yielded: perfunctory-positive, perfunctory negative, organic-positive, and organic negative (p. 104). White further related the notion of "least effort" to the high occurrences of perfunctory citations and low density of organic and negative citations. He elaborated that perfunctory-positive citations need the least contextual effort to create their citation context and organic-negative citations require the most contextual effort. Table 23 displays this fourfold classification arranged on a hypothetical scale of conceptual effort needed to create them, devised by White (p. 104).

Table 23: Setting Citation Contexts (White, 2001, p. 104)

Contextual Effort	**Citation Type**	**Examples**
Least ↓	Perfunctory-positive	Points to related studies, provides background, involves a prestigious name
	Perfunctory-negative	Notes omissions in prior studies, justifies present research
	Organic-positive	Discusses in detail; acknowledges concepts, hypotheses, method, or operations integral to present research
Greatest	Organic-negative	Attacks, refuses in detail

White further explained that creating citation contexts for organic citations constitutes the major task of authoring a scientific article, as they have to be indispensable and essential to the theme of the citing document, and that effort explains the low incidence of this citation type. As is shown in Table 23, negative citations always take more contextual effort than positive ones. White reasoned that authors have to explain the shortfalls of previous studies and justify their criticism to enable them to negate previous research, and they cannot just "throw in" these negative citations (p. 105). Based on the notion of "contextual effort", White concluded that organic-positive citations have the most essential bond with previous literature, and as a result, they are the most important citation type.

White study stands as the only study that linked the notion of "least effort" to the essentiality concept of citation types and its relation to high or low incidence of citation occasions.

Hanney et al. (2005) assessed the overall importance of cited papers to citing papers. They adopted a four point scale (peripheral, limited, considerable, essential) similar to that developed by Cano (1989), but defined each term precisely to enhance agreed understanding and application among assessors. When assessors applied the template to all second generation papers, the level of agreement between all six assessors improved from "slight agreement" to "fair agreement" when "limited" and "peripheral" categories were collapsed together as "low importance" categories, and "essential" and "considerable" categories were collapsed together as "high importance" categories (pp. 367, 368, 369). The results of this study showed that for only one percent of citing papers, cited papers were classified as having "essential" importance. For 8 percent, the overall importance of cited papers was classified as "considerable". Cited papers were classified as being of "limited" importance for 56 percent and of "peripheral" importance for 35 percent of citing articles (p. 371). In addition, the median publication year of citing papers suggested that the importance of cited papers to citing papers diminished over time (p. 371). This study also revealed that contrary to the "peripheral" cited articles for which 80 percent of citation occasions were categorized as "note/review only", 50 percent of "essential" cited articles were categorized as "support" in classification of citation occasions (compared to 15 percent for "peripheral" cited articles) (pp. 373-374). Hanney et al. also examined the relationship between the location of citation occasions and the importance of cited papers to citing articles. No significant difference was found in terms of citation location for all four "importance" categories (peripheral, limited, considerable, and essential). All four categories mostly occurred in the "discussion" section, followed by "introduction, then "materials & methods", and then "results" section (p. 375).

Tang and Safer (2008) asked citing authors to rate the importance of a citation on a seven-point scale from "slightly important" to "absolutely important"

(p. 257). Results revealed a moderately important rated citation trend, meaning that citing authors gave an average of 4.92 along citation importance scale to cited references (pp. 258-259). More important rated citations were motivated by "conceptual ideas" and/or "method and date" reasons, whereas less important rated citations were mostly judged to be motivated by providing "general background" information, suggesting "limitation" or "future research" reasons (pp. 263, 268). This study also explored the association between citation importance and citation function. Citation function was defined based on three criteria: frequency of citation occurrences, citation locations, and citation reasons. If a citation appeared only once, only in the "introduction" section, and for providing "general background" information, it was labeled as a "perfunctory" citation. "Organic" citations were motivated by "methodology and data" reasons and/or by "conceptual" reasons. Results showed that "organic" citations were a positive predictor for citation importance, whereas "perfunctory" citations proved to be a negative indicator (p. 268). Tang and Safer study emphasized the value of textual properties (citation frequency, length, and location) in predicting citation importance. Also, citations triggered by "conceptual" or "methodology and data" reasons were judged more important than other citations (pp. 267, 269).

2.3. Interaction of Information Science[8] with other Disciplines

Beginning in the 1970s, an increasing concern was reflected in the literature that Information Science (IS) has little interaction with other fields and appears somewhat an isolated field. Small (1981) investigated the relationship of IS to the social-sciences through a co-citation analysis and concluded that "at least in the context of social and behavioural sciences, Information Science appears somewhat isolated. It certainly is not the central discipline with strong linkages to many other fields, that many would like it to be" (p. 49).

Pettigrew and McKechnie (2001) examined the use of theory in IS literature. They analyzed 1160 articles that appeared in six leading IS journals from 1993 to 1998. Their citation analysis indicated that outside the IS field, IS theories are not heavily cited, except by IS scholars publishing in journals of other disciplines (p. 70).

Koehler (2001) mapped collaboration patterns of authors published in the *Journal of the American Society for Information Science (JASIS)* from 1950 to 1999 as a probable "legitimate sole surrogate for Information Science" (p. 117). Based on authors collaboration patterns, he concluded that "cross-fertilization of ideas" has been a visible trend in IS (p. 117).

The following section reviews some studies that focused on the interaction of IS discipline with other disciplines.

2.3.1. Contribution of other Disciplines to Information Science

Al-Sabbagh (1987), in his Ph.D., thesis randomly selected ten percent of the references of the *Journal of the American Society for Information Science (JASIS)* to identify the disciplines that contributed to IS between 1970 and 1985. Findings of this study identified 32 different disciplines that contributed to IS during the study period, including Computer Science, Library Science, Science - General, Psychology, Management, Chemistry, Mathematics, and Statistics. This study showed that the contribution of Computer Science to IS tripled between 1970 and 1985. On the contrary, the contribution of Library Science to IS

[8] For the definition of Information Science, see the first chapter, section 1.5. "Definition of Terms"

weakened during the study period and decreased from 14.28 percent in 1974 to 9.6 percent in 1985 (p. III). This study also found that most references of JASIS papers were given to IS literature; leading to the conclusion that IS has been "the major contributor to its literature" during the study period (p. IV).

Buttlar (1999) analyzed 61 Library and Information Science dissertations to examine the nature of sources that were mostly cited and also to see the degree to which LIS dissertations cite other disciplines. A total of 7980 references were analyzed and results showed that about 50 percent of time, LIS dissertations make references to sources published in their own field (LIS). This study also concluded that LIS imports ideas from other disciplines, primarily from Education, Computer Science, Health/Medicine, Sociology, and Psychology (p. 237).

Holmes (2002), in his Ph.D. thesis, investigated whether IS functions as an interdisciplinary field and if it does, what are the disciplines that contribute to IS. This study focused on six specific years: 1973, 1978, 1983, 1988, 1993, and 1998. To conduct the study, Holmes produced a list of IS journals and extracted references from some of the sampled articles. Then he plotted these references against the Dewey Decimal and Library of Congress schemes. This study concluded that IS is an interdisciplinary field and Library Science, Computer Science, Economics, and Management are its principal and main contributors. Secondary contributors to IS included Engineering, Sociology, Education, Psychology, Medicine, Linguistics, Mathematics, and Law. This study proved that the principal and secondary contributors to IS change over time. However, only Computer Science, Economics, Engineering, Library Science, and Management enjoyed significant levels of contribution "for the entire period under study" (p. III).

Peritz and Bar-Ilan (2002) examined 2814 references of 169 articles published in *Scientometrics* in 1990 and 2000. The purpose of this study was "to examine the extent to which the field of bibliometrics and scientometrics make use of sources outside the field" (p. 269). Results of this study showed that in 1990, 47.3 percent, and in 2000, 56.9 percent of the references originated from

Scientometrics and Bibliometrics, Library and Information Science (LIS), Sociology, and History and Philosophy of Science disciplines (p. 269).

Chang and Huang (2012) investigated interdisciplinary changes in Library and Information Science (LIS) from 1978 to 2007. The purpose of the study was to identify the disciplines from which the sources cited by LIS articles originate. Ten leading LIS journals were selected, which included 7704 articles, from which a representative sample of 1536 articles was chosen to collect data. Results of this study showed that LIS authors still rely heavily (over 50 percent) on sources published in their own field and "a few disciplines influence LIS (General Science, Business/Management, Computer Science, Education and Sociology)" (pp. 22, 25). Nevertheless, the authors concluded that based on the results of this study, "the level of LIS interdisciplinarity has been increasing over time, indicating that LIS researchers have been increasingly citing more sources outside the LIS discipline, and a decreasing tendency within LIS to cite LIS sources" has been observed (pp.29-30).

2.3.2. Contribution of Information Science to Other Disciplines

Cronin and Pearson (1990) investigated the contributions made by information scientists to other disciplines. They analyzed citations (originating from non-IS sources) "to the works of six main figures in the field for the period 1980-1989" to see if IS is "a net importer of ideas from other disciplines" or if it exports attractive goods (such as paradigms, theories, models, and insights) to other fields and appears as a strong and credible field (pp. 381, 382-383, 385). Results confirmed the first situation; 90 percent of within IS generated ideas had not enough scientific impact to break through the intellectual borders of IS and were not incorporated into the scholarly literature of other disciplines.

Large and Koshman (1993) analyzed citations made to four LIS journals and four non-LIS journals. The purpose was to examine to what extent the LIS field exchanged ideas with other fields during 1985 to 1989. Results showed that "LIS journals were cited infrequently or not at all" in non-LIS journals, suggesting that "while information scientists exploit the literature of diverse fields, their own work is little used by those outside the LIS domain" (p. 298).

This situation remained more or less the same until 1996, when Meyer and Spencer (1996) reported the first signs of more interaction with other disciplines. The main purpose of their study was to examine whether scholars from other disciplines "read, discussed, and cited library literature". Meyer and Spencer analyzed citations to twenty four Library Science journals (with an impact factor of 0.4 or higher) over a twenty year period (1972-1994) and used journal subject categories on DIALOG to define scientific disciplines. Results of this study showed that 13.4 percent of citations to Library Science journals originated from other disciplines. Consequently, the authors concluded that while "citations from other fields are higher than previous studies indicate, compared to other fields in the social sciences, Library Science is not commanding citations at the level of the more developed fields" (pp. 23, 26).

Eight years after Meyer and Spencer (1996), a more promising and stable situation was reported. Tang (2004) analyzed citations to 150 Information and Library Science (ILS) articles, randomly drawn in six years (1975, 1980, 1985, 1990, 1995, and 2000), with 25 articles from each year. The purpose was to explore the interdisciplinary breath of the ILS field through examining citations to journals. The number of extra-disciplinary citations showed that ILS actively interacts with "a wide spectrum of disciplines in the domains of science, social science, and the humanities", but disciplines may differ by year. This study concluded that ILS "has reached its scholarship maturity and that it is a highly interdisciplinary field that attracts learned interests from a variety of disciplines" (pp. 54, 61).

Four years later, Odell and Gabbard (2008) replicated the Meyer and Spencer (1996) study to measure "the developing influence of LIS journal literature" (p. 547). This study ranked LIS journals based on the number of received citations from other fields and then identified "the subject categories and journals that most frequently cite LIS articles". The main research question of this study was "what is interdisciplinary impact of LIS scholarship?" (pp. 547-548). Results of this study showed that sixty-seven journals listed in "Information Science and Library Science" JCR subject category received a total of 109,775

citations from 1996 to 2004; and out of these citations, 27 percent originated from 215 JCR subject categories (p. 550). When the result of this study was compared with the Meyer and Spencer (1996) study, it was shown that "the fields most likely to cite LIS literature from 1972 to 1994 have continued to cite LIS journals more than most disciplines do". However, Computer Science (from 15.5 percent to 34.9 percent) and Business and Management (from 8.0 percent to 15.0 percent) had doubled their share during this period. In sum, this study reported a 14 percent increase in terms of other fields' citations to LIS journals; nevertheless, it explained that part of this increase could be related to the new journal titles that were added to the "Information Science and Library Science" JCR subject category after 1994, and also due to the dropping of some library profession journals (pp. 546, 560).

Levitt et al. (2011) investigated whether research in Social Science has become more interdisciplinary and "compared the extent to which the interdisciplinarity of different Social Science subjects has changed" since 1980 (p. 1118). They used the "Percentage of Cross-Disciplinary Citing Documents (PCDCD)" in the Social Science Citation Index (SSCI) to evaluate the level of interdisciplinarity in 14 SSCI subject categories (p. 1118). This study used the percentage of citing documents that are published outside the subject category as a potential metric for interdisciplinarity to show "that much of the impact of an article is outside the discipline of the article" (p. 1121). The interdisciplinarity of a SSCI subject category was evaluated based on "the percentage of cross-disciplinary citing documents (PCDCD), defined by:

$$PCDCD = 100 * NCD/N$$

where NCD is the number of citing documents that are not in the [same] subject [category], N is the total number of citing documents, and both NCD and N exclude author self-citation. According to the authors, "NCD is calculated by subtracting from N the number of citing documents that are in the [same] subject [category]" (p. 1121).

Table 24: The percentage of cross-disciplinary citing documents for every ten years from 1980 Adopted from (Levitt et al., 2011, p. 1122)

Subject	PCDCD 1980	PCDCD 1990	PCDCD 2000	PCDCD 2000 divided by PCDCD 1990
Business	48.90%	51.40%	58.70%	1.14
Economics	31.30%	32.00%	43.10%	1.35
Education & Education Research	43.00%	41.10%	50.70%	1.23
Information Science & Library Science	19.50%	26.30%	57.80%	2.2
International Relations	58.20%	55.20%	60.90%	1.1
Law	62.30%	23.50%	42.80%	1.82
Management	52.70%	49.50%	55.40%	1.12
Neurosciences	61.40%	50.40%	48.00%	0.95
Political Science	53.60%	51.50%	55.10%	1.07
Psychiatry	48.60%	46.90%	53.20%	1.13
Psychology	74.30%	74.70%	81.50%	1.09
Public, Environmental & Occupational Health	65.90%	65.70%	68.00%	1.04
Social Sciences, Interdisciplinary	78.30%	82.40%	82.00%	1
Sociology	58.50%	62.00%	66.90%	1.08
Median	55.90%	50.90%	56.60%	1.11

A summary of the findings of this study is presented in Table 24. The first three columns report the PCDCD for articles published in 1980, 1990, and 2000. The last column indicates the increase in interdisciplinarity in different subject categories. As illustrated in this table, "the average level of interdisciplinarity in Social Science increased between 1990 and 2000" (p. 1126), nevertheless, the extent of interdisciplinarity varied within subject categories over time. For example, Information Science and Library Science (IS&LS) ranked the least (14^{th}) interdisciplinary subject category in 1980 (19.50 percent PCDCD), elevated one level (13^{th}) in 1990 (26.3 percent PCDCD), and then ranked 7^{th} in 2000 (57. percent PCDCD). Interestingly, IS&LS had the largest increase in interdisciplinarity between 1990 and 2000 in SSCI (see fourth column). Table 24 also conveys "substantial PCDCD variations" between subject categories (p. 1121). For example, the percentage of PCDCD for Psychology was 81.5 in 2000, but 42.8 for Law in the same year. The authors further explored whether an increased level of interdisciplinarity may "reflect changes in the set of journals in

the SSCI subject categories" (p. 1127). For economics, it was found that changes in the journal set do not correlate with an increase in the level of interdisciplinarity. However, for IS&LS, it was suggested that "a considerable part of the increased IS&LS interdisciplinarity is due to the replacement of journals with higher citation in IS&LS with journals with lower citation in IS&LS" (p. 1123). This change in the journal categorization process in SSCI subject categories led the authors to conclude that "this [finding] undermines the evidence for increasing IS&LS interdisciplinarity and, by extension, the evidence for Social Science as a whole" (p. 1127). This research also suggested that the level of interdisciplinarity had started slowing down after about 2004.

2.3.3. Reciprocal Interaction of Information Science with Other Disciplines

Pluzhenskaya (2008) analyzed articles in the journal "Library and Information Science Research (LISR)" published from 1994 to 2004 to examine the balance between what is imported to and what is exported from the Library and Information Science (LIS) field. This study reported that LISR made references to LIS and other disciplines with a ratio of 6:5, whereas for citation received, this LIS/other disciplines ratio was found to be 8:1. Based on this result, the author concluded that "LISR authors seem to draw on other disciplines' publications almost as often as on the ones originated from LIS," however, the higher ratio of LIS citations confirms the prevalence of importing qualities of LIS (pp. 1, 4). Pluzhenskaya also showed that almost the same disciplines (Sociology, Education, Psychology, Medicine, Health Science, Computer Science, and Communication) "cite LIS publications and are cited by LIS authors", conveying some mutual interest and meaningful connections between LIS and those disciplines (p. 5).

Sugimoto et al. (2008) analyzed the relationship between Library and Information Science (LIS) and Management Information Systems (MIS) through using bibliometric tools. They selected 48 top-ranked journals in each field and examined the articles within one field that cited the other field. The main goal was to identify the reciprocal impact of LIS and MIS to investigate "the knowledge

imported/exported between LIS and MIS" (pp. 1441, 1443). Findings indicated that MIS has a greater impact on LIS than the reverse. It was also shown that 18.43 percent of LIS articles cited any of the 48 MIS journals, while only 4.18 percent of MIS articles cited any of the 48 LIS journals (p.1444). The authors concluded that these findings imply that "LIS is a weak exporter", an assertion that reinforces previous studies of LIS in the context of other fields (p.1444). Ten journals in both fields accounted for over 60 percent of citations to each discipline. These journals were mainly focused on "the information technology systems rather than on how people used [information systems]" (p.1444).

Cronin and Meho (2008) built on previous research that reported that information studies have begun to contribute more significantly to the literature of other disciplines. They conducted "a large-scale, longitudinal citation analysis of intellectual trading between information studies and cognate disciplines" and showed that "exports from IS to other fields have increased significantly over time" (pp. 551, 560). In order to explain such a striking increase, Cronin and Meho extracted the most frequently author-assigned keywords to publications citing IS periodicals and showed that "internet" and "information retrieval" were the most frequently assigned keywords in citing documents. As a conclusion, they related the increasing contribution of IS to other disciplines to the recent advances in internet applications and information technology. This study concluded that the field "has become a more successful exporter of ideas as well as a less introverted one than was previously the case" (p. 551). However, authors did not attempt to provide any further explanation about what exactly information studies is exporting to other fields and how substantial the contributions of IS publications are to those disciplines.

Larivière et al. (2012) used a variety of bibliometric measures to present "a condensed history of Library and Information Science (LIS) over the course of more than a century" (p. 997). One of the aspects examined in this study was the interaction of LIS with other disciplines. Data were sourced from Thomson Reuters Web of Science (WoS); however, LIS literature was defined based on the "classification created by CHI Research (now The Patent Board). All papers

published in journals having the classification "Information Science and Library Science" in the field and subfield" were included in the analysis (p. 1000). When references of these papers were examined, the results showed that about 36 percent of all references were made to an LIS publication, an indication that the import dependency has steadily decreased from 3.5 (since the mid-1990s) to about 1.3 in 2012 (p. 1011). It was also shown that LIS literature imports mainly from Management (18 percent in 2010), Computer Science (around 8 percent), General and Internal Medicine (4 percent), General Biomedical Research (less than 1 percent), and Education (about 1 percent) (p. 1010). Analysis of citations received by LIS literature showed an increase in the interdisciplinary aspect of LIS over 15 years, an increase from 20 percent (in 1995) to 60 percent (in 2010). Results showed that Management (10 percent), Computer Science (8 percent), General and Internal Medicine (less than 3 percent), Biochemistry and Molecular Biology (less than 3 percent), and Education (2 percent) are among the main disciplines citing LIS papers. Based on these findings, this study concluded that LIS has gained the status of a permeable field instead of an insular field in terms of exchanged references and citations: "LIS scholars now cite and receive citations from other fields, notably from Computer Science and Management, more than from LIS itself", a major shift that occurred in 1990 and "contributed to the increase of the average impact of LIS papers" (pp. 997, 1010-1011, 1013).

2.4. Summary

The first section of this chapter presented a selective review of relevant studies regarding citation motivations and citation context analysis. These studies were mostly motivated by a critical view towards citation analysis on the grounds that citation counts may not adequately indicate the level of use of cited documents. Therefore, researchers went beyond the initial impression of citation counts and attempted to yield a deeper insight into the nature of citations, mostly through devising or using a citation classification scheme or a list of citation motivations. The first section provided the present study with a basis upon which the classification scheme specific to the present research will be constructed.

The second section reviewed bibliometric studies that investigated the interactions of IS with other disciplines to understand the degree to which IS as a discipline has been influenced by other disciplines and the degree to which it is capable of contributing to the intellectual development of other fields. These studies have emphasized the interdisciplinary nature of IS and most of them have attempted to identify those disciplines that actively interact with IS. However, their results did not show the depth of the contribution of IS to other disciplines. As the only study that examined the citation contexts in the discipline of IS, Hooten (1991) focused on the difference between use of frequently and infrequently cited documents and examined the functional use and nature of IS citations received from other disciplines. But this study suffered from a methodological flaw; the researcher categorized citations along four different classification schemes without any effort to deal with the problem of overlapping categories. This may explain why she was led to conclude that "a difference in use [of frequently and infrequently cited documents] may exist but could not be measured by the taxonomies used in this study" (p. 401).

Therefore, there is still a lack of knowledge about what IS contributes to other disciplines and how substantial that contribution is. No previous research has attempted to explore the nature of citations that IS receives from other disciplines in a unified theoretical framework. The present research holds the virtue of greater depth than all other relevant research and explores whether IS is contributing theoretical concepts or empirical results and what the impact of IS literature, represented by highly cited JASIST papers, is on the advancement of knowledge in other disciplines.

Chapter 3: Conceptual Framework

3.1. Introduction

Given the increasing use of citation counts as a tool for evaluating the quality of publications and scientific achievements, researchers have started questioning the function and role of citations. Case and Higgins (2000) share their concern:

> Investigating the motivation for citations does indeed pose epistemological and methodological problems. What can we assume about the nature of bibliographic citations? Do they express simply a relationship between two documents and the ideas they contain? Or might authors have other, perhaps more personal, motivation for citing the work of another author? Are all citations of equal value?…and yet, most citation analyses do not recognize the varied purposes of citations, treating them all as functionally equivalent (p. 636)

The debate over the function and role of citations has resulted in the emergence of two positions. One sees science as a normative institution that is governed by its internal system of rewards and sanctions. Scientists, working within this institution, publish to be rewarded and to get recognition. This view suggests that scientists acknowledge intellectual debts to their peers through citing their publications and are mostly motivated by the cognitive or methodological content of the cited documents (Baldi, 1998). Advocates of this position suggest that scientists should not be influenced by other non-professional citation motivations related to the personal characteristics of the authors or be affected by social or political issues.

Social constructivists have challenged the normative theory of citations over the last few years. They do not agree that science is an institution with its own norms and sanctions. Instead, they believe that manipulation of political and financial resources and the use of rhetorical devices construct scientific knowledge and that the production of knowledge conforms to social norms. Advocates of this position believe that scientists are looking for support when they publish, and that citations are rhetorical devices to persuade peers rather than

a reflection of intellectual debt. Constructivists claim that citations of eminent authors are used to persuade readers and to validate arguments (Baldi, 1998).

Normative and constructivists positions suggest two different approaches for the allocation of rewards within the scientific community. If scientists decide to cite a document based on "*what one says"*, they are behaving in accordance with the normative theory of citations. But when other factors motivate scientists to cite, mostly "*who says that"* factor, they are advocating a social constructivist approach. The problem is that these two different approaches are not completely distinctive and they are not mutually exclusive. Citers are prompted by complex citation motivations (Vinkler, 1987; Brooks, 1986; Cano, 1989) and a scientist may cite a document to acknowledge its intellectual contribution to his paper and, at the same time, to persuade the reader that he (the author himself) is prominent in his field (Baldi, 1998).

Case and Higgins (2000) posed the question "how can we study such an internal phenomenon as an author's decision to cite another document?" (pp. 635-636). Cronin (1984) pointed out that we need both sufficient theories and evidence of citing behavior: "in the absence of explicit and universally recognized consistencies in individuals' citation practices, it is difficult to see how citation can be defined as a norm-regulated activity" (p. 22). Small (1978), in a similar comment, stated: "we do not know enough about why authors cite (or the various functions citations can have) to be able to interpret studies based on statistical analysis of citation counts" (p. 327).

To date, a number of conceptual and empirical studies have investigated the validity of these theories and some of them have tried to investigate if one theory works better for specific situations (e.g., disciplines or journals). The following two sections provide a brief summary of these studies.

3.2. Normative Theory

Normative theory suggests that authors cite what they use and give their colleagues credit by citing their works. Thus, citations are influenced by intellectual impact and they can sufficiently represent intellectual contributions.

According to this theory, evaluative bibliometrics can work as an appropriate tool for evaluating scientific achievements. White (2004b) pointed out that normative theory provides a "default explanation- a rule to which [constructivist] explanations, even if valid, are exceptions" (p. 94).

In a study designed to investigate the most frequent use of references, Spiegel-Rosing (1977) found a very low percentage of negational or disproval references (0.8 percent). This result prompted her to challenge those studies that use negational citation rates as a serious argument against the use of citation counts to evaluate scientific achievements.

Vinkler (1987) advocated the normative theory of citation by showing that 17 percent of citations were prompted by both professional and non-professional (connectional reasons), and only 2 percent of citations were motivated by "connectional incentives" alone. He further analyzed types of professional motivations and confirmed that 16 percent of all professionally-motivated citations were confirming or supporting the contents of the citing paper, whereas citations with a critical nature amounted to only 3 percent of all professional citation motivations (p. 63). Despite this fact, Vinkler admitted that confirmative citations ranked fourth as the most frequent professional citation motivation.

Baldi (1998) assessed the validity of normative versus constructivist theory of citations through a network-analytic model. He treated citations as "dynamic relationships between citing and cited documents to examine the extent to which the specifications of potentially citing and cited documents may influence the probability that a citation will be made" (p. 830). Baldi criticized past studies for ignoring the role of citing documents and focusing only on cited documents and insisted that the citation process is a dynamic relationship between citing and cited documents and that the characteristics of each document may influence the whole process. He further defined citation occurrence as a dependent variable and mapped all the citation links, from later papers to earlier papers, in a research area. Baldi selected 100 highly cited and less cited articles on "celestial matters" and tested the normative theory of citations to see "if citations reflect the worth and content of contributions" (p. 835). This study suggested a

model of citation behavior "in which citations are simultaneously determined by the characteristics of citing and cited articles and their authors" (p. 843). This model proposed that authors usually cite relevant documents and "seem little concerned with the characteristics of authors who write them" (p. 829).

As a prelude to his paper, White (2004b) informed his readers that his article would provide new evidence that citation patterns follow the normative theory of citations and that non-professional factors should not affect the use of citation counts in evaluation of scientific achievements. He selected 28 "citation identities" (well-known scholars) from various disciplines and counted citee reputation (number of citations that they received). Based on this data, White concluded that the normative theory of citations is a simpler and more elaborate explanation for citation behavior than is the constructivist theory. However, he suggested that both theories "are complementary rather than mutually exclusive, and neither need to be given up for the other" (p. 115).

In an attempt to validate the application of citation counting in science evaluation, Krampen et al. (2007) showed that 70 percent of all citations analyzed in Psychological publications are high quality, precise citations that refer to theories, results, and methods, thus providing another confirmation for the normative theory of citations.

3.3. Constructivist Theory

The constructivist theory denies the assumptions of normative theory and suggests that citations may reflect other motivations, including social, political and financial issues, and that intellectual influence cannot be assumed as the main citation motivation. The followers of this theory question the validity of evaluative bibliometrics, arguing that authors may cite other publications, after being prompted by authoritative or persuasional motives. Moravcsik and Murugesan (1975) found a large proportion of perfunctory references (40 percent) and a significant role for "disputed references" in their study. This led them to cast doubt on the validity of citation counting in scientific evaluations. This was the first time that the quality of citation counts as an indicator of scientific impact

was empirically challenged. Gilbert (1977) argued that authors cite previous research to persuade their colleagues, to justify their own positions, and sometimes they give references to respected papers to "bolster their own arguments" (p. 116). Gilbert even remarked that "many references are selected because the author hopes that the referenced papers will be regarded as authoritative by the intended audience" (p. 117). He concluded that references help authors "to increase a paper's power to persuade" (p. 120).

Two studies conducted by Brooks in (1985) and (1986) revealed that persuasiveness was the most prevalent citer motivations. Brooks (1985) further pointed out that "authors can be pictured as intellectual partisans of their own opinions, scouring the literature for justification" (p. 227) and warned against naively assuming that authors give references to valuable resources in a positive manner, a concluding remark that actually supports the constructivist theory (p. 228). In another study, Cano (1989) showed that perfunctory and negational citations with a low utility level ranked first, comprised 28 percent of all citations and were mostly focused in the introductory sections of papers. She further elaborated on the notions of "discreteness and quality of value of citations" and concluded that it is "impractical to use the citation as a unit of measurement for the study of information transfer and information use" (p. 289).

Shadish et al. (1995) could hardly find any empirical evidence to refute the normative theory of citations, but they tended to interpret their results to warn against the misuse of citation counts for evaluation purposes. They reported that surveyed authors cited scholarly works mostly to support their own assertions, to document a source of method, and to represent a genre of studies, similar to what Moravcsik and Murugesan (1975) called "perfunctory citations" (p. 485). Shadish et al. also showed that less than 2 percent of their respondents identified quality of the work as the most important reason why they cited the reference and emphasized that "citations are not interchangeable with quality…and if we judge the quality of a work solely by its citation count, we probably undervalue some very creative work that peers judge to be of high quality" (pp. 481, 492). The lack of an association between quality of a work and the number of citations that it

receives was also emphasized in this research. The results of White and Wang (1997) showed that citing acts under-represent economist's total use of literature and this buttresses some "concerns already raised in previous literature about the normative theory of citing and the use of citations as a basis for evaluating scholars, journals, and academic departments or for showing previous influences on scholarship" (p. 147). This study also found some evidence of general concerns that influence decision making, but these concerns proved to be "almost independent of considerations of the use of a document during the research project" (p. 148).

Maricic et al. (1998) assessed whether citation counts really do reflect the impact of cited documents within the scientific communication process. Their data did not reveal any congruency between citation counts and context analysis based on structural and intensity factors. This finding prompted the authors to conclude that "our result may be taken as yet another warning against indiscriminate use of citation counts for evaluative purposes" (p. 538).

Case and Higgins (2000) suggested that authors tended to add some degree of cognitive authority and legitimacy to their own works through association with the cited work. To establish themselves as a critical and authoritative scholar and to prove that others' works deserve criticism, authors sometimes criticize publications by citing them. These two conclusions supported the results of other constructivist studies and led Case and Higgins to eventually question the legitimacy of citation counts in university promotion decisions (p. 643).

Hanney et al. (2005) could not find any significant relationship between "the number of times a paper was cited and the proportion of citations in which the cited article was classified as being of high importance". This result prompted the authors to conclude that attempting to concentrate on highly cited papers would not reveal the impact of research or lead to key papers (p. 376). Leydesdorff (2008) refuted the assumption that citation practices are homogenous within different disciplines. He further argued that the original purpose of impact

factor and *Journal Citation Reports (JCR)* was not to evaluate research and warned against the use of citation indicators in research evaluations.

3.4. The Need for a Grand Theory of Citation

The debate over the function and role of citations in research evaluation has resulted in the emergence of two positions: normative theory which suggests that scientists acknowledge their intellectual debts to their peers through citations, and constructivist theory which advocates that authors cite to persuade their readers and to validate their arguments. As discussed earlier, these different approaches are not so distinctive and are not mutually exclusive (Baldi, 1998).

It is also important to note that citers usually have complex citation motivations (Vinkler, 1987; Brooks, 1986; Cano, 1989) and citing decision is an internal and complicated phenomenon (Case & Higgins, 2000); we hardly know why authors cite and what exactly motivates them to cite (Small, 1978). Some previous researchers have tried to validate the normative and constructivist theories and have attempted to investigate if one theory works best for their own research purposes. Case and Higgins (2000) reflected on the specific reasons for citing a particular document:

> It is obvious that writers cite documents that are "relevant" to their topic, which provide useful background for their research and which may acknowledge intellectual debts—what we might call a *normative* style of citation. It also seems apparent that authors prefer to cite documents that are supportive of what they write, preferably by noted experts—a *persuasional* citation strategy. However, within these general strategies or styles of citation, s*pecific* reasons for citing a particular document at a particular time seem to vary widely, according to both anecdotal and systematic evidence (p. 636)

Liu (1997) suggested some connections between the theories and stated that "both theories cannot be treated in isolation and should not be viewed as entirely conflicting". He further suggested that "the dynamic linkage of them is a necessary step in the quest for the satisfactory theories of citation" (p. 86). White (2004b) was another scholar who suggested that both theories "are complementary rather than mutually exclusive, and neither need to be given up

for the other" (p. 115). Nicolaisen (2003) also proposed a unification of both theories towards a satisfactory theory of citation.

3.5. Citation Cube Model

Small (1998) suggested that "there is no basis for saying one theory is better than another…what both theories ignore about citations is their symbolic function" (pp. 143,144). He stressed that authors associate some particular ideas with cited documents when they cite these documents and any theory of citation should take account of this symbolic act of citers (p. 337). He further criticized citation behavior and context analysis studies:

> These studies have missed the role citations play as symbols of concepts or methods…The interpretation of citations as concept symbols is a more direct interpretation of citation practice than previous "classification" attempts, because it is a more closely related to the way citations are deployed by authors in scientific papers…None of these [citation reasons] appear to be adequate to explain the full range of motivation for citing. What does appear to be more nearly universal is the citation as a symbol for an idea…the concept symbol interpretation of citation practice does not contradict the functional, social or political interpretations, but is complementary to them (pp. 327-328, 337)

He further suggested adding a network epistemology flavor to the normative theory and "borrowing methods of textual dissection and deconstruction from the constructivists, but without adopting their relativism" (p. 147). Small (2004) later developed his idea of "citations as concept symbols" to re-consider the normative and constructivist theories and to synthesize them in a unified model, "where the dual function of citations as vehicles of peer recognition and constructed symbols for specific original achievements in science is realized" (p. 71). He proposed a broader context for these two theories and called it the Citation Cube Model. This cube had literalness and consensus as its two dimensions and it was devised to highlight similarities or differences between the citing and cited document (p. 60).

Figure 1 shows two dimensions of the Citation Cube Model.

Figure 1: The Citation Cube Model (Developed by Small, 2004, p. 77)

	Consensus Low	High
Literalness Low	CONSTRUCTIVE Misattribution, Misinterpretation, Idiosyncratic negative, Revolutionary	CONSTRUCTIVE Ritual negative, Common misattribution, Conventional, Transformation, Obliteration by incorporation
High	NORMATIVE Substantive, organic, creative connection, unusual quotation	NORMATIVE Perfunctory, ceremonial, Common direct quotation, Conventional interpretation, Paradigmatic

Small (2004) described his model as follows:

In this scheme, negative citation would have low literalness since the citation diverges from the original text, but could have low consensus if the author was alone in his disagreement or high consensus if the citing author's critical opinion was shared by the community. In the latter case, the negatively cited work has become symbolic of an incorrect idea. Normatively compliant citations, such as perfunctory or ceremonial citations would concentrate in the high literal, high consensus box, while deviant cases, such as a revolutionary negative citation or paradigm breaking reinterpretation, would fall mainly into the low literal, low consensus region. In general, Merton's recognition model would work best for high literal citations, while the constructivist model would work best for low literal citations. A mis-citation or misattribution could fall in either of the low literal boxes, depending on its prevalence, but an OBI case would fit best in the high consensus, low literal category, since such citations are uniformly omitted. A particularly apt but not universally recognized citation, sometimes described as organic or substantive, would fall into the low consensus, high literal category. A commonly recognized reinterpretation or reformulation would fall into the high consensus, low literal category, as would a commonly made misinterpretation or distortion. In this scheme, the degree of self-citation would

> constitute a dimension orthogonal to the first two, creating a citation cube consisting of eight categories (p. 77-78)

The Citation Cube Model seems promising for answering the research questions of the present study. As Bornmann and Daniel (2008) point out, "this is the first conceptual approach for a unified theory" (p. 66); it is the only model that benefits from both the normative and constructivist theories of citations and attempts to accommodate all types of citation motivations in a single model. The heart of this model is its emphasis on the relationship between cited and citing documents. The significance of this relationship has been earlier emphasized by previous researchers, e.g., Baldi (1998), but no previous research has tried to use the Citation Cube Model to demonstrate the relationship between citing and cited papers.

Based on the outcome of the classification scheme that will be developed later in the present study, each square of the Citation Cube Model will be filled with appropriate categories (the categories that are shown on the model in Figure 1 are examples that Small used to represent his model). The literalness and the consensus dimensions of this model will enable the present research to demonstrate the conglomeration of categories and whether there is a consensus about them.

Chapter 4: Methodology

4.1. Introduction

This chapter describes the methodological approach that was applied to investigate the research questions. It begins with a description of the overall design of the study and the logic behind selecting citation context analysis as the research method. Then, some details of the procedures that were followed to select and collect data are discussed and the methods undertaken to analyze data are outlined. This chapter concludes with the limitations of the study that have resulted from data collection and data analysis procedures.

4.2. Overall Design of the Study

The approach to the research design of the present study originates from the family of citation analysis research. This family of research involves counting the times a paper or an author is cited and assumes that influential papers and prominent authors are cited more frequently than others (Meho, 2007). However, citation analysis has been constantly criticized for some of its shortcomings: the problem of homographs (authors with the same name and initials), mutual citations (authors citing each other), self-citations (authors citing themselves), ceremonial citations (the cited work is authored by a recognized authority in the field), and negational citations (citing work negatively evaluates cited work) (Smith, 1981; Meho, 2007; Bornmann and Daniel, 2008). Cano (1990) remarks that "citation analysis is methodologically unsound for some of the tasks it proposes to accomplish such as the mapping of fields and the delineation of boundaries between fields…at least until a theory of the nature of the citing process is developed" (p. 28). The present study was inspired by this notion and tried to go beyond the initial impression of citation counts to explore the nature of the citations. This attempt was reflected in the selection of the research method for the present study and also the approach that was taken for collecting and analyzing the data. Citations were used as a "radioactive tracer" to see where IS research eventually informed research in other disciplines, and what the nature of

this contribution was. The following section discusses the research method and the procedures followed to collect and analyze the data in detail.

4.2.1. Citation Context Analysis

The present study used citation context analysis to analyze citation context and to explore the nature of citations, following the procedures outlined by Small (1982) and later elaborated by White (2004a). Small (1982) defined a "citation context" as the "particular passage or statement within the citing document containing the reference". He also defined "citation context analysis" as "any attempt to utilize these passages in a systematic fashion" to discover "various functions or reasons for citing a particular work, or to characterize some feature of the citing or cited item" (p. 288). Small further differentiated between two approaches for analyzing the text surrounding the citation. In the first approach, abstract and implicit features of the citation context are classified and relationships or connections between cited and citing documents are inferred and extracted through this classification attempt. In the second approach, citation passages or explicit words or phrases embedded in citation contexts are analyzed, relying on the assumption that this context characterizes the topic of the cited document as if citations "stood for subject headings" (White, 2004a, p. 99).

The current research used the first approach to explore the nature of citations that highly cited JASIST papers received from citing papers published in other disciplines. However, for a few top highly cited papers, the keywords or phrases embedded in citation contexts were also extracted and analyzed to explore why these papers were highly cited. As Small (1982) suggests, these two approaches "have not been entirely distinct" (p. 288). White (2004a) labeled both approaches as "forms of citation context analysis" (p.100); however, sometimes the second approach has been called "citation content analysis" or "content analysis of citation context" in the related literature (McCain & Turner, 1989; Small, 1982).

4.2.1.1. Implicit Citation Context Analysis

Implicit citation context analysis requires the researcher/coder to analyze, judge, and code relationships between cited and citing papers as they are inferable from the context surrounding each citation. Attempts to understand relationships or connections between cited and citing documents and to interpret the links between them resulted in the creation of citation categories that have formed the basis of a citation scheme (McCain & Salvucci, 2006). This citation scheme was used to interpret results within the conceptual framework of the study in order to ultimately answer the research questions.

4.2.1.2. Explicit Citation Context Analysis

In explicit citation context analysis, the location of each citation occasion within citing papers is recorded. In addition, the frequency of each citation occasion related to the same highly cited JASIST papers is also recorded. The frequency of co-citations for each citation occasion is another property that is noted and recorded.

4.2.2. Unit of Analysis

Each citation occasion of highly cited JASIST papers constitutes the unit of analysis for the present research. Citation occasion is defined as the text surrounding each embedded citation of highly cited JASIST papers mentioned in the citing papers[9] and includes all implicit and explicit properties (including the implicit meaning attached to each citation occasion and explicit citation location, frequency, and co-citation frequency).

4.2.3. Time Frame

The method used for selecting highly cited JASIST papers[10] allowed the time frame to extend for eight years (2001-2008), beginning with the date the title of the journal was changed from *Journal of the American Society for Information* Science *(JASIS)* to *Journal of the American Society for Information Science and*

[9] See section 4.3.1.1. "Data Selection"
[10] For details, see section 4.3.1.2. "Highly Cited Papers: Selection Rationale and Criteria"

Technology (JASIST). Contrary to the case for cited papers, the time frame for citing papers was purposefully limited to exclude any citing paper published after 2008. This period (2001-2008) provided the present research with sufficient time to ensure the comprehensiveness and consistency of the data. Here it should also be noted that the data collection procedure was completed by July 31, 2009. Therefore, citing papers, added to the Web of Science after this date, were inevitably excluded from the present study.

One may argue that the selected time frame for cited papers (2001-2008) is too close to the closing date of data collection to see the full effects of all citations. In response to this concern, it should be noted that the majority of highly cited JASIST papers (85.5 percent) were published before 2005 and 76.4 percent of cited papers were published before 2004. On the other hand, previous studies found that "40 percent [of cited papers] are cited at least once within 3 years of publication" (Larivière et al., 2012, p. 1002), "more than 42 percent of the citations" [are] accumulated "within the five years immediately preceding the date of the [cited papers]" (Thompson, 1989, p. 88), 50 percent are cited after five years (Larivière et al., 2012, p. 1002), and "the average percentage [holds] at the 55.6 percent throughout the twenty years of study" (Thompson, 1989, p. 88). These data lead to the conclusion that at least 85.5 percent of highly cited JASIST papers that were published before 2005, had enough time (three years) to mature and receive citations.

4.3. Procedures for Data Selection and Data Collection

This section describes the procedures used to execute the research methodology. The data source and methods of data collection are also discussed.

4.3.1. Data Selection

All the citation data used in the present research was extracted from the Thomson Reuters (formerly ISI) Web of Science database, a multidisciplinary and international database that covers over 9000 journals in all scientific fields. This database follows an objective and high standard journal selection procedure and it has 100 years of scientific back files and citations (Thomson Reuters, 2009). Web

of Science has been overwhelmingly used for citation analysis studies as the most authoritative and comprehensive citation database. See the following studies as some examples, Oppenheim & Renn, 1978; Small, 1978; Small & Greenlee, 1980; Peritz, 1983; Stewart, 1983; Cozzens, 1985; Dolman & Bodewitz, 1985; Amsterdamska & Leydesdorff, 1989; McCain & Turner, 1989; Hooten, 1991; Shadish et al., 1995; Case & Higgins, 2000; Nicolaisen, 2002; Ahmed et al., 2004; Hanney et al., 2005; Ioannidis, 2005; Martens & Goodrum, 2006; Herlach, 1978; Finney, 1979; Cano, 1989.

4.3.1.1. JASIST as the Source of Data and its Selection Rationale

In the present research, *Journal of the American Society for Information Science and Technology (JASIST)* was selected as the source from which the data was drawn to analyze the citation contexts. In order to answer the research questions, citation occasions to JASIST' highly cited papers were tracked to extract their citation contexts.

JASIST started out as *American Documentation,* with its first issue published in 1950. The "American Documentation Institute" changed its name to the "American Society for Information Science (ASIS)" in 1968 (Bates, 1999b), and two years later, the society changed the title of its affiliated journal, *American Documentation*, to *Journal of the American Society for Information Science (JASIS)*. In 2000, the society changed its name to American Society for Information Science and Technology (ASIS&T) and, accordingly, the title of its affiliated journal was changed to the current title, *Journal of the American Society for Information Science and Technology (JASIST)*, to emphasize technological advances in IS and to embrace a wide range of audiences from various fields who shared a common interest in Information Science and Technology[11] (American Society for Information Science and Technology, 2010).

JASIST as the source of data for the present research was mainly selected based on the consensus that is shared in the IS literature regarding its representativeness of the IS field. In IS literature, JASIST has been referred to as

[11] In 2013, the society changed its name to the Association for Information Science and Technology (ASIS&T)

one of the prominent, highly regarded, and well-respected scholarly journals in the IS field (Yang, 2009; Smith, 1999); a premier and preeminent journal (Nisonger, 1999; Kraft, 1999) that has accumulated numerous citations over the years. Previous researchers have emphasized its broad subject coverage along with its large pool of authors (Hooten, 1991, p. 398). In addition, JASIST has been described as a leading and even principal journal of the IS field (Chua & Yang, 2008; Harter & Hooten, 1992; Kim, 2009). Brooks (1999) labeled JASIS as a "journal of postmodern Information Science" (p. 1030). JASIST has also been specified as an accurate "representative journal of Information Science scholarship" (Sawyer & Huang, 2007, p. 1440; Tsay, 2008, p. 125), as an "oft-studied journal within Information Science" (Sawyer & Huang, 2007, p. 1440), and also as a probable "legitimate sole surrogate for Information Science" (Koehler, 2001, p. 117).

Aspects of JASIST authorship (Lipetz, 1999), author collaboration trends (Chua & Yang, 2008), and foreign authorship distribution (He & Spink, 2002) have been widely investigated in the literature. Bates (1999a), in an attempt to present "a tour of Information Science through the pages of JASIS", asserts that JASIS adequately represents "every significant area of research in Information Science" and its articles have proved to be "very influential in the development of Information Science research area" (pp. 975, 976). White and McCain (1998) used JASIS as a data source to visualize the disciplinary characteristics of IS. Nisonger (1999) reviewed 178 journal ranking studies, published in Library and Information Science literature between 1952 and 1997, and analyzed the position of JASIS in those rankings. The results of this study revealed that "JASIS has consistently been a highly ranked journal in the majority of studies", especially when citation-based criteria were used (p. 1017). This study also showed that "JASIS ranked in the top 5 for 15 of the 19 years from 1979-1997 in the annual [Journal Citation Report] (JCR) impact factor ranking" (p. 1008). Chua and Yang (2008) chose JASIST to explore multi-disciplinarity in IS and justified their selection based on the three compelling factors: First, JASIST "has been constantly ranked among the top-tier journals in Information Science …in terms

of total cites, impact factor and immediacy index"; second, the fact that it has been affiliated with ASIST for nearly six decades; and third, because it encompasses a broad range of topics within information science and does not limit its scope towards narrowly-defined areas (p. 2157)

Yang (2009) investigated the history and the development of IS through studying JASIST top 40 citation classics. In Cronin and Meho (2008), JASIST was ranked second in terms of total number of articles in the ISI database (*Library Quarterly*, a library science journal, was ranked first in this study) (p. 556).

Al-Sabbagh (1987) in his Ph.D. thesis, studied "the evolution of the interdisciplinarity of Information Science" using bibliometric methods. He conducted a survey to determine the best IS journal that adequately represents the field. He compiled a list of thirty IS experts, based on their contributions to the IS field over the last 25 years, their membership in ASIS, their teaching experience in the IS field, their experience in managing IS departments, schools, or colleges and also based on their membership in the editorial boards of IS journals. Then, in a mailed letter, he asked these experts to compile a ranked list of the five IS journals that they assumed to be the most representative of the field. *Journal of the American Society for Information Science (JASIS)* was the only journal that was selected by all 25 experts who responded to the researcher's request. This journal was also the first choice of 21 respondents. Based on the opinion of these experts, Al-Sabbagh used JASIS as the only source of data in his Ph.D. dissertation (pp. 72-77).

Nisonger and Davis (2005) conducted a "perception study" and asked the collective opinion of experts to rank seventy-one Library and IS journals on a 1 to 5 ordinal scale. Surveyed experts included thirty-seven deans, directors, or department chairs of schools with ALA-accredited LIS education programs and also fifty-six directors of ARL libraries. Results of this study revealed that LIS deans rated JASIST the most prestigious journal in terms of value for tenure and promotion (pp. 341, 350).

Two other factors that influenced the selection of JASIST as the source of data for the current research included its wide coverage and the large number of

abstracting and indexing services that cover this journal. The "scope note" of this journal, addressed to potential contributors and readers, illustrates the wide range of interests of this journal. The five main subject areas, and 48 sub-headings, presenting the most important aspects of the field, are listed below (American Society for Information Science and Technology, 2012).

.1. "Theory of Information Science

- Foundations of information science
- Information theory
- Bibliometrics
- Information retrieval -- models and principles
- Evaluation and Measurement
- Representation, organization, and classification of information: image analysis and recognition, non-text (non-print) and multimedia, hypertext and hypermedia
- Artificial intelligence -- natural language processing, expert systems

2. Communication

- Theories of communication
- Non-print media
- Human-computer interaction
- Network design, operation, and management
- Models and empirical findings about information transfer
- Collective intelligence computer-supported cooperation groupware
- Information transfer
- Innovation processes

3. Management, Economics, and Marketing

- Economics of information
- Information Policy
- Models of information in decision making
- Information resource management
- Services to special user groups
- User and usage studies: individual, organizational
- Social studies of information
- Strategic use of information

4. Applied Information Science

- Information systems design
- Applications of Information Science
- Scholarly case histories
- Information system operations
- Standards
- Information technology --hardware and software

- Automation of information systems
- Online retrieval systems
- Office automation and records management
- Archival systems management
- Electronic document management
- Electronic records, versioning, workflow, archiving, security
- Machine reasoning for retrieval
- Digital libraries
- Spatial information systems (GIS)

5. Social and Legal Aspects of Information

- Impact of information systems and technology upon society
- Ethics and information
- Legislative and regulatory aspects
- History of Information Science
- Information Science education
- International issues
- Information infrastructure
- Privacy
- Intellectual Property
- Copyright"

Moreover, this journal is covered by 53 indexes and abstracts:

- "ABI/INFORM Database (ProQuest)
- Academic Search (EBSCO)
- Business ASAP (GALE Cengage)
- Cambridge Scientific Abstracts (CSA/CIG)
- CAS: Chemical Abstracts Services
- Ceramic Abstracts
- Chemical Abstracts Service/SciFinder (ACS)
- CIJE: Current Index to Journals in Education (ERIC)
- COMPENDEX (Elsevier)
- CompuMath Citation Index (Thomson Reuters)
- CompuScience Database (FIZ Karlsruhe)
- Computer & Information Systems Abstracts (CSA/CIG)
- Computer Abstracts International Database (Emerald)
- Computer Science Index (EBSCO)
- CSA Advanced Polymer Abstracts
- CSA Civil Engineering Abstracts (CSA/CIG)
- CSA Computer Abstracts (CSA/CIG)
- CSA Computer information & Technology Abstracts
- CSA Mechanical & Transportation Engineering Abstracts (CSA/CIG)
- CSA Technology Research Database (CSA/CIG)
- Current Contents: Social & Behavioral Sciences (Thomson Reuters)
- Current Index to Statistics (ASA/IMS)
- EBSCO Masterfile Elite (EBSCO)
- EMNursing (Elsevier)
- Engineered Materials Abstracts (CSA/CIG)
- Ergonomics Abstracts (EBSCO)
- Expanded Academic ASAP (GALE Cengage)

- FRANCIS (CNRS)
- InfoTrac
- INSPEC (IET)
- International Aerospace Abstracts & Database (CSA/CIG)
- ISTA: Information Science & Technology Abstracts (EBSCO)
- Journal Citation Reports/Science Edition (Thomson Reuters)
- Journal Citation Reports/Social Science Edition (Thomson Reuters)
- Library Literature & Information Science Index (HW Wilson)
- LISA: Library & Information Science Abstracts (CSA/CIG)
- LISTA: Library, Information Science & Technology Abstracts (EBSCO)
- MasterFILE Premier (EBSCO)
- MasterFILE Select (EBSCO)
- Materials Business File (CSA/CIG)
- METADEX
- NISEE: Earthquake Engineering Abstracts (CSA/CIG)
- PAIS: Public Affairs Information Service (CSA/CIG)
- PASCAL Database (INIST/CNRS)
- Proquest 5000 (ProQuest)
- Proquest Discovery (ProQuest)
- Proquest Education Journals (ProQuest)
- Proquest Research Library (ProQuest)
- Science Citation Index Expanded™ (Thomson Reuters)
- SCOPUS (Elsevier)
- Social Sciences Citation Index (Thomson Reuters)
- Social SciSearch (Thomson Reuters)
- Web of Science (Thomson Reuters)"

(Wiley Online Library, 2012)

In the present study, the whole data set was limited to papers published in JASIST (from 2001 onwards), assuming that the appending of the term "technology" to JASIS and the time period after 2001 reflects not only recent IS literature, but also offers a vintage chance to observe a new era in IS research orientation in which influences of information technology play an important role (Chua & Yang, 2008, p. 2157). Eugene Garfield, incoming president of ASIS at the time in 1999, who for the first time proposed such a name change (from ASIS to ASIST), argued that this name change would reinvigorate ASIST to become a highly prestigious society that collaborates with many other information-related societies and would enable the ASIST to embrace the needs of practitioners as well as educators and researchers (Garfield, 1999).

Since any citation context analysis needs a minimum number of citing papers for each cited paper, the data set was limited to highly cited JASIST papers. These highly cited papers provided the present study with a sufficient

number of citing papers to explore citation contexts of highly cited JASIST papers. Table 25 compares the citation frequency of highly cited JASIST papers with the rest of JASIST papers and shows that 55 highly cited papers received 1945 citations until 2008, while 1355 non-highly cited papers received only 1107 citations.

Table 25: Highly Cited JASIST Papers versus other JASIST Papers along with their Citation Frequencies

JASIST papers (2001-2008)	N	Citation frequency (2001-2008)
Highly cited papers	55	1945
Non-highly cited JASIST papers	1355	1107

4.3.1.2. Highly Cited Papers: Selection Rationale and Criteria

4.3.1.2.1. Relevant Approaches

Highly cited papers have been widely investigated in previous studies, e.g., Ahmed et al. (2004), Case and Higgins (2000), Oppenheim and Renn (1978) and Shadish et al. (1995). Some researchers have reported that highly cited papers are usually less creative and are more likely to be thought of as exemplars than are other papers (Shadish et al., 1995, pp. 485, 489, 491). Case and Higgins (2000) suggested that highly cited works are usually concept markers, authored by widely recognized researchers in a field and usually feature literature reviews. This study emphasized that "highly cited documents are different and that difference is worth studying further" (p. 642). The higher research quality of highly cited papers has been also prominently addressed in the literature (Levitt & Thelwall, 2008). Some researchers have associated this quality with the numerous studies that have investigated various characteristics of highly cited papers. Asknes (2003) suggested that highly cited papers are "potential candidates for identifying and monitoring 'Excellent' scientific research" (p. 159). Tijssen, Visser, and Van Leeuwen (2002) concluded that highly cited papers represent "world class" research.

There is no standard definition for highly cited papers and accordingly no concerted methodology for selecting them, however, two different approaches are discernible in the literature. Previous studies have adopted either fixed or relative thresholds to identify highly cited papers (Aksnes, 2003). Fixed or absolute thresholds select a specific "citation frequency" (the frequency of citations that a paper has received), above which cited papers would count as highly cited papers. This approach has been widely applied in the literature (Garfield, 1977; Cano, 1990). Nevertheless, there is no consistent adherence to a citation frequency threshold in the literature: Cano (1990) noted that a paper "must receive 10 or more citations in the first year after publication to qualify for the label of highly cited" (p. 58). Aversa (1985) defined "very highly cited papers" as those that received 30 or more citations in a five-year time span after their publication year. Four years later, McCain and Turner (1989) followed Aversa criterion (30+ citations in 5 years) in selecting highly cited papers in molecular genetics field. Brooke, Nathan and Pawlik (2009) selected 50 top cited articles in their research and Smith (2008) opted for 10 articles with the highest citation frequency. Levitt and Thelwall (2009) examined 0.01 percent of the most highly cited articles, included in the "Information Science and Library Science" subject category, indexed in ISI Web of Science and published before 2007, and selected the top 82 articles to investigate their citation characteristics. Zhu, Wu, Zheng, and Ma (2004) labeled papers with 20 or more citations as highly cited papers. Aksnes and Sivertsen (2004) selected five top cited articles in each field for every year covered in their study. Nevertheless, they admitted that no specific criterion for selecting these five highly cited papers had been adopted and top five highly cited papers "may not be very highly cited" in small fields, compared to larger fields (p. 216). This comment echoes some critiques that have been raised in the literature regarding this approach: that an absolute or fixed threshold does not account for different attributes of scientific fields and also does not account for the various ages of papers. Some fields are larger and well-established and some fields are emerging and small. Also, citation counts accumulate over time and older papers are likely to receive more citations than recent ones.

In response to these critiques, another group of researchers adopted the second approach and opted for a relative citation threshold for defining or identifying highly cited papers. Glanzel and Schubert (1992) proposed:

> We say that a paper published in the journal j is highly cited if the number of citations it has received during a given period exceeds ks(j) = s. max(l, xj), where xj is the average citation rate of the journal j in the same period. In verbal terms, a paper is considered highly cited if it has received at least s citations, and the number of citations mounts at least s-times the average citation rate of the journal in which the paper has been published. The coefficient s is responsible for adjusting the final group size of selected papers. The term max (l, xj) contains a fixed component which has two functions, it filters noise and makes sure that the mean citation rate of highly cited papers increases with rising thresholds, i.e., with growing (p. 374)

Aksnes (2003) applied a method of selecting highly cited papers that had similarities to the method adopted by Glanzel and Schubert (1992), but included another criterion. Aksnes first calculated the average citation rate for each field, taking into account both the field size and publication time factor, then determined a threshold or "score value" of 17. Based on these factors, a paper was labeled highly cited if it had received 17 times the average rate of citations in that field and publication year. Nevertheless, Aksnes admitted that this threshold (17 times) was selected somewhat arbitrarily (p. 161).

Another source that follows the second approach, more similar to Aksnes' (2003) approach, is the Essential Science Indicator database. Thomson Reuters (formerly ISI) Web of Knowledge includes Essential Science Indicators as one of its databases. This database identifies most highly cited papers, highly cited authors, emerging research areas, top journals, and also the countries that have the highest impact in each research field (Thomson Reuters, 2010a). To select highly cited papers, Essential Science Indicators selects the top 1 percent of papers and then considers both field size and publication date to produce citation count thresholds, "corresponding to this top cut". Each threshold is specific to one broad field and one publication year, allowing "comparable representation" for older and more recent highly cited papers corresponding to each research field

(Thomson Reuters, 2010b; The Thomson Corporation, 2009). Essential Science Indicators has established highly cited paper thresholds for 22 broad fields for a 10 year period, from 2000 to 2010 (The Thomson Corporation, 2009). This database includes only two papers from *Journal of the American Society for Information Science (JASIS),* with 105 and 100 citation counts, both published in 2000. This journal belongs to the broad "Social Sciences, General" field, and, apparently, its highly cited papers have been selected based on the citation threshold established for this broad field (as demonstrated and bolded in Table 26, adopted from Thomson Reuters 2010b). For unexplained reason(s), this database does not cover *Journal of the American Society for Information Science and Technology (JASIST),* otherwise, the present research could benefit from this journal's highly cited papers list.

Table 26: Highly Cited Paper Thresholds for the Period of 2000-2010 (Thomson Reuters, 2010b)

Rank	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agricultural Sciences	103	91	83	79	65	51	39	29	18	8	3
Biology & Biochemistry	228	210	193	175	149	119	90	68	44	21	4
Chemistry	152	139	141	121	113	96	74	57	37	20	4
Clinical Medicine	196	180	173	157	137	116	89	66	41	19	6
Computer Science	71	76	80	54	40	36	26	25	16	8	3
Economics & Business	140	111	101	85	70	55	38	27	15	7	3
Engineering	71	67	62	58	51	41	33	26	16	9	
Environment/Ecology	155	144	141	119	107	86	65	48	29	13	4
Geosciences	139	124	109	94	82	70	56	39	26	12	5
Immunology	277	273	256	228	205	165	142	105	65	36	6
Materials Science	112	100	96	100	84	73	56	41	28	14	3
Mathematics	57	50	47	39	36	30	23	18	12	7	
Microbiology	198	178	169	148	136	115	89	58	40	18	4
Molecular Biology & Genetics	399	363	324	290	237	210	158	124	81	40	7
Multidisciplinary	84	97	125	114	81	106	79	64	55	29	11
Neuroscience & Behavior	266	260	221	184	156	134	107	74	46	22	4
Pharmacology & Toxicology	154	163	153	129	114	88	79	56	36	15	3
Physics	145	135	117	105	95	78	62	46	31	15	4
Plant & Animal Science	110	106	101	86	79	62	48	35	22	11	3
Psychiatry/Psychology	177	161	140	133	114	84	69	47	26	11	4
Social Sciences, general	**79**	**71**	**67**	**58**	**53**	**42**	**31**	**22**	**13**	**7**	**3**
Space Science	167	185	158	158	138	124	101	78	47	26	7

4.3.1.2.2. Selection Criteria Used in this Research

To allow comparable representation for older and more recent JASIST papers, the present research selected highly cited JASIST papers based on two criteria: citation counts and publication age. By using citation counts, the present research could collect sufficient citation contexts to investigate the research questions. By taking the time factor into account, the problem of publication age and its impact on citation accumulation could be circumvented. So while the nature of the present study and its demand for more citation contexts allowed the present research to adopt the first approach (using citation counts as a fixed or absolute threshold) to identify highly cited JASIST papers, the second approach (using the time factor as a relative threshold) helped the present research to identify those recently published and potentially highly cited papers that would be otherwise excluded from the data set.

For the purposes of the present research, Web of Science was searched for all papers published in JASIST from 2001-2008. A total of 51 top highly cited JASIST papers were selected as the data source for highly cited papers. A preliminary data review and screening showed that the total citation counts (around 500 citing papers) could provide the present research with time-wise feasible and manageable data. The maximum number of citation counts for these highly cited papers was 170 and the minimum number was 22. The researcher found this cut off citation threshold, 51 highly cited papers, similar to what was suggested by Brooke et al. (2009) (50 top cited articles), similar to the thresholds suggested by Aversa (1985) (30 times and more) and by Zhu et al. (2004) (20 times or more).

To include younger and potential JASIST papers that could not get into the selected 51 top highly cited papers due to their short publication age, the researcher used a "highly cited papers thresholds table" (illustrated in Table 26; developed by Essential Science Indicators) and focused on the row corresponding to the broad "Social Science, General" field. Then Web of Science was searched to find those JASIST papers with more than this row's thresholds citation counts for their publication year. This procedure added 4 more JASIST papers to the

selected highly cited papers, three papers published in 2007 and one in 2008, cited from 7 to 21 times. Consequently, following this procedure, the total number of highly cited JASIST papers identified for the present research and selected as the data source reached 55 highly cited papers.

4.3.2. Data Collection

In order to answer the research questions, the present study required the collection of both qualitative and quantitative data. Following the citation context analysis method, the implicit citation context of each citation occasion was analyzed and captured in citation categories that were later classified to ultimately form the citation scheme (to answer the first research question). In order to answer the second research question, the explicit citation contexts were analyzed to identify the sections of the citing papers in which the citation occasions were occurred. Also explicit citation context analysis helped to gather some quantitative data, including citation occasion frequency and co-citation frequency.

The following section outlines the steps taken to collect the required data. This section has been arranged based on the three different integrated sources of data collection focus: cited papers, citing papers and citation context.

4.3.2.1. Cited Papers

As the first step in collecting the data related to the cited papers, all selected 55 highly cited JASIST papers were first sorted by a "times cited" option and then were marked on the Web of Science database to be downloaded along with the needed detailed data. In the output file, the following fields were included: author, title, source, document type, times cited, keywords, cited reference count, page count, authors' addresses, and abstract. The downloaded file in tab-delimited (Windows) format was then imported into an Excel worksheet and each highly cited paper was given a unique identification code, from A1 to A74. These 55 selected papers constituted the "first generation" or "source papers" upon which later analyses and comparisons were based[12]. Papers A1 to

[12] See appendix B for a list of highly cited JASIST papers

A69 were sorted according to the total number of received citations. The last four papers (paper A70 to A74) were the last four added "potential" highly cited papers, which were selected later following the Thomson Reuters highly cited papers threshold table (Table 26).[13]

4.3.2.2. Citing Papers

Each of the selected 55 highly cited JASIST papers (the first generation papers) was connected to a number of citing papers (the second generation papers). For each cited paper, these second generation citing papers were retrieved from the Web of Science database (meaning that the second generation papers were limited to those papers indexed in the Web of Science database). The identified eight-year time frame for the present research (2001 to 2008) limited the number of second generation papers to 1945 citing papers (all the citing papers published after 2008 were eliminated from the data). The number of citing papers was then more refined to suit the purposes of the present research:

1. *Exclusion of IS/LS citing papers:* Based on the subject category of journals in which the citing papers were published, two distinct categories of citing papers were identified. Those published in journals with the "Information Science and Library Science" subject category, and the second group published in other journals, categorized in all other subject categories. Since the purpose of the present research was to explore the extent of the IS research impact on other disciplines (as reflected in citation contexts of highly cited JASIST papers), citing papers published in the first group of journals (with the "Information Science and Library Science" subject category) were excluded from the second generation or citing papers data set. In the present study, Journal Citation Reports (JCR) subject categories were used as representative of scientific disciplines and "citations outside category [was used] as an indicator of cross-disciplinary research activity"

[13] For details, see section 4.3.1.2.2. "Selection Criteria Used in this Research"

(Porter & Chubin, 1985, p.161). To explore the extent of the IS research impact on other disciplines, citations received from citing papers published in other disciplines were used as "radioactive tracer" to see where IS research eventually informs the research in other disciplines, and what the nature of this contribution is. This stage dropped the number of second generation papers to 492 citing papers.

2. *Exclusion of author self-citations*: Author self-citations were excluded from the analysis. Author self-citations occur when the citing paper has at least one author in common with the cited paper (Levitt et al., 2011, p. 1121), although the percentage of self-citations is usually low, it is generally omitted from citation investigations. In previous studies, self-citation has been frequently regarded as a common author behavior, through which authors may try to inflate their citation counts (Dolman & Bodewitz, 1985; White, 2001, p. 89). Bonzi and Snyder (1991) suggested that authors cite their own work to identify earlier work on which their current study built (as cited in Hanney et al., 2005, p. 376). White (2001) labeled this motivation as an "organic relationship" between cited and citing papers (p. 105). Self-citation has also been regarded as a "disturbing variable", a potential problem, and a source of error that presumably "appears to be excessive" and is "not worthy of careful study in their own right" (MacRoberts & MacRoberts, 1992, p. 344; Garfield, 1979; Lawani, 1982, p. 281). Hanney et al. (2005) argued that self-citations are "often viewed as unacceptable in evaluations of research performance" (p. 376).

   Previous studies have attempted to correct for this problem by either excluding self-citations, e.g., , Levitt et al. (2011), Chubin and Moitra (1975), Pettigrew and McKechnie (2001) and Larivière et al. (2012), or by equalizing for them (McCain and Turner, 1989). However, as MacRoberts and MacRoberts (1992) noted, little justification can be found in the literature for any particular approach (p. 344). As an instance of the second approach, McCain and Turner

(1989) included self-citations in their data, nevertheless, they allowed strong “penalties” for self-citations with “fractional index weights” within their devised formula of “utility index” , allowing self-citations to contribute “a much smaller increment to any summary measure” (pp. 132, 138).

There is also inconsistency in the rate of self-citations reported in previous studies. As discussed earlier, Chubin and Moitra (1975) ultimately excluded self-citations from their analysis, nevertheless, they reported a rate of 7 percent for self-citations. Tagliacozoo (1977) reported that self-citations amount to 16.6 percent in plant physiology and 17.5 percent in neurobiology (Lawani, 1982, p. 281). MacRoberts and MacRoberts (1992) reported a rate of 10 to 30 percent of all citations falling into the self-citation category. Lawani (1982) reported a 14.73 percent self-citation rate for 237 sample papers published in agronomy and a 10.11 percent self-citation rate for 109 sample research papers in cancer research literature. White (2001) reported a range of 3 to 8 percent for self-citation rates of eight prominent information scientists. Dimitroff and Arlitsch (1995) reported a 6.6 percent average self-citation rate for Library and Information Science authors. Snyder and Bonzi (1998) examined patterns of self-citation in six disciplines. Their results suggested that 9 percent of all citations were self-citations across all six disciplines. However, in the physical sciences, the rate of self-citation was 15 percent as opposed to 6 percent in the social sciences and 3 percent in the humanities (p. 431). Wallace, Larivière, and Gingras (2012) reported that the rate of self-citations hovers around 20 percent in natural and medical sciences and 10 percent in social sciences and humanities (p. 3). In another study, Larivière et al. (2012) reported that 14.23 percent of citations were self-citations.

The present study followed the first approach and consequently excluded self-citations from the analysis to ensure the consistency of

the data. Some self-citations were inevitably excluded in the first stage (when IS/LS citing papers were excluded). The rest, which were excluded in the second stage, amounted to 14.23 percent of outside IS/LS citations in the present study. Table 66 (appendix B) shows the number and percentages of self-citations that were excluded in the second stage. This exclusion reduced the number of citing papers (second generation papers) to 422.

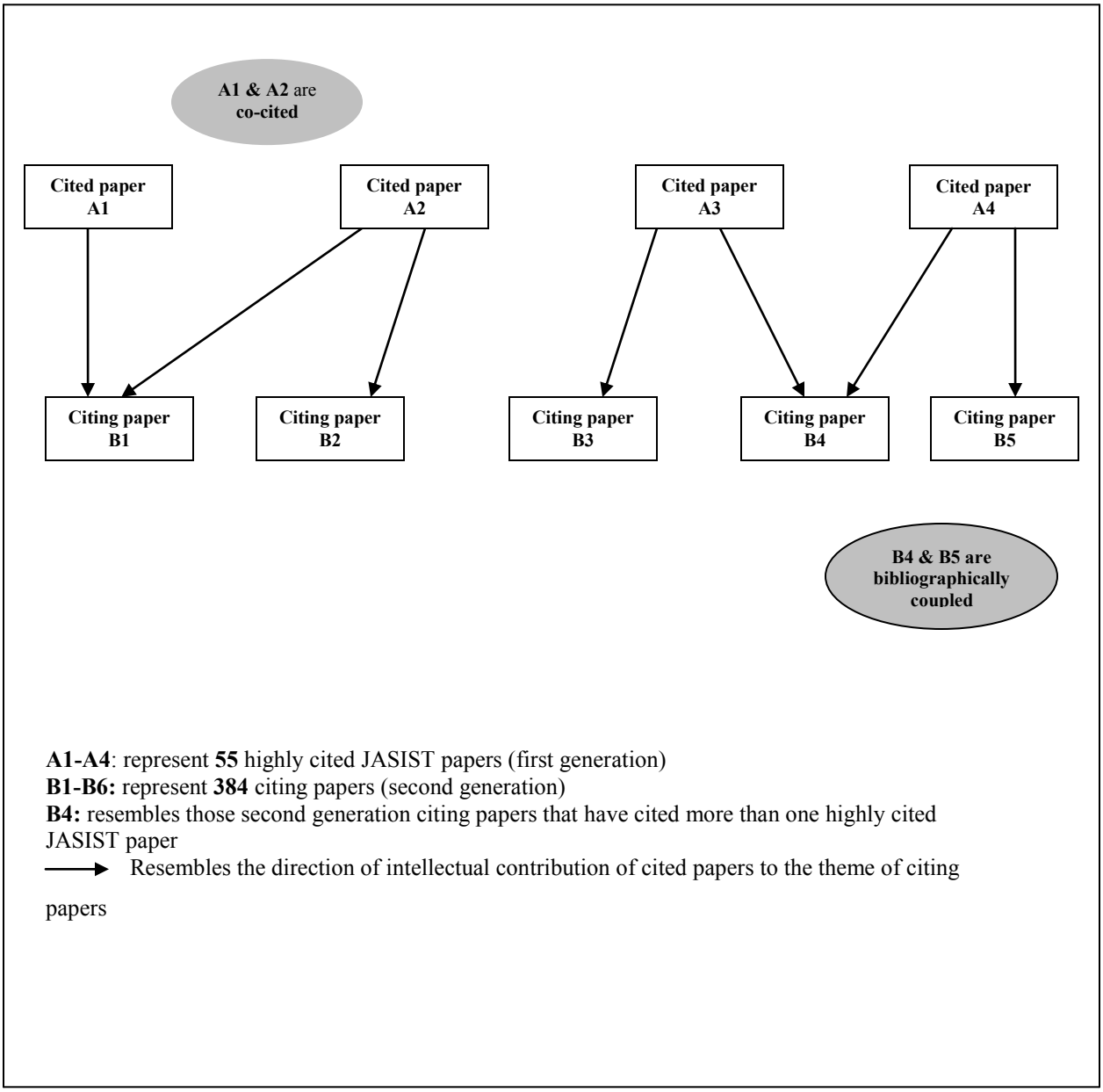
3. *Exclusion of print-only citing papers:* For the next step, electronic full text versions of 422 citing papers were retrieved, downloaded and saved in a folder labeled the same as their corresponding highly cited JASIST paper's identification number. Full texts were retrieved through the McGill Library web portal and also through Google Scholar. Out of 422 second generation citing papers, electronic full text version of 28 citing papers could not be located and they seemed to be available only in printed format. These 28 citing papers were excluded from the data set and this exclusion reduced the number of second generation papers to 394 citing papers. For those citing papers available solely in printed format, apart from the accessibility problem, locating each citation occasion within citing papers proved to be impractical.
4. *Exclusion of non-English citing papers:* Second generation papers were also limited to English language citing papers. Logistically, it was not feasible for the researcher to code the citation context adequately and accurately when she was not familiar with the language of the citing papers. On the other hand, translating non-English language citing papers required keeping the original tone and citation context similar to what the author meant in the source language, which proved impractical, and considering the low number of these papers (only 10 papers) unworthy for the current study. This limitation dropped the number of citing papers from 394 to 384 citing papers. Since some second generation papers had cited more than one first

generation highly cited JASIST paper, the list of citing papers included some duplicates and the unique number of second generation citing papers was 311 citing papers.

5. All of 311 citing papers were marked on the Web of Science database to be downloaded along with the needed detailed data. In the output file, the following fields were included: author, title, source, document type, times cited, keywords, cited reference count, page count, authors' addresses, and abstract. The downloaded file in tab-delimited (Windows) format was then imported into an Excel worksheet and each citing paper was given a unique identification code, from B1 to B384. These 384 second generation papers comprised the source of the data for citing papers, which included the citation context of highly cited JASIST papers.

The relationship between highly cited JASIST papers and second generation citing papers and the number of each group included in the analysis are depicted in Figure 2 (Hanney et al., 2005, p. 365).

Figure 2: Cited and Citing Papers' Relationship, Adopted from (Hanney et al., 2005, p. 365)



A1-A4: represent **55** highly cited JASIST papers (first generation)
B1-B6: represent **384** citing papers (second generation)
B4: resembles those second generation citing papers that have cited more than one highly cited JASIST paper
⟶ Resembles the direction of intellectual contribution of cited papers to the theme of citing papers

4.3.2.3. Citation Context

In order to answer the research questions of the present study, qualitative and quantitative data related to the citation context of each highly cited JASIST paper was needed. The data corresponding to first and second generation papers were also gathered to enable the present research to collect citation context data. The following section explains in detail the procedure undertaken to extract and collect citation context data:

1. Each time, one highly cited JASIST paper was picked from the list of highly cited papers and the electronic full texts of its corresponding citing papers were searched to retrieve the contexts of citation occasions. To find each citation occasion, the title of that selected highly cited JASIST paper was searched within its corresponding citing papers. When the title of a highly cited JASIST paper was retrieved within the "reference list" of a citing paper, then depending on the citation style used in the citing paper, the full text of the citing paper was searched by either the author name(s) or the reference number assigned to that cited paper in the "reference list" of citing paper. Sometimes the reference numbers were exclusive (e.g., 1-5), in that case, the whole paper was browsed to find relevant citation occasions.
2. Once a citation occasion was located within a citing paper, the whole paragraph containing the citation occasion(s) was copied and then pasted into a Word document. As soon as the paragraph was pasted into this document, the exact citation occasion(s) was highlighted within this paragraph and the Word document file was saved. The name of the file was the same as the identification code corresponding to its highly cited JASIST paper. As a result, each cited paper had one associated Word document that contained all the bibliographic information related to citing papers along with citation contexts data.
3. Each Word document contained a list of citing papers, sequentially numbered. For each citing paper, the title and author name(s) were recorded and bolded in the Word document. Also, the exact location of

each citation occasion was recorded (whether it was in “introduction”, “literature review”, “method”, “conceptual framework”, “results”, “conclusion”, or “discussion”). Figure 3 shows a sample page of such a Word document.

Figure 3: A Sample Page of a Citation Context Word Document Corresponding to a Highly Cited JASIST Paper (Web User Studies: A Review of Web Searching Studies and a Framework for Future Research, Authored by Jansen, BJ; Pooch, U)

1) Search-engine research: a European-American overview and systematization of an interdisciplinary and international research field
Marcel Machill, Markus Beiler and Martin Zenker
UNIVERSITY OF LEIPZIG, GERMANY

User behavior and competence

When formulating the search query most users do not exploit the possibilities that are available for narrowing down and precisely targeting the search. For example, only 49 percent of German users know about search operators (Machill et al., 2003b: 167). In addition, various log file analyses revealed that the majority of search queries consist of one-word searches and that, on average, only about 1.7 pages of the results list, each comprising 10 search results, are viewed and a maximum of 10 search results are clicked on **(cf. Jansen and Pooch, 2001)**. Also, there is often no reflection on the selection of the search results (Machill et al., 2003b: 272f.). However, Beiler (2005: 16f.) provides indications that this situation is not only to be explained in terms of a low level of competence. Instead, at a meta-level it can be rational and economically sensible if the form in which results are presented by search engines does not satisfy the demands for a selection process characterized by reflection.

2) Competent information search in the World Wide Web: Development and evaluation of a web training for pupils
Peter Gerjets a,*, Tina Hellenthal-Schorr b
a Knowledge Media Research Center, Research Unit Knowledge Acquisition with Hypermedia,
Konrad-Adenauer-Strasse 40, D-72072 Tuebingen, Germany
b Saarland University, Saarbruecken, Germany
Available online 11 April 2007

Introduction

Contrary to these promising introductory remarks with regard to the potential benefits and the ubiquitous availability of the WWW, however, the web is also characterized by several problematic features that impose additional cognitive processing demands and knowledge requirements onto information seekers. Due to these features, the web can be seen as "a unique searching environment that necessitates further and independent study" **(Jansen & Pooch, 2001, p. 244)**

For each citation occasion, a unique citation context identification number was assigned and recorded in an Excel sheet. In total, 55 highly cited JASIST papers were cited in 635 citation occasions, among which, 5 citation occasions were mentioned only in the "reference list" (without any reference in the text of citing papers). So the total number of citation context occurrences reached 630 citation occasions.

4. As discussed in the "Literature Review" chapter, Cano (1989) introduced the "citation location parameter as a novel bibliometric variable" (p. 284) to be used in conjunction with citation counts to improve the quality of citation counts for evaluative purposes. Later, other studies also focused on the notion of citation location and tried to identify its relationship with citation significance or citation level variables (McCain & Turner, 1989; Hanney et al., 2003; Hanney et al., 2005; Maricic et al., 1998; Huang, Nakamori, Wang and Ma, 2005; Tang & Safer, 2008)[14].

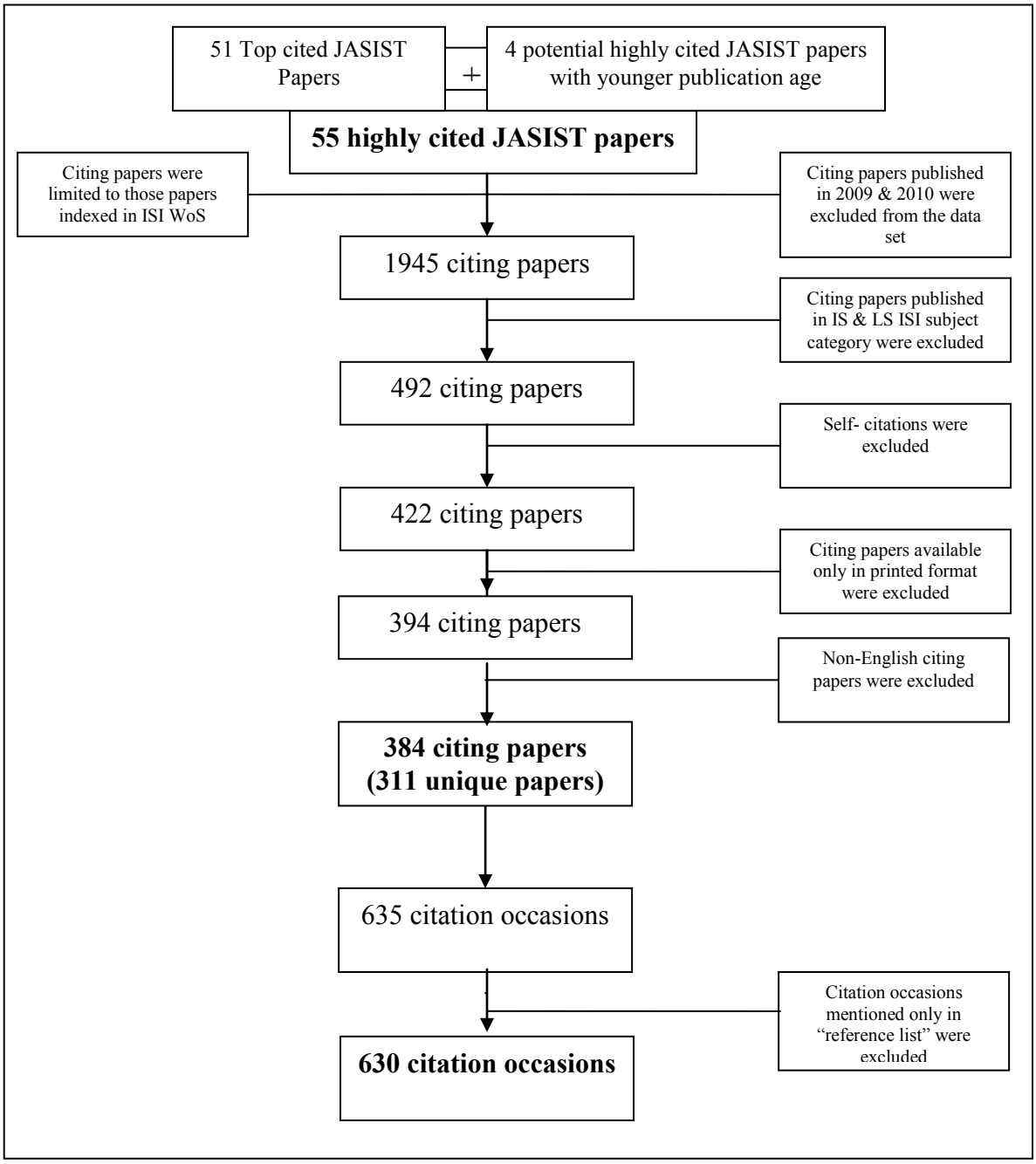
   For present research, the location that a citation occasion occupies in the citing paper is meaningful, because it sheds more light on the nature of citations. Given the purpose of the present research, the notion of "citation location parameter" was limited to the specific location/position of each citation occasion within the citing paper. This specific location was identified and recorded both in the Word document and the Excel sheet. Then all the recorded sections were grouped and the citation locations categories emerged from the data: "introduction", "literature review", "methodology", "conceptual framework", "results", "discussion", and "conclusion". Some review articles or proceedings papers lacked this rigid structure and, accordingly, did not include some standard sections, such as methodology or results sections. To include those citation occasions appearing in these papers, "in-text" section was appended to the citation locations categories. If a citation occurrence happened in more than one occasion in the same citing paper, the locations of all occurrences were recorded.

[14] For details, see the "Literature Review" chapter

If a citation occasion was mentioned in a second or third level sub-heading, the main heading and any possible second or third level sub-headings were also recorded; e.g., if the sub-heading was "theoretical framework", but it was under the "research methodology" main heading, subheading and main heading were both recorded.

5. When an author cites a cited paper more than once in the same citing paper, a "multiple citation occasions" variable is added to the textual properties of citations. White (2001) calls this reoccurrence "synchronic recitation" (p. 88). To answer the second and third research questions of the present study, the total citation occurrences of each highly cited JASIST paper in the same citing paper was also recorded in the Excel sheet. As discussed in the "Literature Review" chapter, previous studies explored whether multiple citation occasions are associated with more relevance, value, contribution, or significance of a cited paper to the theme of a citing paper (Voos & Dagaev, 1976; Bonzi, 1982; Chubin & Moitra, 1975; Herlach, 1978; Oppenheim & Renn, 1978; Small, 1982, p. 300; McCain & Turner, 1989; Hooten, 1991; Maricic et al., 1998; Hanney et al., 2005; Tang & Safer, 2008).
6. As one of the textual properties of each citation context, the number of co-cited papers in the same citation context was also recorded. The total number of co-cited papers in the same citation occasion was assumed to indicate the significance of the cited paper to the theme of the citing paper. When a highly cited JASIST paper was the only cited paper that appeared in a citation context, it could potentially convey a different meaning compared to the situation when it was co-cited with some other cited papers. This proposition was further explored and evaluated in the third research question of the present study. Figure 4 summarizes the data collected for the present research.

Figure 4: A Summary of the Data Collected for this Research



To facilitate the coding procedure, all collected citation context data, saved in Word document files, were imported into Nvivo, a qualitative data analysis software package. The following explains how citation context data were imported into the Nvivo software:

1. For each highly cited JASIST paper, a folder with the same identification code (as its corresponding highly cited JASIST paper) was created within Nvivo.
2. Within each highly cited JASIST paper folder, a document was created to include citation context data. The name of the document included the citation context identification number(s), identification code of highly cited JASIST paper and identification code of citing paper. For example, if a highly cited JASIST paper with identification code "1" was cited twice (in citing paper) with identification code "502" (with citation context identification numbers "23" & "24"), the name of the document within the folder "1" was "23 & 24-1-502". As a result, each document created in Nvivo software was a representative of the relationship between each highly cited JASIST paper, its corresponding citing paper, and its corresponding citation contexts data.
3. Then, the paragraphs including citation occasions were copied from its corresponding Word document into its associated Nvivo file.
4. In total, 50 folders were created in Nvivo software (as a result of excluding IS-LS subject category citing papers, and also self-citations and non-English citing papers, five highly cited JASIST papers with A5, A10, A51, A52, A54 identification codes were left with no citing paper)[15]. Within these 50 folders, 379 documents were created (5 citation occasions were mentioned only in the "reference list" section of the citing papers, without any citation occasion in the text of the citing papers). In sum, 630 citation occasions were imported into the Nvivo software.

4.4. Procedures for Data Analysis

The following section explains procedures undertaken to prepare data for the analysis. This section begins with a brief description of coding, and then proceeds with an elaboration of how the classification scheme of the present research was generated.

[15] See appendix B for a full description of these papers

4.4.1. Coding

Coding is an integral part of citation context analysis through which distinct units of meanings attached to each citation occasion are extracted. In present research, coding process started with reading each citation context to obtain a sense of the data. In the next step, citation contexts were re-read word by word to derive codes or units of meaning. Then the researcher made some notes of her first impression and initial analysis. As this process continued, identified units of meaning or initial codes were subsequently labeled to generate the initial draft of citation categories. Based on the similarities between initial drafts of citation categories, they were classified into appropriate macro-level categories to form the rough draft of citation scheme. As sorting the subcategories into macro-level categories proceeded, some macro-level categories were merged to form the main citation function categories. Next, exact definition for each category and its associated subcategories were developed (Hsieh & Shannon, 2005).

During the coding process, the citation categories that emerged were refined and re-evaluated for consistent coding. While each category was created with an initial and rough definition, these definitions were modified throughout the coding process. When a general category repeatedly emerged from the data, it was subdivided into two or more specific categories to precisely reflect the meaning attached to each citation occasion. When this decision was made, all the citation occasions coded under that general category were re-coded again, and the more specific new categories were used to re-code those citation occasions.

The coding process was guided by the Citation Cube Model, which is a compromise between the normative and constructivist theories of citations. Therefore, the coding approach used in this research can be called a “directed” or “deductive” approach to context analysis (Hsieh & Shannon, 2005). In this approach, the researcher tries to validate or extend an existing theoretical framework to focus coding process and further analysis. In addition, the fact that the citation scheme developed in this study was inspired by citation schemes

created in previous studies[16] provides another evidence for the "directed" or "deductive" approach to context analysis in this research.

The researcher purposefully avoided creating any category related to citation motivations, assuming that these motivations were potentially expressed more adequately by the citing authors themselves (through questionnaires or interviews). Therefore, the present research limited itself to the citation context and what was inferable from this context, contrary to citation motivations, which were beyond this context and were present in the minds of citing authors. For example, citation motivations such as "political pressure" or "persuasive" were avoided in the present research[17].

To initiate the coding procedure, Nvivo was used to capture implicit functions of citation occasions. Citation functions were initially coded as free nodes and each citation occasion was coded under one citation category. As coding proceeded and citation functions or categories repeatedly emerged from the data, a brief description was added to the free node's property to define each citation category. Throughout the coding process, these definitions were always subject to revision and refinement. Those citation occasions coded under the same citation category were constantly re-evaluated to ensure that they were conveying the same meaning. An intra-reliability assessment (coder agreeing with herself over time) was constantly performed to ensure the consistency of the coding (Wever, Schellens, Valcke & Keer, 2005, p. 8). In case of any inconsistency, the citation occasion was re-coded or moved to the citation category where it seemed more fitted. Free nodes presenting citation categories were arranged to create preliminary macro-level categories and then were re-arranged and eventually converted to tree nodes to create hierarchical relationships to form the preliminary version of the citation scheme.

Coding to extract implicit meanings embedded in each citation context required the researcher to analyze, judge, and infer the relationships between cited

[16] For details, see section 4.4.2.2. "Procedure for Devising the Citation Scheme"

[17] For details, see section 4.4.2.2.2: "The Content of the Citation scheme"

and citing papers. The researcher was privileged to have the necessary IS background to analyze the context more accurately, as previous studies have emphasized on the need for expertise, or at least familiarity, with the background or context of the citations for the researcher/coder (Holmes, 2002, p. 94).

4.4.2. Citation Scheme Designed for this Research

To provide a broad framework for identifying contributions of highly cited JASIST papers to the themes of citing papers, a citation scheme was specifically devised for the present research. The following section explains the purpose and content of this citation scheme and also outlines the procedures carried out to devise it.

4.4.2.1. The Purpose and Content of the Citation Scheme

The citation scheme developed in the present research was mainly devised to reveal relationships between highly cited JASIST papers and subsequent citing papers, reflecting the main purpose of the present research (to explore the nature of citations that highly cited JASIST papers received from subsequent citing papers). This main focus of this citation scheme is noteworthy as it justifies the main structure of the scheme and explains the selection of its main and sub-categories, later elaborated and discussed in the present study. Earlier citation schemes constructed in previous studies were used in a way that helped with the specific purpose and focus of present research.

The question of what to incorporate in a citation scheme is an important and strategic question in any citation context analysis study. As discussed earlier, citation motivations or reasons were not extracted or incorporated into the citation scheme. Besides the fact that exploring citation motivations was beyond the focus of the present research, incorporating citation motivations or reasons into the citation scheme would have required asking and consulting citing authors to give meanings to their own citations and most information about these motivations can only be gathered directly from citing authors (through interviews or questionnaires). This consultation was not logistically feasible for the present research and it proved impractical to infer these citation motivations from the

citation contexts or from an etic perspective (Moed, 2005, p. 26; Harwood, 2008). To illustrate this point further, in the Garfield (1962) list of citation reasons, there is a category as "paying homage to pioneers". Unless the researcher asks the citing author to state his/her citation motivation, it is not possible to understand this motivation based solely on the citation context. Some other examples of citation motivations, which were not incorporated into the citation scheme but were suggested in other researchers' citation schemes or list of citation reasons, may also be illustrative. These examples of citation motivations include but are not limited to: "persuasive" (Bornmann & Daniel, 2008), "citations for social reasons" (Shadish et al., 1995), "political pressure" or "raise citation count" or "there were no other sources of data" (Bonzi & Snyder, 1991), "the cited paper was published in an important (respected) journal", or "the cited paper was written by widely known, respected author(s) with absolute professional credit (reputation)", or "the paper was cited by other, too" (Vinkler, 1987), and "social consensus" (Brooks, 1985).

4.4.2.2. Procedure for Devising the Citation Scheme

The following section outlines the procedures carried out to generate the citation scheme specific for present research. Here it should be stressed that the ultimate goal was to understand relationships between cited papers and subsequent citing papers to reveal the contributions of cited papers to the theme of citing papers, rather than to construct a neat and inclusive citation scheme.

1. As discussed in the "Literature Review" chapter, there were already some generated citation schemes developed in previous studies upon which the present research could build. To benefit from these previous endeavors, the present research selected one of the most comprehensive schemes suggested by Bornmann and Daniel (2008) as the procrustean bed to which other schemes could be related and compared. This scheme is one of the few citation schemes in which all the categories have been exactly defined and the frequency percentage for each citation category found in previous studies has been identified.

2. As a result of this comparison, Table 65 (appendix A) was constructed. This table is similar to what Small (1982) created. As this table illustrates, the inclusive scheme of Bornmann and Daniel (2008) had the capability to encapsulate all the categories suggested by previous researchers**.** Of course, correspondences are not definite and some multiple assignments have been inevitable. Detailed definition of each main category suggested in previous studies was reviewed to ensure the consistency of categories listed under the same main category.
3. The major decision that the researcher had to make was whether to use one of the existing citation schemes and probably modify it based on the search questions, or to let the citation scheme emerge from the data. After a close look at existing citation schemes, three major shortcomings in existing citation schemes were identified: first, they seemed too general for the present research and this study needed more specific and well-defined citation categories to explain the meanings attached to each citation occasion; second, most of them entailed a mixture of citation motivations (ideally detectable through interviewing citing authors) and citation functions (attributed by researchers or coders to the citation context). For example, in Bornmann and Daniel's (2008) citation scheme, "persuasive" and "perfunctory" are two distinct categories that needed two different instruments to extract them. The coder/researcher may infer from the citation context that a citation is "perfunctory", because the citation occasion does not seem very crucial to the theme of citing paper, but it is not possible to ensure whether citation occasion has had a "persuasive" nature to influence the reader (unless we ask the citing author to identify his/her citation motivation). Beyond that, how would it be possible to differentiate between "persuasive" and "perfunctory" categories? This leads to the third problem: most of the citation schemes included some non-exclusive citation categories that were

poorly defined and a single citation occasion could be categorized under more than one category at the same time.

4. Due to the abovementioned shortcomings, the researcher decided to let the citation scheme emerge from the data. This approach does not mean that the citation scheme devised in the present research was absolutely detached from previous endeavors. Instead, the present research was inspired by all the citation categories created in previous studies and even some similar labels were used to describe main citation categories.
5. As was discussed in the coding section, free nodes related to citation categories were re-arranged to create preliminary main categories and then were converted to tree nodes to create hierarchical relationships to form a rough draft of a citation scheme specific for the present research. Through several iterations, main and sub-citation categories were refined and polished to serve the main purpose of the present study, revealing the nature of citations. The ultimate purpose was to have a multi-level citation scheme that could lend itself to consistent coding and could permit trends to be detected sufficiently. This citation scheme will be discussed later in the "Findings" chapter.

4.5. Limitations

Inevitably, the present study, as in all research, is limited by its research method and source of data.

Citation analysis has proved its worth in studying how earlier works are incorporated into subsequent citing papers. To indicate this incorporation, there should be consensus among a large group of citing authors and the view of a single author only counts when it is supported by the majority of other citing authors. However, a concern has been raised in the literature that sometimes authors fail to cite what they had incorporated in their studies. To circumvent this limitation, the size of the data set should be large enough in citation analysis, so even if minorities of researchers fail to cite some sources, the whole data set and its emergent pattern remain valid and reliable. This study focused on highly cited papers to obtain the highest number of citation occasions, but, in generalizing the results, this limitation should be acknowledged.

The present study needed citation contexts to investigate its research questions. Accordingly, 55 highly cited JASIST papers were selected as the source of data. There is a chance that citations made to highly cited papers be motivated by different reasons than citations made to less cited works. Previous studies have reported that highly cited papers are usually less creative (Shadish et al., 1995), concept markers (Case and Higgins, 2000), representing higher research quality (Levitt & Thelwall, 2008), "potential candidates for identifying and monitoring 'excellent' scientific research" (Asknes, 2003, p. 159), and representing "world class" research (Tijssen, et al., 2002). These possible peculiar characteristics may have some implications for the generalizability of findings that need to be acknowledged in the limitations.

For the purpose of the present research, the source of data was limited to citing papers indexed in Web of Science database. Web of Science covers "the most important journals" rather than complete coverage and does not index books. The data set selected for the present study could be larger in terms of publication coverage (to include books, monographs, and reports), or to include other citing papers covered and indexed in similar databases, e.g., Scopus or Google Scholar.

The present research is also constrained by other "limitations of ISI Web of Knowledge such as language biases and under representation of national and local journals" (McKechnie, Goodall, Lajoie-Paquette and Julien, 2005). While the current research was limited by this choice, its impact was minimized by the fact that the Web of Science database covers all disciplines equally and the notion of contributions of highly cited JASIST papers, which implies a comparative assessment of highly cited JASIST paper contributions to other disciplines, remains a valid and researchable question.

The policy of Web of Science to include journals or proceeding papers also may have imposed some limitations on the data. A few months after the data collection was completed, a considerable number of proceeding papers were added to the Web of Science database that could have been included in the data, however, it was not feasible for present research to include them. The data is also limited to the terms and conditions of McGill University's subscription to the Web of Science. The subscription may have limited the access to some citing papers and consequently may have impacted and/or limited the data and the analysis.

Another limitation that originates from selecting Web of Science as the source of data for the present research concerns the subject categories of Journal Citation Reports (JCR), to which journals are assigned. Since "all the articles in a journal are designated to the same subject category, there may be a loss of precision in the findings". However, this kind of "coarse-grained categorization" (Levitt et al., 2011, p. 1125) seems more likely to have the same effect for all citing disciplines and, consequently, would not influence the present study in a significant way.

The scope of the present study is limited to one journal, JASIST, the time line is limited to seven years (2001-2008), and only outside IS citations to highly cited JASIST papers have been examined. The rationale behind choosing highly cited JASIST papers as the source of data for the present research was already

discussed in the "Methodology" chapter[18]. As acknowledged there, although JASIST adequately represents many facets of the IS research area, no claim is made that JASIST represents the whole field or it is necessarily a representative sample of all IS journals or literature, especially that the field evolves rapidly and interacts actively with other disciplines.

Excluding non-English citing papers from the data set, during data collection procedure, may introduce another limitation to the present study. However, the small number of these papers (only 10 citing papers) and reliability concerns of the translated versions justifies this limitation. In addition, eliminating citing papers, which were available only in printed format, may have limited the data in some way. Apart from the accessibility issue, finding each citation occasion in a printed version demanded full scanning of these papers, which proved logistically impossible for the present research.

Classifying citation occasions according to a citation scheme is neither simple nor rapid. The greatest difficulty in terms of classifying citation occasions comes with the fact that it is not feasible to move into the heads of citing authors to see what have been their citing motivations. Another problem is the time needed to devise and undertake the classification scheme. An element of subjectivity involved in coding of citation contexts and generating the citation scheme introduces another limitation to the present study. Generating a citation scheme and assigning citation occasions to the appropriate categories remains a subjective decision and biases introduced by the individual researcher poses a limitation to the present study. To obviate this problem, an intra-reliability assessment (coder agreeing with herself over time) was constantly performed to ensure the consistency of the coding (Wever, Schellens, Valcke & Keer, 2005, p. 8). In case of any inconsistency, the citation occasion was re-coded or moved to the citation category where it seemed more fitted. Ideally, inter-coder reliability should also be employed. However, given the amount and depth of coding needed, this was not feasible within the time constrains of the present research.

[18] For details, see the "Methodology" chapter, section 4.3.1.1. "JASIST as the Source of Data and its Selection Rationale"

The results of the present research should be interpreted in light of operational definitions of the terms "discipline" and "contribution"[19]. Here it is acknowledged that not all scholars publish in their own scholarly journals and some may choose to cross disciplinary borders and publish in neighboring journals. Also, not all authors who publish in JASIST are affiliated with IS departments or associations. In addition, some IS scholars may choose not to publish in JASIST and prefer other journals, or may prefer to publish in books and other types of publications, or they even may choose not to publish and still have a significant contribution to other disciplines. In generalizing the results of the present study, this limitation needs to be acknowledged.

[19] See the first chapter, section 1.5. "Definition of Terms" for details

Chapter 5: Findings

This chapter is mainly concerned with the findings of detailed analyses of implicit and explicit citation contexts in order to reveal the nature of citations. Following a short description of cited and citing papers (as the source of data for the present research) at the outset of this chapter, findings will be presented according to the three research questions of the present study. While the first research question is mainly concerned with the analysis of implicit citation contexts to explore the function of citations, the second research question is addressed by analyzing explicit citation contexts, specifically citation locations, frequency of citation occasion occurrences and frequency of co-citation occurrences. In order to answer the third research question, results related to the impact of highly cited JASIST papers on subsequent citing papers will be presented at the end of this chapter.

5.1. Description of the Data: Main Characteristics of Cited and Citing Papers

5.1.1. Highly Cited JASIST Papers

Following the procedure that was discussed in the "Methodology" chapter[20], fifty-five highly cited JASIST papers were selected as the source of data for the present research. To each highly cited JASIST paper, a unique identification code was assigned, from A1 to A74. These selected highly cited JASIST papers constituted the "first generation" or "source papers", upon which later analyses and comparisons were based[21]. The following section summarizes some of the important characteristics of this data.

[20] See sections 4.3.1.2. and 4.3.2.1. for details
[21] See appendix B for a list of highly cited JASIST papers

5.1.1.1. Publication Year

As is illustrated in Table 27, 76.4 percent of highly cited JASIST papers were published from 2001 to 2003. This data confirms the fact that citation counts accumulate over time. This fact also justifies the decision to include a time factor in selecting highly cited JASIST papers[22].

Table 27: Publication Year of Cited Papers

Publication Year	Frequency	Percent	Cumulative Percent
2001	14	25.5	25.5
2002	19	34.5	60.0
2003	9	16.4	76.4
2004	5	9.1	85.5
2005	1	1.8	87.3
2006	2	3.6	90.9
2007	4	7.3	98.2
2008	1	1.8	100.0
Total	55	100.0	

5.1.1.2. Document Types

Table 28 shows that the majority of the highly cited JASIST papers (94.5 percent) were articles. However, there were also two instances of editorial material and one review among cited papers.

Table 28: Document Types of Cited Papers

Document Type	Frequency	Percent	Cumulative Percent
Article	52	94.5	94.5
Editorial material	2	3.6	98.2
Review	1	1.8	100.0
Total	55	100.0	

[22] For details, see section 4.3.1.2. "Highly Cited Papers: Selection Rationale and Criteria"

5.1.1.3. Number of Authors and Co-authors

As illustrated in Table 29, 36.4 percent of the cited papers were authored by one researcher, whereas 30.9 percent were written/co-authored by two authors. The rest of the cited papers (32.7 percent) had three to five authors. The median number of authors for cited papers was 2 with a standard deviation of 1.1. None of the highly cited JASIST papers had more than five authors.

Table 29: Number of Authors and Co-authors for Highly Cited JASIST Papers

No. of Authors	Frequency	Percent	Cumulative Percent
1	20	36.4	36.4
2	17	30.9	67.3
3	12	21.8	89.1
4	4	7.3	96.4
5	2	3.6	100.0
Total	55	100.0	

In total, 116 author/co-author names were identified for 55 highly cited JASIST papers, however, only 84 authors were unique names and the rest had contributed to two to six highly cited papers.

Table 30 illustrates those authors whose names appeared several times as authors/co-authors of 55 highly cited JASIST papers.

Table 30: Names that Appeared Repeatedly as Authors/Co-authors of Highly Cited JASIST Papers

Two Papers	Three Papers	Four Papers	Five Papers	Six Papers
Bilal, D	Cronin, B	Jansen, BJ	Thelwall, M	Spink, A
Bornmann, L	Ford, N			
Daniel, H-D	Foster, A			
Ellis, D	Vaughan, L			
Harries, G	White, HD			
Meho, L I.				
Saracevic, T				
Shaw, D				
Wilson, TD				
Wolfram, D				

5.1.1.4. Author and Co-author Affiliations

5.1.1.4.1. Number of Affiliations

As an indication of collaboration between researchers affiliated with various institutions, author affiliations for each highly cited paper were also recorded. As Table 31 shows, from 17 highly cited JASIST papers that were authored by two researchers, nine of them were written by two authors affiliated with two different institutions. Also among 12 highly cited JASIST papers that had three authors, six of them (half of them) were written by authors affiliated with two different institutions and one was authored by three researchers affiliated with three different institutions. The proportion of highly cited JASIST papers bearing a single address was 61.82 percent (authored by one to four authors). There was 32.72 percent of highly cited JASIST papers with two different affiliations (authored by two to five researchers); 1.82 percent had three author affiliations (written by three authors) and 3.64 percent bore four addresses (written by four authors).

Table 31: No. of Authors and No. of Author Affiliations Cross-tabulation

		No. of Author Affiliations				
		1	**2**	**3**	**4**	
No. of Authors	1	20	0	0	0	20
	2	8	9	0	0	17
	3	5	6	1	0	12
	4	1	1	0	2	4
	5	0	2	0	0	2
Total		**34**	**18**	**1**	**2**	**55**
Percentage		**61.82%**	**32.72%**	**1.82%**	**3.64%**	**100%**

5.1.1.4.2. Author and Co-author Affiliations by Discipline

As Table 32 illustrates, 52.6 percent of authors or co-authors (out of 116 authors/co-authors) were affiliated with a Library and/or Information Science school, college, department, or institution, and there were two librarians among the authors either. A total of 23.3 percent of authors/co-authors were affiliated with a Computer Science school or institution and 22.4 percent had an affiliation related to other disciplines. Other disciplines included Social Pharmacy and Pharmacoepidemiology (3 cases), Health Ethics and Philosophy (1 case), Industrial Engineering (2 cases), Industrial Sciences and Technology (1 case), Business School (2 cases), Sandia National Laboratories (3 cases), Management Information Systems (4 cases), Social Psychology and Research on Higher Education (5 cases), Economics (1 case), Environmental Science and Management (1 case), Biology (1 case), Psychiatry (1 case), and Language Studies (1 case).

Table 32: Author and Co-author Affiliations by Discipline

Institutions	Frequency (out of 116 total authors/ co-authors)	Valid Percent	Cumulative Percent
Library and/or Information Science	61	52.6	52.6
Computer Science	27	23.3	75.9
Other Disciplines	26	22.4	98.3
Librarians	2	1.7	100.0
Total	116	100.0	

Table 73 (appendix F) lists author affiliations by discipline for highly cited JASIST papers.

5.1.1.5. Main Topics

In order to extract the main topics of highly cited JASIST papers, they were searched and retrieved from the LISA database. All the topics presented in Table 33 have been extracted from the LISA thesaurus.

As shown in Table 33, highly cited JASIST papers belonged to two main subject areas: 1) bibliometrics (19 papers); and 2) information retrieval, searching, and information seeking behavior (28 papers). The rest (8 cited papers) belonged to Library and Information Science (2 papers), knowledge management (1 paper), knowledge discovery (1 paper), world wide web (2 papers), and Medicine, Biology, and Genetics (2 papers). In a similar study, Cronin and Pearson (1990) also divided "the tools and techniques papers" into two groups: bibliometrics and information storage and retrieval (p. 382). Table 67 (appendix C) lists all the main topics (extracted from the LISA thesaurus) for highly cited JASIST papers.

Table 33: Main Topics of Highly Cited JASIST Papers Extracted from LISA Database and Thesaurus

Cited Papers' ID	WWW	Searching	Citation analysis/ Bibliometrics/ Informetrics/ Webometrics/ Citations	User behavior/ Users/ user Interfaces/ Information seeking behavior	Children and young people	Information retrieval/ Computerized information storage & retrieval	Library & Information Science	Natural language processing	Knowledge Management	Knowledge discovery	Medicine/ microbiology/ genetics	Scholarly publishing	Main Subject Group**
A1	X	X		X									2
A2	X	X											2
A3	X		X										1
A4			X										1
A5	X		X										1
A6	x	X		X	X								2
A7		X				X							2
A8	X	X	X										1
A9	X	X				X							2
A10							X						3
A11						X							2
A12			X										1
A13	X												3
A14		X					X						2
A15						X							2
A16	X												3
A17			X				X						1
A18		X				X					X		2
A19								X					3
A20			X				X						1
A21		X				X							2
A22			X										1
A23	X	X		X	X								2
A24	X			X	X								2
A25		X				X							2
A26	X	X		X		X							2

Cited Papers' ID	WWW	Searching	Citation analysis/ Bibliometrics/ Informetrics/ Webometrics/ Citations	User behavior/ Users/ user Interfaces/ Information seeking behavior	Children and young people	Information retrieval/ Computerized information storage & retrieval	Library & Information Science	Natural language processing	Knowledge Management	Knowledge discovery	Medicine/ microbiology/ genetics	Scholarly publishing	Main Subject Group**
A27									X				3
A28		X				X							2
A29	X	X											2
A30	X	X		X		X							2
A31	X	X		X									2
A32		X		X							X		2
A33	X		X	X									1
A34	X	X		X		X							2
A35	X		X									X	1
A36	X	X		X		X							2
A37			X										1
A38	X	X	X										1
A39		X		X		X							2
A40											X	X	3
A42	X		X										1
A43		X		X		X							2
A44	X	X		X		X							2
A47										X	X		3
A50				X									2
A51	X	X		X	X	X							2
A53			X									X	1
A54			X								X		1
A57							X						3
A61				X									2
A69				X									2
A70			X								X	X	1
A71			X										1
A72			X										1

Cited Papers' ID	WWW	Searching	Citation analysis/ Bibliometrics/ Informetrics/ Webometrics/ Citations	User behavior/ Users/ user Interfaces/ Information seeking behavior	Children and young people	Information retrieval/ Computerized information storage & retrieval	Library & Information Science	Natural language processing	Knowledge Management	Knowledge discovery	Medicine/ microbiology/ genetics	Scholarly publishing	Main Subject Group***
A74			X				X						1

Group 1: citation analysis, bibliometrics, informetrics, webometrics, citations; Group 2: user behavior, users, user interfaces, information seeking behavior, searching and information retrieval; Group 3: other topics

5.1.1.6. Number of Citations Received

Highly cited JASIST papers differed substantially in terms of total citations received and also in terms of the number of citations received from outside the IS field. As shown in Table 34, on average, highly cited JASIST papers received 35.36 total citations with a standard deviation of 24.08. However, the median number of total citations was 28. The minimum number of total citations was 7 and the maximum number was 170 with a range of 163 total citations. As shown in Figure 5, the frequency distribution of total citations is an asymmetrical or skewed distribution. While the majority of cited papers had total citations of 22 to 46, a few highly cited JASIST papers had total citations of more than 46. Table 34 shows descriptive statistics for total number of citations received by highly cited JASIST papers. In Table 35 and Figure 6, the two outlier papers (cited papers A1 and A2) were excluded from the data. The number of total citations for these papers was more than three standard deviations from the mean (170 total citations for A1 and 108 total citations for A2).

Table 34: Descriptive Statistics for Total Citations Received by Highly Cited JASIST Papers

N	55
Mean	35.36
Median	28.00
Mode	24[a]
Std. Deviation	24.088
Minimum	7
Maximum	170
Sum	1945
a. Multiple modes exist. The smallest value is shown	

Figure 5: Frequency Distribution of Total Citations

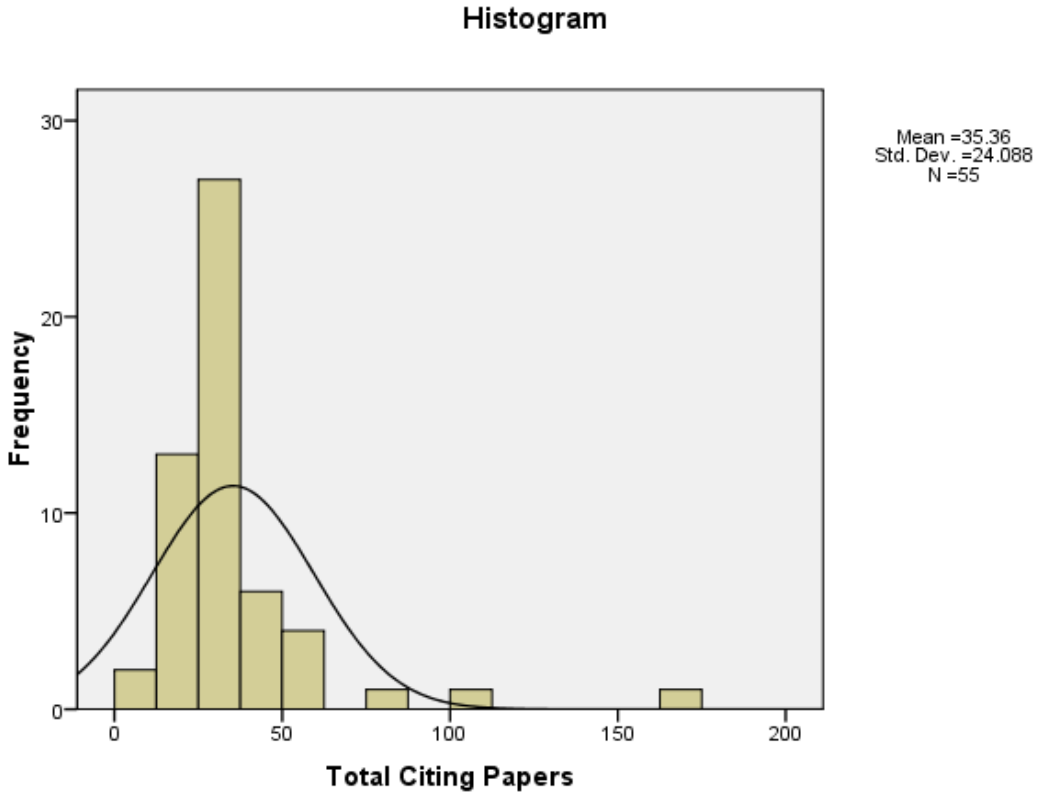
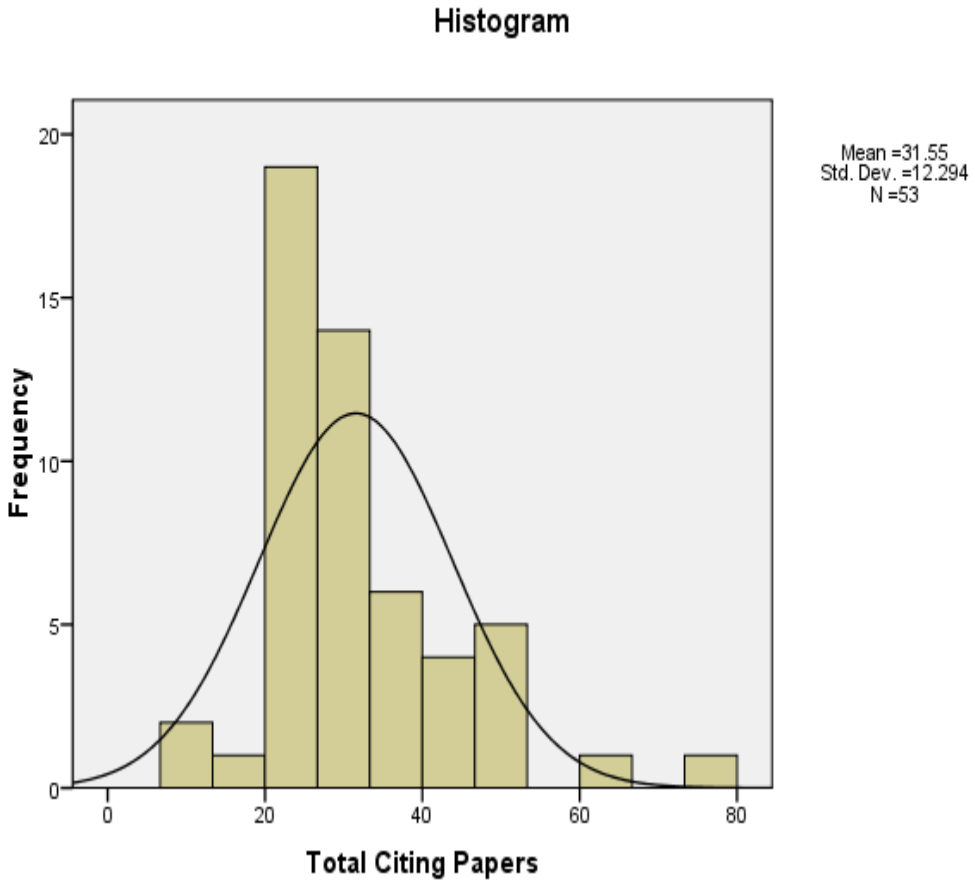


Table 35: Descriptive Statistics for Total Citations Received by Highly Cited JASIST Papers, Excluding the Outliers (Cited Papers A1 and A2)

N	53
Mean	31.55
Median	27.00
Mode	24[a]
Std. Deviation	12.294
Minimum	7
Maximum	77
Sum	1672
a. Multiple modes exist. The smallest value is shown	

Figure 6: Frequency Distribution of Total Citations, Excluding Outliers (Cited Papers A1 and A2)



In terms of number of citations received from outside the IS field, highly cited JASIST papers received 8.95 citations on average with a standard deviation of 9.66. However, the median number for citations received from outside the IS field was 6. The maximum number of citations was 57 and the minimum number was 0 with a range of 57 citations. As shown in Figure 7, the frequency distribution of outside IS citations is an asymmetrical or skewed distribution. While the majority of cited papers received between 1 and 11 outside citations, a few highly cited JASIST papers received more than 11 citations from outside the IS field, (see Table 36, Table 37, Figure 7 , and Figure 8 for details. Table 36 shows descriptive statistics for the number of outside IS citations received by highly cited JASIST papers. In Table 37, the outlier paper (cited paper A1) was excluded from the data. The number of outside IS citations for this paper was more than five standard deviations from the mean (55 citations).

The percentage of outside IS citations to total citations was also interesting. On average, highly cited JASIST papers received 25.3 percent of total citations from outside the IS field, however, the median number was 18.51 percent. The maximum percentage of outside the IS field citations was 85.19 and the minimum was 0, with a range of 85.19 percent.

Table 36: Descriptive Statistics for Outside Information Science Citations Received by Highly Cited JASIST Papers

N	55
Mean	6.98
Median	5.00
Mode	1
Std. Deviation	8.655
Minimum	0
Maximum	55
Sum	384

Figure 7: Frequency Distribution of Outside Information Science Citations

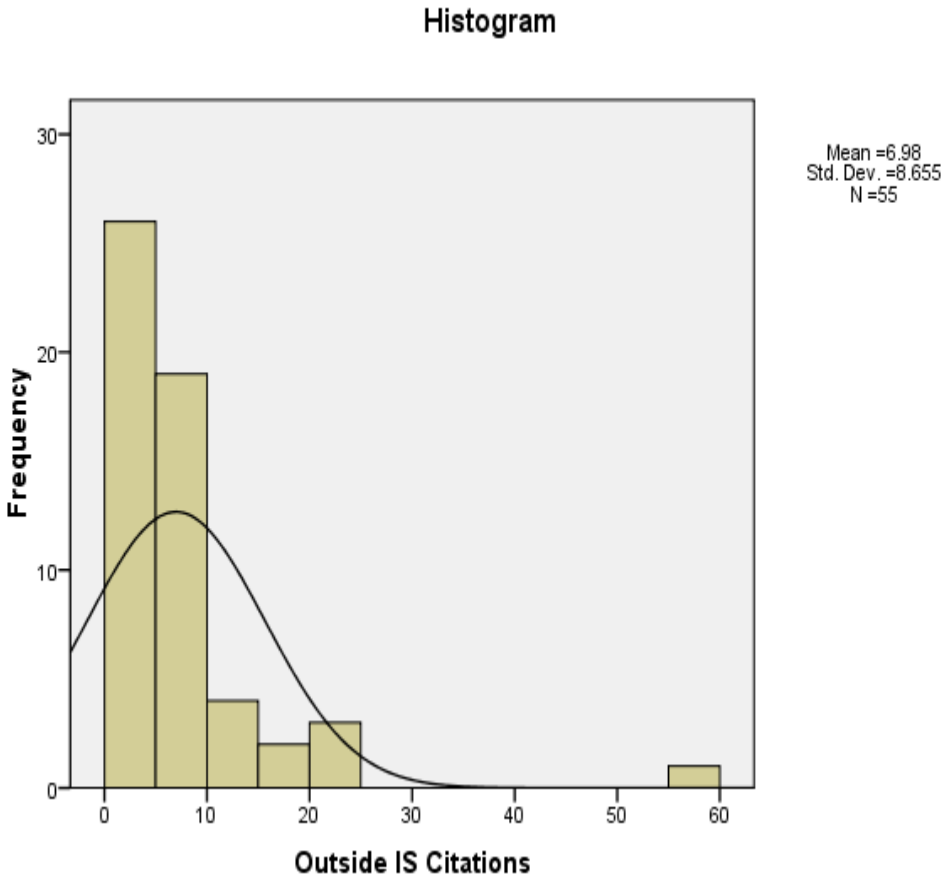
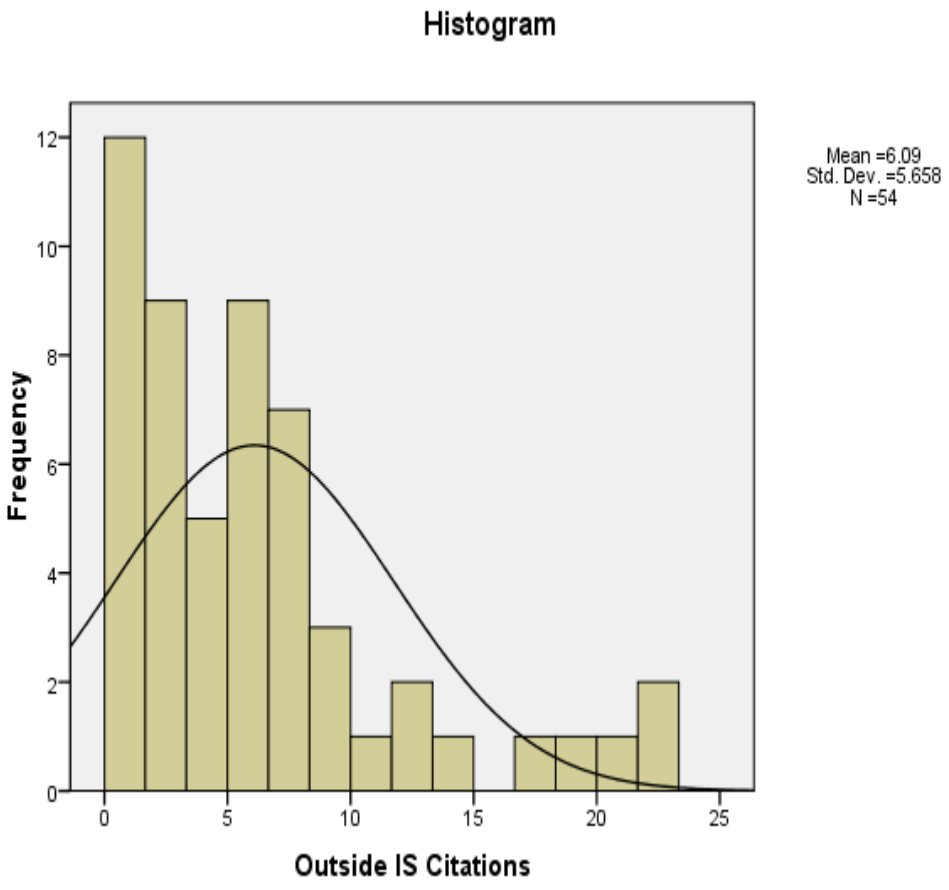


Table 37: Descriptive Statistics for Outside Information Science Citations Received by Highly Cited JASIST Papers, Excluding the Outlier (Cited Paper A1)

N	54
Mean	6.09
Median	5.00
Mode	1
Std. Deviation	5.658
Minimum	0
Maximum	22
Sum	329

Figure 8: Frequency Distribution of outside Information Science Citations, excluding the Outlier (Cited Paper A1)



5.1.1.6.1. Number of Citations Received versus Publication Year

In order to examine if total number of citations received correlates with publication year of highly cited JASIST papers, a Spearman Rho Correlation coefficient test was performed. Results suggested that number of citations negatively correlated with publication year ($R = -0.402$, $P = 0.002$). The negative value means that the earlier the year of the publication, the more the total number of citations received.

5.1.1.6.2. Number of Citations Received versus Main Topics

As discussed earlier, highly cited JASIST papers belonged to two main subject areas: 1) bibliometrics (including citation analysis, bibliometrics, informetrics, webometrics, and citations); and 2) information retrieval, searching, and information seeking behavior (including user behavior, users, and user interfaces). The third group included all other highly cited JASIST papers with a wide variety of main topics (including Library and Information Science (2 papers), knowledge management (1 paper), knowledge discovery (1 paper), world wide web (2 papers), and Medicine, Biology, and Genetics (2 papers).

The first group (bibliometrics), which included 19 highly cited JASIST papers received 31.79 total citations on average with a median number of 25. The second group (information seeking behavior, information retrieval, and searching), which included 28 papers, received 38.50 total citations on average with a median of 28.5.

When the number of citations received from outside the IS field was explored, while the first group (bibliometrics), which included 19 highly cited JASIST papers, received 5 citations on average from outside the IS field (with a median of 5), the second group (information seeking behavior, information retrieval, and searching) received 11.21 citations on average from outside the IS field (with a median of 8). As Table 38 and Table 39 illustrate, the second group (information seeking behavior, information retrieval, and searching) were more likely to receive more citations, both total citations and also citations from outside the IS field.

However, when the Mann-Whitney test [23] was performed to see if the difference is statistically significant, results suggested that the differences are not statistically significant [For total citations: *U=216.5, P=0.283*, for outside citations: *U=180.5, P=0.063* and for percentage of outside citations to total citations: *U=191.5, P= 0.106*], all *P* values are more than 0.05 critical value].

[23] This test was chosen because the distribution of the data was skewed

Table 38: Frequency of Total Citations and Outside Information Science Citations Received by Group One (Highly Cited JASIST Papers with Bibliometrics, Citation Analysis, Informetrics, Webometrics, and Citation Main Topic)

	Total Citing Papers	Outside Information Science Citations	Percentage of Outside IS Citations
N	19	19	19
Mean	31.79	5.00	17.4379
Median	25.00	5.00	16.1290
Mode	23[a]	1[a]	16.67
Std. Deviation	17.239	3.333	11.75112
Range	70	10	43.98
Minimum	7	1	3.85
Maximum	77	11	47.83

Table 39: Frequency of Total Citations and Outside of Information Science Citations Received by Group Two (Highly Cited JASIST Papers with User Behavior, Users, User Interfaces, Information Seeking Behavior, Searching, and Information Retrieval Main Topic)

	Total Citing Papers	Outside Information Science Citations	Percentage of NON-LIS Citations
N	28	28	28
Mean	38.50	11.21	28.1232
Median	28.50	8.00	20.1993
Mode	27	5	.00[a]
Std. Deviation	30.278	12.173	23.29011
Range	148	57	85.19
Minimum	22	0	.00
Maximum	170	57	85.19

5.1.1.6.3. Number of Citations Received versus Affiliations of the Authors

One may argue that the multidisciplinary nature of JASIST in terms of the affiliation of its authors/co-authors may allow this journal to receive more citations from outside the IS field, as these authors may be well-known in other discipline's literature and, accordingly, their colleagues may decide to cite their publications based on their acquaintance with the author.

To validate this argument, highly cited JASIST papers were divided into two groups in terms of their author affiliations: a) the first group included those papers with author(s) affiliated solely with an information/library school, department, college, institution or librarians; and b) the second group included those papers with at least one author affiliated with other institutions (non-Information Science schools, departments, institutions or librarians). 31 highly cited JASIST papers (56.37 percent) belonged to the first group and twenty four papers (43.63 percent) were assigned to the second group.

As Table 40 and Table 41 illustrate, there are some differences between the mean number of the two groups in terms of total number of citations, total number of citations received from outside the IS field and also the percentage of outside citations to total citations. However, when a Mann-Whitney test [24] was performed to see if the difference is statistically significant, results suggested that the differences are not statistically significant [For total citations: *U=362.5, P=0.872*, for outside citations: *U=290, P=0.163* for percentage of outside citations to total citations: *U=288.5, P= 0.156*].

[24] This test was chosen because the distribution of the data was skewed

Table 40: Frequency of Total Citations and Outside of Information Science Citations Received by the First Group of Highly Cited JASIST Papers (Papers with All Authors Affiliated with only Information/Library schools, Departments, Colleges, Institutions or Libraries)

	Total Citing Papers	Outside Information Science Citations	Percentage of outside Information Science Citations
N	31	31	31
Mean	31.39	6.87	20.8929
Median	28.00	5.00	16.6667
Mode	27	1[a]	14.29
Std. Deviation	9.298	5.852	17.03421
Range	35	23	85.19
Minimum	18	0	.00
Maximum	53	23	85.19

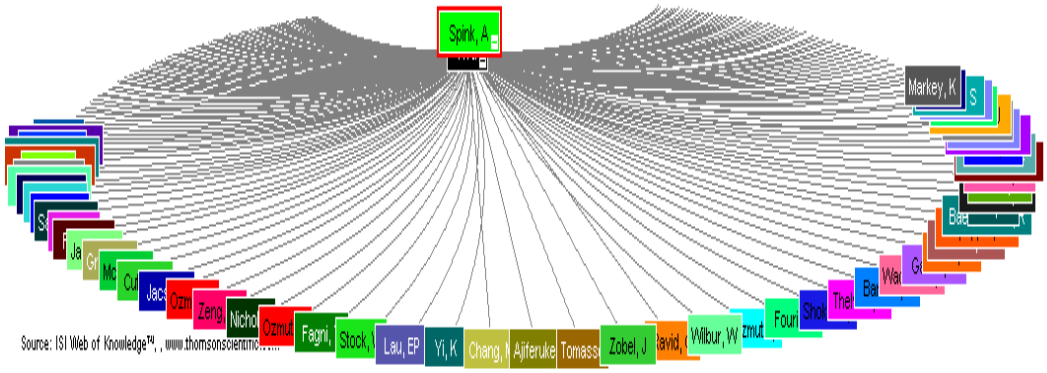
Table 41: Frequency of Total Citations and Outside of Information Science Citations Received by the Second Group of Highly Cited JASIST Papers (Papers with at least One Author Affiliated with Other Disciplines: Other Than Information/Library Schools, Departments, Colleges, and Institutions or Libraries)

	Total Citing Papers	Outside Information Science Citations	Percentage of outside IS Citations
N	24	24	24
Mean	40.50	11.62	30.5431
Median	28.00	8.00	25.2629
Mode	24[a]	2	16.67
Std. Deviation	34.651	12.703	23.40164
Range	163	56	78.91
Minimum	7	1	3.85
Maximum	170	57	82.76

5.1.2. Citing Papers

Figure 9 illustrates how an example of a first generation paper (highly cited JASIST paper) generated second generation (citing) papers. As is shown in this figure, each highly cited JASIST paper was connected to a number of citing or second generation papers. Following the procedure that was discussed in the "Methodology" chapter[25], 384 citing papers were identified as second generation citing papers. Since some second generation papers had cited more than one first generation highly cited JASIST paper, the list of citing papers includes some duplicates and the unique number of second generation citing papers was 311. The following section summarizes some of the main features of these citing papers. Only one highly cited JASIST paper was cited in 55 citing papers published outside the IS field. Three papers were cited between 20 to 22 times; six papers between 10 to 19 times; with the remaining papers (40 papers) cited less than 10 times during the 7-year period. There were five papers that received no citation outside of IS field journals (while they were still highly cited in terms of their total number of citations). Therefore, the number of citations (published in outside IS field) given to each of the first generation (cited) papers ranged from zero to 55.

Figure 9: An Example of the Relationship between Cited and Citing Papers (Source: Web of Knowledge http://cm.isiknowledge.com/viewCitationTree.do)



[25] See section 4.3.2.2. "Citing Papers" for details

5.1.2.1. Publication Year

81.8 percent of citing papers were published from 2005 to 2008 (see Table 42 for details).

Table 42: Publication Year of Citing Papers

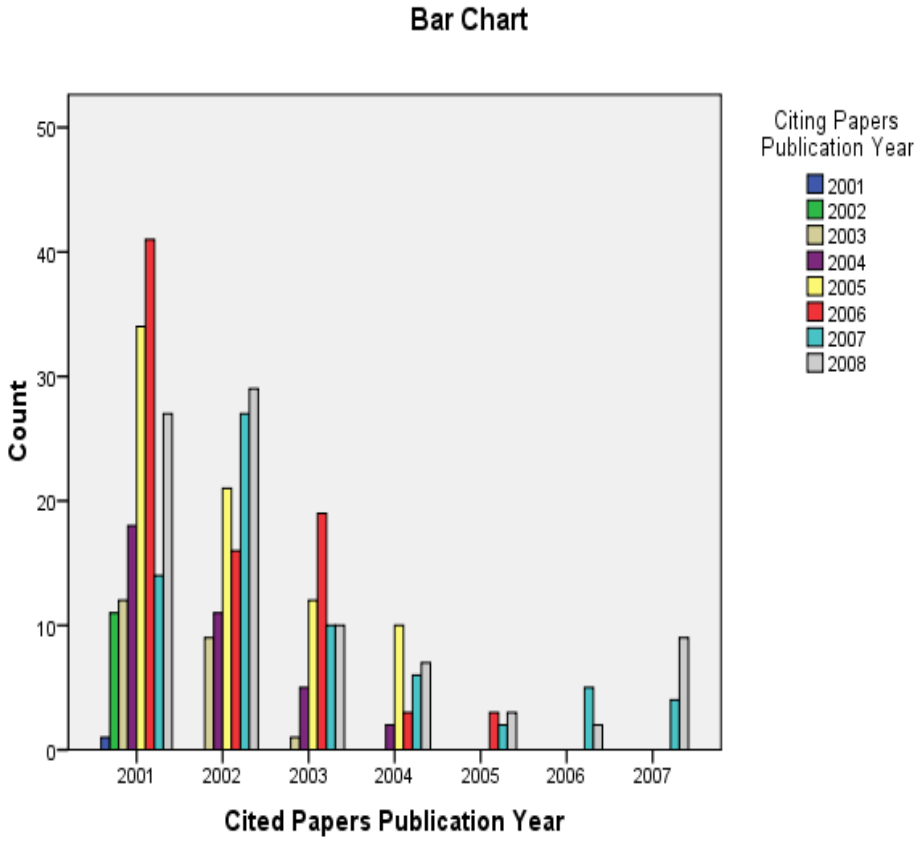
Publication Year	Frequency	Percent	Cumulative Percent
2001	1	.3	.3
2002	11	2.9	3.1
2003	22	5.7	8.9
2004	36	9.4	18.2
2005	77	20	38.3
2006	82	21.3	59.6
2007	68	17.7	77.3
2008	87	22.6	100.0
Total	384	100.0	

Table 43 cross-tabulates publication year of cited and citing papers. As shown below, for 2001 and 2002 cited papers, it took 5 to 6 years for them to mature in use and receive the maximum number of citations outside the IS field. However, for those published in 2003, the number of citations culminated in 2006, only 3 years after their publication. This downward trend continued for 2004 and 2005 cited papers, as the peak of citations occurred only one year after their publication. Nevertheless, it should be noted that cited papers published in 2005 again attracted more interest in 2008 (3 years after their publication). Figure 10 also illustrates the frequency and publication year of second generation (citing) papers.

Table 43: Publication Year of Cited Papers and Publication Year of Citing Papers Cross-Tabulation

		Publication Year of Citing Papers								
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Total**
Publication Year of Cited Papers	**2001**	1	11	12	18	34	**41**	14	27	**158**
	2002	0	0	9	11	21	16	27	**29**	**113**
	2003	0	0	1	5	12	**19**	10	10	**57**
	2004	0	0	0	2	**10**	3	6	7	**28**
	2005	0	0	0	0	0	3	2	3	**8**
	2006	0	0	0	0	0	0	**5**	2	**7**
	2007	0	0	0	0	0	0	4	**9**	**13**
Total		**1**	**11**	**22**	**36**	**77**	**82**	**68**	**87**	**384**

Figure 10: Number and Publication Year of Second Generation (Citing) Papers



5.1.2.2. Document Types

As Table 44 illustrates, most of the citing papers (66.7 percent) were research articles. Conference proceedings constituted 25.3 percent of citing papers. Also 4.7 percent of citing papers were reviews and the rest of citing papers (3.4 percent) were either editorial material or letters.

Table 44: Document Types of Citing Papers

Document Type	Frequency	Percent	Cumulative Percent
Article	256	66.7	66.7
Conference Proceeding	97	25.3	92
Review	18	4.7	96.7
Editorial Material	10	2.6	99.3
Letter	3	.8	100.0
Total	384	100.0	

5.1.2.3. Number of Authors and Co-Authors

Compared to highly cited JASIST papers, citing papers were more diverse in terms of the number of authors. Only 21.1 percent of citing papers were written by one author, 75 percent had one to three authors, and 15.4 percent had four authors. Less than 10 percent of citing papers had five to twelve authors. The median number of authors for citing papers was 2 and the mean was 2.73, with a standard deviation of 1.58. Table 45 illustrates the frequency and percentage of authors for citing papers.

Table 45: Number of Authors for Second Generation Papers (Citing Papers)

No. of Authors	Frequency	Percent	Cumulative Percent
1	81	21.1	21.1
2	117	30.5	51.6
3	90	23.4	75.0
4	59	15.4	90.4
5	24	6.2	96.6
6	2	.5	97.1
7	5	1.3	98.4
8	2	.5	99.0
10	2	.5	99.5
11	1	.3	99.7
12	1	.3	100.0
Total	384	100.0	

5.1.2.4. Subject Categories and Citing Disciplines

As an indication of the disciplines that cited highly cited JASIST papers, subject categories of citing papers were extracted from Web of Science database. Since in Journal Citation Reports (JCR)[26], subject categories are assigned to the journals (in which citing papers have been published), not to the individual citing papers, each subject category reflects the overall content of the citing journal, not specifically each citing paper.

As shown in Table 46, 56.2 percent of second generation (citing) papers were assigned to only one subject category, 39.6 percent of the citing papers were assigned to two to three subject categories, and 3.9 percent were assigned to four to five subject categories.

Table 46: Frequency of Citing Papers Subject Categories

No. of Subject Categories	Frequency	Percent	Cumulative Percent
1	216	56.2	56.4
2	117	30.5	86.9
3	35	9.1	96.1
4	10	2.6	98.7
5	5	1.3	100.0
Total	383	99.7	
Missing System[27]	1	.3	

Table 68 (appendix D) lists all subject categories (first, second, third, fourth, or fifth subject categories) and the frequency of citing papers that were assigned to each subject category[28]. In order to present the main subject categories, sub-categories were consolidated into more general subject categories. As shown in Table 69 (appendix D), 64.58 percent of citing papers were assigned to various Computer Science main and sub-subject categories. The rest (34.42

[26] For details, see the first chapter, section 1.5. "Definition of Terms"
[27] "Web of Science" record related to one of the citing papers did not include "subject category" field. Therefore, this citing paper was marked "missing data" for this table.
[28] Citing papers are published in journals, and journals are assigned to subject categories in Thomson Reuters' Journal Citation Reports (JCR).

percent) were assigned to other subject categories, mostly to Psychology, Education, Business, Communication, and Engineering.

As earlier mentioned, 43.5 percent of citing papers were assigned to more than one subject category. Therefore, in order to have a more accurate picture of subject categories, all first subject categories were extracted and presented in Table 70 (appendix D). To compare results obtained from Table 68 and Table 70 (appendix D), the first subject category (Computer Science, theory and methods) and its frequency is explained here as an example: between 18.23 to 20.83 percent of citing papers were assigned to the "Computer Science, theory and methods" sub-category. In other words, for 70 citing papers (18.23 percent) this subject category was the first subject category, and for 10 citing papers (2.6 percent) this subject category was the second, third, fourth or fifth subject category. Similar to Table 69, in Table 71, sub-categories have been consolidated to form the main first subject categories (appendix D).

5.2. First Research Question: Citation Functions

In the present research, function is defined based on the notions of impact and contribution; whether a cited paper contributes to the theme of a citing paper or whether it has a meaningful impact on the development of the citing paper's main theme. The citation scheme generated in the present research helped to demonstrate the function of cited papers in subsequent citing papers.

The following section explains an attempt to depict the potential contributions of highly cited JASIST papers to subsequent citing papers published in the literature of other disciplines through a citation scheme. As discussed in the "Methodology" chapter, a review of citation schemes devised in previous studies informed the present research to generate the citation scheme specific to this study. Through the coding process, distinct units of meaning attached to each citation occasion were extracted. Units of meaning were labeled to generate main citation categories and then through iterative round of analysis, categories were classified into appropriate macro-level categories to construct hierarchical relationships and, ultimately, form the citation scheme. The citation categories

that emerged were refined and re-evaluated to ensure that they conveyed the exact same meaning. The main purpose was to have a multi-level citation scheme that could lend itself to consistent coding and could permit the trends to be detected sufficiently, rather than to construct a neat and inclusive citation scheme.

In addition, given the main focus of the present research, which was more concerned with the impact of cited papers on citing papers, citation motivations or reasons were not explored or incorporated into the citation scheme when analyzing citation contexts.[29] Exploring citation motivations was beyond the focus and scope of the present research. Citation motivations may only be gathered directly from the citing authors (through questionnaires or interviews) and as was noted in the "Literature Review" chapter, using this methodology from an "etic" perspective (through the eyes of the analyst) was not feasible (Harwood, 2008, p. 1007).

Following the coding process and the procedure that was adopted for generating the citation scheme, five main functions embedded in the citation contexts were inferred and extracted. These five functions and their subsequent sub-functions are broken down in Table 47.

[29] For details, see the "Methodology" chapter

Table 47: Citation Scheme and the Frequency of Citation Occasions

Main Contributions (No. of Total Citation Occasions : 630)	Sub-categories	Citation Occasion Frequency
1. Applied: 4.45% (28 Citation occasions)	1.1. Data	5
	1.2. Index	4
	1.3. Analysis approach	3
	1.4. Research model	2
	1.5. Scale	2
	1.6. Concept	2
	1.7. Software/ tool	2
	1.8. Theoretical framework	1
	1.9. Criteria	1
	1.10. Algorithm	1
	1.11. Hypothesis	1
	1.12. Continuation/expansion/modification of previous studies	4
2. Contrastive: 7.3% (46 Citation occasions)	2.1. Comparative	19
	2.2. Affirmative	14
	2.3. Critical	13
3. Supportive: 8.25% (52 Citation occasions)	3.1. Methodology	36
	3.2. Findings	4
	3.3. Assumption	4
	3.4. Research purpose	3
	3.5. Data	2
	3.6. Sample size	1
	3.7. Algorithm	1
	3.8. Further research suggestion	1
4. Reviewed: 37.78% (238 Citation occasions)	4.1. Findings	80
	4.2. General topic	56
	4.3. Method	33
	4.4. General topic and findings	23
	4.5. Measures/ metrics/ scales/ schemes/ Index	13
	4.6. Comparative review	9
	4.7. General topic and contribution	7
	4.8. Concepts & definitions	6
	4.9. Method & findings	4
	4.10. Research suggestions	3
	4.11. Model	2
	4.12. Acknowledging authors' contribution	1
	4.13. Dependent & independent variables	1
5. Perfunctory: 42.22% (266 Citation occasions)	5.1. Noted	136
	5.2. Factual	124
	5.3. Further reading	6

5.2.1. Applied Function

When a citing paper borrowed or adopted a significant element from a cited paper and used it in developing its own theme or study, or when the whole cited paper inspired the citing paper to develop a significant element, or when a citing paper built upon a cited paper, expanded or furthered a cited paper's study, or even modified a cited paper's method or approach, the contribution of the cited paper to the citing paper was coded under the main category "applied". These significant elements could include a key concept or criterion, a method or technique, an analysis approach, a theory or a theoretical framework, a hypothesis, an algorithm, a design feature, a research model, data or material, an instrument or equipment or tool, a variable, an equation, an index, a scale or even software which were generated, described, documented or employed in the cited paper. In Hanney et al. (2005), the "applied" citation category showed the highest level or almost perfect level of agreement between 6 assessors, implying that this function is easily detectable and prominent in citation contexts.

Citation context data examined in the present study revealed that 28 citation occasions (4.45 percent) out of 630 total citation occasions conveyed an "applied" function. In total, citing papers included 20 articles, 7 proceeding papers, and 1 review paper. Table 48 lists all contributions grouped under the main "applied" category along with definitions (specific to the present research), and examples of citation occasion(s). For an in-depth description of cited papers associated with this citation function and an analysis of their contributions to the theme of citing papers, see appendix H.

Table 48: "Applied" Main Category: Definition, Frequency of Citation Occasions and some Examples of Citation Occasions

Sub-categories	Definition	Frequency of citation occasions	An example of a citation occasion
1.1. Data	Citing paper uses the same data set as cited paper or citing paper extracts its data from cited paper's data	**5**	In our experiments, we used fifty queries extracted from a well-studied query log from the Excite search engine **[9].** **Source: (Ali & Williams, 2003)**
1.2. Index	Citing paper uses an index borrowed from or similar to cited paper	**4**	All data were extracted from Relation Index **(Pudovkin & Garfield, 2002),** Journal Citations Reports, 2003–2005 Social Sciences Citation Index, Web of Science, and Thomson Scientific. NCA = National Communication Association; ICA = International Communication Association. **Source: (Feeley, 2008)**
1.3. Analysis approach	Citing paper uses the same analysis approach proposed by cited paper	**3**	By using the factor analysis method, the same approach proposed by **Ford et al. (2001**, 2002), it was possible to investigate the commonalities and differences among these indicators and to identify what these indicators conceptually represent the students' searching behaviors. **Source: (Vu & Gallinari, 2005)**

Sub-categories	Definition	Frequency of citation occasions	An example of a citation occasion
1.4. Research model	Citing paper borrows a research model from cited paper and explores its application in the context of its study	**2**	The research model was adapted from **Chen and Macredie (2002)** as it classifies previous studies and presents the effects of CS on hypermedia learning and the relationship between key areas (NL, LC and MT). This learning model forms a bridge between CS and hypermedia learning that can be applied for the design of adaptive hypermedia systems to tailored and match with particular preferences of FD and FD students. Furthermore, this research is further enhance with the integration of a quantitative aspect in verifying Chen and Macredie's learning model, given that they took a qualitative approach in presenting the effects of CS on hypermedia learning. **Source: (Lee, Cheng, Rai and Depickere, 2005)**
1.5. Scale	Citing paper uses a scale developed in cited paper	**2**	To measure this construct, we utilized a scale developed by **Wilson et al. (2002, p. 714)** used in measuring uncertainty reduction experienced by users engaged in problem-solving processes using online searches. **Source: (D'Ambra & Wilson, 2004)**
1.6. Concept	Citing paper acquires a concept from cited paper and integrates/uses it in its own study	**2**	Specifically, we integrate the concept of "uncertainty" (Wilson, 1999; **Wilson et al., 2002**) into the task-technology fit (TTF) model (Goodhue and Thompson, 1995; Mathieson and Keil, 1998; Goodhue et al., 2000) to evaluate Web usage within the non-work domain of personal travel planning and purchase. **Source: (D'Ambra & Wilson, 2004)**

Sub-categories	Definition	Frequency of citation occasions	An example of a citation occasion
1.7. Software/tool	Citing paper applies a software package or tool adopted from cited paper	**2**	Similarly, we filtered, normalized and clustered all of the microarray data in the TAIR database and made them available for mining using VxInsight, a 3-D terrain visualization software package (arabidopsis. org/tools/bulk/microarray/analysis/index. jsp) **[2].** **Source: (Weems, Miller, Garcia-Hernandez, Huala and Rhee, 2004)**
1.8. Theoretical framework	Citing paper adapts its theoretical framework from cited paper	**1**	The questionnaire was designed based on the theoretical framework adapted from **Chen and Macredie (2002)** characteristics and learning patterns of FD and FI individuals and it was also partially taken from Entwistle and Entwistle (1992) approaches to learning. **Source: (Lee et al., 2005)**
1.9. Criteria	Citing paper applies a criteria established in cited paper	**1**	Following the criteria established by Geissler and the similar ideas used by **Swanson [10]**, in the mining procedure, we consider many important properties of the virus such as the genetic aspects of virulence; airborne transmission of viral disease; and stability of viruses in air or aerosol mixtures etc… Our objective is to identify which viruses have been investigated with respect to these properties. **Source: (Hu, Yoo, Rumm and Atwood, 2005)**
1.10. Algorithm	Citing paper applies an algorithm borrowed from cited paper	**1**	The present analysis also takes advantage of a recent algorithm **(Pudovkin & Garfield, 2002)** that provides a more accurate measure of the semantic relationship between pairs of journals. **Source: (Feeley, 2008)**

Sub-categories	Definition	Frequency of citation occasions	An example of a citation occasion
1.11. Hypothesis	Citing paper adopts a hypothesis generated in cited paper	**1**	2) Resulting hypotheses generated by other text mining techniques using MIM were collected **[2],** [5], [12]. A list of 25 generated and filtered hypotheses was also presented to the experts without providing any indication concerning which ones were inferred by our model and which ones were generated by other systems. Column Four of Tables X and XI represent the evaluations using our method, and Table XII refers to the scored provided by MIM-based methods. **Source:(Atkinson & Rivas, 2008)**
1.12.a. Based on previous study	Citing paper bases its research/study on cited paper	**2**	The four research questions explored in the present study are based on **Bilal** (2000, **2001**) work with children's use of the Yahooligans! search engine and Slone's (2003) exploration of user goals and experience in relation to search effectiveness. **Source: (Smith, 2007)**
1.12.b. Modification of previous study	Citing paper modifies cited paper's study or approach	**1**	We developed a method to analyze bibliographies by modifying **Davis and Cohen's** approach. **Source: (Robinson & Schlegl, 2005)**
1.12.c. Expansion of previous study	Citing paper expands and furthers cited paper's study or research	**1**	To make this case we report on a study designed to further and expand upon the work of **Philip M. Davis and Suzanne A. Cohen** at Cornell University (2001). **Source: (Robinson & Schlegl, 2005)**

5.2.2. Contrastive Function

When a citing paper contrasted its data, method, model, theory, findings, etc. with what was used, documented, reported, or found in a cited paper, the contribution of the cited paper to the citing paper was coded under the main category "contrastive". "Contrastive" function was more specifically defined using three different sub-categories:

a. **Affirmative:** Citing paper confirmed, agreed, approved, verified, positively evaluated, or supported a claim, data, method, finding, etc., that was previously described or recorded in the cited paper. Sometimes results of the citing paper corresponded to a general trend reported in the cited paper, or the results reported in citing paper proved to be consistent with what was reported in the cited article.
b. **Comparative:** Citing paper just contrasted or compared its findings, approach, scheme, sample, method, etc. with cited paper without any further comments. Sometimes the citing author illustrated a point of view or finding and then compared it with a perspective or finding in the cited paper.
c. **Critical:** Citing paper negatively evaluated, questioned, critically analyzed, disapproved, corrected, criticized, disputed, negated, or even refused or refuted the entire cited paper or an element used or developed in it (e.g., data, method, model, results, etc.). Sometimes, the citing author pinpointed the cited paper's deficiencies and contrasted them to the strength of his own paper (Shadish et al., 1995, 482) and then suggested an alternative approach to obviate the cited paper's limitations and also to modify or improve its method or findings.

Citation context data examined in the present study showed that 7.3 percent of citation occasions (46 out of 630) conveyed a comparative function. In total, citing papers included 27 articles, 17 proceeding papers, 1 review paper, and 1 editorial material. Table 49 lists all the sub-categories coded under the main "contrastive" category along with definitions (specific to the present research) and examples of citation occasion(s).

Table 49: "Contrastive" Main Category: Definition, Frequency of Citation Occasions and some Examples of Citation Occasions

Sub-categories	Definition	Frequency	Examples of citation occasions
2.1. Comparative	Citing paper contrasts/compares its findings, approach, scheme, sample or method to what has been reported in the cited paper.	**19**	The average initial query length was 3.2 words, which is somewhat higher than, but comparable to, what has been found through Web query log analysis **[Spink et al. 2001].** **Source: (Teevan, 2008)** The fact that Spink et al. **[29]** recorded much longer user sessions in their work (the mean and median number of queries per user session were 4.86 and 8, respectively) for sessions carried out using Excite than we recorded for tasks carried out on Google may be due to several reasons **Source: (Chli & De Wilde, 2006)**
2.2. Affirmative	Citing paper confirms/supports cited paper's findings. Or citing paper's results are consistent with what has been reported in cited paper. Or results of the citing paper correspond to a general trend reported in the cited paper.	**14**	We observe that major Web sites do not often change their content though presentation or layer occasionally changes (as supported by rigorous studies such as **Koehler's** longitudinal study on Web page change and persistence **19**). **Source: (Chiu, 2005)** This is consistent with other studies of actual queries, which have shown that about 5%–10% are explicit phrase queries **[Spink et al. 2001**; Jansen and Pooch 2001] **Source: (Williams, Zobel and Bahle, 2004)**

Sub-categories	Definition	Frequency	Examples of citation occasions
2.3. Critical	Citing paper criticizes cited paper; mentions its deficiencies or what has not been stated, or achieved in the cited paper. Citing paper sometimes also pinpoints cited paper's limitations.	**13**	Although **Wathen and Burkell** presented a clear model of Web site evaluation, the sequence and recurrence of presumed, surface, and reputable evaluation are unclear. **Source: (Eastin, Yang and Nathanson, 2006)** Thus, **[14]** shows differences but it neither states that the reason for these differences is "the peculiarities of the Web users", nor does it discuss possible reasons for these differences. **Source: (Buzikashvili, 2005)**

5.2.3. Supportive Function

Sometimes citing authors made references to highly cited papers to establish the legitimacy of their topics, to substantiate an assumption or a claim, to justify their central arguments, data, or methods, to confirm their findings, or to support an assertion, an opinion, a method, or a result. In the present study, citing authors referred to highly cited JASIST papers to justify their algorithm, assumption, data, sample size, methodology, research purpose, or results or to justify further research suggestions.

Citation context data examined in the present study revealed that 8.25 percent of citation occasions (52 out of 630) conveyed a "supportive" function. In total, citing papers included 28 articles, 22 proceeding papers, 1 review paper and 1 editorial material. A closer look at the citation context data revealed that 69.23 percent of citation occasions (36 out of 52) coded under the "supportive" category helped authors to substantiate and justify their "research methodologies". The rest of the citations coded under the "supportive" category were meant to substantiate or legitimate the citing paper's algorithms, assumptions, data, research purposes, sample sizes, results, or further research suggestions. Table 50 lists all contributions grouped under the main category "supportive" along with definitions (specific to the present research) and examples of citation occasion(s).

Table 50: "Supportive" Main Category: Definition, Frequency of Citation Occasions and some Examples of Citation Occasions

Sub-categories	Definition	Frequency	An example of a citation occasion
3.1. Methodology	Citing paper justifies its methodology or its design based on what has been reported or found in the cited paper.	**36**	We used the individual ratings for only the first 10 search results as previous research has demonstrated that consumers of search engines typically looked at only the first page of the search results and clicked on the first few search results at the top of the page **[45**,56]. **Source: (Kumar & Lang, 2007)**
3.2. Findings	Citing paper substantiates its results or findings based on what has been suggested in cited paper.	**4**	The average query length was 2 words, which is in keeping with the average length of queries submitted by users of both Web search engines **[23]** and digital libraries [10]. **Source: (Bradshaw, 2003)**
3.3. Assumption	Citing paper justifies its assumption based on the similar assumption made in the cited paper. Or findings in the cited paper support or justify citing paper's assumption.	**4**	That is, we suppose that queries are the same length, regardless of the size of the collection that is being queried, an assumption that has some basis in observed user behavior **(Spink et al., 2001)** **Source: (Moffat, Webber, Zobel and Baeza-Yates, 2007)**

Sub-categories	Definition	Frequency	An example of a citation occasion
3.4. Research purpose	Citing paper supports its purpose based on what has been found or proposed in cited paper.	**3**	Given that some recent information systems researchers have proposed that information systems may support TMS and distributed teams **[1**,5,16], we also examined the consequences of our observations for the design and implementation of information systems based TMS. **Source: (Jackson & Klobas, 2008)**
3.5. Data	Citing paper justifies its data based on the findings of the cited paper.	**2**	Second, all our queries were originally submitted to the Excite search engine, introducing the possibility that these queries do not represent techniques of the general Web search engine user population. However, **Jansen and Pooch [2001]** have shown users of Web search engines exhibit common characteristics. **Source: (Eastman & Jansen, 2003)**
3.6. Further research suggestion	Citing author legitimates his further research suggestion based on the cited paper.	**1**	Checking an author's citation identity or citation image **(White, 2001)** would provide further information on his or her impact by examining the relationship between the number of articles produced and how often those articles are cited. **(Baker, Robertson-Wilson and Sedgwick, 2003)**

Sub-categories	Definition	Frequency	An example of a citation occasion
3.7. Algorithm	Citing paper refers to some results achieved in cited paper to justify its proposed algorithm	**1**	According to Search Engine Watch4, the busiest search engine serves 250M queries per day in Feb 2003. Based on the results in [6] and **[10],** we estimate that there are about 25% unique queries, which is 62.5M, and less than 1% queries occurring more than 100 times5. Assuming we process the top 10% queries and use the first 1,000 web pages returned for every query, the computation complexity of our proposed method will be 6.25*1010. Considering 3 billion web pages that are currently searchable on the Web, the computation complexity of traditional shingle-based algorithms will be close to 9*1018! As can be seen, our proposed query-dependent algorithm is linear to the number of queries, and thus it is much more scalable than shingle-based approaches. **Source: (Ye, Song, Wen and Ma, 2004)**
3.8. Sample size	Citing paper justifies its sample size based on what has been defined as sample size in cited paper.	**1**	Like many studies in new developed subject areas, the sample size of this study was rather small (e.g., **Bilal**, 2000, **2001**; Lin and Tsai, 2007; Fiorina, Antonietti, Colombo and Bartolomeo, 2007). **Source: (Tu, Shih and Tsai, 2008)**

5.2.4. Reviewed Function

Describing or reviewing relevant and similar prior studies always comprises a significant number of references in a paper. Citing authors usually provide their readers with some background reading to set the stage for the research area or problem. Sometimes citing authors introduce readers to the origin of an idea or concept discussed in their paper. This type of citation illustrates the history or state of the art of the research problem that is investigated in the citing paper, or reviews the current state of knowledge or research area in a subject field related to the citing paper. Usually citing authors acknowledge the pioneering achievements of other researchers and discuss a range of previous researchers' views on the topic. In sum, "reviewed" citations provide the readers with contextual information necessary to understand the broad context of the study or the significance of the research questions or problems of the citing paper.

A considerable number of citation occasions examined in the present study, 37.78 percent (238 out of 630), were coded under the main category "reviewed". In total, citing papers included 160 articles, 70 proceeding papers, 4 review papers and 4 editorial material. A closer look at the data revealed that citing authors mostly tended to report on findings or results of the previous relevant studies (33.61 percent), general topic of the cited papers (23.53 percent) and also previous studies' methodologies (13.86 percent). 9.66 percent of citation occasions also reviewed both general topic and findings of the cited papers. The rest of the citation occasions (15.14 percent) described and reviewed previous studies' concepts and definitions, variables, contributions, measures/ metrics/ scales/ schemes/ Indices, models or research suggestions. In one citation occasion, citing author acknowledged the contribution of cited author to the citing paper and made a reference to a relevant paper authored by cited author. In 9 citation occasions (3.78 percent), some relevant prior papers were reviewed and compared without any relationship to the citing paper. Table 51 lists all the contributions grouped under the main category "reviewed", along with definitions (specific to the present research) and examples of their citation occasion(s).

Table 51: "Reviewed" Main Category: Definition, Frequency of Citation Occasions and some Examples of Citation Occasions

Sub-categories	Definition	Frequency	An example of a citation occasion
4.1. Findings	Cited paper reports on the findings or results of cited paper.	**80**	**Spink et al. (2001)** reported that the average number of terms included in a search query was between two to three. **Source: (Lin & Soibelman, 2007)**
4.2. General topic	Citing paper reports the general topic of the cited paper	**56**	**Koehler** (1999, **2002**) studied changes in Web pages to understand the extent to which pages and their content are stable, and whether different types of pages have different characteristics in terms of content and stability. **Source: (Ryan, Field and Olfman, 2003)**
4.3. Method	Citing paper reviews the method of cited paper	**33**	In one attempt to quantify content lifetime, 360 randomly selected web pages were tracked for a period of four years, and a half-life of only two years was measured for the set **(9).** **Source: (Benson, Karsch-Mizrachi, Lipman, Ostell and Wheeler, 2008)**
4.4. General topic and findings	Citing paper reports on the general topic and findings of the cited paper	**23**	Some researchers, such as Silverstein et al. [49] and **Spink et al. [53**,50] have performed content analysis of Web search engine data logs at the term level and topic level and found that user queries were mostly on entertainment, pornography, travel and commerce. **Source: (Ozmutlu, Cavdur and Ozmutlu, 2006)**

Sub-categories	Definition	Frequency	An example of a citation occasion
4.5. Measures or metrics or scales or schemes or index	Citing paper reports on measures or metrics or scales or schemes or indices suggested or used in the cited paper	**13**	**Kekäläinen and Järvelin** (2002a, **2002b**) suggested graded relevance assessment measures based on cumulated gain, which are related to traditional measures such as expected search length (Cooper, 1968), average search length (Losee, 1998), and normalized recall (Rocchio, 1966, Salton and McGill, 1983). **Source: (Typke, Wiering and Veltkamp, 2007)**
4.6. Comparative review (without any relation to the citing paper)	Citing paper compares two or more cited studies, without any obvious relation to the citing paper.	**9**	Some experimental findings supported the notion that field-dependents and field-independents (Chang, 1995; Chuang, 1999; Reed and Oughton, 1997), as well as holists and analytics (Lee and Hsu, 2004), navigate hypermedia differently, whereas other investigations failed to prove it (**Chen & Macredie, 2002**; Chou, 2001; Graff, 2003a; Riding & Grimley, 1999). It is difficult to identify the reasons for these discrepancies as the various researchers employed different methodologies and kinds of samples, so that direct comparisons between the studies carried out have been impossible. **Source: (Fiorina et al., 2007)**

Sub-categories	Definition	Frequency	An example of a citation occasion
4.7. General topic and contribution	Citing paper describes the general topic and significance/contribution of cited paper	**7**	If we look at the tasks of studies [12], [17], [24] mentioned in **[14]** as a base for conclusions about TIR search, we discover a coverage orientation of these externally assigned tasks: a partial coverage of topics and apparent coverage of documents (inquiry to search as many documents as possible). **Source: (Buzikashvili, 2005)**
4.8. Concepts & definitions	Citing paper cites a concept that has been reviewed or elaborated in the cited paper	**6**	A widely cited definition based on Messick's (1984) defined cognitive style as individual differences in preferred ways of organising and processing information and experience (**Chen & Macredie, 2002**; Sadler-Smith, 2001; Triantafillou, Pomportsis, & Demetriadis, 2003). **Source: (Lee et al., 2005)**

Sub-categories	Definition	Frequency	An example of a citation occasion
4.9. Method & findings	Citing paper reports on the method and findings of the cited paper	**4**	**Bilal** (2000, 2001, **2002**) has taken task characteristics as the starting point for three studies on the Web-search activities of children (see also the "Characteristics of Search Strategies" section). The same group of students were given a "factbased search task" (searching for an answer to a factual question), a "research task" (searching for information to answer an inquiry), and a "fully self-generated task" (searching for information on an inquiry they had thought of themselves). For the last two tasks the students were asked to mark relevant texts on a printout; for the first they were expected to find the correct answers. In fact, two sorts of task characteristic were involved here. Differentiations are made, on the one hand, between "imposed" and "self-generated" tasks and, on the other hand, between an information query (well-defined) and a research query (ill-defined). The students had the most trouble with the research task and were most successful with the question of their choice. **Source: (Kuiper, Volman and Terwel, 2005)**
4.10. Research suggestions	Citing paper reports on some suggestions made in the cited paper	**3**	Given that many potentially valuable results are likely to be ignored, **Spink et al. [1]** assert "We need a new generation of Web searching tools that work with people to help them persist in electronic information seeking to resolve their information problems. **Source: (Anderson, Hussam, Plummer and Jacobs, 2002)**

Sub-categories	Definition	Frequency	An example of a citation occasion
4.11. Model	Citing paper reviews the model suggested and developed in the cited paper	**2**	Several models considering the relationship of information seeking and uncertainty have emerged from the Information Science discipline (Belkin, 1980; Kuhlthau, 1993, 1996, 1997, 1999; Wilson, 1999; **Wilson et al., 2002)**. The Wilson model is particularly salient in identifying stages in the problem resolution process that are identifiable and recognisable to the individual. **Source: (D'Ambra & Wilson, 2004)**
4.12. Acknowledgement	The contribution of cited paper' author along with his article is acknowledged in the citing paper	**1**	Marc Weeber, an enthusiastic, visionary informatics researcher **[13**, 14], gave us crucial assistance at the start of the project; and Vetle Torvik, a brilliant and creative young mathematician [15, 16], has joined us as Project Manager. **Source: (Smalheiser, 2005)**

Sub-categories	Definition	Frequency	An example of a citation occasion
4.13. Dependent & independent variables	Independent and dependent variables defined in cited paper are reviewed in citing paper	**1**	**An example of a citation occasion:** **Table 1** Behavioral variables: a summary from the information search literature Research article Independent variables Dependent variables Hsieh-Yee [29] Search experience End-user search Subject knowledge tactics Hoischer and Strube [28] Web experience Search tactics Domain-specific knowledge Search process Search task Search success **Spink et al. [46]** Uncertainty Search processes Cognitive styles Information-seeking Successive episodes search behavior **Source: (Kumar & Lang, 2007)**

5.2.5. Perfunctory Function

A large number of citation occasions examined in the present study had little importance, significance, or contribution to the theme, analysis or results of the citing paper. Citing authors made these perfunctory references to the cited papers without additional comments. Usually more than one citation was mentioned in the same context, the cited paper was apparently not very relevant to the citing paper's immediate concern or theme and the citing author made no attempt to compare or analyze the cited paper's contribution to the citing paper (Bornmann & Daniel, 2008). These citation occasions were coded under the "perfunctory" citation category solely based on the context of citations. It was neither the purpose nor within the methodological limitation of the present research to explore citer motivations or reasons behind their citation decisions.

Based on citation context data, perfunctory citations were categorized into three sub-categories:

a) Noted sub-category: cited paper is part of the relevant literature but "it neither serves an explicit role in the analysis nor is compared to other relevant literature" (Hanney et al., 2005, p. 366). This type of citation occasion does not seem much tied to the central issue discussed in the citation context.

b) Factual sub-category: citing paper refers to general and known fact(s) or information that has been documented or discussed in the cited paper. However, this fact is not specific to the cited paper and is not an investigated result of the cited paper.

c) Further reading sub-category: this sub-category includes those citation occasions that alert and refer readers to future and further reading resources.

Most of the citation occasions examined in the present study, 42.22 percent (266 citation occasions out of 630), were coded under the main category "perfunctory". In total, citing papers included 181 articles, 56 proceeding papers, 19 review papers, 7 editorial material, and 3 letters. From these 266 perfunctory citations, 51.12 percent of citation occasions (136 out of 266) were coded under

the “noted” sub-category, 46.62 percent (124 out of 266) were coded under the “factual” sub-category, and 2.26 percent (6 out of 266) were coded under the “further reading” sub-category. Table 52 lists all contributions grouped under the main category “perfunctory” along with definitions (specific to the present research) and examples of citation occasion(s).

Table 52: "Perfunctory" Main Category: Definition, Frequency of Citation Occasions and some Examples of Citation Occasions

Sub-categories	Definition	Frequency	An example of a citation occasion
Noted	Cited paper is part of the relevant literature but it does not serve an explicit role in the development of the theme of citing paper and is not much tied to the central issue discussed in the citation context. E.g. if citing paper reports on the findings of the cited paper, the report is not very specific and it usually includes several cited papers together.	**136**	The h index received instantaneous public attention [2] and has been controversially discussed ever since [**3**–7]. **Source: (Schreiber, 2007)** This idea is used to explain the evolution of the science and the competition of the different paradigms (Chen, Cribbin, Macredie, & Morar, 2002; Kuhn, 1962; Small, 2003; **White, 2003**). **Source: (Acedo & Casillas, 2005)** Pathfinder analysis, a technique that has been widely used in cognitive psychology (e.g., Schvaneveldt, 1990) and more recently in citation analysis (Marion and McCain, 2001; **White, 2003**), is a viable approach for generating a network structure of authors. **Source: (Nerur, Rasheed and Natarajan, 2008)**
Factual	Citing paper refers to general and known fact(s) or information that has been documented or discussed in the cited paper. However, this fact is not specific to the cited paper.	**124**	The overall picture that emerges is that only in some cases does the learners' browsing behaviour depend on their levels of field-dependence/independence **(Chen & Macredie, 2002).** **Source: (Fiorina et al., 2007)** Furthermore, relevance is described as a multilevel phenomenon, according to which some documents may be more relevant than others [10,**11**,12]. **Source: (Toms, O'Brien, Kopak and Freund, 2005)**

Sub-categories	Definition	Frequency	An example of a citation occasion
Further reading	Citation occasions that alert and refer readers to future and further reading sources. E.g., "this is explained more fully in ..."	**6**	In another approach, the set of linguistic terms is assumed to be finite and ordered. Thus, the semantics of a term is provided just by its position in the order imposed—no fuzzy numbers are associated. In such a case all operations on the linguistic terms have to be specifically defined. For details, see [7,10,**11**]. **Source: (Zadrozny & Kacprzyk, 2006)**

5.2.6. First Research Question: A Summary of Findings

Results related to functions of citation occasions are summarized in Table 53. For the majority of citation occasions (80 percent), functions were assessed as either "reviewed" (37.78 percent) or "perfunctory" (42.22 percent). For the rest of the citation occasions (20 percent), 8.25 percent were classified as "supportive", and for a further 7.3 percent, functions were assessed as "contrastive". Only 4.45 percent of citation occasions were evaluated to have an "applied" citation function.

Table 53: A Summary of Citation Functions

Citation Function Main Categories	Frequency of Citation Occasions (%)
Applied	28 (4.45%)
Contrastive	46 (7.3%)
Supportive	52 (8.25%)
Reviewed	238 (37.78%)
Perfunctory	266 (42.22%)

32.14 percent of citations categorized with the "applied" function were cited for using either the same data set or the same or similar index to cited papers. Citation occasions with "contrastive" functions were mentioned mostly (41.3 percent) for comparing findings, approaches, schemes, samples, or methods of the citing paper to similar elements in cited papers. For 69.23 percent of citation occasions assessed as having the "supportive" function, the citing paper's methodology or design was justified based on what was reported or found in cited papers. Citation occasions with "reviewed" functions were mostly (57.14 percent) reporting on the findings, results, or general topics of cited papers. For 51.12 percent of citation occasions categorized as perfunctory, cited papers had a "noted" sub-function and did not serve an explicit role in the development of the main theme of citing papers. Table 72 (appendix E) lists main citation functions of highly cited JASIST papers along with frequencies and percentages.

5.3. Second Research Question: Textual Properties

The following section summarizes the results obtained from the analyses of the explicit contexts of citations. These findings are presented according to the three text-based properties of citation contexts: 1) citation location; 2) frequency of citation occasions; and 3) frequency of co-citation occurrences.

5.3.1. Citation Location

Scientific articles reporting original research results "tend to have a definite, rather formulaic structure – "introduction", "methods", "results", and "discussion" - an organizational format recommended by many style manuals and required by most scientific journals" (McCain & Turner, 1989, p. 133) . This structure enables readers to rapidly scan and retrieve information from the article. Therefore, it sounds reasonable to assume that the location of a citation occasion within this structured text would reflect the level of usefulness of the cited paper and the information that it contains (McCain & Turner, 1989, p. 133-134). Here, the basic assumption is that a citation occasion located in the methodology, results, or conclusion is more significant or meaningful than the one located in the introductory sections. In other words, less significant citations usually tend to appear toward the introductory sections (Bonzi, 1982; Tang & Safer, 2008).

None of the citation classification schemes (discussed in the "Literature Review" chapter) included citation location in the definition of citation categories (McCain & Turner, 1989, p. 133-134). In addition, no unique and consistent definition of citation location parameter has been proposed in the previous literature (see section 2.2.4.1). Nevertheless, all definitions follow a pragmatic approach that echoes the metastructure of scientific papers and reflects what the accepted norm is in publishing practice (Maricic et al., 1998). The following list summarizes different approaches that are presented in the literature to define the "citation location" parameter:

- "Introduction", "materials/methods", "results", and "discussion" (Hanney et. al 2005)
- "Introduction", "experiment", and "results/discussion" (Bertram, 1972)

- For research papers, “introduction”, “methods”, and “results & discussion” (McCain & Turner, 1989).
- “Introduction”, “methodology”, “discussion”, and “conclusion” (Voss & Dagaev, 1976; Finney, 1979).
- “Introduction”, “methodology”, “results”, and “discussion/conclusion” sections (Maricic et al, 1998).
- “Abstract”, “introduction”, “literature review”, “method”, “results”, “discussion”, “summary”, “results and discussion”, “discussion and summary”, “figure & table”, and “appendix/endnote/footnote” (Tang & Safer, 2008).

For the purpose of the current research, the location of each citation occurrence was recorded with respect to the following sections of the citing papers (see section 4.3.2.3 for more details):

I. Introduction
II. Literature review
III. Method
IV. Conceptual framework
V. Results
VI. Discussion
VII. Conclusion
VIII. Reference list
IX. Appendix

This detailed definition of the “citation location” parameter proved to be a pragmatic approach for the present research and was found to be more consistent with the definition presented in Tang and Safer (2008) study. Later, to simplify the analysis, some closely related sections were merged to give a more general and a macro picture of citation locations (e.g., “introduction” and “literature review” formed the “introductory section”, “methodology” and “conceptual framework” formed the “methodological section”, “discussion” and “conclusion” formed the “concluding section”). This level of analysis was found to be more similar to the approach used in Maricic et al. (1998) study.

When a citation occurrence happened more than once in the same citing paper, the position of all occurrences were recorded. Some review articles, theoretical papers, or conference proceedings lacked this rigid structure and, accordingly, did not follow the definite structure of research articles, e.g., they did not include methodology or results sections. When a citation occasion occurred in these papers, its location was recorded as "in-text citation". Therefore, "in-text citation" refers to a citation occasion that has occurred in a citing paper that did not follow the formulaic structure of research articles.

Results obtained from the analysis of citation location concentration shows that while more than half of citation occasions tended to concentrate in the "introduction", "literature review", and "in-text" sections (64.7 percent), 20.1 percent were populated in the "method" and "conceptual framework" sections. Citations located in the "results" section comprised 5.7 percent of citations, and citations occurring in the "discussion" or "conclusion" sections comprised 8.5 percent of all citation occasions. One percent of citation occasions were mentioned only in "reference list" or "appendix".

Table 54 summarizes the concentration of citation occurrences in different citation locations according to the five categories of citing papers (articles, proceeding papers, reviews, editorial material, and letters). As shown in this table, for "Articles", "Proceeding papers", and "Reviews", the highest proportion of citation occasions occurred in the "introduction", "literature review", and "in-text" sections. "Articles" and "Proceeding papers" included more citation occasions in the "method" section, compared to "Reviews". Meanwhile, "Reviews" had the highest proportion of citation occurring in the "discussion" and "conclusion" sections (15.3 percent), and the least belonged to "Proceeding papers" (4.5 percent). Statistically, it was not possible to examine the relationship between the citation location variable and the type of citing papers by a Chi-square test due to the fact that 56.0 percent of cells had an expected count of less than 5 (the minimum expected count was .03).

Table 54: Citation Locations Concentration According to Different Types of Citing Papers

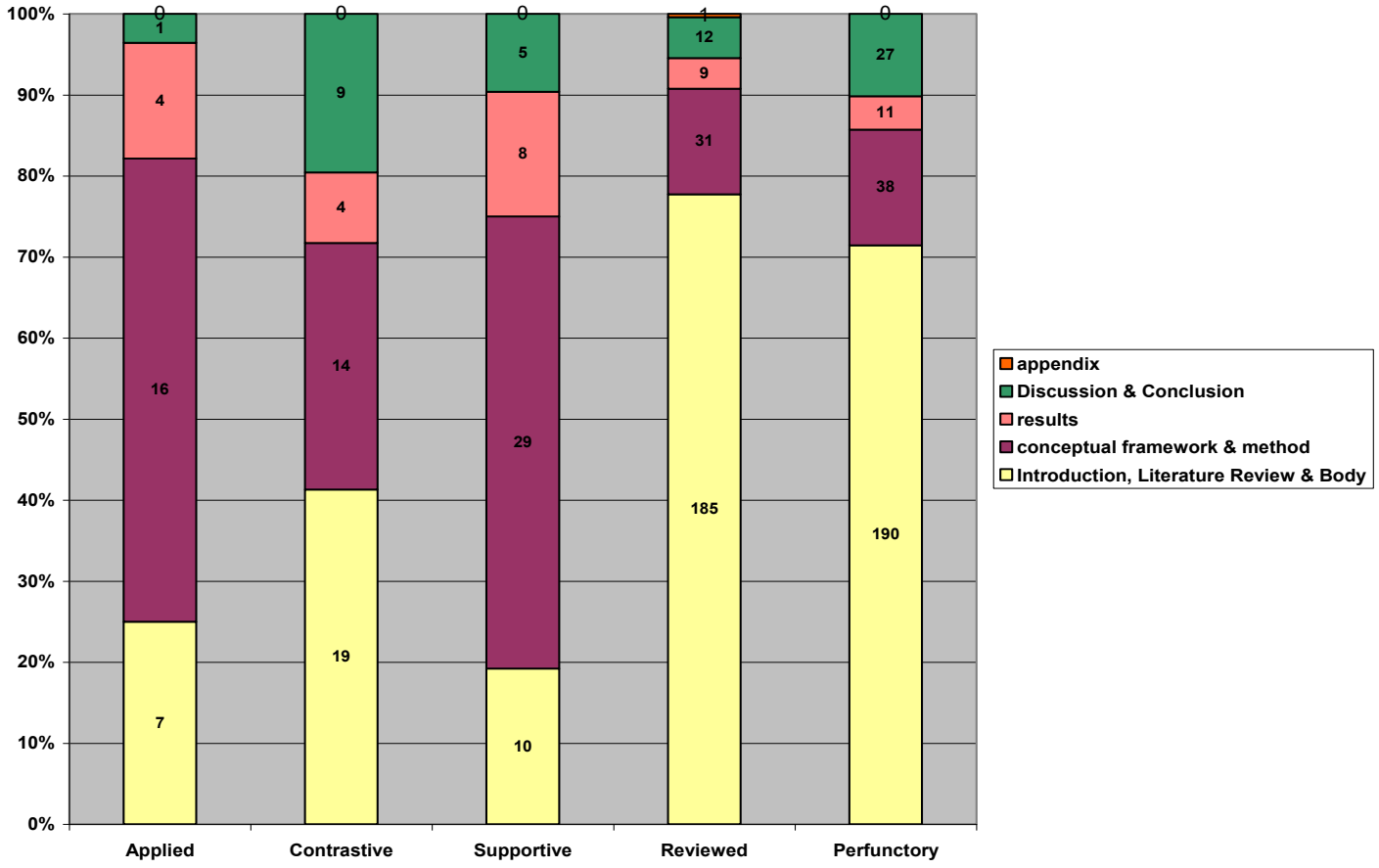
Citing Papers Types	Introduction, Literature Review & "In-text" (%)	Method & Conceptual Framework (%)	Results (%)	Discussion & Conclusion (%)	Reference List (%)	Appendix (%)	Total Occasions
Article	63.5	20.3	5.3	10	0.7	0.2	**419**
Proceeding paper	64.9	22.4	6.9	4.5	1.1	0	**174**
Review	65.4	11.5	7.7	15.3	0	0	**26**
Editorial material	92.4	7.7	0	0	0	0	**13**
Letter	100	0	0	0	0	0	**3**
Total (percentage)	**64.7**	**20.1**	**5.7**	**8.5**	**0.8**	**0.2**	**635**

When the relationship between citation location and citation function was examined, some interesting patterns emerged. While a majority of citation occasions occurring in the "introduction" and "literature review" sections of citing papers had "reviewed" or "perfunctory" functions, most of the citations occurring in the "method" or "conceptual framework" sections had "applied" or "supportive" functions. Meanwhile, the highest proportion of citations occurring in the "discussion" or "conclusion" sections had "contrastive" functions. Citation occasions cited in the "results" section were most likely to have either "supportive" or "applied" functions. The largest density of citations (65 percent) were concentrated in the "introductory sections" and these citation occasions mostly had "reviewed" and/or "perfunctory" functions (these two functions comprised 80 percent of citation functions), the remaining 20 percent of citation occasions (with "applied", "contrastive", and "supportive" functions) were more dominant in "method", "results", "discussion" or "conclusion" sections (see Table 55 and Figure 11 for details).

Table 55: Distribution of Citation Main Categories Occurring in Various Locations

Main categories	Introduction/ Literature Review/ In-text (%)	Method/Conceptual Framework (%)	Results (%)	Conclusion/ Discussion (%)	Appendix (%)	Total Occasions
Applied	25%	57.1%	14.3%	3.6%	0	28
Contrastive	41.3%	30.4%	8.7%	19.6%	0	46
Supportive	19.2%	55.8%	15.4%	9.6%	0	52
Reviewed	77.7%	13%	3.8%	5%	.4%	238
Perfunctory	71.4%	14.3%	4.1%	10.2%	0	266
Total Occasions	**65.2%**	**20.3%**	**5.7%**	**8.7%**	**.1%**	**630**

Figure 11: Citation Location versus Citation Function Categories



A chi-square test was performed to examine whether there is any significant association between citation location and citation function for each citation occasion. Results showed a significant association between citation location and citation function (χ^2 = 114.1, df =8, p<0.000). As Table 56 shows, citation occasions with "applied" function were mostly located in the "method" section (count=16; expected count=5.7), but less concentrated in the "introduction", "literature review", and "in-text" sections (count=7; expected count=18.3). Citation occasions with the "contrastive" function were more concentrated in the "results", "conclusions", and "discussion" sections (count=13; expected count=6.6). Citation occasions with the "supportive" function were mainly concentrated in the "method" section (count=29; expected count=10). Only a few citation occasions with the "supportive" function were mentioned in the "introduction", "literature review", and "in-text" sections (count=10; expected count=18.3). Contrary to the above three functions ("applied", "contrastive", and "supportive"), "reviewed" and "perfunctory" citations were mostly located in the "introduction", "literature review", and "in-text" citations (for "reviewed" citations: count=185; expected count=155.3), (for "perfunctory" citations: count=190; expected count=173.5). However, concentration of "perfunctory" citations in the "results", "conclusions", and "discussion" sections was equal to the expected count (count=38; expected count=38.4). In sum, "supportive", "reviewed", and "perfunctory" citations in the observed count row ("introduction", "literature review", and "in-text") contributed a lot to the value of the chi-square. In other words, differences between observed count and expected count for these cells are much higher than they are for other cells. Therefore, there may be a stronger relationship between the rows and columns that make up these cells.

Table 56: Citation Function and Citation Location Cross-Tabulation Table

			Citation location coding			Total
			introduction, literature review & in-text	**method & conceptual framework**	**results, conclusions, discussions**	
Main functions (main column)	**Applied**	Count	7	16	5	28
		Expected Count	18.3	5.7	4.0	28.0
	Contrastive	Count	19	14	13	46
		Expected Count	30.0	9.3	6.6	46.0
	Supportive	Count	10	29	13	52
		Expected Count	33.9	10.6	7.5	52.0
	Reviewed	Count	185	31	22	238
		Expected Count	155.3	48.4	34.4	238.0
	Perfunctory	Count	190	38	38	266
		Expected Count	173.5	54.0	38.4	266.0
Total		Count	411	128	91	630
		Expected Count	411.0	128.0	91.0	630.0

5.3.2. Multiple Citation Occasions

When a cited paper is recited multiple times in the same citing paper, a "multiple citation occasions" variable or, as White (2001) calls this reoccurrence, "synchronic recitation", would be added to the textual properties of citations. A few previous researchers have examined the effect of multiple citation occasions on the value of citations. Most of these studies concluded that multiple citation occasions are associated with more relevance and this textual property can be an integral part of evaluating citations significance[30]. Based on these previous studies, the present research also assumed that multiple re-citation of a cited paper would correlate with a more significant contribution of the cited paper to the theme of the subsequent citing paper.

An incidence of multiple citation occasions was defined based on citation style recommendations: often last name of author, date of the publication, and, sometimes, page number(s), or just the reference number of the cited paper. But if an author was referring to the previous sentence by a subjective pronoun, e.g., "he [the cited author] also noted that this result could be related to"…, this referral to the previously cited author was not recorded as another citation occasion.

Results obtained from recording multiple citation occasions in the present study showed that most cited papers (72 percent) were cited more than once in at least one subsequent citing paper. On average, highly cited JASIST papers were cited 1.65 times in subsequent citing papers with a standard deviation of 1.459.

[30] See the "Literature Review" chapter, section 2.2.4.2. for details

5.3.2.1. Multiple Citation Occasions versus Citation Location

To examine whether there is a significant difference in terms of citation location between multiple and single citation occurrence(s), citing papers were assigned to two groups: those citing papers that included multiple citation occasions of the same cited paper (citation frequency was beyond the average rate of 1.65), and those that included a single citation occasion of the same cited paper. A chi-square test was performed to examine if there is a significant association between multiple citation occurrences and citation location. Results suggested a probable significant association between multiple citation occurrences and citation location ($\chi^2 = 13.034$, df =4, $p<0.011$). A close look at the cross-tabulation table illustrated that while single citation occurrences tended to concentrate more in the "introduction", "literature review", and "in-text" sections of the citing papers, multiple citation occurrences were more likely to occur in the "method" section.

5.3.2.2. Multiple Citation Occasions versus Citation Functions

To examine whether there is a significant difference in terms of citation functions between multiple and single citation occurrence(s), citing papers were assigned to two groups: those that included multiple citation occasions (citation frequency was beyond the average rate of 1.65), and those that included a single citation to the same cited paper. A chi-square test was performed to examine if there is any significant association between multiple citation occasions and citation function main categories. Results suggested a strong association between multiple citation occasions and citation function main categories ($\chi^2 = 50.606$, df =4, $p<0.000$). It is noteworthy that, for the main category "perfunctory", the counted value (N=23) for citing papers with multiple citation occasions was half the expected value (N=47), suggesting that multiple citation occasions of cited papers rarely associates with the "perfunctory" function for the same cited paper.

5.3.3. Co-citation Frequency

Usually, citing authors make reference to several previous studies in the same citation context. Co-citation frequency as a citation context textual property

has not been noted or investigated in previous studies. This is the first time that the attribution of this property is recorded and its associated with other implicit and explicit textual properties is investigated in a research study. Here the assumption is that in any single citation context, there is a negative relationship between the significance of a cited paper and the number of cited papers that are co-cited in the same citation context. In other words, if a cited paper is mentioned as the only reference in a citation context, hypothetically it should have a more significant contribution to the theme of the citing paper, and the contribution is so unique that no other reference was needed to convey the same meaning.

Co-citation frequency was defined based on the number of citations that were co-cited in the same context and/or parenthesis. For example, when a citing author referred to previous studies like this: "to see related literature, see (McCain, 1989; Moffat, 2007; Nerur, 2008)", the co-citation occurrence for McCain (1989) (assuming that it was a highly cited JASIST paper) was recorded 3. On average, highly cited JASIST papers were co-cited with 1.13 other cited sources (co-citation frequency of 2.13), with a standard deviation of 1.742. Table 57 illustrates the frequencies of co-citation occurrences for highly cited JASIST papers.

Table 57: Co-citation Frequencies for Citation Occasions of Highly Cited JASIST Papers

Co-citation Frequencies	Frequency	Percent
1	327	51.90
2	136	21.59
3	61	9.68
4	53	8.41
5	24	3.81
6	6	0.95
7	10	1.59
8	4	0.63
9	1	0.16
10	6	0.95
11	1	0.16
12	1	0.16
Total	630	100.00

To examine whether co-citation frequency has any significant association with the function of citations, all citation occasions were categorized into two groups: the first group were co-cited with none or with only one other cited paper; the second group included an above-average number of co-citations recorded in the present study (more than 2 co-citations). A chi-square test was performed to examine if there is any significant association between co-citation frequency and citation function main categories. Results suggested a strong relationship between co-citation frequency and citation function main categories ($\chi^2 = 22.237$, df =4, $p<0.000$). Particularly for the first group (those that co-occurred with none or with only one other cited paper), the observed number of citation occasions assigned to the main category "applied" was considerably beyond the expected count (count=27; expected count=20.3) and it is noteworthy that the observed count of citation occasions assigned to the main category "perfunctory" was considerably below the expected count (count=173; expected count=195). On the contrary, for the second group, the observed number of citation occasions categorized under the main category "applied" was considerably below the expected count (count=1; expected count=7), but above the expected count for the main category "perfunctory" (count=93; expected count=70).

Whether there is a significant association between the citation location variable and the frequency of co-citation occurrences was also tested through a chi-square test. Results suggested a probable significant relationship between co-citation frequency and citation location ($\chi^2 = 11.830$, df =4, $p<0.019$). The first group of citation occasions (those co-cited with none or with only one other cited source) were located in the "method" section more frequently than what the expected count suggested (count=109; expected count=94), but were less concentrated in the "introduction", "literature review", and "in-text" sections, compared to what the expected count suggested (count=290; expected count=302). On the contrary, the second group were more populated at the "introduction", "literature review", and "in-text" sections (count=121; expected count=108) and less populated in the "method" section, compared to what the expected count suggested (count=19; expected count=33).

5.3.4. Second Research Question: A Summary of Findings

The second research question analyzed the explicit characteristics of citation contexts and examined three text-based properties of citation contexts: 1) citation location; 2) frequency of citation occasions; and 3) frequency of co-citation occurrences.

Results obtained from the analysis of citation location concentration showed that while more than half of the citation occasions tended to concentrate in the "introduction", "literature review", and "in-text" sections (65.2 percent), 20.3 percent were populated in the "method" and "conceptual framework" sections. Citations located in the "results" section comprised 5.7 percent and citations occurring in the "discussion" or "conclusion" sections comprised 8.7 percent of all citation occasions. When the relationship between citation location and citation function was examined, it was shown that a majority of citation occasions occurring in the "introduction" and "literature review" sections of citing papers had "reviewed" or "perfunctory" functions, contrary to most of the citations occurring in the "method" or "conceptual framework" sections, which had "applied" or "supportive" functions. Meanwhile, the highest proportion of citations occurring in the "discussion" or "conclusion" sections had "contrastive" functions. Citation occasions cited in the "results" section were most likely to have either "supportive" or "applied" functions. The largest density of citations (65 percent) was concentrated in the introductory sections (with mostly "reviewed" or "perfunctory" functions), the remaining 35 percent of citation occasions were scattered across all sections (with mostly "applied", "contrastive", and "supportive" functions)[31]. A chi-square test suggested a strong association between the citation location variable and citation function main categories.

Results obtained from recording multiple citation occasions showed that 28 percent of cited papers were never cited more than once in their corresponding citing papers. On average, highly cited JASIST papers were cited 1.65 times in subsequent citing papers with a standard deviation of 1.459. Statistical testing showed a probable significant association between multiple citation occasions and

[31] See Table 55 and Figure 11 for details

citation locations. While single citation occurrences tended to concentrate more in the "introduction", "literature review", and "in-text" sections of citing papers, multiple citation occurrences were more likely to occur in the "method" section. In addition, a strong association was found between multiple citation occasions and functions of cited papers, specifically with the main category "perfunctory", which was found to rarely associate with multiple citation occasions. These results suggest that the multiple citation occasions variable can be taken as an indication (but not a sole indicator) of a meaningful contribution of cited papers to citing papers in which citation to the same cited paper occurs more than once.

Results obtained from recording co-citation frequency showed that, on average, highly cited JASIST papers were cited with 1.13 other cited sources, with a standard deviation of 1.742. Statistical testing suggested a significant association between co-citation frequency and citation function main categories.

5.4. Third Research Question: The Impact of Highly Cited JASIST Papers on Citing Papers

The first two research questions investigated citation functions and textual properties at the level of each citation occasion. In other words, if a citing paper included multiple citation occasions to the same highly cited JASIST paper, the implicit citation context of each citation occasion was examined and its citation function main category was identified and recorded separately to answer the first research question of the present study. Furthermore, to answer the second research question, citation context of each citation occasion was examined to extract its explicit textual properties (including citation location, frequency of multiple citation occasions, and frequency of co-citation occurrences). Therefore, the first and the second research questions addressed each individual citation occasion and its implicit and explicit citation context separately.

On the other hand, we know that citations are all nested within the context of a citing paper and each citation incidence is related to and dependent on other citation incidences (Tang & Safer, 2008, p. 252). The third research question of the present study was designed to address this issue with two specific purposes: First, to relate explicit citation context textual properties to each other (including

citation location, citation frequency, and frequency of co-citation occurrences); and second, to relate citation functions (addressed in the first research question) with citation context textual properties (addressed in the second research question) to show the impact level of highly cited JASIST papers on their corresponding citing papers. In other words, the third research question of the present study relates all the data associated with each citation occasion to each other and conglomerate the implicit and implicit citation context data to generate an impact score at the following two levels:

a. at the level of each citation occasion
b. at the level of each citing paper

This impact score will show the impact level of highly cited JASIST papers on their corresponding citing papers. The value of this score varies from 0 to 4. These values constitute the "impact scale" that will be discussed later in this chapter. Table 58 illustrates the level of analysis related to each research question along with the method used to collect the data.

Table 58: Research Questions versus Level of Analysis and Method Used to Collect the Data

Research Questions	Level of Analysis	Method used to collect data
1. Citation Function	Each citation occasion	Implicit citation context analysis
2. Textual properties of citations a. Citation location b. Citation frequency c. Co-citation frequency	Each citation occasion	Explicit citation context analysis
3. Impact of highly cited JASIST papers on citing papers	a. At the level of each citation occasion b. At the level of each individual citing paper	Implicit & explicit citation context analysis

To illustrate the two levels of analysis related to the third research question, Table 59 illustrates how highly cited JASIST paper A11 has been cited in its 20 corresponding citing papers. Citing papers have cited this paper (A11) with different frequencies. For example, citing paper B264 has cited A11 only once, contrary to citing paper B1096 that has cited A11 thirteen times. The first level of analysis accumulates all the impact values for each of these thirteen citation occasions and produces the first level of impact scores. Then, the highest impact score related to these 13 citation occasions will be recorded as the second level impact score, representing the impact score of cited paper A11 to citing paper B1096.

Table 59: Highly Cited JASIST Paper A11 along with its Corresponding Citing Papers and its Citation Frequencies in Each Citing Paper

Highly Cited JASIST Paper	Citing Papers Codes	Frequency of Citation Occasions
A11	B115	1
	B120	2
	B191	1
	B263	2
	B264	1
	B307	3
	B445	1
	B507	1
	B522	1
	B596	1
	B616	2
	B617	2
	B618	2
	B696	3
	B930	1
	B933	2
	B982	1
	B1000	1
	B1008	2
	B1096	**13**

In calculating impact scores, the researcher tried to make decisions consistent with previous research findings and also tried to use values that seemed more likely to express any existing trends in citation occasions. Obviously, some decisions were more straightforward than others; nevertheless, every effort was made to ensure that the method used to calculate impact scores would be logical, systematic, and reasonably based on the findings of previous studies.

To calculate impact scores, a five point impact scale, similar to what Cano (1989) suggested and then later Hanney et al. (2005) used, was devised to inter-relate citation context data for each citation occasion and also for each citing paper. The values of this scale varied from 0 (the lowest impact level) to 4 (the highest impact level).

The definition of this five point scale and the procedure to assign values was adopted from Tang and Safer (2008), inevitably with a few small modifications. To analyze the association between citation function and citation importance, Tang and Safer defined "perfunctory" and "organic" citations based on satisfying specific criteria:

> Perfunctory citations were derived based on satisfying three criteria: the reference was cited only once, the reference occurred only in the introduction section, and the reference was cited for general background. If a reference was cited for conceptual reasons or for methodology or data reasons, the reference was defined as organic. (p. 264)

The way that Tang and Safer defined "organic" and "perfunctory" citations seemed pragmatic and applicable to the present research because the definition is straightforward and leaves little room for arbitrary decisions. Also, since a binary value (0 or 1) was used for collapsed categories, little room was left for subjective interpretation.

The following section explains how values were assigned to each citation occasion:

1) **Citation function**:
   - "Applied", "supportive", and "contrastive" functions were assigned a value of 1.
   - "Reviewed" and "perfunctory" functions were assigned a value of 0.
2) **Citation location:**
   - A value of 1 was assigned if citation occasion was located in method, conceptual framework, results, discussion, or conclusion sections of citing paper.
   - If citation occasion was located in "introduction", "literature review" or "in-text" of citing paper, it was assigned a value of 0.
3) **Multiple citation occasions:**
   - If cited paper was cited in more than one occasion in citing paper, it was assigned a value of 1.
   - If cited paper was cited only once in citing paper, it was assigned a value of 0.
4) **Frequency of co-citation occurrences:**
   - If citation occasion co-occurred with none or only one other cited source, it was given a value of 1.
   - If citation occasion co-occurred with more than one cited source, it was given a value of 0.

In sum, if citation function of a citation occasion was calssified as "applied" or "contrastive" or "supportive", and this citation occasion was co-cited with none or only one other cited source, and it was located in either method, or conceptual framework, or results, or discussion, or conclusion sections, and there was more than one citation occasion to the same cited paper in the citing paper, the level of impact for that citation occasion was coded under the highest level of the impact scale (impact score=4). To demonstrate how these values were practically assigned, the impact scores of highly cited JASIST paper A11 that was cited in 20 corresponding citing papers are illustrated in Table 60. This table shows how impact scores were calculated for each citation occasion and then were conglomorated to calculate the impact score for each citing paper.

Table 60: Highly Cited JASIST Paper "A11", along with its Corresponding Citing Papers' Impact Scores

Cited Paper ID	Citing Papers' ID	Function	Assigned Values	Location	Assigned Values	Frequency	Assigned Values	Co-citation Occurrences	Assigned Values	Impact score (at the level of each citation occasion)	Impact score (at the level of each citing paper)
11	115	Perfunctory	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	120	Supportive	**1**	Method	**1**	2	**1**	1	**1**	**4**	**4**
11	120	Supportive	**1**	Method	**1**	2	**1**	1	**1**	**4**	
11	191	Perfunctory	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	263	Reviewed	**0**	Method	**1**	2	**1**	1	**1**	**3**	**3**
11	263	Perfunctory	**0**	Method	**1**	2	**1**	1	**1**	**3**	
11	264	Perfunctory	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	307	Perfunctory	**0**	Intro, LR, "In-text"	**0**	3	**1**	1	**1**	**2**	**2**
11	307	Perfunctory	**0**	Intro, LR, "In-text"	**0**	3	**1**	1	**1**	**2**	
11	307	Reviewed	**0**	Intro, LR, "In-text"	**0**	3	**1**	1	**1**	**2**	
11	445	Supportive	**1**	Method	**1**	1	**0**	2	**1**	**3**	**3**
11	507	Perfunctory	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	522	Perfunctory	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	596	Perfunctory	**0**	Results	**1**	1	**0**	1	**1**	**2**	**2**
11	616	Perfunctory	**0**	Intro, LR, "In-text"	**0**	2	**1**	4	**0**	**1**	**1**
11	616	Perfunctory	**0**	Intro, LR, "In-text"	**0**	2	**1**	4	**0**	**1**	
11	617	Perfunctory	**0**	Results	**1**	2	**1**	2	**1**	**3**	**3**
11	617	Perfunctory	**0**	Results	**1**	2	**1**	1	**1**	**3**	
11	618	Perfunctory	**0**	Intro, LR, "In-text"	**0**	2	**1**	1	**1**	**2**	**2**
11	618	Reviewed	**0**	Intro, LR, "In-text"	**0**	2	**1**	5	**0**	**1**	

Cited Paper ID	Citing Papers' ID	Function	Assigned Values	Location	Assigned Values	Frequency	Assigned Values	Co-citation Occurrences	Assigned Values	Impact score (at the level of each citation occasion)	Impact score (at the level of each citing paper)
11	696	Reviewed	**0**	Method	**1**	3	**1**	1	**1**	**3**	**3**
11	696	Perfunctory	**0**	Conclusion& Discussion	**1**	3	**1**	1	**1**	**3**	
11	696	Perfunctory	**0**	Intro, LR, "In-text"	**0**	3	**1**	1	**1**	**2**	
11	930	Reviewed	**0**	Intro, LR, "In-text"	**0**	1	**0**	1	**1**	**1**	**1**
11	933	Perfunctory	**0**	Intro, LR, "In-text"	**0**	2	**1**	1	**1**	**2**	**2**
11	933	Reviewed	**0**	Intro, LR, "In-text"	**0**	2	**1**	1	**1**	**2**	
11	982	NA	**NA**	Appendix & Reference	**0**	1	**0**	NA	**NA**	**NA**	**NA**
11	1000	Perfunctory	**0**	Conclusion& Discussion	**1**	1	**0**	2	**1**	**2**	**2**
11	1008	Perfunctory	**0**	Intro, LR, "In-text"	**0**	2	**1**	1	**1**	**2**	**2**
11	1008	Reviewed	**0**	Results	**1**	2	**1**	4	**0**	**2**	
11	1096	Applied	**1**	Method	**1**	13	**1**	1	**1**	**4**	**4**
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	2	**1**	**3**	
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	1	**1**	**3**	
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	1	**1**	**3**	
11	1096	Perfunctory	**0**	Results	**1**	13	**1**	1	**1**	**3**	
11	1096	Perfunctory	**0**	Intro, LR, "In-text"	**0**	13	**1**	1	**1**	**2**	
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	3	**0**	**2**	
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	3	**0**	**2**	
11	1096	Perfunctory	**0**	Method	**1**	13	**1**	3	**0**	**2**	
11	1096	Perfunctory	**0**	Intro, LR, "In-text"	**0**	13	**1**	10	**0**	**1**	
11	1096	Reviewed	**0**	Intro, LR, "In-text"	**0**	13	**1**	3	**0**	**1**	
11	1096	Applied	**1**	Method	**1**	13	**1**	1	**1**	**4**	

Cited Paper ID	Citing Papers' ID	Function	Assigned Values	Location	Assigned Values	Frequency	Assigned Values	Co-citation Occurrences	Assigned Values	Impact score (at the level of each citation occasion)	Impact score (at the level of each citing paper)
11	1096	Applied	**1**	Conclusion& Discussion	**1**	13	**1**	1	**1**	**4**	

As Table 60 illustrates, assigned values related to citation functions, citation locations, frequency of citation occasions, and frequency of co-citation occurrences were added up to calculate impact scores at the level of each citation occasion. The generated impact scores ranged from 0 to 4 (0 conveying the lowest impact level and 4 representing the highest impact level). In the next step, in order to obtain the impact level of each citing paper, the highest impact score related to the level of each citation occasion was picked up to illustrate the impact level of cited paper to the same citing paper. For instance, if a cited paper was cited twice in the same citing paper, once at the scale level of 1 and once at the scale level of 3, the impact level of cited paper to the citing paper was recorded 3. The last column of Table 60 represents impact scores at the level of each citing paper.

Table 74 (appendix G) shows the impact levels of highly cited JASIST papers. For instance, highly cited paper A11 has contributed at the highest level of impact (impact score=4) for 10 percent of its citing papers. For 21 percent of its citing papers, its impact level has been assessed to be relatively high (impact score=3), for 31 percent of its citing paper, this highly cited paper has shown a moderate impact level (impact score=2), and for 37 percent of its citing papers, its impact level has been categorized as relatively low (impact score=1).

As Figure 12 illustrates, for 24 percent of citing papers, highly cited JASIST papers have had a “high” (9 percent) or “rather high” (15 percent) impact levels. For 25 percent of citing papers, the impact level of highly cited JASIST papers was categorized as “moderate”. For 51 percent of citing papers, the level of impact was categorized as “rather low” (38 percent) or “low” (13 percent).

In Figure 13, highly cited JASIST paper “A1” has been excluded from the data, because it is an outlier data point in terms of its total number of citations (170, more than 3 standard deviations from the mean), its total number of outside IS citations (57, more than 5 standard deviations from the mean), and, also, its frequency of citation occasions (95). Figure 13 shows the impact level categories when this data point was excluded from the dataset. For 22 percent of citing papers, highly cited JASIST papers had “high” (7 percent) or “rather high” (15 percent) impact levels. For 26 percent of citing papers, the impact level of highly cited papers was categorized as “moderate”. And, for 52 percent of citing papers,

the impact level of highly cited papers was assessed to be “rather low” (38 percent) or “low” (14 percent).

Figure 12: Percentage for Each Impact Level Category

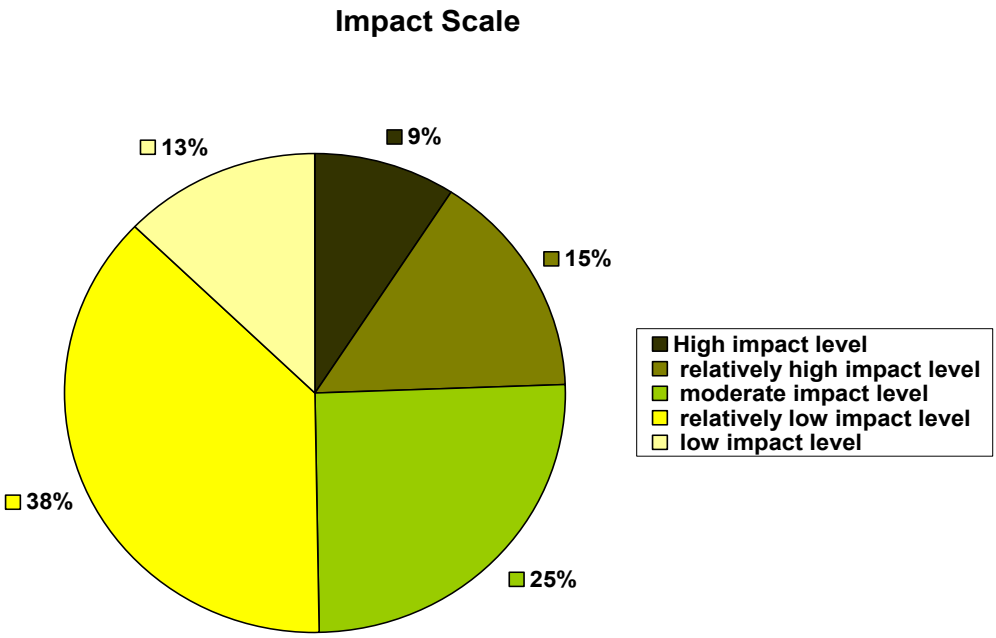
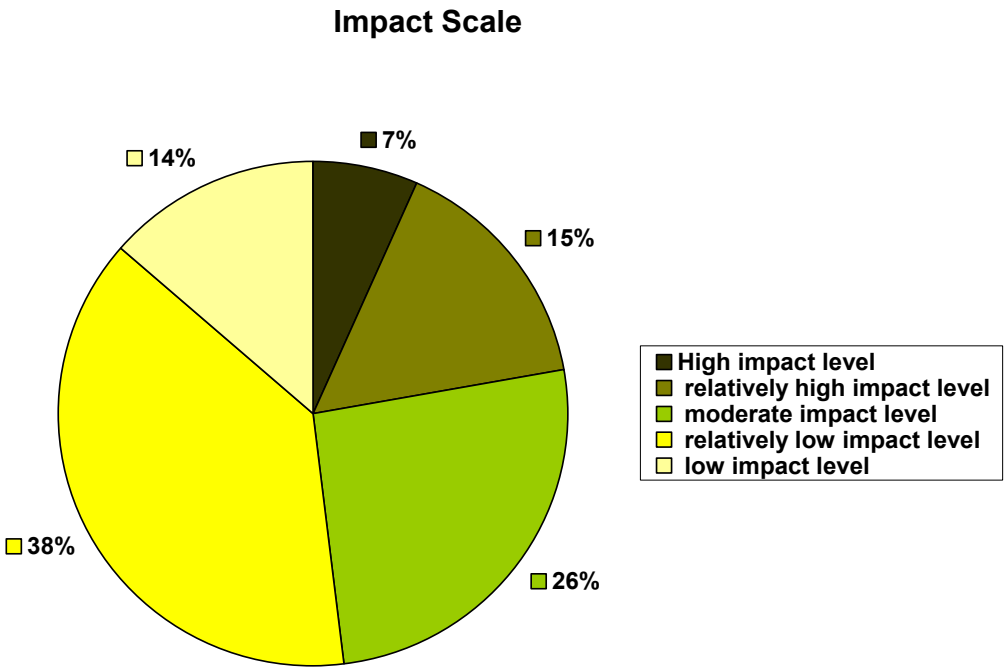


Figure 13: Percentage for Each Impact Level Category, Excluding the Outlier (Cited Paper A1)



5.4.1. Impact Scale versus Outside Information Science Citations

To examine whether the five levels of impact scale and the total number of outside IS citations, received by highly cited JASIST papers in each category, are significantly correlated, the correlation between these two variables was calculated. Table 61 shows Spearman Rho nonparametric correlation values for levels of impact scale versus outside IS citations. For highly cited JASIST papers, the Spearman Rho correlation table showed a high degree of correlation between the five levels of impact scale and outside IS citations. However, there are some differences among these correlation figures. The highest correlation with outside IS citations seems to be with "relatively low" impact level (impact score=1), followed by "moderate" impact level (impact score=2), then "relatively high" impact level (impact score=3), then "low" impact level (impact score=0), and then, the lowest correlation was found with "high" impact level (impact score=4).

Table 61: Impact Scale Levels versus Outside IS Citations Correlation (Spearman Rho Correlation)

Impact Scale	N	Spearman Rho Correlation	Probability
High Impact Level (Impact Score=4)	50	0.473	0.001
Relatively High Impact Level (Impact Score=3)	50	0.616	0.000
Moderate Impact Level (Impact Score=2)	50	0.698	0.000
Relatively Low Impact Level (Impact Score=1)	50	0.825	0.000
Low Impact Level (Impact Score=0)	50	0.592	0.005

5.4.2. Third Research Question: A Summary of Findings

It may seem sufficient to examine implicit and explicit citation context properties for each citation occasion separately, but the present research needed a conglomerated single impact scale to reflect interrelationships between these properties, and to convey the impact level of highly cited JASIST papers on their corresponding citing papers. The present research attempted to devise such an impact scale in which all implicit and explicit citation context properties were included in the calculation of impact scores.

Results related to the impact levels suggested that for 24 percent of citing papers (and for 22 percent, if the outlier paper was excluded), highly cited JASIST papers had a “high” or “relatively high” impact levels. For 25 percent of citing papers (and for 26 percent, if the outlier paper was excluded), the impact level of highly cited JASIST papers was categorized as “moderate”. Finally, for 51 percent of citing papers (and for 52 percent, if the outlier paper was excluded), the level of impact was categorized as “low” or “relatively low”.

Chapter 6: Discussion

The present research set out to explore the nature of citations that highly cited JASIST papers received from citing papers published outside the IS field. The "Findings" chapter presented results obtained from devising a citation classification scheme, recording textual properties, and devising an impact scale. These findings ultimately help to illuminate the contribution of highly cited JASIST papers to the theme of citing papers. This chapter briefly discusses discrepancies between findings reported in the present study and results reported by other researchers as they relate to citation functions and textual properties, then discusses the significance of findings, and eventually relates them to the broader context of IS contributions to other disciplines.

6.1. First Research Question: Citation Functions

In the present research, function is defined based on the notions of impact and contribution- whether a cited paper contributes to the theme of a citing paper or whether it has a meaningful impact on the development of the main theme of citing paper. The citation scheme generated in the present research helped to demonstrate the functions of cited papers in their corresponding citing papers. Following a coding process and procedure that was adopted for generating a citation scheme, five main functions contributed by cited papers and embedded in citation contexts were inferred and extracted. The following section briefly presents results related to each main function and compares them to results reported in previous studies.

6.1.1. Applied Function

When a citing paper borrowed or adopted a significant element from a cited paper and then used it in developing its own theme or study, or when an entire paper inspired a citing author to develop a significant element, or when a citing paper built upon a cited paper, or expanded or furthered a previous study, or modified a method or approach used in the cited paper, the contribution of a cited paper to a citing paper was coded under the main category "applied". Citation

context data examined in the present study revealed that out of 630 total citation occasions, 28 (4.45 percent) conveyed an "applied" function.

A review of devised citation schemes or citation motivation lists that were identified in previous studies showed that the notion implied by the main category "applied" is strongly supported and well established in related studies; previous researchers have also noted and investigated a similar function in their studies. However, only Lipetz (1965) and Hanney et al. (2005) have used the "applied" label. Other studies have used "methodological", "operational", "affirmational", and "develop" labels to describe the same function.

Case and Higgins (2000) reported that a cited paper sometimes "documents the source of a method or design feature" and includes an instrument or variable measures that may inspire citing authors or may be applied somehow in the development of the theme of the citing paper (p. 639). Garfield (1962) called this contribution "identifying methodology, equipment, etc" (p. 85). Lipetz (1965) included an "applied" sub-category under a main category known as "disposition of the scientific contribution of the cited paper in the citing paper" (p. 83). Moravcsik and Murugesan (1975) named this category the "operational" function. Oppenheim and Renn (1978) also included "use of theoretical equation" and "use of methodology" categories in their citation scheme (p. 226).

In another study, Vinkler (1987) included this rationale in his questionnaire: "a significant part of the cited work (theory, preparation of substance, measuring methods) is utilized". He then asked citing authors to express their citation motivations in this questionnaire (p. 54). He concluded that 35 percent of authors stated that their work "is based entirely on the cited work" (p. 54). Bornmann and Daniel (2008) included "methodological" and "affirmational" types in their unified citation typology. They defined "methodological" citations as "use of materials, equipment, practical techniques, or tools of cited work, use of analysis methods, procedures, and design of cited work" (p. 66). Under the main category "affirmational", two functions seem similar to the main category "applied" that was generated in the present research: "citing work is strongly influenced by cited work" and "citing work depends on

cited work" (p. 66). Shadish et al (1995) also included a question in their subscales that asked citing authors if "this reference documents the source of a method or design feature used in your study" (p. 482). Spiegel-Rosing (1977) also included two content categories in her scheme: "cited source contains data and material (from other disciplines than citing article) which is used sporadically in the citing text, in tables or statistics" and also "cited source contains the method used" (p. 105). Brooks (1985) also included an "operational information" scale in his "motivational scales" and defined it as "borrowing techniques, tools, equipments or results from the cited paper" (p. 226).

Peritz (1983) included a "methodological" category in her classification scheme and defined it as "these are the citations of works describing some aspect of the methods used in the citing study". This main category was further sub-divided into two other sub-categories: "citations referring to the design of the study" and "citations referring to methods of analysis" (pp. 304-305). Ahmed et al. (2004) included two main classification categories in their scheme- the first referred to a specific use of information included in the cited paper and the second referred to using a method described in the cited paper (p. 154). Hanney et al (2005) had a very similar category in their devised template, which was labeled "apply" and was defined as "the citing article uses a method (or methods) described in the cited article" (p. 366). They also included a "develop" category in their template and defined it as "the citing article is developing a concept or method previously described in the cited article" (pp. 366, 375).

Table 62 lists the sub-categories of the main category "applied" along with their frequencies, e.g., the research model developed or used in a cited paper was later applied on two citation occasions, or the theoretical framework or the hypothesis used in a cited paper was further applied in only one citing paper. As discussed earlier, this function requires a cited paper to include a significant data, index, scale, tools or concepts that may inspire citing authors to apply them somehow in the development of the theme of their papers. This function also implies that a cited paper documents the source of an analytic approach, research model, theoretical framework, algorithm, or hypothesis that may attract citing

authors from outside the IS discipline to apply them in their own papers. Moreover, a cited paper could be so influential or attractive that it may motivate citing authors to extend the study, to modify its approach, or to further develop its research method.

Table 62: Sub-categories of the Main Category "Applied" along with their Frequencies

Main Contributions (No. of Total Citation Occasions : 630)	Sub-categories	Citation Occasion Frequency
1. Applied: 4.45% (28 Citation occasions)	1.1. Data	5
	1.2. Index	4
	1.3. Analysis approach	3
	1.4. Research model	2
	1.5. Scale	2
	1.6. Concept	2
	1.7. Software/ tool	2
	1.8. Theoretical framework	1
	1.9. Criteria	1
	1.10. Algorithm	1
	1.11. Hypothesis	1
	1.12. Continuation/expansion/modification of previous studies	4

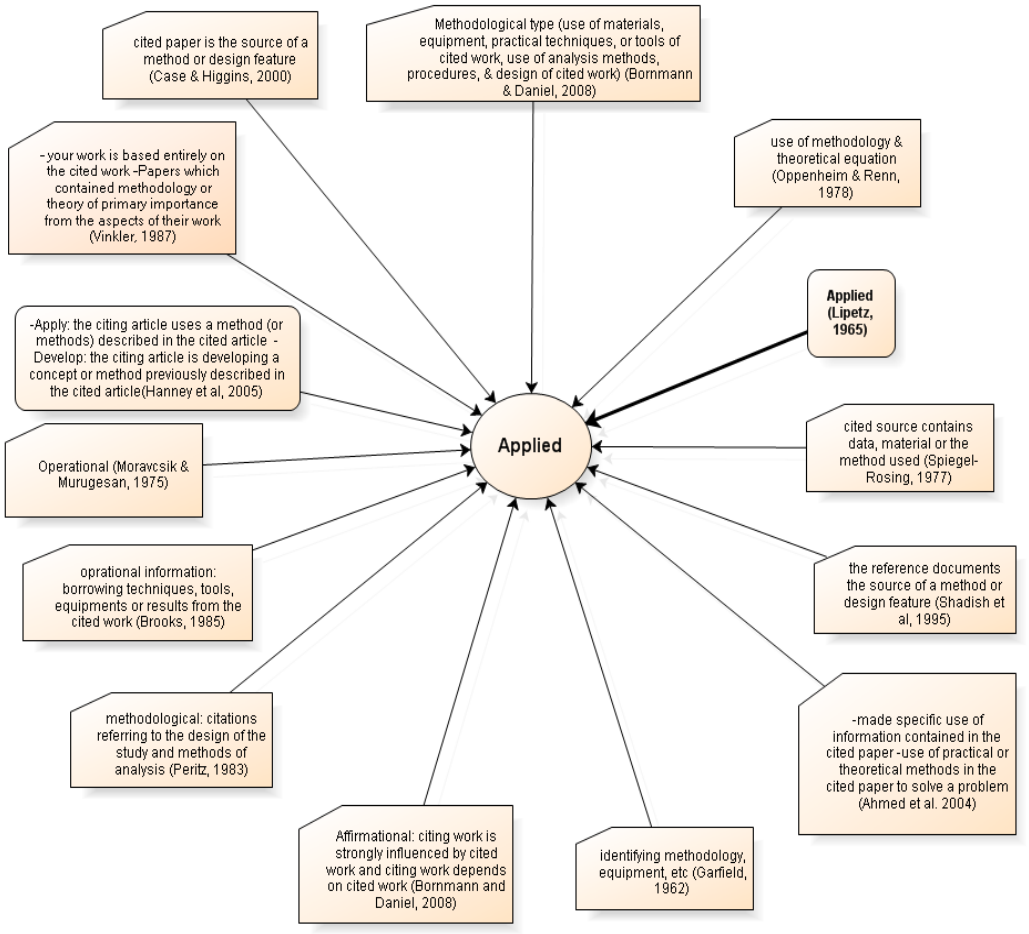
Interestingly, "applied" citations occurred most frequently in "method" or "conceptual framework" sections. Within the Citation Cube Model (see Figure 1 and Figure 19), the "applied" function might be positioned close to the low consensus dimension but the high literalness dimension. This function conveys the highest level of literalness but a few citing authors decide to cite in order to convey this function. This function can also be interpreted as more evidence to support some characteristics of IS research literature that have been identified in previous studies. Previous studies have raised some concerns regarding the use of theory in IS. Hjørland (1998) stated that "it is a well-known fact that IS lacks good theories; most work is of a pragmatic nature, which resists scientific analysis and generalization" (p. 607). Pettigrew and McKechnie (2001) noted that outside the IS field, IS theories are not heavily cited, except by IS scholars publishing in journals related to other disciplines (p. 70). Kim and Jeong (2006) found that the share of theory development articles is declining and overall levels of theory incidence is low in LIS, "urging LIS researchers to recognize the importance of

continuous and creative research in LIS" (p. 548). Julien (1996) found that out of the 163 research studies focused on information needs and uses, only 45 (28 percent) were theoretically grounded (p. 58). Julien later commented that this figure is "a sobering indictment of research in information needs and uses" (p. 62).

Research methods used in IS studies have also been a source of attention and even concern. Jarvelin and Vakkari (1993) found that in the IS research literature published from 1965 to 1985, "the proportion of empirical research strategies was high (49-56 percent) with the survey method (20-23 percent) as the "single" most important method,…which suggests one-sidedness in its theoretical assumptions and problem formulations". This study also raised the concern that IS research lacks more general conceptual analysis research strategies that could help to clarify LIS theories (pp. 129, 139). Julien (1996) also reported that survey methods were predominant and accounted for 56 percent of research methods employed in information needs and uses literature. Other methods included cluster analysis, content analysis and unobtrusive observation. Julien concluded that "with a refocusing of the research questions posed, especially in information needs and uses, a variety of research methods is appropriate" (pp. 61-62). Hider and Pymm (2008) also confirmed the prominence of experimentation and survey in research strategies, though they reported a downward trend for surveys since 1975. This study showed that while quantitative strategies, such as bibliometrics and transaction log analysis, are used in a fairly significant number of studies (50 percent), qualitative approaches, such as case studies, content analysis, and ethnography, accounted for more than 20 percent of research strategies. Powell also (1999) suggested that "researchers in Library and Information Science should consider expanding their methodological repertoire as they attempt to resolve the many research problems confronting them" (p. 113).

Figure 14 shows how the main category "applied" (generated in the present study) was inspired and supported by previous studies.

Figure 14: Comparative and Similar Instances of the main category "Applied" in other Citation Schemes or Citation Motivation Lists



6.1.2. Contrastive Function

When a citing paper contrasted its data, method, model, theory, findings, etc. with what was used, documented, reported, or found in a cited paper, the contribution of the cited paper to the citing paper was coded under the main category of "contrastive". The "contrastive" function was more specifically defined using three sub-categories: "affirmative", "comparative", and "critical". Citation context data examined in the present study showed that 7.3 percent of citation occasions (46 out of 630) conveyed a "contrastive" function: 19 conveyed a "comparative" sub-function, 14 were assigned to the "affirmative", and 13 to "critical" sub-categories.

A review of devised citation schemes or citation motivation lists showed that the notion implied by the main category "contrastive" and its sub-categories ("affirmative", "comparative", and "critical") were also investigated in previous studies. However, labels and definitions may have varied across different studies. Garfield (1962) called this contribution "correcting the work of others" and also "criticizing previous work" (p. 85). Lipetz (1965) included "improved or modified", "questioned", "affirmed", and also "refuted" sub-categories under the main category "disposition of the scientific contribution of the cited paper in the citing paper" (p. 83). Moravcsik and Murugesan (1975) called this category "confirmative vs. negational". Peritz (1983) included a "comparative" category in her classification scheme. Oppenheim and Renn (1978) added "supplying information or data for comparison" to their citation scheme (p. 226). Vinkler (1987) included "the cited work is fully refused, criticized" to his list of citation motivations (p. 54).

Bornmann and Daniel (2008) added three categories to their unified citation typology: a) "affirmational type…(citing work confirms cited work; citing work is supported by cited work; citing work depends on cited work; citing work agrees with ideas or findings of cited work; citing work is strongly influenced by cited work)… b) contrastive type…(citing work contrasts between the current work and cited work; citing work contrasts other works with each other; citing work is an alternative to cited work) and c) negational type…(citing

work disputes some aspects of cited work; citing work corrects/ questions cited work; citing work negatively evaluates cited work)" (pp. 66-67). Shadish et al. (1995) asked citing authors if "this reference has deficiencies that contrast to the strength of your article" and also if "this reference illustrates a perspective or finding that contradicts a perspective or finding in your article". Citing authors were supposed to judge their citation decisions along this subscale (p. 482). Chubin and Moitra (1975) appended an "affirmative" category under which they defined a "supplementary" sub-category. Under the "supplementary" sub-category, they defined another sub-category and labeled it "additional information". This sub-category was defined as "when the referenced paper contains an independent supportive observation with which the citer agrees" (pp. 426-427). Spiegel-Rosing (1977) identified six uses of previous research which sound similar to the "comparative" main category generated in the present study:

> a) Cited source contains the data (pertaining to the discipline of the citing article) which are used for comparative purposes, in tables and statistics b) Cited source is positively evaluated c) Cited source is negatively evaluated d) Results of citing article prove, verify, substantiate the data or interpretation of cited source e) Results of citing article disprove, put into question the data as interpretation of cited source f) Results of citing article furnish a new interpretation/ explanation of the data of the cited source (p. 105)

Brooks (1985) included a "negative credit" scale in "motivational scale" and defined it as "negating, disputing, correcting and criticizing other works" (p. 226). Frost (1979) added two categories in his citation classification scheme. These two categories represented the approval and disapproval of the cited scholar (pp. 407,408). Bonzi and Snyder (1991) included a "critically analyze/correct earlier work" citation reason in their questionnaire (p.253). Peritz (1983) included a "comparative" citation category in her classification scheme and defined it as "this category contains the citations to other studies with which the present one is being compared" (pp. 304-305). Ahmed et al. (2004) added two main categories to their citation scheme: a) made use of data for comparison purposes and b) criticism of the cited paper (p. 154). Hanney et al. (2005) included a category in their devised template and labeled it "support". It had this

definition: “the citing article is supporting a concept or method previously described in the cited paper (p. 366).

Interestingly, the highest proportion of citations occurring in the “discussion” or “conclusion” sections had “contrastive” functions. Meanwhile, citation occasions with the “contrastive” function were mostly concentrated in “results”, “conclusions”, and “discussion” sections (observed count=13; expected count=6.6). This data can be interpreted in a number of ways: citing authors compared, affirmed, or criticized an element of cited papers when presenting their own results, discussing their findings, or relating their findings to previous studies. In the first two sub-categories (affirmative and comparative), citing authors most probably found cited papers of value to contrast or affirm their data, method, theory, conceptual framework, or findings to what was suggested in the cited papers. However, the third sub-category (critical citations) conveys a different meaning. Citing authors decided to cite the papers to refute, negate, criticize, correct, improve, modify, question, or dispute the deficiencies that citing authors found in the cited papers.

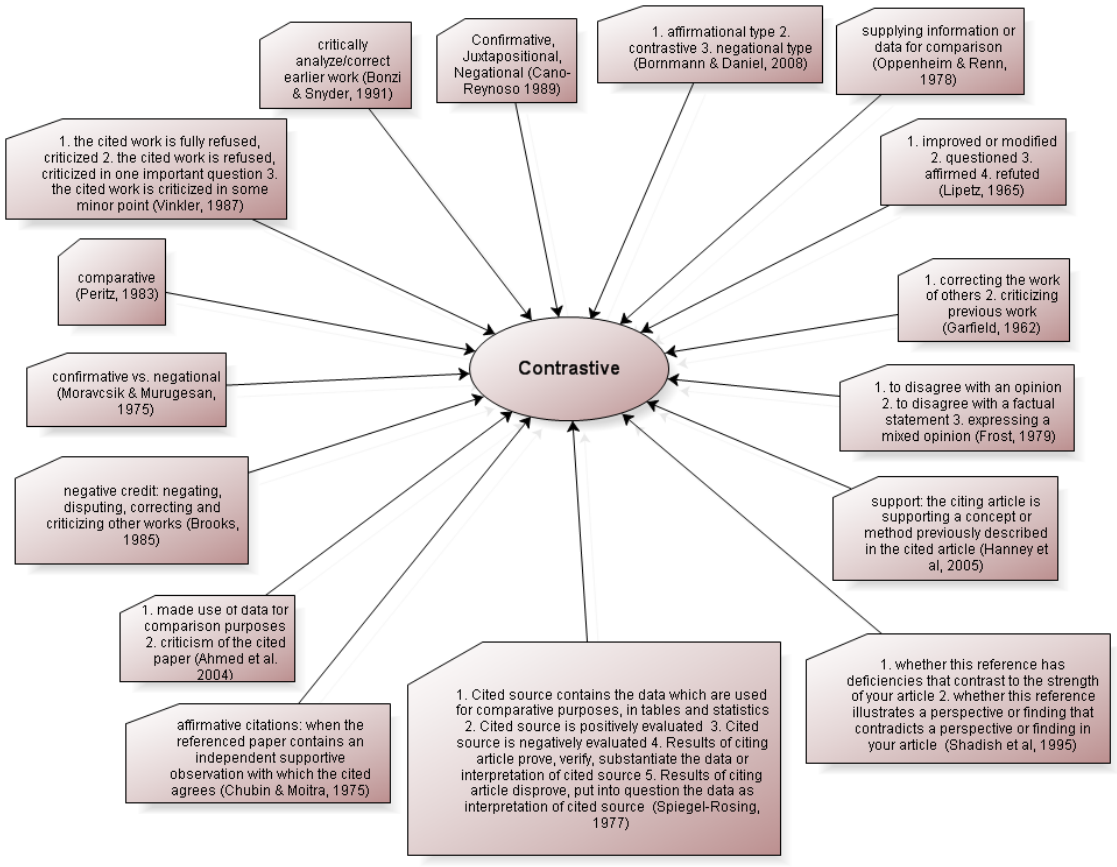
Negational or critical citations have been a source of concern or even warning in the citation analysis literature. Some previous researchers have referred to a significant number of disputed or negational citations and, consequently, have cast doubt on the validity of citation counts in scientific evaluations (Moravcsik & Murugesan, 1975). Others have warned against naively assuming that authors give references to valuable resources in a positive manner (Brooks, 1985; Case & Higgins, 2000). Nevertheless, the very low percentage of critical citations in the present study (2.06 percent) may be interpreted as advocating normative theory in citation practices and to further prove that normative theory provides a “default explanation- a rule to which [constructivist] explanations, even if valid, are exceptions” (White, 2004b, p. 94).

To interpret the frequency of “contrastive” main function within the Citation Cube Model, this function can be positioned close to the high literalness and the low consensus dimensions. However, it would be more meaningful to differentiate between three sub-categories: affirmative and comparative sub-

categories can be positioned closer to the high literalness and the low consensus, but the critical sub-category can be positioned closer to the low literalness and the low consensus (see Figure 1 and Figure 19).

Figure 15 shows how the main category “contrastive” (generated in the present study) was inspired and supported by previous studies.

Figure 15: Comparative Instances of the Main Category "Contrastive" in other Citation Schemes or Citation Motivation Lists



6.1.3. Supportive Function

Sometimes citing authors made references to cited papers to establish the legitimacy of their algorithm, to substantiate an assumption, to justify their data, sample size or research purpose, to legitimate their methods, to confirm their findings, or to suggest further studies. Citation context data examined in the present study revealed that 8.25 percent of citation occasions (52 out of 630) conveyed a "supportive" function. As Table 63 illustrates, in 69.23 percent of citation occasions coded under the "supportive" category (36 out of 52), citing authors substantiated and justified their "research methods".

Table 63: Sub-categories of the Main Function "Supportive" along with their Frequencies

3. Supportive: 8.25% (52 citation occasions)	3.1. Methodology	36
	3.2. Findings	4
	3.3. Assumption	4
	3.4. Research purpose	3
	3.5. Data	2
	3.6. Sample size	1
	3.7. Algorithm	1
	3.8. Further research suggestion	1

As Figure 16 illustrates, the notion implied by the main category "supportive" is also well investigated and established in previous studies. Some studies used other labels, e.g., evolutionary, argumental or affirmational; others just described the meaning implied by this function and refrained from suggesting any specific label. Bornmann and Daniel (2008) defined the "affirmational" category as "citing work confirms and agrees with ideas or findings of cited work and is supported by cited work" (p. 66). Case and Higgins (2000) found that 11 percent of citing authors stated that cited papers helped them "to establish the legitimacy of the topic" of their papers (p. 640). Shadish et al. (1995) referred to justification of central argument, illustration of possible future research avenues, supporting an assumption, and establishing the legitimacy of the topic (pp. 482, 483). Bonzi and Snyder (1991) included "substantiating claims" as a citation motivation in their questionnaire (p.253). In Vinkler (1987), 70 percent of authors

admitted that "the cited work confirms and supports the results published in the citing paper" (p. 54).

Brooks (1985) included "positive credit" in his citation motivational scale and defined it as "paying homage to pioneers, substantiating claims, and justifying the data" (p. 226). Peritz (1983) included an "argumental, speculative, hypothetical" category in her classification scheme and defined this category as "all citations made in supporting the formulation of new hypotheses and conjectures, suggestions for further research, speculations and other arguments" (p. 305). Supporting a factual statement or an argument was also mentioned in Frost (1979) citation classification scheme (pp. 405-409). As an example of previous research use and as a result of content analysis of citations, Spiegel-Rosing (1977) identified a function that is similar to the "supportive" function generated in the present study: "cited source substantiates a statement or assumption, or points to further information (p. 105). Small (1982) labeled this citation function "supported (substantiated)", Moravcsik and Murugesan (1975) called this function "evolutionary" (p. 90), and Garfield (1962) labeled this function "substantiating claims" (p. 85).

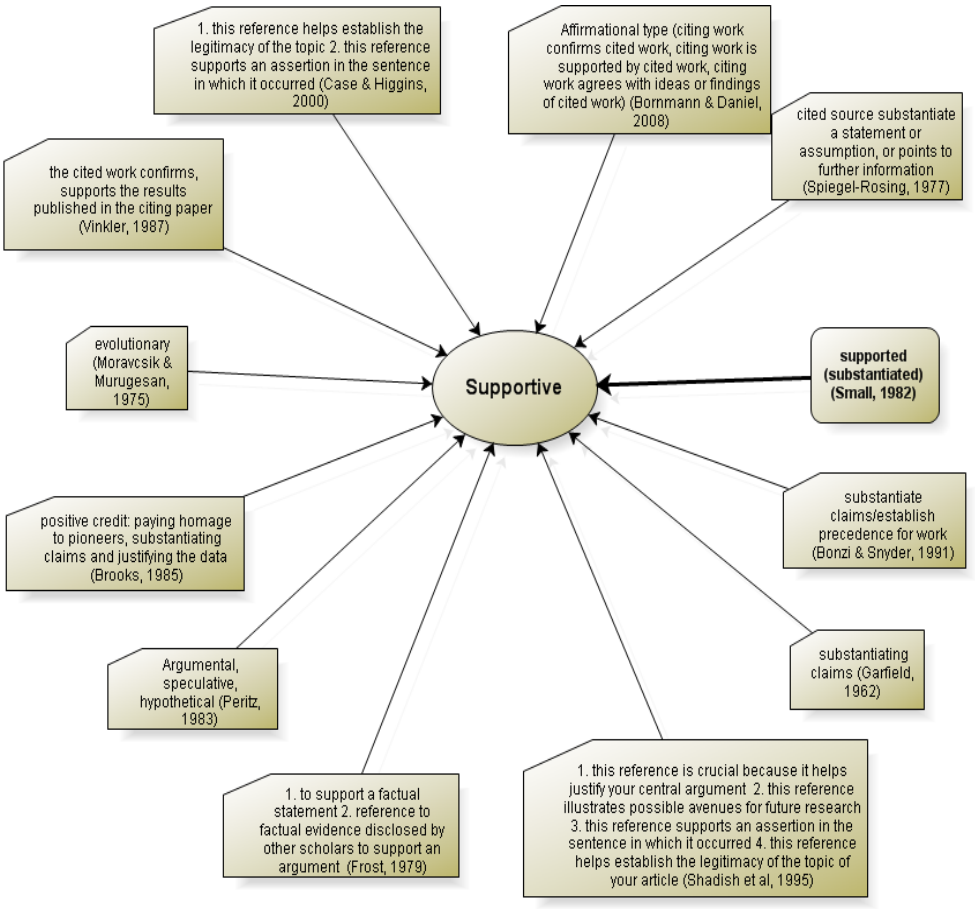
To interpret the frequency of this function within the Citation Cube Model, this main category can be positioned close to the high literalness but the low consensus dimensions (see Figure 1 and Figure 19), as this function conveys a close intellectual relationship between cited and citing papers, but a few citing authors share the same view.

It is also interesting to note that citation occasions with the "supportive" function were mainly concentrated in the "method" section (observed count=29; expected count=10). This is in total agreement with the finding that 69.23 percent of citation occasions coded under the "supportive" category were meant to substantiate and justify the "research methods" of citing papers. When this result was compared with the "applied" category, an interesting pattern emerged. Under the main category "applied", five citation occasions conveyed that an analysis, approach, or research model had been adopted from cited papers and applied in citing papers. But under the main category "supportive", 36 citation occasions

(69.23 percent) conveyed that citing papers substantiated or justified their research methods based on what was reported in the cited papers. Probably, the dominance of empirical research and specifically surveys, and to a lesser extent, transaction log analysis and bibliometric research methods in IS research literature inspired citing authors to substantiate or justify their methods by citing highly cited JASIST papers (Jarvelin & Vakkari, 1993; Julien, 1996; Hider & Pymm, 2008).

Figure 16 shows how the main category “supportive”, (generated in the present study) was inspired and supported by previous studies.

Figure 16: Comparative Instances of the Main Category "Supportive" in other Citation Schemes or Citation Motivation Lists



6.1.4. Reviewed Function

Reviewing relevant literature always comprises a significant part of citing papers. Citing authors usually provide their readers with some background reading to set the stage for the research area or problem. Sometimes citing authors introduce their readers to the origin of an idea or concept that they plan to discuss later in their papers. This type of citation function illustrates the history or state of the art of research problems, or even reviews the current state of knowledge or research area in a subject field related to the citing paper. Usually citing authors acknowledge the achievements of previous researchers and discuss their views on the topic. In sum, "reviewed" citations provide the readers with contextual information necessary to understand the broad context of the study, the significance of the research questions, or the importance of the main problem addressed in the citing paper. Table 64 lists the sub-categories of the main function "reviewed" along with their frequencies.

Table 64: Subcategories of the Main Category "Reviewed" along with their Frequencies

4. Reviewed: 37.78% (238 Citation occasions)	4.1. Findings	80
	4.2. General topic	56
	4.3. Method	33
	4.4. General topic and findings	23
	4.5. Measures/ metrics/ scales/ schemes/ Index	13
	4.6. Comparative Review	9
	4.7. General topic and contribution	7
	4.8. Concepts & definitions	6
	4.9. Method & findings	4
	4.10. Research suggestions	3
	4.11. Model	2
	4.12. Acknowledging authors' contribution	1
	4.13. Dependent & independent variables	1

A considerable number of citation occasions examined in the present study, 37.78 percent of citation occasions (238 out of 630), were coded under the main category "reviewed". As Figure 17 illustrates, the notion implied by the main category "reviewed" has also been well investigated and established in previous studies. Providing historical background and description of other relevant works are the main notions described by previous researchers and

expressed by different labels and descriptors. Bornmann and Daniel (2008) defined the "assumptive" function as referring "to assumed knowledge that is general/specific background,…in an historical account to acknowledge cited work pioneers" (pp. 66-67). Hanney et al. (2005) included the "review only" category in their devised template and defined this function "as part of the relevant literature" (p. 366). Ahmed et al. (2004) included two main classification categories in their scheme which referred to the similar meaning implied by the main category "reviewed" generated in the present research: the first one referred to historical background and the second one referred to the description of relevant work (p. 154).

Case and Higgins (2000) reported that a cited paper sometimes reviews previous work in the same area (p. 639). Shadish et al. (1995) also mentioned two functions similar to the "reviewed" function: reporting an article which is similar to citing article and reviewing previous work in the same area (pp. 482, 483). In their questionnaire, Bonzi and Snyder (1991) asked citing authors to identify if a specific cited work was the best relevant work on the topic and whether their work was built on a specific previous study. They also asked citing authors to express if they aimed to introduce a relevant body of work to the readers through these references (p.253). Vinkler (1987) reported that 100 percent of the authors confirmed that reviewing relevant literature to complement and to introduce preliminaries was one of their citation motivations (pp. 54, 55). Brooks (1985) included a "currency scale" in his citation motivational scale and defined this function as "reviewing the current state of knowledge in the field and referring to the latest output of author's contemporaries to show how up-to-date the author is" (p. 226).

Peritz (1983) included three categories in her classification scheme: the first category was labeled "setting the stage for the present study". This category was defined as all the references to previous work on which the research question of the present study was built. The second category was labeled "background information", and included all references that documented "basic data on the setting of the investigation". The third category was labeled "historical", implying all references with a historical subject or acknowledging the work of pioneers (pp.

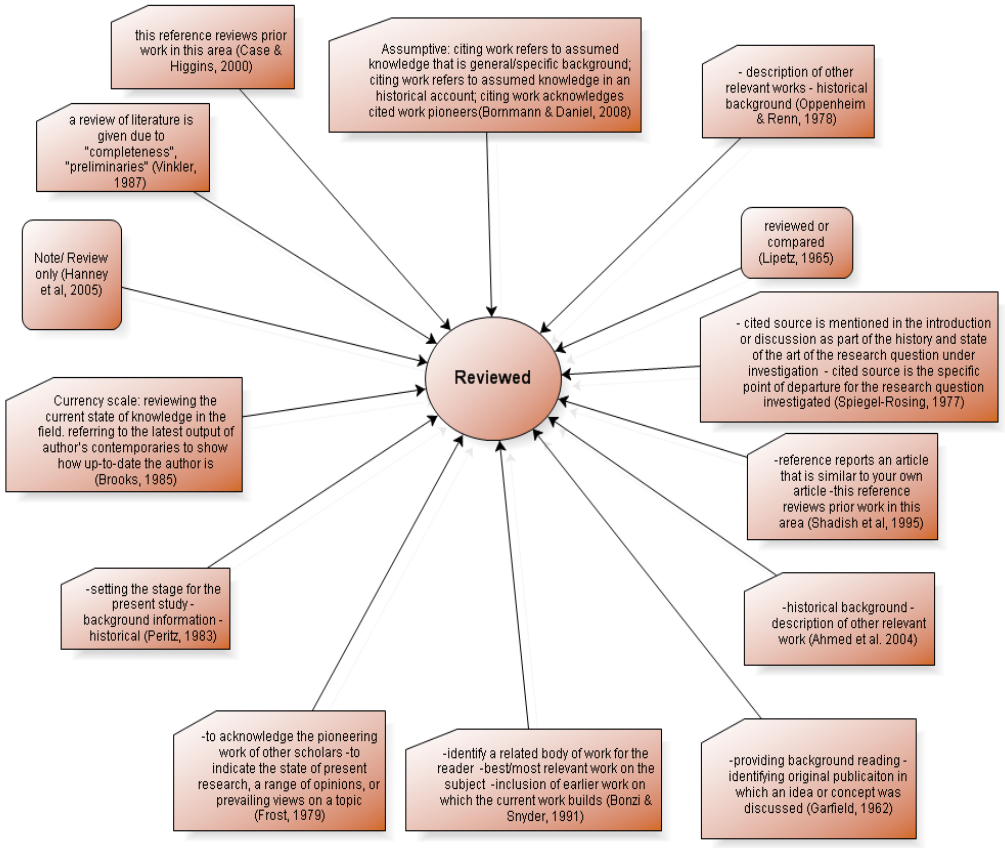
304-305). Acknowledging the "pioneering work of other scholars" and describing the present research context and a range of opinions on the topic comprised two categories of Frost (1979) citation classification scheme (pp. 405-409). Description of other previous works and providing historical background were also among the citation reasons identified and included in Oppenheim and Renn (1978) citation scheme (p. 226). Spiegel- Rosing (1977) also emphasized historical and state of the art functions of citations and stated that sometimes a "cited source is the specific point of departure for the research question under investigation" (p. 105). Lipetz (1965) grouped the "reviewed or compared" category under the main category "disposition of the scientific contribution of the cited paper in the citing paper" (p. 83). Garfield (1962) called this function "providing background reading" to introduce the origin of a discussed idea or concept (p. 85).

In the present research, most of the "reviewed" citations (77.7 percent) were located in "introduction" and "literature review" sections of citing papers, which confirms the fact that "reviewed" citations provide historical background information and also describe relevant literature to readers. Nevertheless, 13 percent of "reviewed" citations were mentioned in "method" and "conceptual framework" sections. To interpret the frequency of the "reviewed" function within the Citation Cube Model, one can certainly position this function along the high consensus dimension. However, the position of this main function along the literalness dimension is debatable. The researcher believes that this function can be positioned in a moderate position (neither high nor low) in the literalness dimension (see Figure 1 and Figure 19).

As Table 64 illustrates, this main function also included 37 citation occasions that belonged to the "research method" sub-category. This means that 15.54 percent of citations categorized this way were meant to review the research methods used in cited papers. Again, the dominance of empirical research and specifically surveys, and to a lesser extent, transaction log analysis and bibliometric research methods used in IS research literature, probably inspired citing authors to cite highly cited JASIST papers (Jarvelin & Vakkari, 1993; Julien, 1996; Hider & Pymm, 2008).

Figure 17 shows how the main category “reviewed” (generated in the present study) was inspired and supported by previous studies.

Figure 17: Comparative Instances of the Main Category "Reviewed" in other Citation Schemes or Citation Motivation Lists



6.1.5. Perfunctory Function

A large number of citation occasions examined in the present study had little importance, significance or contribution to the theme, analysis or results of the citing papers. Usually citing authors made these perfunctory references to the cited papers without any additional comments. Most of the time, more than one citation was mentioned in the same context, the cited paper was apparently not very relevant to the immediate concern of citing author, and the citing authors made no attempt to describe the contribution of cited papers to their papers (Bornmann & Daniel, 2008). Based on citation context data, perfunctory citations were categorized into three sub-categories: a) Noted, b) Factual, and c) Further reading. A large number of citation occasions examined in the present study, 42.22 percent (266 out of 630), were coded under the main category "perfunctory".

As Figure 18 illustrates, the "un-important", "not very relevant", and "not specifically related" notions associated and implied by the main category "perfunctory" have also been examined and investigated in previous studies. Bornmann and Daniel (2008) described the "perfunctory" function as a redundant or perfunctory reference to cited work, or "cited work is apparently not strictly relevant to the author's immediate concerns" (pp. 66-67). Hanney et al. (2005) included a "note only" category in their devised template and defined this function "as part of the relevant literature… [with] no explicit role in the analysis". They also included a "peripheral" category in their template and described it as "the cited article is of little importance to the citing article. Citation is simply background, an aside, for completeness or indeed irrelevant" (p. 366).

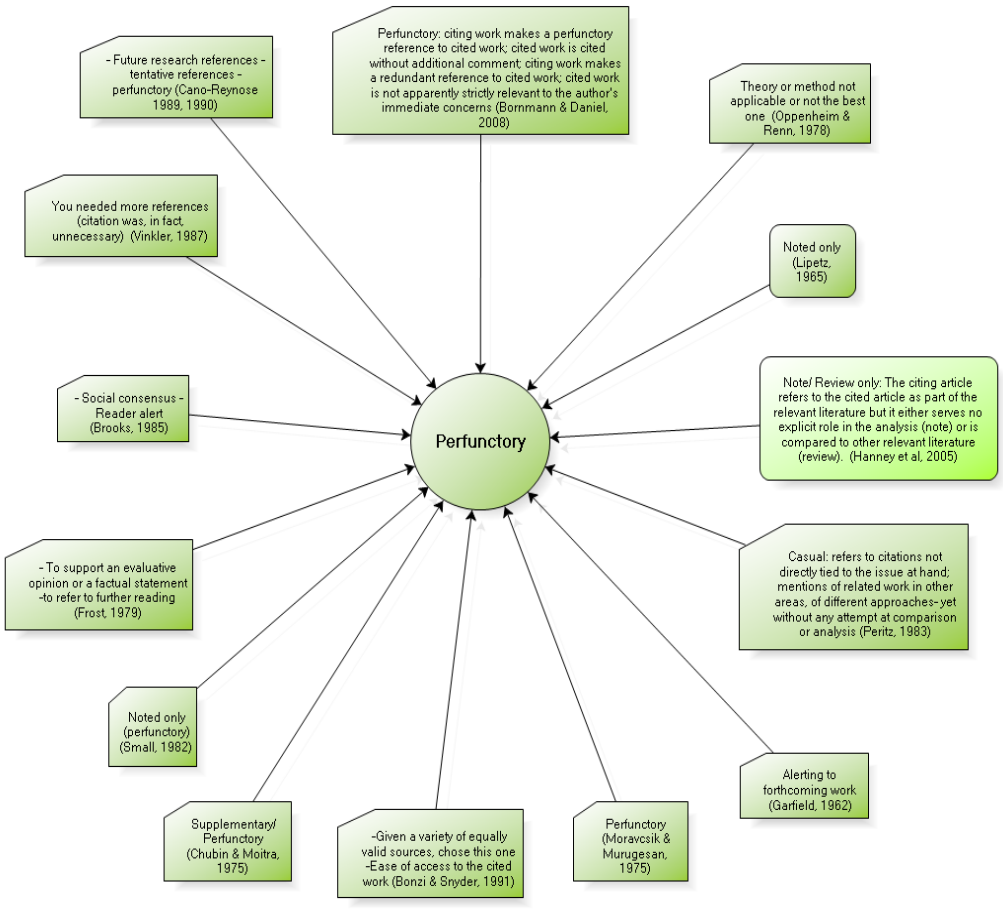
In their questionnaire, Bonzi and Snyder (1991) asked citing authors to identify if a specific cited work had equal value to other sources and whether ease of access to the cited work was a citation motivation (p.253). In Vinkler (1987), five percent of authors admitted that the reference to the cited work was unnecessary and the authors just needed more references (pp. 54, 55). Brooks (1985) included "reader alert" in his citation motivational scale and defined this function as "alerting the readers to new and future work" (p. 226). Peritz (1983)

included a “casual” category in her classification scheme and defined it as “citations not directly tied to the issue at hand; mentions of related work in other areas, of different approaches- yet without any attempt at comparison or analysis” (p. 305). Small (1082) labeled this citation function “noted only/ perfunctory”, while Moravcsik and Murugesan (1975) and also Chubin and Moitra (1975) labeled this function “perfunctory”. Similar to Brooks (1985), Garfield (1962) and Frost (1979) also referred to alerting and referring to forthcoming work or a further reading sub-function of this main citation category. Similar to Hanney et al. (2005), Lipetz (1965) also included a “noted only” sub-category under the main category “disposition of the scientific contribution of the cited paper in the citing paper” (p. 83). Oppenheim and Renn (1978) included “theory or method not applicable or not the best one” in their citation scheme (p. 226).

In the present research, “perfunctory” citations were mostly located in the “introduction” and “literature review” sections (observed count=190; expected count=173.5). However, the concentration of “perfunctory” citations in “results”, “conclusions” and “discussion” sections was equal to the expected count (count=38; expected count=38.4). This finding may cast some doubt on the significance of citation locations. Within the Citation Cube Model, the position of “perfunctory” citations can be located along the high consensus and the low literalness cube. The high frequency of “perfunctory” citations, 42.22 percent, can be interpreted as an indication of the prevalence of constructivist theory of citations. In other words, for 42.22 percent of citation occasions, the cited paper had little importance, relevance, or role to the theme of citing papers. This fact leads to the conclusion that citing authors probably just needed more references or may have had motivations other than perceived contextual usefulness of cited papers. However, exploring probable motivations is beyond the limitations of the present study.

Figure 18 shows how the main category “perfunctory” (generated in the present study) was inspired and supported by previous studies.

Figure 18: Comparative Instances of the Main Category "Perfunctory" in other Citation Schemes or Citation Motivation Lists



6.2. Second Research Question: Textual Properties

The following section compares results obtained from analyses of explicit contexts of citations. These findings are presented according to two text-based properties of citation contexts: 1) citation location; 2) frequency of citation occasions. The third textual property, frequency of co-citation occurrences, is addressed for the first time in the present research and therefore no other studies were found to compare the results with.

6.2.1. Citation Location

Scientific papers that report the results of original research "tend to have a definite, rather formulaic structure – "introduction", "methods", "results", and "discussion"- an organizational format recommended by many style manuals and required by most scientific journals" (McCain & Turner, 1989, p. 133) . This structure enables the readers to rapidly scan and retrieve information from the article. Therefore, it sounds reasonable to assume that the location of a citation occasion within this structured text would reflect the level of usefulness of the cited paper and the information that it contains (McCain & Turner, 1989, p. 133-134). Here, the basic assumption is that a citation occasion located in methodology, results, discussion or conclusion section is more significant or meaningful than one located in the introductory sections. In other words, it seems that less significant citations tend to appear toward the introductory sections (Bonzi, 1982; Tang & Safer, 2008).

Results obtained from analysis of citation location concentration showed that 65.2 percent of citation occasions tended to concentrate in the "introduction", "literature review", and "in-text" sections, 20.3 percent were populated in the "method" and "conceptual framework" sections. Citations located in the "results" section comprised 5.7 percent and citations located in the "discussion" or "conclusion" sections comprised 8.7 percent of citation occasions.

Voos and Dagaev (1976), Cano (1989), and Maricic et al. (1998) also confirmed this finding and reported that the majority of citations occurred in the introductory sections of citing papers. Cano (1990) reported that non-classic

citations were mostly concentrated in the "literature review" or "discussion" sections. Tang and Safer (2008) found that in Psychology papers, most citations were concentrated in the "introduction" section (64.7 percent). This paper also reported that authors published in the Biology field "tended to cite almost the same proportion of citations in the "introduction" (50.9 percent) and "discussion" (45.9 percent) sections" (p. 259). This study also reported that 17.7 and 19.4 percent of citation occasions concentrated in the "method" section. However, only 6.8 and 9.8 percent were mentioned in the "results" section for Psychology and Biology citing papers. Interestingly, these rates of citation concentration in the "method" and "results" sections were similar to what was found in the present research (20.3 percent for the "method" section and 5.7 percent for the "results" section). Nevertheless, Tang and Safer reported a higher proportion of citations in the "discussion" section, compared to the present research (45.9 percent for Biology and 25.4 percent for Psychology papers). Voos and Dagaev (1976) also reported that the "conclusion" section is the second location that absorbs the most citation occasions (they reported that the first location is the "introduction" section).

In the present research, the majority of citation occasions that were located in the "introduction" and "literature review" sections were found to have either "reviewed" or "perfunctory" functions. This finding was strongly supported by previous studies. Bonzi (1982) reported that "little used citations" tended to concentrate more heavily in the introductory sections. Cano (1989) also confirmed that "perfunctory" citations comprised the largest category of citations in the beginning sections of citing articles. Maricic et al. (1998) showed that "cursory citations" were more dominant in the "introduction" section. Tang and Safer (2008) also found that the majority of citations in the "introduction" section were cited for general background and conceptual reasons. As discussed earlier, the high concentration of "perfunctory" and "reviewed" citations in the "introduction" or "literature review" sections can be interpreted as an indication of the prevalence of constructivist theory of citations. In other words, the majority of citation occasions conveyed little importance, relevance, or significance of

cited papers to the theme of citing papers. This fact leads to the conclusion that citing authors probably just needed more references or may have had motivations other than the perceived contextual usefulness of cited papers. However, exploring probable motivations is beyond the limitations of the present study.

This study also found that most of the citations located in the "method" or "conceptual framework" sections had "applied" or "supportive" functions. Cano (1989) also reported that organic citations were more concentrated in the middle (32 percent) and in the end (41 percent) of citing papers. In another study, Cano (1990) reported that methodological citation types were exhibited more in the "techniques and methods" sections. Maricic et al. (1998) also showed that more meaningful citations tended to locate more in the "method", "results" and "discussion" sections. Tang and Safer (2008) showed that almost half of the citations located in the "method" section were cited for methodology and data reasons (47.6 percent).

The most interesting finding of the present study related to the citation location parameter was that citations mentioned in the "results" section were most likely to have either "supportive" or "applied" functions. Moreover, the highest proportion of citations located in the "discussion" or "conclusion" sections had "contrastive" function. Tang and Safer (2008) reported that citations located in the "discussion" section were most likely to be cited for conceptual reasons (36.1 percent) or for general background (30.9 percent). No other study reported a "contrastive" function for citations that were dominant in the "conclusion" or "discussion" sections.

6.2.2. Multiple Citation Occasions

The present research investigated whether more citation occurrences of the same cited paper would correlate with more significant contribution of cited papers to the theme of citing papers. Results related to multiple citation occasions showed that 28 percent of cited papers were cited only once in citing papers. The rest (72 percent) were cited more than once in at least one of their corresponding citing papers. On average, highly cited JASIST papers were cited 1.65 times in

citing papers with a standard deviation of 1.459. Oppenheim and Renn (1978) found an average of 1.13 times for the Physical Chemistry field and consequently suggested an average rate of 1.05-1.15 times for the science area in general. Herlach (1978) found that 31.6 percent of cited references were cited multiple times in the text. Hanney et al. (2005) also reported that for one percent of citing papers, cited papers were cited seven times on average and, interestingly, cited papers served an essential function for the citing paper.

To investigate whether there is a meaningful association between multiple citation occasions and citation functions, a chi-square test was performed. This test showed a strong association between multiple citation occasions and main categories of citation functions ($\chi 2 = 50.606$, df =4, $p<0.000$). Specifically for the main category "perfunctory", the counted value (N=23) for those citing papers with multiple citation occasions was half of the expected count (N=47), suggesting that multiple citation occasions of cited papers rarely associate with the "perfunctory" function for the same cited papers. Voos and Dagev (1976) also suggested that "multiple citations are associated with more relevance or more importance of a cited paper" (p. 21). Two other studies that collected experts' judgments about the topical relevance of multiple citation occasions reported that cited papers with multiple citation occasions were judged to have a higher relevance (Herlach, 1978; Tang & Safer, 2008).

In sum, the results reported in Voos and Dagaev (1976), Herlach (1978), Bonzi (1982), and Tang and Safer (2008) supported the hypothesis that multiple occurrences of a citation occasion correlate with more relevance or rank in terms of citation significance. Nevertheless, McCain and Turner (1989) warned against the use of citation occasion counts (or as they called it, the multiple references or "op. cits" problem) as a sole parameter to characterize the usefulness of the cited papers to subsequent research (pp.136, 137). Tang and Safer emphasized that the impact of multiple citations on citation significance is dependent on the context of the citation occasion and is associated with other citations in the same citing paper (pp. 260,262,266,267,269). Hanney et al. (2005) went even further and

emphasized that the number of times a paper is cited cannot be used to indicate the importance of that paper to the articles that cite it (p. 357).

6.3. Third Research Question: Impact Scale

As discussed in the "Findings" chapter, for 24 percent of citing papers, highly cited JASIST papers had "high" or "relatively high" impact levels. For 25 percent of citing papers, the impact level of highly cited JASIST papers was ranked "moderate", for 38 percent, the level of impact was ranked "relatively low", and for 13 percent, the level of impact was ranked "low".

A few previous studies have combined various citation context properties to devise an overall scale or indicator to assess the impact of cited papers. However, the label used for this overall scale or indicator varies across different studies: Prabha (1983) used "critical references", McCain and Turner (1989) used "utility index", and Cano (1989) used "utility level" (including peripheral, moderate, heavy, and essential utility levels). "Utility level" was later adopted by Hanney et al. (2005). Marcicic et al. (1998) used "cursory or essential" and Tang and Safer (2008) applied the "importance" label to express the impact level of cited papers on their corresponding citing papers.

Similar to the results earlier reported in the present research that cited papers with "reviewed" or "perfunctory" citation functions had mostly "low" or "relatively low" impact levels, Cano (1989) also found that scientists judged "perfunctory" and "negational" citations to have a low utility rank (mostly "peripheral" or "moderate"). Contrary to this group, scientists ranked "operational", "conceptual", "organic" and "evolutionary" citations to have a high utility-content level (mostly "heavy" or "essential") (pp. 286-7). Hanney et al. (2005) reported that "essential" citations comprised one percent and "considerable" citations comprised eight percent of citations. Interestingly, the total amount of these two figures (9 percent) exactly corresponds to what was found in the present study as "high impact level" citations (9 percent). Moreover, the total percentages of citations ranked as having "moderate" or "low" impact levels (63 percent) reported in the present study, roughly corresponds to 56

percent, which was reported in Hanney et al (2005) as “limited importance” citations.

Tang and Safer (2008) asked citing authors to rate the importance of a citation on a seven-point scale from “slightly important” to “absolutely important” (p. 257). Results revealed that authors rated the importance of their cited references as “moderately important”. In other words, authors assigned a 4.92 average rating to their cited references on a scale of one to seven (pp. 258-259). More important rated citations were motivated by “conceptual ideas” and/or “method and data” reasons, whereas less important rated citations were mostly motivated by providing “general background” information, suggesting “limitation”, or “future research” (pp. 263, 268).

Tang and Safer (2008) also examined any association between citation importance and citation function. The definition of citation function was based on three criteria: frequency of citation occurrence, citation location and citation reason. If a citation appeared only once, only in the “introduction” section, and for providing “general background” information, it was labeled as a “perfunctory” citation. “Organic” citations were motivated by “methodology and data” reasons, and/or by “conceptual” reasons. Results showed that “organic” citations were a positive predictor for citation importance, whereas “perfunctory” citations proved to be a negative indicator (p. 268). This study emphasized the value of textual properties (citation frequency, length, and location) in predicting citation importance. Also citations triggered by “conceptual” or “methodology and data” reasons were judged more important than other citations (pp. 267, 269).

6.4. Citation Model and the Nature of Citations

Results reported in the present study showed that citations are not of equal value and their nature may vary across a wide spectrum of different functions and roles with different impact levels on the themes of citing papers. Here it is important to note that the main purpose of the present research was not to validate or investigate whether the citation pattern of highly cited JASIST papers conforms to normative or to constructivist theories of citations. Instead, the present research set out to explore the nature of citations and this purpose justified the selection of Citation Cube Model as a conceptual framework that combines both normative and constructivist theories into a unified theory of citations.

Some results obtained in the present research support normative theory, while others are more in favor of constructivist theory. The following section summarizes those results that support normative and constructivist theories of citations within the limitations of the research purpose of the present study. In the next section, results of the present study will be presented within the Citation Cube Model. Then Citation Pyramid Model that was devised in the present research will be discussed.

6.4.1. Results Supporting Normative Theory

To examine whether author affiliation of highly cited JASIST papers had any correlation with the number of citations received, highly cited JASIST papers were assigned to two different groups: a) those papers whose authors were affiliated solely with Information/Library schools, departments, colleges, institutions; and b) those papers that were authored by at least one author affiliated with other institutions. The first group included 31 highly cited JASIST papers (56.37 percent) and the second group included 24 papers (43.63 percent). The mean number of total citations, total citations received from outside the IS discipline, and also the percentage of outside citations to total citations was

obviously not the same in the two groups. However, the Mann-Whitney test[32] showed that this difference was not statistically significant[33].

The very low frequency of critical or negational citations in the present study (2.06 percent) can be assumed as another support for normative theory. Critical or negational citations imply that citing authors decide to cite papers to refute, negate, criticize, correct, improve, modify, question, or dispute the deficiencies that they have found in the cited papers. Negational or critical citations have been a source of concern or even warning in the citation analysis literature. Some previous researchers have referred to a significant number of disputed or negational citations and have, consequently, cast doubt on the validity of citation counts in scientific evaluations (Moravcsik & Murugesan, 1975). Others have warned against naively assuming that authors give references to valuable resources in a positive manner (Brooks, 1985; Case & Higgins, 2000). Nevertheless, as discussed earlier, the very low percentage of critical citations in the present study (2.06 percent) can be interpreted as advocating normative theory in citation practice.

6.4.2. Results Supporting Constructivist Theory

The citation classification scheme that was devised in the present research helped to explore the functions of citation occasions. Following the coding process and the procedure that was adopted for generating the citation scheme, five main citation functions contributed by cited papers and embedded in the citation contexts were inferred and extracted. Results showed that the majority of citation occasions (80 percent) had either "reviewed" (37.78 percent) or "perfunctory" (42.22 percent) functions. For the rest of the citation occasions (20 percent), 8.25 percent were classified as "supportive" and 7.3 percent as "contrastive". Only 4.45 percent of citation occasions showed to have an "applied" citation function. These results confirm that in 20 percent of citation occasions, highly cited JASIST papers were indispensable to the theme of citing

[32] This test was chosen because the distribution of the data was skewed
[33] See section 5.1.1.6.3. for more details

papers. For the majority of citations (80 percent), the function of citation occasions was not necessarily related to the contextual relationship between cited and citing papers. In other words, for 80 percent of citation occasions, citing authors might have had motivations to cite highly cited JASIST papers other than perceived contextual usefulness of cited papers to the theme of their papers. However, exploring probable motivations is beyond the limitations of the present study. These findings can be interpreted as being more in agreement with the constructivist theory of citations.

In addition, for 51 percent of citing papers, the impact level of highly cited JASIST papers was ranked “relatively low” or ”low”, for 25 percent of citing papers, the impact level was ranked “moderate”, whereas for 24 percent, the impact level was rated “high” or “relatively high”. This low level of “high” or “relatively high” citation impact provides more evidence to support the constructivist theory of citations. This theory casts some doubt on the validity of citation counts for evaluating scientific achievements and suggests that citations may reflect other motivations, including social, political, and financial issues.

6.4.3. Citation Cube Model

The following section summarizes results reported in the present study within the Citation Cube Model, suggested by Small (2004). This is the first research that operationalizes this model and interprets the results within the framework of this model.

The citation classification scheme that was devised in the present research was used to extract five main citation functions. As shown in Figure 19, these functions are placed in the cube according to the literalness and the consensus dimensions. As citation functions get close to the high literalness dimension, they convey a stronger contextual similarity between cited and citing papers. On the contrary, as citation functions get close to the high consensus dimension, more consensuses about them is expected and, accordingly, the frequency of their occasions increases. “Applied”, “contrastive” (comparative and affirmative sub-categories), and “supportive” citations have high literalness, but low consensus, as

few citation occasions convey these functions. On the other hand, “reviewed” citations convey relatively moderate literalness (they have been positioned in both high and low literalness cubes) and high consensus as more citation occasions convey this function. “Contrastive” (critical) citations have low literalness, because these citations are meant to negate the cited paper, and low consensus, as their frequency is very low. “Perfunctory” citations obviously have low literalness, but occupy a very high consensus position as a lot of citation occasions convey this function.

As Small (2004) noted, normatively compliant citations, such as “applied”, “contrastive”, and “supportive” citations concentrate in the high literal cubes, while constructively compliant citations, such as “perfunctory”, fall mainly into the low literal cube. On the other hand, if a citation function is commonly recognized and shared between citing authors, it falls into the high consensus cube (e.g., “perfunctory” citations), but if a citation function is not very prevalent, it concentrates in the low consensus cube (e.g., “contrastive”: critical) (pp. 77-78). As Bornmann and Daniel (2008) pointed out, the "Citation Cube Model is the first conceptual approach for a unified theory” (p. 66). It is the only model that benefits from both the normative and constructivist theories of citations that attempts to accommodate all types of citation functions in a unified model. The heart of this model is its emphasis on the fact that both the normative and constructivist theories “are complementary rather than mutually exclusive, and neither need to be given up for the other” (White, 2004b, p. 115).

Figure 19: Results Interpreted within the Citation Cube Model (Developed by Small, 2004, p. 77)

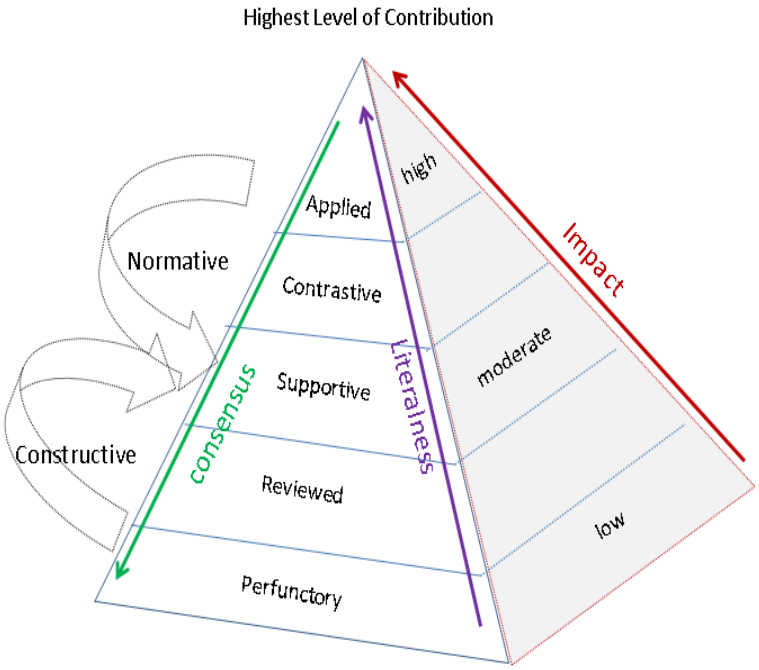
	Consensus	
	Low	**High**
Literalness **Low**	**CONSTRUCTIVE** *Contrastive (critical)*	**CONSTRUCTIVE** *Perfunctory* *Reviewed*
High	**NORMATIVE** *Applied* *Contrastive (comparative)* *Contrastive (affirmative)* *Supportive*	**NORMATIVE** *Reviewed*

6.4.4. Citation Pyramid Model

Results reported in the present research inspired the researcher to note some limitations concerning the Citation Cube Model:

1. In the Citation Cube Model, it is not visually possible to show the quantity of citation occasions that have fallen into each citation category. For example, it is not possible to show that the majority of citation occasions (80 percent) had either "reviewed" (37.78 percent) or "perfunctory" (42.22 percent) functions, compared to 4.45 percent of citation occasions that had an "applied" citation function.
2. In the Citation Cube Model, there are specific boundaries between the four squares, conveying a sense of isolation between squares and between the literalness and the consensus dimensions. This sense of separation does not conform to the fluid nature of the literalness and the consensus dimensions. Citations can belong to either dimension more or less, but there is no specific point that separates their position.
3. The third dimension of the Citation Cube Model, "self-citations", is not presentable in this model. Although in the present study, self-citations were excluded from the data set at an early stage of the data collection procedure.
4. Due to these limitations, the researcher tried to expand the Citation Cube Model to obviate these shortcomings and also to include the citation impact scale that was devised in the present research.
5. Figure 20 represents the Citation Pyramid Model.

Figure 20: Citation Pyramid Model



Citation Pyramid Model proposes a broader context for citation context and citation motivation studies. This model is capable of illustrating the frequency of citations that probably would fall into each of the main citation function categories. For example, it is shown that citation occasions with the "applied" function occur less frequently compared to citation occasions with the "perfunctory" function. The Citation Pyramid Model also highlights the significance of impact scale that was devised in the present research. As earlier discussed, textual properties significantly associate with citation functions and this association is adequately highlighted in the Citation Pyramid Model. It is also noteworthy that the two theories of citations, "normative" and "constructivist" theories are shown to be quite unified and interrelated to each other, a quality that

is hardly evident in the Citation Cube Model. Finally, the top of the Citation Pyramid Model corresponds to the highest level of contribution.

Citation Pyramid Model may have some significant implications for the design of citation context studies. The fact that as we get closer to the top of the pyramid, the citations assume more meaningful citation impact may imply that future citation context analysis may only need to focus on the top of the pyramid to explore the contextual relationship between cited and citing documents. As an instance, the present research could employ a qualitative research method, such as Delphi method, to identify the potential fruitful research models, theories, and methods in different sub-areas of Information Science research (e.g. information seeking behavior, information retrieval, bibliometrics), and then explored their citation contexts in corresponding citing documents. Because, as this model illustrates, most of citations would inevitably fall into high consensus level and would require tremendous time and effort to extract and identify them.

Citation Pyramid Model also implies some significant role for citation textual properties, including citation location, citation frequency, and co-citation frequency. Some of these properties can be automated easily, e.g. co-citation frequency. Others need more effort and programming to be extracted from the text, e.g. citation location and frequency. Nevertheless, based on the findings of this study, the value of these explicit textual properties is tremendous in adding value to citation counts.

Citation Pyramid Model also shows that both normative and constructivist theories are complementary rather than mutually exclusive in explaining citation motivations and functions. This complementary role implies that future citation context studies may need to integrate both theories in generalizing their findings. These studies may also need to strive for a grand theory of citation rather than trying to validate whether normative or constructivist theory explain the complex issue of citation motivations.

6.5. Nature of Citations: Some Speculations on the Findings

In the following section, some properties of the top six highly cited JASIST papers will be discussed in more details. These six papers were selected based on the following two criteria:

1. They ranked among the top three papers in terms of the "total number of citations".
2. They ranked among the top three papers in terms of the percentage of "total citations received from outside the IS field" to "total number of citations".

6.5.1. The Three Top Cited Papers in Terms of the Total Number of Citations

Paper A1:

Spink, A., Wolfram, D., Jansen, M. B. J., & Saracevic, T. (2001). Searching the Web: The public and their queries. *Journal of the American Society for Information Science and Technology, 52,* 226-234.

This paper received the highest number of total citations (170) and also the highest number of outside IS citations (57). This paper was almost solely cited in the Computer Science field (92 percent), mainly in research articles (57.41 percent). Authors of this paper are affiliated with both Computer Science and IS. The first author, Amanda Spink, is the author/co-author of nineteen other JASIST papers. This paper ranked at the highest level of the impact scale (considering its total number of citations).

The main topic of this paper relates to "information seeking behavior". More specifically, it analyzed over one million web queries by Excite search engine users:

> We found that most people use few search terms, few modified queries, view few Web pages, and rarely use advanced search features. A small number of search terms are used with high frequency, and a great many terms are unique; the language of Web queries is distinctive. Queries about recreation and

> entertainment rank highest. Findings are compared to data from two other large studies of Web queries. This study provides an insight into the public practices and choices in Web searching (Spink, Wolfram, Jansen and Saracevic, 2001, p. 226).

It is noteworthy that when the citation context of this paper was scanned to extract keywords out of the citation context, the most frequently occurring term repeated in at least twenty-six citing papers was "query length". Other terms included "query traffic", "query topics", "query terms", "query syntax", "query modification", "query logs", "query evaluation", "query expansion", "query classification", "query per session", and "query misspelling rate". Based on this finding, it seems that this paper is marked by an interesting unified citation identity over time, "a quality which is rare among cited papers" (McCain & Turner, 1989, p. 148).

It is also interesting to note that 32.6 percent of total citation occasions (15 out of 46) coded under the main function "contrastive", were associated with this cited paper. In other words, the findings reported by Spink et al. (2001) were further contrasted and confirmed in later studies. Also the data, method, or findings used and reported in this study were later used and even compared with the data, method, or results applied or produced in its citing papers. For example, the findings of Teevan (2008) affirmed the "query length" variable reported by Spink et al. (2001): "The resulting queries were approximately 2.4 words long, which is a very typical query length [Spink et al. 2001]" (p. 17).

Based on these findings, it is possible to speculate about the reasons that this paper was so frequently cited in the Computer Science field. Most probably, this paper filled a gap in Computer Science literature at that time regarding "search engine users behavior", "query length", and the way that users interact with search engines when they approach them. The scope of this study (one million queries) and its findings regarding "query length", "query syntax", "query evaluation", and the number of queries per each search session may have attracted citations from the Computer Science discipline. Also, the research strategy used

in this research, transaction log analysis, probably contributed to the high number of its citations.

Paper A2:

Jansen, B. J. & Pooch, U. (2001). A review of Web searching studies and a framework for future research. *Journal of the American Society for Information Science and Technology, 52,* 235-246.

This paper ranked second in terms of the total number of citations received (103 citations), however, most of these citations originated from within the IS field (81 citations). Citations from outside IS (22 citations) mostly originated from Computer Science. It is also interesting to note that both authors were affiliated with Computer Science and the main topic of the paper was focused on "reviewing web searching studies". When citation contexts of this cited paper were scanned to extract the most frequent keywords, unlike cited paper A1, no specific term could be pinpointed as the most frequent keyword. Some more frequent terms included "query length", "query terms", "search engines", "search results", "user queries", "users' searching behavior", "web searching", and "web users".

Paper A3:

Thelwall, M. (2001). Extracting macroscopic information from Web links. *Journal of the American Society for Information Science and Technology 52,* 1157-1168.

This paper ranked third in terms of the total number of citations received (77 citations), however, only 4 citing papers were published outside the IS field (these four papers were published in Computer Science, Engineering and Medical Informetrics). Due to the limited number of citation contexts, the impact level probably does not say much about this paper. The scarcity of outside IS citations might be related to the main topic of this paper and/or the results that were

reported in it, that probably did not attract many citing authors from outside the IS discipline.

6.5.2. The Three Top Cited Papers in Terms of the Percentage of Outside Information Science Citations to Total Citations

Paper A18:

Srinivasan, P. (2004). Text mining: Generating hypotheses from MEDLINE. *Journal of the American Society for Information Science and Technology, 55,* 396-413.

This paper ranked first in terms of the percentage of outside IS citations to total number of citations (85.19 percent). Contrary to the previous cited papers, (A1, A2, and A3), that were published in 2001, this paper was published in 2004, implying that it had less time to accumulate citations. The author is affiliated with the IS field, but this paper was mainly cited in Computer Science, Biochemical Research, and Biotechnology & Applied Microbiology research papers.

The most frequently occurring citation terms extracted from citation contexts were related to Medical Subject Heading (MeSH): "MeSH terms", "MeSH vocabulary", "MeSH-based profiles", and "MeSH weights". Other frequent keywords included "concept profiles", "concept pairings", and "concept relationships". In terms of the impact level, this paper ranked very low (below the 17^{th} level) and its citation functions were never assigned to the "applied" or the "contrastive" functions, and only twice to the "supportive" function. This paper was mainly cited for "reviewed" or "perfunctory" reasons. Probably, text mining algorithms that were presented in this research and their application in the Medline database attracted citations from Computer Science, Biochemical Research, and Biotechnology & Applied Microbiology research papers.

Paper A11:

Chen, S. Y. & Macredie, R.D. (2002). Cognitive styles and hypermedia navigation: Development of a learning model. *Journal of the American Society for Information Science and Technology, 53,* 3-15.

This paper ranked second in terms of the percentage of outside IS citations to total citations (78.05 percent). The author is affiliated with the Computer Science field. This paper was mainly cited in Computer Science, Education, and Psychology research papers.

The most frequently occurring terms, mentioning repeatedly in the citation contexts, were "field dependent individuals" and "field independent individuals". Other terms included "cognitive style(s)", "hypermedia learning", "hypermedia navigation", "learner control", "learning styles", and "navigation". In terms of the impact scale, this paper ranked fourteenth for "high impact level (impact score=4)" and sixteenth for "relatively high impact (impact score=3)". One of the citing papers designed its data collection instrument based on the theoretical framework adopted from this cited paper. For two other citing papers, the contribution was judged to be "supportive", as they justified their research methodology through citing this paper.

Paper A19:

Weeber, M., Klein, H., de Jong-van den Berg, L., & Vos, R. (2001). Using concepts in literature-based discovery: Simulating Swanson's Raynaud-fish oil and migraine-magnesium discoveries. *Journal of the American Society for Information Science and Technology, 52*, 548-557.

This paper ranked third in terms of the percentage of outside IS citations to total citations (65.71 percent). The author is affiliated with the Social Pharmacy & Pharmacoepidemiology and also with the Health Ethics & Philosophy. While this paper was mainly cited in Computer Science, it also gained some attractions

from the Biochemical Research, Medical Informatics, and Business research papers.

The most frequently occurring terms extracted from the citation contexts included “literature based discovery (LBD)”, “natural-language processing (NLP)”, “Swanson’s theory”, and “text mining”. In terms of the impact scale, this paper ranked fifteenth for “high impact level” and nineteenth for “relatively high impact level”. One of the citing papers built its hypothesis based on this study, while the other adopted and adjusted some data from it. For these two citing papers, the function of the cited paper was judged to be “applied”.

Presumably, “literature based discovery (LBD)”, “natural language processing”, and “text mining” made this paper appealing to Computer Science scholars. The fact that the model developed in this study was later implemented in a natural language processing system, using biomedical Unified Medical Language System (UMLS) concepts as its unit of analysis, most probably aroused the interest of Biochemical Research and Medical Informatics scholars (Weeber, Klein, den Berg and Vos, 2001, p. 548).

6.6. Interaction of Information Science with Other Disciplines

As discussed earlier, IS has been characterized as an interdisciplinary field which absorbs, through its intellectual borders, parts of other disciplines (Borko, 1968; Holmes, 2002; Saracevic, 1999; Tang, 2004). This cross-disciplinary fertilization enables IS to interact constantly with other disciplines to integrate assumptions and approaches across disciplinary boundaries in order to tackle complex research problems (Saracevic, 1999, p. 1059; Chua & Yang, 2008, p. 2163). In previous studies, some disciplines, including Psychology, Education, Computer Science, Communication, Sociology, Economics, Management, Business, and Medical Sciences have been identified as having some record of reciprocal interaction with IS over time.

As discussed in the "Findings" chapter, on average, highly cited JASIST papers were mainly cited (74.7 percent) inside the IS field. On the other hand, 25.3 percent of total citations originated from outside the IS field. Out of this 25.3 percent, 64.58 percent of citing papers were published in Computer Science journals. The rest of citing papers (34.42 percent) were mainly published in Psychology, Education, Business, Communication, and Engineering journals[34].

Not surprisingly, IS exports more citations to Computer Science than to any other discipline. This finding parallels the findings of other researchers that IS firstly and principally contributes to Computer Science (Tang, 2004; Meyer & Spencer, 1996; Odell & Gabbard, 2008; Cronin & Meho, 2008). On the other hand, previous studies have found that Computer Science has been a principal contributing discipline to IS since 1973. For example, in Buttlar (1999), Holmes (2002) and Larivière et al. (2012), Computer Science was ranked second as one of the principal contributor to IS.

The contribution of IS to Computer Science is hardly surprising, as it is so expected. This long-standing reciprocal interaction may reflect the advent and advances of information technologies, the World Wide Web, and Internet applications. Not surprisingly, computers are increasingly used to collect, store,

[34] See Table 69, appendix D for details

disseminate, and manage the vast quantities of information produced in recent years (Cronin & Meho, 2008; Larivière et al., 2012).

This study reported a 64.58 percent contribution rate (out of 25.3 percent export rate) to Computer Science. When only the first subject categories were concerned, the rate dropped to 51.3 percent. Previous studies have reported a range of 8 to 34.9 percent for the same contribution. The discrepancy between the contribution rate of IS to Computer Science reported in the present study to rates reported in previous studies may be explained by several factors: first, some studies reported the contribution rate out of total citations (Larivière et al., 2012), whereas others reported the contribution rate out of total outside IS citations, similar to the present study (Meyer & Spencer, 1996; Odell & Gabbard, 2008). Second, the present study only examined the most highly cited papers of JASIST whereas others may have included other journals (Pluzhenskaya, 2007) or all the publications in the field (Cronin & Meho, 2008; Larivière et al., 2012). In Journal Citation Reports (JCR), JASIST belongs to two subject categories: "Information Science & Library Science", and "Computer Science, Information Systems". The second category may have increased the visibility of this journal to Computer Science scholars. Third, the time frame of the present study was limited to eight years, whereas other studies may have had a wider time window (e.g., 110 years in Larivière et al., 2012). The fourth probable factor may be related to the affiliations of the authors in JASIST. However, the Mann-Whitney test did not show any significant correlation between the number of citations received from outside the IS field and the affiliation of the authors (whether all authors were affiliated with IS/LIS schools or institutions or at least one of the authors was affiliated with other disciplines; e.g., Computer Science).

Results of the present study showed that the second discipline to which IS mainly contributes is Psychology. Psychology deals with people at the individual level and information user studies focus on information seeking behavior of individuals or groups of individuals. This micro-level focus makes it unsurprising that IS research often interfaces with Psychology. In many ways, information scientists empirically test information behavior and needs of individuals and, most

probably, this line of research provides a rich ground for psychologists to test their theories. It is interesting to note that the rank of Psychology seems to fluctuate over time, although it has kept its position as one of the main disciplines that feed from IS. In 1996, Psychology was ranked fourth in Meyer and Spencer (1996). Eight years later, it was ranked tenth in Tang (2004) study. Again in 2007, Psychology regained its position and ranked second in Pluzhenskaya (2008). In Odell and Gabbard (2008), Psychology was ranked fifth, and in Cronin and Meho (2008), Psychology was ranked eighth. Finally in the present study, Psychology ranked second, next to Computer Science.

The third discipline to which IS mainly contributes is Education. Education was also ranked differently in previous studies. It was ranked first in Pluzhenskaya (2008), second in Tang (2004), fourth in Cronin and Meho (2008), fifth in Larivière et al. (2012), sixth in Meyer and Spencer (1996), and twelfth in Odell and Gabbard (2008). The strong and reciprocal relationship between IS and Education can be interpreted in terms of the common roles and functions that teachers and information professionals play in educational settings. Teachers and information professionals support one another in several ways. They both aspire to promote the use of information to enrich the learning experience. They both have to deal with different information media to maximize learning achievements (Shenton, 2011). This convergence and coincidence of roles makes interaction between the two disciplines quite promising. Information professionals most probably have to use educational theories to succeed in educational settings. On the other hand, teachers and educators need to be aware of current information technologies and media trends to be able to make the best of them.

The fourth discipline to which IS mainly contributes is Business. Business was also ranked fourth and fifth in two other studies (Tang, 2004; Odell & Gabbard, 2008). Reciprocal interactions of IS with Business might be explained by growing attention to the critical role of information in business success and the development of information systems and their applications in business management.

Next to Business, Communication was ranked fifth in the present study. In Tang (2004), it was ranked third, in Pluzhenskaya (2008), it was ranked seventh, and in Odell and Gabbard (2008), it was ranked eleventh. The reciprocal interaction of communication and IS might be interpreted in light of the common research topics that both disciplines share. Scholarly communication, human computer interaction, information seeking behavior, information society, and social networking are among the most fruitful and common research grounds of IS and Communication. Some IS educational programs combine both Communication and IS in their titles, e.g., "College of Communication and Information Sciences" (the university of Alabama), "Faculty of Information and Media Studies" (Western Ontario university), and "School of Communication and Information" (Rutgers university) (Borgman & Rice, 1992).

The present study reported that on average, highly cited JASIST papers received 35.36 total citations from both inside and outside the IS field (with a standard deviation of 24.08 and a median number of 28). In terms of the number of citations received from outside the IS field, on average, highly cited JASIST papers received 8.95 citations (with the standard deviation of 9.66 and the median number of 6). The percentage of outside IS citations to total citations is also interesting. On average, highly cited JASIST papers received 25.3 percent of their total citations from outside the IS field (the median number was 18.51 percent). The rate of 25.3 percent for outside IS citations (export rate) conformed closely to export rate of 27 percent reported in Odell and Gabbard (2008), who replicated the Meyer and Spencer study (1996). Karamuftuoglu (2007) reported that "different studies [that] surveyed different ranges of journals and time periods, found that about 8%–13% of all citations to IS literature come from other disciplines, whereas this is around 25% in developed disciplines (So, 1988)" (p. 1985).

To interpret the export rate of IS and compare it with the export rate of other disciplines, a study conducted by Levitt et al. (2011) is of great value (as the researcher could not find any similar study). Levitt et al. (2011) reported an export rate of 19.5 percent for Information Science and Library Science (IS&LS)

in 1980, 26.3 percent in 1990, and 57.8 percent in 2000. They also reported that IS&LS ranked the least (14th) interdisciplinary subject category in 1980 (19.50 percent PCDCD[35]), elevated one level (13th) in 1990 (26.3 percent PCDCD), and then ranked seventh in 2000 (57 percent PCDCD). Interestingly, IS&LS had the largest increase in interdisciplinarity between 1990 and 2000 in the Social Science Citation Index (SSCI). Nevertheless, this research suggested that the export rate of IS&LS has started to slow down after about 2004[36].

There is a considerable discrepancy between the export rates reported in Levitt et al. (2011) (57.8 percent), and what was reported in the present study (25.3 percent). This discrepancy can be explained in terms of the different sources of data for these two studies; Though, Levitt et al. (2011) did not exactly specify the source of data for their study: "The main data used in this paper are from the fourteen SSCI subjects for which a minimum of 1,500 articles were published in both 1990 and 2000" (p. 1121). Another explanation might be related to what Levitt et al. (2011) reported about the slowdown of the export rate of IS&LS after about 2004.

[35] PCDCD stands for "the percentage of cross-disciplinary citing documents"
[36] See section 2.3.2 and also Table 24 for more details

Chapter 7: Conclusion

The main assumption underlying the present research was that Information Science is an interdisciplinary field that interacts with other disciplines to integrate assumptions and approaches across disciplinary boundaries in order to tackle complex research problems. Previous studies have reported that IS has started to attract learned interests from a variety of disciplines and intellectual exports of IS to other disciplines have increased significantly over time (Tang, 2004; Cronin & Meho, 2008).

A review of the related literature showed that while there is much research into the interdisciplinary nature of IS from different perspectives, little research exists on the nature, extent and quality of extra-disciplinary interactions. There is little evidence to show whether IS is contributing insights, paradigms, theories, models, techniques or just marginal information. Also, a knowledge gap still exists in the literature regarding whether IS contributions to other disciplines are fundamental or marginal to the advancement of knowledge in those disciplines. This study was designed to address this gap. The main purpose was to conduct in-depth analyses of implicit and explicit citation contexts of IS literature to explore the nature of citations that appear in the literature of other disciplines. It is hoped that by understanding the significance of IS contributions, a common ground between researchers across disciplinary borders can be established, shared advances in methodologies, tools and theories can be built, and, ultimately, complex research problems and interests can be addressed more effectively (Sugimoto et al., 2008).

This chapter presents a summary of key findings, discusses theoretical and practical implications of the study, and, ultimately, presents some directions for future research.

7.1. Summary of Key Findings

7.1.1. Nature of Citations

Results of the implicit and explicit analyses of citation contexts showed that citations convey different meanings, serve different purposes, and all citation functions are not of equal significance. It was also demonstrated that the nature of citations may vary across a wide spectrum of different functions and roles, with different impact levels on the themes of citing papers

The present research provided some support for the normative theory of citations and demonstrated that some citations are inspired by the methodological or theoretical content of cited papers (Baldi, 1998). Conformity of textual properties with citation functions further confirmed the fact that sometimes citing authors give their colleagues credit by citing their works. The very low percentage of critical citations in the present study (2.06 percent) may also be interpreted as advocating the normative theory of citations. The present research also showed that the total number of citations received from outside IS had no significant correlation with the affiliation of JASIST authors (whether authors were affiliated with IS/LIS schools or not).

The view of social constructivists was also supported in the present research. According to this theory, citing authors are looking for support or credit and, accordingly, their citations are rhetorical devices designed to persuade readers and validate their own arguments rather than a reflection of intellectual contribution (Baldi, 1998). Results of the present study showed that the majority of citation occasions (80 percent) had either "reviewed" (37.78 percent) or "perfunctory" (42.22 percent) functions. In other words, at least for 42.22 percent of citation occasions ("perfunctory" citations), citing authors might have had motivations to cite highly cited JASIST papers other than perceived contextual usefulness of cited papers to the theme of their papers. However, exploring probable motivations was beyond the limitations of the present study. In addition, for 51 percent of citing papers, the impact level of highly cited JASIST papers was ranked "relatively low" or "low", and for 25 percent of citing papers, the impact level was ranked "moderate". This high popularity of "low" or "relatively

low" citation impact levels provides evidence to support the constructivist theory of citations. Constructivist theory casts some doubt on the validity of citation counts for evaluating scientific achievements and argues that citations may reflect other motivations, including social, political, and financial issues.

The present research also advocated for complexity of citation motivations (Vinkler, 1987; Brooks, 1986; Cano, 1989). A scientist may cite a document to acknowledge its intellectual impact and at the same time, to persuade the reader that he (the author himself) is prominent in his field (Baldi, 1998). Therefore, whether evaluative bibliometrics can assess scientific achievements remains an elusive question. Here, it is important to note that the main purpose of the present research was not to validate or investigate whether the citation pattern of highly cited JASIST papers conformed to normative or constructivist theories of citations. Instead, the present research set out to explore the nature of citations and its purpose justified the selection of the Citation Cube Model as a conceptual framework that combines both normative and constructivist theories into a unified theory of citations.

. The Citation Pyramid Model was suggested in the present research to provide a common ground for both normative and constructivist theories. This model can show that both theories can be intertwined and act as complementary rather than as mutually exclusive theories to explain such an internal and complex phenomenon as citation motivations (White, 2004b, p. 115).

7.1.2. Function of Citations

The ways in which the literature of IS is used outside its disciplinary boundaries is reflected in the results of citation context analyses. "Applied" citations may be included by citing authors to indicate that some significant element of a cited paper has been applied and incorporated into the citing paper. The "applied" function conveyed the highest level of literalness, however, only a few citations conveyed the "applied" function of cited papers to the theme of citing papers (4.45 percent). The low number of "applied" citations is disappointing but not unexpected, as IS research has been criticized in the past for

the low number of theories or novel research methods. Previous studies have argued that IS "researchers have less interest in stating formal theories for verification through more rigorous research methodology" (Meyer & Spencer, 1996, p. 23). Moreover, a concern has been raised in the literature that IS theories are not heavily cited outside IS (Pettigrew & McKechnie, 2001). Research in IS is more pragmatic "with little attempt to generalize the results to a broader theoretical context" (Meyer & Spencer, 1996, p. 23). It also has been reported that IS research lacks general and conceptual analysis research strategies to adequately clarify IS theories (Jarvelin & Vakkari, 1993). Interestingly, the finding that "applied" citations occurred most frequently in the "method" or "conceptual framework" sections reinforces these arguments.

"Contrastive" citations are used to relate and compare results, data, and methods of citing papers with what has been reported in cited papers. Citing authors compare, affirm, or criticize an element of citied papers when they present their own results, discuss their findings, or relate their findings to former studies. That is why citation occasions with the "contrastive" function were mostly concentrated in "results", "conclusions", and "discussion" sections.

In 8.25 percent of citations, citing authors attempted to support their own methods, theories, arguments, data or tools through citation. "Supportive" citations were mainly concentrated in the "method" section. Interestingly, 69.23 percent of citation occasions coded under the "supportive" category were meant to substantiate and justify the "research methods" of citing papers. Probably, the dominance of empirical research and, specifically, surveys, and to a lesser extent, transaction log analysis and bibliometric research methods in IS research literature inspired citing authors to substantiate or justify their methods by citing highly cited JASIST papers (Jarvelin & Vakkari, 1993; Julien, 1996; Hider & Pymm, 2008).

"Reviewed" citations indicate that citing authors are aware of relevant literature and have decided to acknowledge the contributions of previous scholars (McKechnie et al., 2005). In the present research, a considerable number of citations (37.78 percent) were meant to introduce the reader to the main topics of

citing papers or to provide background reading. Most of the "reviewed" citations (77.7 percent) were located in "introduction" and "literature review" sections of citing papers, which reinforces the argument that "reviewed" citations provide historical background information and introduce the relevant literature to the readers. This main function also included 37 citation occasions that belonged to the "research method" sub-category. This means that 15.54 percent of citations categorized under this main function were meant to review the research methods used in the cited papers. Again, the dominance of empirical research and specifically surveys, may have contributed to these citation occasions.

42.22 percent of citations implied a "perfunctory" role. "Perfunctory" citations conveyed no explicit role or relevance of cited papers to the theme or analysis of citing papers. This fact leads to the conclusion that citing authors probably just needed more references or may have had motivations other than perceived contextual usefulness of cited papers. "Perfunctory" citations were mostly located in "introduction", "literature review", and in-text sections.

7.1.3. Textual Properties of Citations

More than half of citation occasions tended to concentrate in "introduction" and "literature review" sections (65.2 percent), while 20.3 percent were mentioned in "method" and "conceptual framework" sections. Citations located in "results" sections comprised 5.7 percent and citations occurring in "discussion" or "conclusion" sections comprised 8.7 percent of all citation occasions. Moreover, 28 percent of cited papers were cited only once in citing papers, and, on average, highly cited JASIST papers were cited with 1.13 other cited sources, with a standard deviation of 1.742.

Citation functions showed a significant association with all three textual properties, including citation location, frequency of citation occasions, and co-citation frequency. In other words, the closer citation functions were to the high level of literalness, the more likely they were to concentrate in "method", "results", "discussion", and "conclusion" sections. Moreover, they had a higher chance of occurring more than once through the citing paper and, hence, they were more likely to appear as the only citation occasion in the same context. On

the contrary, as citation functions got closer to the consensus dimension, they were most probably located in introductory sections, most probably along with other cited sources in the same context, but likely happening only once throughout the citing paper.

7.1.4. Citation Impact of Cited Papers

For the majority of citing papers (51 percent), the cited papers were assessed as having "relatively low" or "low" impact levels, and for a further 25 percent of citing papers, the cited papers were assessed as having "moderate" impact levels. For 24 percent of citing papers, cited papers were evaluated as having "high" or "relatively high" impact levels.

The Spearman Rho correlation test showed a high degree of correlation between the five categories of the impact scale and the number of outside IS citations for each cited paper. Nevertheless, there are some differences among these correlation figures. The highest correlation with outside IS citations was found with the category "relatively low" (impact score=1), followed by "moderate" impact level (impact score=2), then "relatively high" impact level (impact score=3)", then the "low" impact level (impact score=0). The lowest correlation was found with the "high" impact level category (impact score=4). In other words, those cited papers that had "relatively low" or "moderate" impact levels on citing papers had a higher chance of being cited outside IS. Nevertheless, whether these results suggest that the impact of cited papers cannot simply be assessed by counting the number of citations remains an elusive question, considering the limitations of the present research.

7.2. Contribution of Information Science to Other Disciplines

It is clear that highly cited JASIST papers are being used and cited. The high rate of citations within IS journals (74.7 percent) indicates that these papers are cited primarily in other IS journals. Nevertheless, the 25.3 percent export rate suggests that highly cited JASIST papers are cited outside the IS discipline,

though at a lower level. This finding suggests that IS literature is yet to have a meaningful theoretical and methodological impact on other disciplines.

This study showed that out of 25.3 percent of outside IS citations, 64.58 percent of citing papers were published in Computer Science field. It seems that information technology and technological innovations have changed the literature of IS and have opened it to new research methods, new research topics and ultimately new research paradigms. Information technologies have probably also shifted the position of IS within the scientific community. Based on the results of the present study, it is evident that IS is slowly moving away from the social sciences and is moving towards more technology-oriented fields, like Computer Science (Tang, 2004, p. 62). Information science now shows a more prominent correlation with Computer Science than it did in earlier decades (Odell & Gabbard, 2008, pp. 547-249). These findings emphasize increased opportunities for integrated and collaborative research and teaching among the Computer Science and the IS professionals. The similarities that exist between Computer Science and IS in terms of their definitions, methodologies, and technologies suggest a shared body of research. Yet, their different discipline-based purposes reflect parallel research streams.

The rest of citing papers (34.42 percent) were published mainly in Psychology, Education, Business, Communication, and Engineering journals. The fact that almost the same disciplines have cited IS literature over time might be of interest. It can convey that there are a meaningful common research interests, shared topics, and common tools between IS and these disciplines. A closer examination of these disciplinary connections might help in understanding the interdisciplinary nature of IS and to promote interdisciplinary quality research (Pluzhenskaya, 2008, pp. 5-6). More interdisciplinary research may be conductive to attracting more citations from outside the IS field (Levitt & Thelwall, 2009, p. 45).

The level of contribution of IS (25.3 percent) may have two possible explanations: First, some close disciplines, like Psychology, Education, and Communication are more distinct, mature, and well-established than the discipline

of IS. Information Science as an academic discipline is relatively new, emerged after Second World War (Saracevic, 1999). As the discipline becomes more established, its capacity to influence its academic neighbors will also increase. The second explanation relates to the applied nature of IS. If this explanation is true, then it is expected that IS imports theories from related disciplines, empirically tests those theories, and then exports results back to neighboring disciplines. This explanation may describe its export to Psychology, Education, Communication, and Business. Information Science has definitely passed the stage of being an insular field and is increasingly commanding recognition through citations from a wide range of disciplines. Nevertheless, to obtain the status of a mature and influential field, information science has a long way to go.

7.3. Implications of the Study

This thesis has made several contributions to the advancement of knowledge in the discipline of Information Science.

The first contribution is a methodological one, and involves the introduction of co-citation frequency as another explicit citation context property. Results of the present study suggested that this property is highly correlated with citation functions. Extraction of this property can easily be automated and it can add value to previous citation context properties (including citation functions, citation location and citation frequency).

The second contribution of this thesis is both a methodological and theoretical one. The present research is valuable in identifying the impact of Information Science research literature on other disciplines, validating citation context analysis as an accurate bibliometric method. The present study combined an implicit citation context property (citation function) with three explicit citation context properties (citation location, citation frequency, and frequency of co-citations at each citation occasion level) and then devised an impact scale at the citing paper level. This impact scale was used to determine the impact of highly cited JASIST papers on their corresponding citing papers. In future studies, this scale can be tested to evaluate its capacity to enrich citation context studies.

The third contribution of this thesis is a theoretical one and concerns the development of the Citation Pyramid Model. This model was built on the Citation Cube Model, but expanded that model to show the frequency of citation functions along the two "literalness" and "consensus" dimensions. This characteristic is in accordance with many findings reported in previous studies that report that low literal citations are more likely to have a high consensus level, and more meaningful and contextually related citations with a high level of literalness are less likely to receive many citations, resulting in a low level of consensus. The Citation Pyramid Model also serves the purposes of the present research and shows that the highest level of contribution and the highest level of citation impact are at the top of the pyramid. In addition to the Citation Pyramid Model, the detailed classification scheme devised in the present study helped to reveal the citation functions of highly cited JASIST papers at the most detailed level. No previous research has embarked on such a detailed classification scheme.

The present study attempted to address those aspects of the Information Science literature that are cited outside the IS field. By identifying influential research areas and topics in Information Science, one can better anticipate the fruitful directions Information Science is likely to take. Overall rising trends in the number of outside IS citations demonstrates that more attention is being paid to IS literature, but the results of the present research suggest that the impact of contributions may still be limited. This finding may prompt IS researchers to solidly frame their research in a theoretical perspective to produce more generalizable research findings. Furthermore, IS scholars are encouraged to build theories and integrate those theories into their research, since disciplines with the strongest theoretical base are cited more often by other fields (Meyer & Spencer, 1996, p. 32). Information scientists also need to analyze research in other disciplines and incorporate outside theoretical frameworks into the research questions of their studies (Meyer & Spencer, 1996, p. 32). This study may also encourage information scientists to propose more attractive theories, to design more rigorous studies, to develop stronger research methods and to use more reliable data.

Identification of the disciplines to which IS mainly contributes can lead to a better understanding of the interdisciplinary nature and structure of IS. This understanding may improve the design and establishment of educational programs in IS departments, schools, and colleges and help these programs to relate more efficiently to neighboring disciplines (Borko, 1968).

Findings of the present research may also have some implications for IS educators to design their curricula with a multi-disciplinary flavor. If Information Science is to matter in the broader academic context, then some attention should be paid to expanding communication and more efficient interaction with neighboring disciplines.

7.4. Future Research

Although the present research did not intend to investigate whether Information Science is operating a trade deficit with close academic disciplines, as measured by both references and citations, it did pave the way for future research that may investigate this balance. In particular, it is desirable to try to explore why there is a potential imbalance.

A future study can focus on the references of highly cited JASIST papers (instead of citations), to better understand interactions of IS with other disciplines. This kind of study will shed more light on the knowledge importation of IS from other disciplines, and its results (combined with the results reported in the present study) will, ultimately, reveal reciprocal interactions between IS and other disciplines. Moreover, a similar study that focuses on "inside" IS citations of highly cited JASIST papers (excluding outside IS citations), and to compares its results with the current study will help to better understand the nature of citations of highly cited JASIST papers.

Further research is needed to investigate the intentions of those citing authors who have cited highly cited JASIST papers. This study will complement the present research and will add tremendous value to the results reported in the present study. Such a study can also examine any probable connections that exists between cited and citing authors.

The interaction between IS and Computer Science needs to be examined more closely to determine the reciprocal interactions that these two disciplines enjoy. Similar studies may be conducted between IS and other neighboring disciplines, e.g. Psychology, Education, Business, Communication, and Engineering.

Levitt et al. (2011) investigated export rates of fourteen social science fields. Future studies may investigate export rates of other academic disciplines (e.g., in arts and humanities, sciences and medical sciences) and compare their results to the Levitt et al. study and also to the present study. In addition, further research is necessary to validate and test the Citation Pyramid Model. The model may be tested with new data derived from a variety of disciplines.

If authors are made aware of the significant role of citations for evaluative purposes, and if they are encouraged to be more selective in their citation decisions, then citation counts could be used with more reliability and accuracy. Moreover, developing better citation standards to enrich citation practices may seem an ambitious desire for citation analysis studies. In addition, if authors are required to mention their citation motivations along with a simple classification scheme at the time of writing their papers, then the value of citation counts for evaluative purposes would considerably improve. Previous studies have shown that authors remember their citation reasons best when they are writing up the first draft. If a future project can focus on developing such a standard and then test it with a few authors to investigate its applicability and validity, it would add great value to existing citation context studies.

Future research may address "citation length" as another textual properties. The definition of citation length is based on the total number of words embedded in each citation occasion. This property can also be weighted. In other words, the total number of words referring to a citation can be divided by the total number of words used in the citing paper.

Another inquiry flows from restrictions of the data that was used in the present study. Designing and conducting a study on a greater scale, with cited papers published in other IS journals with "more sophisticated techniques of

identifying disciplines of publications can lead to more accurate conclusions" about the nature of citations received from outside the IS field (Pluzhenskaya, 2008, p. 1).

It would be also desirable to explore the possibility of developing and using an automatic and mechanical extraction technique to assign citation occasions to a classification scheme. But "given the complexities of the task described here it seems unlikely that an immediate solution could be found" (Hanney et al., 2005, p. 376).

7.5. Concluding Remarks

Overall, the results reported in the present study increase our understanding of the nature of citations, which is not immediately apparent by examining citation counts alone. In turn, these findings can pave the way for an assessment of citation counts for further evaluation purposes. The present research concludes that information science literature is yet to have a major theoretical and methodological impact on other disciplines. This study hopes to stimulate debate about the future of information science research.

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Appendices

Appendix A: Unified Table of Citation Schemes and Motivations

Table 65: A Unified Table of Citation Schemes and Motivations

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	"Affirmational (10%-90%)	Assumptive (5%-50%)	Conceptual (1%-50%)	Contrastive (5%-40%)	Methodological (5%-45%)	Negational (1%-15%)	Perfunctory (10%-50%)	Persuasive" (5%-40%)
(Tang & Safer, 2008, p. 253) Table 11	• Correctness of method/ results: Provides evidence for the correctness of my methods or results • Suggest limitations: Cited in order to suggest a limitation of the present study	General background: Provides general background (including classic works) that is broadly applicable to my study	Conceptual idea: Identifies a publication which presented a conceptual idea that is specifically relevant to my study	Suggest limitations: Cited in order to suggest a limitation of the present study	Method and data: Identifies a publication which developed methodology or quantitative techniques/data used in the study	Dispute or correct it: Cited in order to dispute it or correct it	Future studies: Identifies a publication that suggests future research for application of my research to other areas	• Correctness of method/ result: Provides evidence for the correctness of my methods or results • Suggest limitations: Cited in order to suggest a limitation of the present study
(Hanney et al., 2005, p. 366) Table 10	"Support	-Note/Review Only - Develop	Develop	Note/Review Only	-Apply - Support - Develop	-Refute	Note/Review Only"	

(Bornmann & Daniel, 2008, pp. 66-67) **Table 12**	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Ahmed et al., 2004, p. 154) **Table 21**	"Made specific use (other than for comparison) of information contained in the cited paper **(4%)**	-Historical background **(48%)** -Description of other relevant work **(37%)**	-Use of theoretical equation for calculation purposes **(5%)**	-Made use of data for comparison purposes **(0%)** -Criticism of the cited paper **(2%)**	-Use of theoretical equation for calculation purposes **(5%)** - Use of practical or theoretical methods in the cited paper to solve a problem **(4%)**	-Criticism of the cited paper **(2%)**	-Description of other relevant work **(37%)**	-Made specific use (other than for comparison) of information contained in the cited paper" **(4%)**
(Case & Higgins, 2000, p. 640) **Table 8**	"this reference supports an assertion in the sentence in which it occurred (not used in present study) **(NA)**	-This reference reviews prior work in this area **(24%)** -this reference is authored by a recognized authority in the field **(5%)**	This reference is a "concept maker"-it represents a genre of studies, or a particular concept in the field **(20%)**		This reference documents the source of a method or design feature **(11%)**			This reference helps establish the legitimacy of the topic of your article **(11%)** - this reference is authored by a recognized authority in the field **(5%)**

(Bornmann & Daniel, 2008, pp. 66-67) **Table 12**	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Shadish et al., 1995, pp. 482-483) **Table 6**	-"Personally influential citation **(15.6%)** -Supportive citation **(22.1%)** - reference reports an article that is similar to your own article **(3.8%)** - this reference reviews prior work in this area **(2.7%)**	-Creative citations **(8.6%)** -Personally influential citation **(15.6%)** -Classic **(18.7%)** -Supportive citation **(22.1%)** -this reference reports what you consider to be an exceptionally high-quality piece of science **(1.6%)** - reference reports an article that is similar to your own article (3.8%) - this reference reviews prior work in this area (2.7%)	Creative citations **(8.6%)**	-This reference illustrates a perspective or finding that contradicts a perspective or finding in your article (3.8%) -This reference has deficiencies that contrast to the strength of your article (2.7%)	-Creative citations **(8.6%)** -this reference documents the sources of a method or design feature used in your study **(16.1%)**	Negative citation **(8.7%)**		-Classic **(18.7%)** -Citations for social reasons" **0%**

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	"Affirmational (10%-90%)	Assumptive (5%-50%)	Conceptual (1%-50%)	Contrastive (5%-40%)	Methodological (5%-45%)	Negational (1%-15%)	Perfunctory (10%-50%)	Persuasive" (5%-40%)
(Bonzi & Snyder, 1991, p. 253) Table 5	"Substantiate claims/establish precedence for work **(29.2%)**	-Identify a related body of work for the reader **(63.7%)** -Substantiate claims/establish precedence for work **(29.2%)** -Inclusion of earlier work on which the current work builds **(39.8%)** -Best/most relevant work on the subject **(47.8%)** -There were no other sources of data **(25.7%)**		Critically analyze/correct earlier work **(16.8%)**		Critically analyze/correct earlier work **(16.8%)**	-Given a variety of equally valid sources, chose this one **(12.4%)** -Ease of access to the cited work **(7.1%)** -Raise citation count **0%**	-Establish the writer's authority in the field **(7.1%)** -Demonstrate knowledge of important work in the field **(27.4%)** -Raise citation count **(0%)** -Political pressure" **(0%)**

(Bornmann & Daniel, 2008, pp. 66-67) **Table 12**	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Hooten, 1991, p. 402) **Table 20**	"Essential/Subsidiary **(13.64%-24.07%)** -Supplementary -more info. **(12.04%-15.91%)** -Confirmative **(92.17%-93.94%)** -Argumental, specula, hypo. **(3.7%-7.58%)** -Substantiates statement **(16.2%-18.94%)** -Source's Data/Inter/Quest **(1.39%-1.52%)** . -Source's data newly interpreted **(0.76%-0.93%)** -Source's data or interpretation substantiated **(0%)**	-Essential/ Subsidiary **(13.64%-24.07%)** -Evolutionary **(73.61%-77.27%)** -Organic **(75.76%-79.63%)** -Setting the stage **(15.91%-25.00%)** -Background **(8.8%-12.12%)** -Historical **(3.03-6.94%)** -Documentary **(29.63%-30.30%)** -Specific point of departure **(5.09%-7.58%)** -Substantiates statement **(16.2%-18.94%)** -Part of history/ state of art **(18.94%-23.61%)**	-Conceptual **(41.67%-44.44%)** -Concept, def., interpret. **(16.67%-21.76%)**	Juxtapositional **(22.73%-29.39%)** -Comparative **(7.58%-9.26%)** -Within discipline data used comparatively **(14.81%-22.73%)**	-Essential/Basic **(41.2%-43.94%)** -Essential/Subsidiary **(13.64%-24.07%)** -Operational **(55.56%-58.33%)** -Organic **(75.76%-79.63%)** -Methodological **(4.17%-6.82%)** -Documentary **(29.63%-30.30%)** -Within discipline data used sporadically **(.76%-5.56%)** -Methods used **(4.17%-6.06%)** -Other discipline material used sporadically **(0%)**	-Negational – partial **(6.06%-6.94%)** -Negational – total **(3.03%-3.70%)** -Negational -Positively evaluated **(6.06%-7.83%)** -Negatively evaluated **(5.3%-6.48%)**	-Supplementary/perfunctory **(12.04%-17.42%)** -Perfunctory **(20.37%24.24%)** -Casual **(12.5%-16.67%)**	-Historical" **(3.03-6.94%)**

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	"Affirmational (10%-90%)	Assumptive (5%-50%)	Conceptual (1%-50%)	Contrastive (5%-40%)	Methodological (5%-45%)	Negational (1%-15%)	Perfunctory (10%-50%)	Persuasive" (5%-40%)
(Cano, 1990, p. 24)	-"Confirmation references -Interpretation/ developmental references	-Assumed knowledge references	-Tentative references		-Methodological references	-Negational references	-Future research references -Tentative references	-Tentative references"
(Cano, 1989, p. 285)	-"Confirmative (2%)	-Evolutionary (14%) -Organic (21%)	Conceptual (19%)	Juxtapositional (4%)	-Operational (12%) -Organic (21%)	Negational (2%)	Perfunctory" (26%)	

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Vinkler, 1987, pp. 54, 55) **Table 4**	"The cited work confirms, supports the results published in the citing paper **(70%)**	In the introduction of your paper or later, a review of literature is given due to "completeness", "preliminaries **(100%)**	A significant part of the cited work (theory, preparation of substance, measuring methods) is utilized **(75%)**	-The cited work is criticized in some minor point **(25%)** -The cited work is refused, criticized in one important question **(35%)**	-Your work is based entirely on the cited work **(35%)** -A significant part of the cited work (theory, preparation of substance, measuring methods) is utilized **(75%)** -A minor part of the cited work (preparation of one substance of secondary importance, application of part of a methodology, application of a statement) is utilized **(95%)**	-The cited work is criticized in some minor point **(25%)** -The cited work is refused, criticized in one important question **(35%)** -The cited work is fully refused, criticized **(5%)**	-You needed more references (citation was, in fact, unnecessary) **(5%)** -The paper is your own, and you want to make publicity to it by citing **(55%)** -You want to make publicity to the cited paper in this way **(15%)**	-The cited paper was published in an important (respected) journal **(5%)** -The cited paper was written by widely known, respected author(s) with absolute professional credit (reputation) **(20%)** -The paper was cited by others, too" **(10%)**
(Brooks, 1985, p. 226) **Table 3**	"Positive credit **(Mean= 0.76 Second rank)**	-Positive credit **(Mean= 0.76 Second rank)** -Reader alert **(Mean: 0.67 Fourth rank)** -Currency scale **(Mean=0.70 Third rank)**			Operational information **(Mean=0.65 Fifth rank)**	Negative credit **(Mean=0.19 Seventh rank)**	-Social consensus **(Mean=0.28 Sixth rank)** -Reader alert **(Mean=0.67 Fourth rank)**	-Currency scale **(Mean=0.70 Third rank)** -persuasiveness **(Mean=1.15 First rank)** -Social consensus" **(Mean=0.28 Sixth rank)**

(Bornmann & Daniel, 2008, pp. 66-67) **Table 12**	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Peritz, 1983, pp. 304-305) **Table 19**	-"Argumental, speculative, hypothetical **(4.6%, 8.2%, 9.9%,11.4%,12.6%),**	-Setting the stage for the present study **(33.4%,36.4%,47%,48.1%,49.5%)** -Background information **(4.7%,5.2%,11.3%, 11.4%, 11.9%)** -Historical **(0%,0.3%,0.4%)** -Documentary **(1%,1.5%,2.6%, 5.8%,6.9%)**		Comparative **(5.3%,8%,9.2%,19.7%,30.8%)**	-Methodological (design) **(3.8%,5.5%,6%,11%)** Methodological (analysis) **(3.6%,6.8%,10.4%)** Methodological **(25.1%)** -Documentary **(1%,1.5%,2.6%, 5.8%,6.9%)**		Casual **(1.2%,1.7%,3%, 3.1%,7.6%)**	Historical" **(0%,0.3%,0.4%)**
(Small, 1982, p. 304)	Supported (substantiated)	Reviewed (compared)		Reviewed (compared)	Applied (used)	Refuted (negative)	Noted only (perfunctory)	

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	"Affirmational (10%-90%)	Assumptive (5%-50%)	Conceptual (1%-50%)	Contrastive (5%-40%)	Methodological (5%-45%)	Negational (1%-15%)	Perfunctory (10%-50%)	Persuasive" (5%-40%)
(Frost, 1979, pp. 405-409) Table 17	-"To support an opinion or factual statement **(Monographs=14%) (journals=8.25%)** - Reference to factual evidence disclosed by other scholars to support an argument **(Monographs=19.6%) (journals=13.8%)**	-To acknowledge the pioneering work of other scholars **(Monographs=.59%) (journals=.67%)** -To indicate the state of present research, a range of opinions, or prevailing views on a topic **(Monographs=18.1%) (journals=22.00%)** -To take an idea a step further **(Monographs=0%) (journals=.19%)** -To acknowledge intellectual indebtedness **(Monographs=1.1%) (journals=.67%)**	-To discuss the meaning of a term or refer to a work in which a given term or symbol first appears **Not specified (not specified)**	-To disagree with an opinion **(Monographs=6.79%) (journals= 8.34%)** -To disagree with a factual statement **(Monographs=2.38%) (journals= 3.20%)** -Expressing a mixed opinion **(Monographs=1.30%) (journals= 3.00%)**			-To support an evaluative opinion or a factual statement **(Monographs=14%) (journals=8.25%)** -To refer to further reading **(Monographs= 13.17%) (journals= 15.88%)** -To provide bibliographic information on a specific edition **(Monographs= 2.5%) (journals=3.98%)**	-To acknowledge the pioneering work of other scholars" **(Monographs= 0.59%) (journals=.67%)**

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Oppenheim & Renn, 1978, p. 226) Table 18	-"Supplying information or data, other than for comparison **(1.1%)**	-Historical background **(39.4%)** -Description of other relevant work **(18.5%)**	Use of theoretical equation **(15.7%)**	Supplying information or data for comparison **(12.7%)** Theory or method not applicable or not the best one **(1.5%)**	-Use of theoretical equation **(15.7%)** -Use of methodology **(10.9%)**	Theory or method not applicable or not the best one **(1.5%)**	-Description of other relevant works **(18.5%)** -Theory or method not applicable or not the best one **(1.5%)**	-Supplying information or data, other than for comparison" **(1.1%)**

(Bornmann & Daniel, 2008, pp. 66-67) Table 12	"Affirmational (10%-90%)	Assumptive (5%-50%)	Conceptual (1%-50%)	Contrastive (5%-40%)	Methodological (5%-45%)	Negational (1%-15%)	Perfunctory (10%-50%)	Persuasive" (5%-40%)
(Spiegel-Rosing, 1977, p. 105) Table 16	-"Cited source substantiate a statement or assumption, or points to further information **(80%)** -Results of citing article prove, verify, substantiate the data or interpretation of cited source **(0.3%)** -Results of citing article furnish a new interpretation or explanation of the data of the cited source **(0%)**	-Cited source is mentioned in the introduction or discussion as part of the history and state of the art of the research question **(5.8%)** -Cited source is the specific point of departure for the research question investigated **(0.6%)** -Cited source substantiate a statement or assumption, or points to further information **(80%)**	-Cited source contains the concepts, definitions, interpretations used **(1.1%)**	-Cited source contains the data which are used for comparative purposes, in tables and statistics **(5.3%)** -Results of citing article prove, verify, substantiate the data or interpretation of cited source **(0.3%)** -Cited source is positively evaluated **(2.4%)** -Results of citing article disprove, put into question the data as interpretation of cited source **(0.4%)**	-Cited source contains the data and materials which are used sporadically in the citing text/in tables or statistics **(0%)** -Cited source contains the method used **(1.4%)**	-Cited source is negatively evaluated **(0.4%)** -Results of citing article disprove, put into question the data as interpretation of cited source **(0.4%)**	-Cited source is mentioned in the introduction or discussion as part of the history and state of the art of the research question under investigation" **(5.8%)**	

(Bornmann & Daniel, 2008, pp. 66-67) **Table 12**	**"Affirmational (10%-90%)**	**Assumptive (5%-50%)**	**Conceptual (1%-50%)**	**Contrastive (5%-40%)**	**Methodological (5%-45%)**	**Negational (1%-15%)**	**Perfunctory (10%-50%)**	**Persuasive" (5%-40%)**
(Chubin & Moitra, 1975, pp. 426-427) Table 15	"Essential/Subsidiary -Supplementary additional information	Essential/Subsidiary			-Essential/Basic -Essential/Subsidiary	Negational citations	Supplementary/perfunctory"	
(Moravcsik & Murugesan, 1975, p. 88) Table 14	-"Confirmative **(87%)**	-Evolutionary **(59%)** -Organic **(60%)**	Conceptual **(53%)**	Juxtapositional **(40%)**	-Operational **(43%)** -Organic **(60%)**	Negational **(14%)**	Perfunctory" **(41%)**	
(Lipetz, 1965, p. 83) **Table 13**	"Affirmed	-Noted only - Reviewed or compared		-Reviewed or compared -Refuted -Questioned -Improved or modified -Replaced	-Applied -Changed the precision (plus or minus) -Change the scope of applicability (plus or minus) -Distinguished	-Refuted -Questioned -Improved or modified -Replaced	-Noted only	-Distinguished"
(Garfield, 1962, p. 85) **Table** 1	"Substantiating claims	-Paying homage to pioneers -Giving credit for related work (homage to peers) -Providing background reading -Identifying original publications in which an idea or concept was discussed -Substantiating claims	Identifying original publication or other work describing an eponymic concept or term	-Correcting one's own work -Correcting the work of others -Criticizing previous work	-Identifying methodology, equipment, etc -Authenticating data and classes of fact (physical constants, etc.)	-Criticizing previous work -Disclaiming work or ideas of others (negative claims) -Disputing priority claims of others (negative homage)	-Giving credit for related work (homage to peers) -Alerting to forthcoming work -Providing leads to poorly disseminated, poorly indexed, or un-cited work	Paying homage to pioneers"

Appendix B: List of Highly Cited JASIST Papers

Table 66: List of Highly Cited JASIST Papers

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A1	Searching the Web: The public and their queries	Spink, A; Wolfram, D; Jansen, MBJ; Saracevic, T	2001	52:3 226-234	170	113	66.47	57	33.53	1	1.75	0	1	55	95
A2	A review of Web searching studies and a framework for future research	Jansen, BJ; Pooch, U	2001	52:3 235-246	103	81	78.64	22	21.36	2	9.09	0	1	19	35
A3	Extracting macroscopic information from Web links	Thelwall, M	2001	52:13 1157-1168	77	73	94.81	4	5.19	2	50.00	0	0	2	2

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A4	Requirements for a co-citation similarity measure, with special reference to Pearson's correlation coefficient	Ahlgren, P; Jarneving, B; Rousseau, R	2003	54:6 550-560	60	50	83.33	10	16.67	1	10.00	0	0	9	9
A5	Conceptualizing documentation on the Web: An evaluation of different heuristic-based models for counting links between university Web sites	Thelwall, M	2002	53:12 995-1005	52	50	96.15	2	3.85	2	100.00	0	0	0	0

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A6	Children's use of the Yahooligans! Web search engine: II. Cognitive and physical behaviors on research tasks	Bilal, D	2001	52:2 118-136	53	45	84.91	8	15.09	0	0.00	0	0	8	29
A7	The concept of relevance in IR	Borlund, P	2003	54:10 913-925	49	30	61.22	19	38.78	0	0.00	0	2	17	34
A8	Scholarly use of the Web: What are the key inducers of links to journal Web sites?	Vaughan, L; Thelwall, M	2003	54:1 29-38	51	46	90.20	5	9.80	1	20.00	0	1	3	4
A9	Judgment of information quality and cognitive authority in the Web	Rieh, SY	2002	53:2 145-161	46	37	80.43	9	19.57	0	0.00	0	0	9	12

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A10	Epistemology and the socio-cognitive perspective in Information Science	Hjorland, B	2002	53:4 257-270	46	45	97.83	1	2.17	1	100.00	0	0	0	0
A11	Cognitive styles and hypermedia navigation: Development of a learning model	Chen, SY; Macredie, RD	2002	53:1 3-15	41	9	21.95	32	78.05	8	25.00	0	4	20	43
A12	Pathfinder networks and author co-citation analysis: A remapping of paradigmatic information scientists	White, HD	2003	54:5 423-434	36	25	69.44	11	30.56	0	0.00	1	3	7	8
A13	Web page change and persistence - A four-year longitudinal study	Koehler, W	2002	53:2 162-171	47	31	65.96	16	34.04	0	0.00	0	2	14	16

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A14	Using the h-index to rank influential information scientists	Cronin, B; Meho, L	2006	57:9 1275-1278	43	33	76.74	10	23.26	0	0.00	4	0	6	11
A15	Using graded relevance assessments in IR evaluation	Kekalainen, J; Jarvelin, K	2002	53:13 1120-1129	35	15	42.86	20	57.14	7	35.00	0	0	13	23
A16	Believe it or not: Factors influencing credibility on the Web	Wathen, CN; Burkell, J	2002	53:2 134-144	36	26	72.22	10	27.78	1	10.00	0	3	6	14
A17	Authors as citers over time	White, HD	2001	52:2 87-108	36	30	83.33	6	16.67	1	16.67	0	0	5	5
A18	Text mining: Generating hypotheses from MEDLINE	Srinivasan, P	2004	55:5 396-413	27	4	14.81	23	85.19	0	0.00	0	1	22	26

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A19	Using concepts in literature-based discovery: Simulating Swanson's Raynaud-fish oil and migraine-magnesium discoveries	Weeber, M; Klein, H; de Jong-van den Berg, LTW; Vos, R	2001	52:7 548-557	35	12	34.29	23	65.71	0	0.00	0	1	22	35
A20	Bibliographic and web citations: What is the difference?	Vaughan, L; Shaw, D	2003	54:14 1313-1322	31	25	80.65	6	19.35	0	0.00	0	0	6	7
A21	Multitasking information seeking and searching processes	Spink, A; Ozmutlu, HC; Ozmutlu, S	2002	53:8 639-652	29	26	89.66	3	10.34	2	66.67	0	0	1	1
A22	Author co-citation analysis and Pearson's r	White, HD	2003	54:13 1250-1259	28	25	89.29	3	10.71	0	0.00	0	0	3	3

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A23	Children's use of the yahooligans! - Web search engine. III. Cognitive and physical behaviors on fully self-generated search tasks	Bilal, D	2002	53:13 1170-1183	34	29	85.29	5	14.71	0	0.00	0	1	4	15
A24	Design criteria for children's Web portals: The users speak out	Large, A; Beheshti, J; Rahman, T	2002	53:2 79-94	33	24	72.73	9	27.27	0	0.00	0	1	8	9
A25	Modeling the retrieval process for an information retrieval system using an ordinal fuzzy linguistic approach	Herrera-Viedma, E	2001	52:6 460-475	29	5	17.24	24	82.76	14	58.33	0	2	8	11

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A26	Mining longitudinal web queries: Trends and patterns	Wang, PL; Berry, MW; Yang, YH	2003	54:8 743-758	30	26	86.67	4	13.33	0	0.00	0	0	4	7
A27	Knowledge integration in virtual teams: The potential role of KMS	Alavi, M; Tiwana, A	2002	53:12 1029-1037	27	15	55.56	12	44.44	2	16.67	0	0	10	23
A28	Domain visualization using VxInsight (R) for science and technology management	Boyack, KW; Wylie, BN; Davidson, GS	2002	53:9 764-774	24	15	62.50	9	37.50	3	33.33	0	0	6	6
A29	MetaSpider: Meta-searching and categorization on the Web	Chen, HC; Fan, HY; Chau, M; Zeng, D	2001	52:13 1134-1147	26	12	46.15	14	53.85	7	50.00	1	1	5	7
A30	Cognitive and task influences on Web searching behavior	Kim, KS; Allen, B	2002	53:2 109-119	27	19	70.37	8	29.63	0	0.00	0	2	6	7

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A31	Vox populi: The public searching of the Web	Wolfram, D; Spink, A; Jansen, BJ; Saracevic, T	2001	52:12 1073-1074	29	24	82.76	5	17.24	0	0.00	0	1	4	10
A32	The effects of domain knowledge on search tactic formulation	Wildemuth, BM	2004	55:3 246-258	28	24	85.71	4	14.29	0	0.00	0	0	4	6
A33	The effect of the Web on undergraduate citation behavior 1996-1999	Davis, PM; Cohen, SA	2001	52:4 309-314	31	26	83.87	5	16.13	0	0.00	0	0	5	8
A34	A temporal comparison of AltaVista Web searching	Jansen, BJ; Spink, A; Pedersen, J	2005	56:6 559-570	26	18	69.23	8	30.77	0	0.00	0	0	8	12
A35	Do the Web sites of higher rated scholars have significantly more online impact?	Thelwall, M; Harries, G	2004	55:2 149-159	25	17	68.00	8	32.00	6	75.00	1	0	1	1

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A36	The role of individual differences in Internet searching: An empirical study	Ford, N; Miller, D; Moss, N	2001	52:12 1049-1066	27	22	81.48	5	18.52	0	0.00	0	0	5	7
A37	What do we know about the h index?	Bornmann, L; Daniel, HD	2007	58:9 1381-1385	23	12	52.17	11	47.83	0	0.00	2	0	9	15
A38	Co-occurrence matrices and their applications in Information Science: Extending ACA to the Web environment	Leydesdorff, L; Vaughan, L	2006	57:12 1616-1628	24	23	95.83	1	4.17	0	0.00	0	0	1	1
A39	Information seeking and mediated searching. Part 2. Uncertainty and its correlates	Wilson, TD; Ford, N; Ellis, D; Foster, A; Spink, A	2002	53:9 704-715	27	25	92.59	2	7.41	0	0.00	0	0	2	4

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A40	Hyperauthorship: A postmodern perversion or evidence of a structural shift in scholarly communication practices?	Cronin, B	2001	52:7 558-569	26	19	73.08	7	26.92	0	0.00	0	0	7	7
A42	The connection between the research of a university and counts of links to its web pages: An investigation based upon a classification of the relationships of pages to the research of the host university	Thelwall, M; Harries, G	2003	54:7 594-602	25	23	92.00	2	8.00	0	0.00	1	0	1	1

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A43	Information-seeking and mediated searching. Part 1. Theoretical framework and research design	Spink, A; Wilson, TD; Ford, N; Foster, A; Ellis, D	2002	53:9 695-703	25	22	88.00	3	12.00	0	0.00	0	0	3	7
A44	Subject categorization of query terms for exploring Web users' search interests	Pu, HT; Chuang, SL; Yang, C	2002	53:8 617-630	24	21	87.50	3	12.50	1	33.33	0	0	2	4
A47	Information discovery from complementary literatures: Categorizing viruses as potential weapons	Swanson, DR; Smalheiser, NR; Bookstein, A	2001	52:10 797-812	23	10	43.48	13	56.52	1	7.69	0	0	12	21

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A50	Disciplinary differences and undergraduates' information-seeking behavior	Whitmire, E	2002	53:8 631-638	25	23	92.00	2	8.00	0	0.00	0	0	2	2
A51	Bounded rationality and satisfying in young people's Web-based decision making	Agosto, DE	2002	53:1 16-27	24	19	79.17	5	20.83	1	20.00	0	0	4	6

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A53	A cast of thousands: Co-authorship and sub-authorship collaboration in the 20th century as manifested in the scholarly journal literature of psychology and philosophy	Cronin, B; Shaw, D; La Barre, K	2003	54:9 855-871	23	16	69.57	7	30.43	0	0.00	0	0	7	12
A54	Algorithmic procedure for finding semantically related journals	Pudovkin, AI; Garfield, E	2002	53:13 1113-1119	24	17	70.83	7	29.17	4	57.14	0	0	3	7
A57	The use of theory in Information Science research	Pettigrew, KE; McKechnie, L	2001	52:1 62-73	23	22	95.65	1	4.35	0	0.00	0	0	1	1

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A61	A nonlinear model of information-seeking behavior	Foster, A	2004	55:3 228-237	22	21	95.45	1	4.55	0	0.00	0	0	1	1
A69	Information grounds and the use of need-based services by immigrants in Queens, New York: A context-based, outcome evaluation approach	Fisher, KE; Durrance, JC; Hinton, MB	2004	55:8 754-766	22	22	100.00	0	0.00	0	0.00	0	0	0	0

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A70	Are there better indices for evaluation purposes than the h index? a comparison of nine different variants of the h index using data from biomedicine	Bornmann, Lutz; Mutz, Ruediger; Daniel, Hans-Dieter	2008	59:5 830-837	7	6	85.71	1	14.29	1	100.00	0	0	0	0
A71	Impact of data sources on citation counts and rankings of LIS faculty: Web of science versus Scopus and Google scholar	Meho, Lokman I.; Yang, Kiduk	2007	58:13 2105-2125	18	17	94.44	1	5.56	0	0.00	0	0	1	2
A72	On the robustness of the h-index	Vanclay, Jerome K.	2007	58:10 1547-1550	12	10	83.33	2	16.67	1	50.00	0	1	0	0

Cited Papers' ID	Title	Authors	Publication Year	Volume: Issue pages	N. of Citing Papers	N. of IS-LS Citing Papers (excluded)	Percent of IS-LS Citing Papers (%)	N. of Outside IS-LS Citations	Percent of Outside IS-LS Citations (%)	Self-Citations (excluded)	Percent of Self-Citations Excluded from the Data (%)	Non-English Citing Papers (excluded)	only Printed Format (excluded)	Citing Papers Included in the Data	Citation Occasions
A74	Using the h-index to rank influential British researchers in Information Science and librarianship	Oppenheim, Charles	2007	58:2 297-301	21	18	85.71	3	14.29	0	0.00	0	0	3	3
Total					**1945**	**1453**	**74.70**	**492**	**25.30**	**70**	**14.23**	**10**	**28**	**384**	**635**

Appendix C: Main Topics of Highly Cited JASIST Papers

Table 67: Main Topics of Highly Cited JASIST Papers

Cited Papers' ID	Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6	Keyword 7	Keyword 8
A1	World Wide Web	BT: searching	BT: user behavior					
A2	World Wide Web	Searching						
A3	World Wide Web	Informetrics						
A4	BT:Bibliometrics	Similarity measures						
A5	BT: World Wide Web	BT: bibliometrics	BT: education					
A6	Searching	users	BT: children and young people	World Wide Web				
A7	Searching	BT: information retrieval	BT: retrieval performance measures					
A8	citation analysis	BT: bibliometrics	BT: searching	communication	webometrics	RT: world wide web	science	
A9	Searching	BT: information retrieval	World Wide Web	Evaluation				
A10	BT: library and Information Science	BT: philosophy	BT: knowledge					
A11	BT: psychological aspects	RT: cognitive aspects	BT: educational technology	BT: Computerized information storage and retrieval	BT: learning			
A12	RT: bibliometrics	visualization	UT: models					
A13	World Wide Web	RT: ageing						

Cited Papers' ID	Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6	Keyword 7	Keyword 8
A14	BT:Bibliometrics	Evaluation	BT: library and Information Science	BT: serials	Articles	Authors		
A15	BT: information retrieval	BT: Retrieval performance measures						
A16	RT: world wide web	Credibility	RT: content analysis					
A17	BT:Bibliometrics	BT: library and Information Science	Authors					
A18	Searching	Medicine	MEDLINE	BT: information retrieval	Mesh	BT: research and development	Data mining	
A19	BT: models	Natural language processing	BT: research and development					
A20	Citations	BT: comparative studies	BT: library and Information Science	bibliometrics				
A21	BT: information retrieval	Searching	RT: evaluation	RT: research				
A22	BT:Bibliometrics	BT: serials						
A23	Searching	users	BT: children and young people	World Wide Web				
A24	World Wide Web	BT: children and young people	BT: user interface	Portals	Design			
A25	Searching	BT: information retrieval	Linguistic analysis					
A26	Searching	Data mining	BT: information retrieval	Query formulation	User behavior	BT: world wide web	Analysis	
A27	Cooperation	Knowledge management	BT: management techniques					

Cited Papers' ID	Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6	Keyword 7	Keyword 8
A28	Searching	BT: information retrieval	Science and technology	visualization				
A29	World Wide Web	Searching	Categories					
A30	World Wide Web	BT: information retrieval	BT: searching	BT: information seeking behavior	Cognitive aspects			
A31	Searching	World Wide Web	RT: evaluation	BT: users				
A32	BT: searching	Microbiology	databases	BT: information seeking behavior	Students	RT: subject analysis		
A33	Citations	Information seeking behavior	Students	World Wide Web	Use			
A34	BT: searching	Evaluation	BT: information retrieval	BT: data collection	statistics	User behavior	BT: users	World Wide Web
A35	BT: bibliometrics	BT: scholarly publishing	BT: world wide web					
A36	RT: world wide web	cognitive aspects	masters degree	BT: information retrieval	BT: searching	BT: information seeking behavior	Students	AltaVista
A37	Bibliometrics	Indexing						
A38	BT: bibliometrics	Co-citation	BT: serials	BT: searching	World Wide Web	Articles		
A39	Searching	intermediaries	BT: information retrieval	Information seeking behavior	BT: research and development			
A40	Medicine	Scholarly publishing						
A42	Informetrics	Links	Productivity	Relationship	BT: research and development	BT: higher education	BT: world wide web	
A43	Searching	BT: information retrieval	Information Seeking Behavior	intermediaries				

Cited Papers' ID	Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6	Keyword 7	Keyword 8
A44	BT: information retrieval	Searching	World Wide Web	Automatic classification	Information Seeking Behavior			
A47	knowledge discovery	BT: medicine	diseases	biology				
A50	Information seeking behavior	Students	Users	Academic libraries				
A51	Information seeking behavior	BT: information retrieval	Searching	World Wide Web	BT: children and young people			
A53	BT: bibliometrics	Collaboration	BT: serials	BT: scholarly publishing	BT: authorship	Articles		
A54	BT: bibliometrics	Genetics						
A57	BT: library and Information Science	Theories						
A61	Information seeking behavior	User behavior	communication	Interdisciplinary aspects	Models	Faculty	BT: users	
A69	RT: user training	Public libraries	BT: users	immigrants				
A70	bibliometrics	Medicine	BT: scholarly publishing					
A71	BT: bibliometrics	BT: databases						
A72	Citations	RT: indexing	Bibliometrics					
A74	Bibliometrics	Library and Information Science	BT: serials	Articles	Authors			

Appendix D: Subject Categories of Citing Papers

Table 68: List of Subject Categories and their Frequencies (Appeared in either the First, or Second, or Third, or Fourth, or Fifth Subject Category)

Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Computer Science, Theory & Methods	80	20.83
Computer Science, Information Systems	68	17.71
Computer Science, Artificial Intelligence	37	9.64
Education & Educational Research	27	7.03
Computer Science, Interdisciplinary Applications	26	6.77
Business	21	5.47
Communication	18	4.69
Psychology, Multidisciplinary	16	4.17
Computer Science, Software Engineering	15	3.91
Ergonomics	15	3.91
Medical Informatics	15	3.91
Psychology, Experimental	14	3.65
Computer Science, Cybernetics	13	3.39
Management	13	3.39
Operations Research & Management Science	13	3.39
Biochemical Research Methods	12	3.13
Biotechnology & Applied Microbiology	12	3.13
Mathematical & Computational Biology	12	3.13
Health Care Sciences & Services	11	2.86
Multidisciplinary Sciences	11	2.86
Telecommunications	10	2.60
Computer Science, Hardware & Architecture	9	2.34
Planning & Development	9	2.34
Engineering, Industrial	6	1.56

Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Physics, Multidisciplinary	5	1.30
Psychology, Applied	5	1.30
Psychology, Educational	5	1.30
Toxicology	5	1.30
Automation & Control Systems	4	1.04
Biochemistry & Molecular Biology	4	1.04
Biology	4	1.04
Engineering, Electrical & Electronic	4	1.04
Genetics & Heredity	4	1.04
History & Philosophy Of Science	4	1.04
Hospitality, Leisure, Sport & Tourism	4	1.04
Medicine, General & Internal	4	1.04
Statistics & Probability	4	1.04
Behavioral Sciences	3	0.78
Chemistry, Analytical	3	0.78
Construction & Building Technology	3	0.78
Ecology	3	0.78
Education, Scientific Disciplines	3	0.78
Engineering, Civil	3	0.78
Environmental Sciences	3	0.78
Environmental Studies	3	0.78
Mathematics, Interdisciplinary Applications	3	0.78
Psychology	3	0.78
Social Sciences, Mathematical Methods	3	0.78
Social Work	3	0.78
Sociology	3	0.78
Engineering, Multidisciplinary	2	0.52
Film, Radio, Television	2	0.52
Geography	2	0.52
Geography, Physical	2	0.52
Geosciences, Multidisciplinary	2	0.52

Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Health Policy & Services	2	0.52
Immunology	2	0.52
Infectious Diseases	2	0.52
Law	2	0.52
Mathematics	2	0.52
Mathematics, Applied	2	0.52
Pharmacology & Pharmacy	2	0.52
Physics, Fluids & Plasmas	2	0.52
Political Science	2	0.52
Psychology, Developmental	2	0.52
Public, Environmental & Occupational Health	2	0.52
Area Studies	1	0.26
Chemistry, Multidisciplinary	1	0.26
Crystallography	1	0.26
Dermatology	1	0.26
Education, Special	1	0.26
Engineering, Manufacturing	1	0.26
Engineering, Mechanical	1	0.26
Evolutionary Biology	1	0.26
Forestry	1	0.26
Mechanics	1	0.26
Medicine, Research & Experimental	1	0.26
Pathology	1	0.26
Pediatrics	1	0.26
Physics, Mathematical	1	0.26
Physiology	1	0.26
Rehabilitation	1	0.26
Social Issues	1	0.26
Sport Sciences	1	0.26
surgery	1	0.26
Tropical Medicine	1	0.26

Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Zoology	1	0.26
Missing Data	1	0.26

Note: The total percentage exceeds 100 percent, as all the subject categories for each citing paper are included in the data

Table 69: List of the Main Subject Categories and Their Frequencies in Citing Papers (Including All Five Subject Categories)

Main Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Computer Science	248	64.58
Psychology	45	11.72
Education & Educational Research	27	7.03
Business	21	5.47
Communication	18	4.69
Engineering	17	4.43
Ergonomics	15	3.91
Medical Informatics	15	3.91
Management	13	3.39
Operations Research & Management Science	13	3.39
Biochemical Research Methods	12	3.13
Biotechnology & Applied Microbiology	12	3.13
Mathematical & Computational Biology	12	3.13
Health Care Sciences & Services	11	2.86
Multidisciplinary Sciences	11	2.86
Telecommunications	10	2.60
Planning & Development	9	2.34
Physics	8	2.08
Mathematics	7	1.82
Medicine	5	1.30
Toxicology	5	1.30
Automation & Control Systems	4	1.04
Biochemistry & Molecular Biology	4	1.04
Biology	4	1.04
Chemistry	4	1.04
Education	4	1.04

Main Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Genetics & Heredity	4	1.04
Geography	4	1.04
History & Philosophy Of Science	4	1.04
Hospitality	4	1.04
Statistics & Probability	4	1.04
Behavioral Sciences	3	0.78
Construction & Building Technology	3	0.78
Ecology	3	0.78
Environmental Sciences	3	0.78
Environmental Studies	3	0.78
Social Sciences	3	0.78
Social Work	3	0.78
Sociology	3	0.78
Film	2	0.52
Geosciences	2	0.52
Health Policy & Services	2	0.52
Immunology	2	0.52
Infectious Diseases	2	0.52
Law	2	0.52
Pharmacology & Pharmacy	2	0.52
Political Science	2	0.52
Public	2	0.52
Area Studies	1	0.26
Crystallography	1	0.26
Dermatology	1	0.26
Evolutionary Biology	1	0.26
Forestry	1	0.26
Mechanics	1	0.26

Main Subject Categories	Frequency of Citing Papers (out of 384 Citing Papers)	Percentages of Citing Papers (out of 384 Citing Papers)
Pathology	1	0.26
Pediatrics	1	0.26
Physiology	1	0.26
Rehabilitation	1	0.26
Social Issues	1	0.26
Sport Sciences	1	0.26
surgery	1	0.26
Tropical Medicine	1	0.26
Zoology	1	0.26
Missing Data	1	0.26

Note: The total percentage exceeds 100 percent, as all the subject categories for each citing paper are included in the data

Table 70: List of the First Subject Categories and their Frequencies in Citing Papers

Main & Sub-disciplines	Frequency of Citing Papers (Out of 384 Citing Papers)	Percent (Out of 384 Citing Papers)
Computer Science, Theory & Methods	70	18.23
Computer Science, Information Systems	54	14.06
Computer Science, Artificial Intelligence	34	8.85
Business	21	5.47
Education & Educational Research	18	4.69
Communication	16	4.17
Computer Science, Interdisciplinary Applications	14	3.65
Psychology, Multidisciplinary	14	3.65
Computer Science, Cybernetics	13	3.39
Biochemical Research Methods	12	3.13
Multidisciplinary Sciences	11	2.86
Computer Science, Hardware & Architecture	9	2.34
Physics, Multidisciplinary	5	1.30
Automation & Control Systems	4	1.04
Biology	4	1.04
History & Philosophy Of Science	4	1.04
Psychology, Educational	4	1.04
Behavioral Sciences	3	0.78
Biochemistry & Molecular Biology	3	0.78
Chemistry, Analytical	3	0.78
Computer Science, Software Engineering	3	0.78
Construction & Building Technology	3	0.78
Ecology	3	0.78
Education, Scientific Disciplines	3	0.78
Engineering, Industrial	3	0.78
Management	3	0.78

Main & Sub-disciplines	Frequency of Citing Papers (Out of 384 Citing Papers)	Percent (Out of 384 Citing Papers)
Mathematics, Interdisciplinary Applications	3	0.78
Medicine, General & Internal	3	0.78
Social Work	3	0.78
Environmental Studies	2	0.52
Geography	2	0.52
Geography, Physical	2	0.52
Health Policy & Services	2	0.52
Hospitality, Leisure, Sport & Tourism	2	0.52
Immunology	2	0.52
Law	2	0.52
Mathematics, Applied	2	0.52
Pharmacology & Pharmacy	2	0.52
Political Science	2	0.52
Psychology, Developmental	2	0.52
Area Studies	1	0.26
Biotechnology & Applied Microbiology	1	0.26
Chemistry, Multidisciplinary	1	0.26
Dermatology	1	0.26
Education, Special	1	0.26
Engineering, Mechanical	1	0.26
Environmental Sciences	1	0.26
Forestry	1	0.26
Genetics & Heredity	1	0.26
Health Care Sciences & Services	1	0.26
Mechanics	1	0.26
Medicine, Research & Experimental	1	0.26
Physics, Fluids & Plasmas	1	0.26
Psychology, Experimental	1	0.26

Main & Sub-disciplines	Frequency of Citing Papers (Out of 384 Citing Papers)	Percent (Out of 384 Citing Papers)
Public, Environmental & Occupational Health	1	0.26
Social Issues	1	0.26
Sociology	1	0.26
surgery	1	0.26
Missing Data	1	0.26
Total	384	100.00

Table 71: List of the First Main Subject Categories and Their Frequencies in Citing Papers

Main Disciplines	Frequency of Citing Papers (Out of 384 Citing Papers)	Percent (Out of 384 Citing Papers)
Computer Science	197	51.30
Business	21	5.47
Psychology	21	5.47
Education & Educational Research	18	4.69
Communication	16	4.17
Biochemical Research Methods	12	3.13
Multidisciplinary Sciences	11	2.86
Physics	6	1.56
Mathematics	5	1.30
Automation & Control Systems	4	1.04
Biology	4	1.04
Chemistry	4	1.04
Education	4	1.04
Engineering	4	1.04
Geography	4	1.04
History & Philosophy Of Science	4	1.04
Medicine	4	1.04
Behavioral Sciences	3	0.78
Biochemistry & Molecular Biology	3	0.78
Construction & Building Technology	3	0.78
Ecology	3	0.78
Management	3	0.78
Social Work	3	0.78
Environmental Studies	2	0.52
Health Policy & Services	2	0.52
Hospitality	2	0.52

Main Disciplines	Frequency of Citing Papers (Out of 384 Citing Papers)	Percent (Out of 384 Citing Papers)
Immunology	2	0.52
Law	2	0.52
Pharmacology & Pharmacy	2	0.52
Political Science	2	0.52
Area Studies	1	0.26
Biotechnology & Applied Microbiology	1	0.26
Dermatology	1	0.26
Environmental Sciences	1	0.26
Forestry	1	0.26
Genetics & Heredity	1	0.26
Health Care Sciences & Services	1	0.26
Mechanics	1	0.26
Public	1	0.26
Social Issues	1	0.26
Sociology	1	0.26
surgery	1	0.26
Missing data	1	0.26
Total	384	100.00

Appendix E: Main Citation Functions of Highly Cited JASIST Papers

Table 72: Main Citation Functions of Highly Cited JASIST Papers

Cited Paper ID	Total Citation Occasions	Total Number of Citing Papers	Applied	Applied (%)	Contrastive	Contrastive (%)	Supportive	Supportive (%)	Reviewed	Reviewed (%)	Perfunctory	Perfunctory (%)
A1	95	55	4	4.21	15	15.79	17	17.89	43	45.26	16	16.84
A2	34	18	0	0.00	5	14.71	3	8.82	18	52.94	8	23.53
A3	1	1	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
A4	9	9	0	0.00	0	0.00	3	33.33	1	11.11	5	55.56
A6	29	8	2	6.90	2	6.90	2	6.90	18	62.07	5	17.24
A7	34	17	0	0.00	2	5.88	1	2.94	9	26.47	22	64.71
A8	4	3	0	0.00	0	0.00	0	0.00	2	50.00	2	50.00
A9	12	9	0	0.00	0	0.00	0	0.00	3	25.00	9	75.00
A11	42	19	3	7.14	0	0.00	3	7.14	8	19.05	28	66.67
A12	8	7	0	0.00	0	0.00	0	0.00	0	0.00	8	100.00
A13	16	14	0	0.00	2	12.50	1	6.25	9	56.25	4	25.00
A14	10	5	0	0.00	2	20.00	0	0.00	3	30.00	5	50.00
A15	23	13	2	8.70	0	0.00	5	21.74	12	52.17	4	17.39
A16	14	6	0	0.00	1	7.14	0	0.00	3	21.43	10	71.43
A17	5	5	0	0.00	0	0.00	1	20.00	0	0.00	4	80.00
A18	26	22	0	0.00	0	0.00	2	7.69	13	50.00	11	42.31
A19	35	22	2	5.71	3	8.57	2	5.71	11	31.43	17	48.57
A20	7	6	0	0.00	0	0.00	0	0.00	0	0.00	7	100.00
A21	1	1	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
A22	3	3	0	0.00	0	0.00	1	33.33	1	33.33	1	33.33

Cited Paper ID	Total Citation Occasions	Total Number of Citing Papers	Applied	Applied (%)	Contrastive	Contrastive (%)	Supportive	Supportive (%)	Reviewed	Reviewed (%)	Perfunctory	Perfunctory (%)
A23	15	4	0	0.00	1	6.67	0	0.00	11	73.33	3	20.00
A24	9	8	0	0.00	0	0.00	0	0.00	4	44.44	5	55.56
A25	11	8	0	0.00	0	0.00	1	9.09	6	54.55	4	36.36
A26	7	4	0	0.00	0	0.00	0	0.00	4	57.14	3	42.86
A27	23	10	0	0.00	0	0.00	1	4.35	1	4.35	21	91.30
A28	6	6	2	33.33	0	0.00	0	0.00	1	16.67	3	50.00
A29	7	5	1	14.29	1	14.29	1	14.29	1	14.29	3	42.86
A30	7	6	0	0.00	1	14.29	0	0.00	1	14.29	5	71.43
A31	10	4	0	0.00	1	10.00	1	10.00	4	40.00	4	40.00
A32	6	4	0	0.00	1	16.67	1	16.67	2	33.33	2	33.33
A33	8	5	2	25.00	1	12.50	0	0.00	4	50.00	1	12.50
A34	12	8	0	0.00	1	8.33	4	33.33	5	41.67	2	16.67
A35	1	1	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
A36	7	5	2	28.57	0	0.00	0	0.00	4	57.14	1	14.29
A37	15	9	0	0.00	0	0.00	0	0.00	3	20.00	12	80.00
A38	1	1	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
A39	4	2	2	50.00	1	25.00	0	0.00	1	25.00	0	0.00
A40	7	7	0	0.00	1	14.29	2	28.57	0	0.00	4	57.14
A42	1	1	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
A43	6	2	0	0.00	0	0.00	0	0.00	4	66.67	2	33.33
A44	4	2	0	0.00	0	0.00	0	0.00	1	25.00	3	75.00
A47	21	12	1	4.76	3	14.29	0	0.00	11	52.38	6	28.57
A50	2	2	0	0.00	0	0.00	0	0.00	2	100.00	0	0.00
A51	6	4	0	0.00	1	16.67	0	0.00	2	33.33	3	50.00

Cited Paper ID	Total Citation Occasions	Total Number of Citing Papers	Applied	Applied (%)	Contrastive	Contrastive (%)	Supportive	Supportive (%)	Reviewed	Reviewed (%)	Perfunctory	Perfunctory (%)
A53	12	7	0	0.00	1	8.33	0	0.00	3	25.00	8	66.67
A54	7	3	5	71.43	0	0.00	0	0.00	2	28.57	0	0.00
A57	1	1	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
A61	1	1	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
A71	2	1	0	0.00	0	0.00	0	0.00	2	100.00	0	0.00
A74	3	3	0	0.00	0	0.00	0	0.00	2	66.67	1	33.33
Total	**630**	**379**	**28**	**4.45**	**46**	**7.30**	**52**	**8.25**	**238**	**37.78**	**266**	**42.22**

Appendix F: Author Affiliations of Highly Cited JASIST Papers

Table 73: Authors Affiliation of Highly Cited JASIST Paper

Cited Papers' ID	Information/Library Science affiliated	Information Science and Computer Science affiliated	Computer Science	Information Science and other disciplines affiliated	Other disciplines affiliated
A1		X			
A2			X		
A3			X		
A4				X	
A5			X		
A6	X				
A7	X				
A8		X			
A9	X				
A10	X				
A11			X		
A12	X				
A13	X				
A14	X				
A15	X				
A16	X				
A17	X				
A18	X				
A19					X
A20	X				
A21				X	
A22	X				

Cited Papers' ID	Information/Library Science affiliated	Information Science and Computer Science affiliated	Computer Science	Information Science and other disciplines affiliated	Other disciplines affiliated
A23	X				
A24	X				
A25			X		
A26		X			
A27					X
A28					X
A29					X
A30	X				
A31		X			
A32	X				
A33	X				
A34		X			
A35			X		
A36	X				
A37					X
A38				X	
A39	X				
A40	X				
A42			X		
A43	X				
A44	X				
A47				X	
A50	X				
A51	X				
A53	X				
A54				X	

Cited Papers' ID	Information/Library Science affiliated	Information Science and Computer Science affiliated	Computer Science	Information Science and other disciplines affiliated	Other disciplines affiliated
A57	X				
A61	X				
A69	X				
A70					X
A71	X				
A72					X
A74	X				
Total	**31**	**5**	**7**	**5**	**7**

Appendix G: Impact Levels for Each Highly Cited JASIST Paper

Table 74: Impact Levels for Each Highly Cited JASIST Paper

Cited Papers' ID	High Impact Level (impact score=4)		Relatively High Impact Level (impact score=3)		Moderate Impact Level (impact score=2)		Relatively Low Impact Level (impact score=1)		Low Impact Level (impact score=0)		Total Citing Papers
	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	
1	13	23.64	8	14.55	11	20.00	19	34.55	4	7.27	**55**
2	2	11.11	3	16.67	4	22.22	9	50.00	0	0.00	**18**
3	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00	**1**
4	0	0.00	3	33.33	3	33.33	1	11.11	2	22.22	**9**
6	1	12.50	3	37.50	2	25.00	2	25.00	0	0.00	**8**
7	2	11.76	1	5.88	7	41.18	5	29.41	2	11.76	**17**
8	0	0.00	1	33.33	0	0.00	1	33.33	1	33.33	**3**
9	0	0.00	1	11.11	1	11.11	6	66.67	1	11.11	**9**
11	2	10.53	4	21.05	6	31.58	7	36.84	0	0.00	**19**
12	0	0.00	0	0.00	2	28.57	3	42.86	2	28.57	**7**
13	1	7.14	1	7.14	0	0.00	7	50.00	5	35.71	**14**
14	1	20.00	0	0.00	1	20.00	1	20.00	2	40.00	**5**
15	2	15.38	4	30.77	4	30.77	3	23.08	0	0.00	**13**
16	0	0.00	1	16.67	2	33.33	2	33.33	1	16.67	**6**
17	0	0.00	1	20.00	0	0.00	4	80.00	0	0.00	**5**
18	0	0.00	3	13.04	5	21.74	9	39.13	5	21.74	**23**
19	2	9.09	4	18.18	4	18.18	9	40.91	3	13.64	**22**
20	0	0.00	0	0.00	2	40.00	1	20.00	3	60.00	**5**
21	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00	**1**
22	0	0.00	0	0.00	2	66.67	0	0.00	1	33.33	**3**

Cited Papers' ID	High Impact Level (impact score=4)		Relatively High Impact Level (impact score=3)		Moderate Impact Level (impact score=2)		Relatively Low Impact Level (impact score=1)		Low Impact Level (impact score=0)		Total Citing Papers
	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	
23	0	0.00	1	25.00	2	50.00	1	25.00	0	0.00	**4**
24	0	0.00	0	0.00	3	37.50	2	25.00	3	37.50	**8**
25	0	0.00	0	0.00	3	37.50	2	25.00	3	37.50	**8**
26	0	0.00	1	25.00	1	25.00	2	50.00	0	0.00	**4**
27	0	0.00	3	30.00	2	20.00	5	50.00	0	0.00	**10**
28	0	0.00	1	16.67	2	33.33	3	50.00	0	0.00	**6**
29	1	20.00	1	20.00	1	20.00	2	40.00	0	0.00	**5**
30	0	0.00	0	0.00	1	16.67	4	66.67	1	16.67	**6**
31	1	25.00	1	25.00	1	25.00	1	25.00	0	0.00	**4**
32	0	0.00	2	50.00	0	0.00	2	50.00	0	0.00	**4**
33	1	20.00	0	0.00	0	0.00	3	60.00	1	20.00	**5**
34	1	12.50	2	25.00	0	0.00	5	62.50	0	0.00	**8**
35	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	**1**
36	1	20.00	0	0.00	2	40.00	1	20.00	1	20.00	**5**
37	0	0.00	0	0.00	4	44.44	2	22.22	3	33.33	**9**
38	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	**1**
39	1	50.00	1	50.00	0	0.00	0	0.00	0	0.00	**2**
40	0	0.00	2	28.57	1	14.29	3	42.86	1	14.29	**7**
42	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00	**1**
43	0	0.00	1	50.00	0	0.00	1	50.00	0	0.00	**2**
44	0	0.00	0	0.00	2	100.00	0	0.00	0	0.00	**2**
47	1	8.33	1	8.33	4	33.33	4	33.33	2	16.67	**12**
50	0	0.00	0	0.00	0	0.00	2	100.00	0	0.00	**2**
51	0	0.00	0	0.00	2	50.00	2	50.00	0	0.00	**4**
53	0	0.00	1	14.29	4	57.14	1	14.29	1	14.29	**7**

Cited Papers' ID	High Impact Level (impact score=4)		Relatively High Impact Level (impact score=3)		Moderate Impact Level (impact score=2)		Relatively Low Impact Level (impact score=1)		Low Impact Level (impact score=0)		Total Citing Papers
	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	N. of Citing Papers	Percentage	
54	2	66.67	1	33.33	0	0.00	0	0.00	0	0.00	**3**
57	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	**1**
61	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	**1**
71	0	0.00	1	100.00	0	0.00	0	0.00	0	0.00	**1**
74	0	0.00	0	0.00	0	0.00	3	100.00	0	0.00	**3**
Total	**35**	**9.23**	**58**	**15.30**	**95**	**25.07**	**143**	**37.73**	**48**	**12.66**	**379**

Appendix H: An In-depth Description of Cited Papers with "Applied" Citation Function

The following section summarizes an in-depth analysis related to the "applied" function. This function was selected for this in-depth analysis because it was judged to present the highest level of contribution. Only 4.4 percent of citation occasions were assigned to this category.

a. The "algorithmic procedure for finding semantically related journals" proposed by Pudovkin and Garfield (2002) was the only algorithm which was adopted or applied outside the Information Science field. The citing article conducted "a bibliometric analysis of communication journals" published from 2002 to 2005 and was published in a Communication field journal (Feeley, 2008).

b. The Information Retrieval (IR) evaluation analysis approach proposed by Kekalainen and Jarvelin (2002), using non-dichotomous graded relevance assessments in IR experiments, was later applied in a proceeding paper published in the Computer Science field. This paper investigated "the effect of performance measures and relevance functions in comparing retrieval systems in INEX, an evaluation forum dedicated to XML retrieval" (Vu & Gallinari, 2005, p. 312). Kekalainen and Jarvelin (2002) study also used a four-point relevance scale which was latter adopted in a proceeding paper which studied "the assessment of relevance for the INEX'02 test collection" and was published in "Advances in Information Retrieval, Proceedings" (Kazai, Masood and Lalmas, 2004).

c. Ford, Miller, and Moss (2001) reported "the results of a study of the role of individual differences in Internet searching" (p. 1049). Individual differences consisted of cognitive styles, levels of prior experience, internet perceptions, study approaches, age and gender. These researchers used "factor analysis" to identify clusters of indicators and to detect any

significant relations between different indicators. In a subsequent citing paper, Hwang, Tsai, Tsai and Tseng (2008) applied "factor analysis", the same approach proposed by Ford et al. (2001), "to analyze the variables to identify clusters of indicators" in order to detect some main searching behaviors of the students to ultimately assist teachers in analyzing their students' web-searching behaviors (pp. 933, 935).

d. "Excite search engine log data", extracted and collected in Spink et al. (2001) study were later used in three subsequent citing papers. Two of these citing papers were articles published in "ACM Transactions on Information Systems" and one of them was a proceeding paper published in "*Lecture Notes in Computer Science*" (Cannane & Williams, 2002; Fagni, Perego, Silvestri and Orlando, 2006; Lee et al., 2005).

e. The hypotheses generated by Weeber et al. (2001) as a result of the implementation of their two-step model of the discovery process were later applied in a citing article which was published in "IEEE Transactions on Information Technology in Biomedicine". These generated hypotheses were then analyzed to generate a new result, using the proposed supervised model (Atkinson & Rivas, 2008).

f. To understand how different learners perceive hypermedia systems, Chen & Macredie (2002) analyzed findings from previous studies and developed a learning research model. This model was later adopted in a study conducted by Lee et al. (2005) published in "Computers & Education" journal. This study attempted to find out "what affects student cognitive style in the development of hypermedia learning system?" Lee et al. also designed their questionnaire "based on the theoretical framework adapted from Chen & Macredie (2002) study" (p. 7).

g. VxInsight, a knowledge visualization tool (software) which was applied to perform domain visualization analysis in Boyack, Wylie and Davidson (2002) study was later applied in two subsequent citing papers. One of these citing papers was an article published in "Infection and Immunity" journal and the other one was a review paper published in "Comparative and Genomics" journal (Weems et al., 2004; Magee, Friedberg, Woitaske, Johanston and Cox, 2005).

h. Wilson, Ford, Ellis, Foster and Spink (2002) developed a scale to measure uncertainty reduction involved in problem-solving processes experienced by online users. This scale was later used in a study which evaluated the performance of the World Wide Web as "an information resource in a specific information domain" and then presented a model "integrating the construct of uncertainty and the task-technology fit model" (D'Ambra & Wilson, 2004, p. 294). This citing article also acquired the concept of "uncertainty" from Wilson et al. study and integrated this concept into its model.

i. Pudovkin and Garfield (2002) study used the index of citation relatedness to proximate the subjective judgments of experts to cluster topical similar journals. They further modified this index and improved it, taking into account the sizes of cited and citing journals. This relatedness index was later applied in three subsequent citing articles published in Communication, Medical and Biochemical research subject fields (Rezaei-Ghaleh & Azizi, 2007; Willett, 2007; Feeley, 2008).

j. Robinson & Schlegl (2005) reported on a study aimed to build upon and expand the research of Davis & Cohen (2001). Davis & Cohen's study investigated the impact of the internet on undergraduate scholarship. Robinson & Schlegl modified their method and supplemented their typology of information resources and added a specific category for

government documents. They also adopted Davis & Cohen's definition of journals, however, Robinson & Schlegl defined electronic citations in a different way rather than Davis and Cohen's approach. Robinson & Schlegl study was published in a Political Science journal.

k. Hu et al. (2005) presented "a semantic-based data mining approach to identify candidate viruses as potential bio-terrorism weapons from biomedical literature" (p. 60). To develop their mining procedure, they adapted some ideas used by Swanson, Smalheiser and Bookstein (2001) and considered many significant properties of the viruses.

l. Smith (2007) designed his theoretical framework and also his research questions based on Bilal (2001) study on children's internet searches and their use of Yahooligans! Search engine.