THE INFORMATION SOCIETY

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The Information Society: The Development of a Scientific Specialty

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The Information Society: The Development of a Scientific Specialty

Abstract

This study explains the application of three bibliometric tools for the exploration of the maturity of the information society as a field of research. We find a disparity between the realization of the information society in everyday life and the state of the research in the area which is at a fairly early stage of evolving into a mature research discipline. Preliminary analysis of the data uncovers the three disciplinary foundations as Library and Information Science, Communication, and Information Systems. The Bradford distribution reveals that the core of information society journals is not yet fully established. Journal citation and self-citation patterns lend further support for this and help identify which journals are firmly part of the core and which are less so. Finally, research collaboration patterns demonstrate that this area of research is moving toward disciplinary maturity. The paper concludes with some practical and academic recommendations.

Introduction

The term "information society" is a brief and modest way of expressing a very elaborate concept. Scholars developed and refined the concept over the past 50 years in a variety of contexts: economic, political, technological, and social. In recent years the vision of an information society is undergoing intensive realization as evidenced by the ubiquity of the Internet and of mobile communication technologies (Hassan 2008). Technology's pervasiveness creates a society that is constantly connected; a society which is interdependent in terms of the flow of information and its influence on all walks of life:

commerce, technology adoption, education, and so on. The present research employs bibliometric techniques to study the current state as well as the evolution of research about the information society. We ask: is the information society a unique, specialized, academic research field that could become an autonomous discipline?

To examine this question we offer an historical review of the term which leads to the definition of the term "information society". The definition provides the background for identifying the areas of research that comprise this field and prepares the ground for the bibliometric analysis. The next section offers a brief summary of some of the highly regarded definitions of 'the information society' by scholars such as Fritz Machlup, Daniel Bell, Alistair Duff, Eugene Garfield, James Beniger, Jerry Salvaggio and Charles Steinfeld. These scholars were selected because they either conceptualized the field or thoroughly reviewed it. Each of the cited scholars published his work in a different time, often referring to some of the previous scholars, adding a new layer to the definition or covering an aspect absent in earlier treatments of the term. Therefore, the next section follows mostly a historical progression producing a more and more elaborate definition of the "information society" until we find commonalities among definitions and offer a working definition for the current research.

Historical Development of the Term "Information Society"

The first characterization of an information society came from labor economist Fritz Machlup. In his well-known book *The Production and Distribution of Knowledge in the United States*, Machlup (1962) defined what constitutes a 'knowledge economy' and showed its growth and contribution to the U.S. economy. He also discussed the trend in employment since the turn of the 20th century: a decline in the number of production

workers accompanied by an increase in knowledge workers pointing to an overall social change in economic terms.

In the 1970 annual meeting of the American Society for Information Science (now the American Society for Information Science and Technology) Eugene Garfield, founder of the Institute for Scientific Information (ISI), chaired a session titled "Information-Conscious-Society". This conference session acknowledged that access to information was a social issue. In his introductory speech Garfield described difficulties people encounter in access to information, and the role of librarians in closing this gap (Garfield 1971b, Garfield 1971a).

It was the sociologist Daniel Bell who coined the term "information society" (Bell 1973, Bell 1979). Bell's discussion of the information society was very much focused on the information economy but he added two important dimensions to it: the flow of information and information technology. Flow described the explosion in the dissemination of scientific knowledge as well as in the wide availability of mass media information. The contribution of information technology, according to Bell, is on a macro, industrial, level, for example by mainframe computers and robots, but also on a personal level by individuals' use of computers and communications. Interestingly, in a critical review of Bell's work, Duff (1998) points out that Bell was not comfortable with the centrality and importance of the term he coined as he felt it was not well-defined.

In 1979 Eugene Garfield distinguished between an 'information conscious' society in which people take information for granted as an integral part of daily activities, and an 'information literate' society where people know how to handle information. The

information society is born out of the marriage of those two concepts, according to Garfield, who predicted that this would occur around the year 2001 (Garfield 1979a). His concise definition was: "Information society is a society in which we take for granted the role of information as it pervades and dominates the activities of government, business and everyday life". He envisioned the elderly, handicapped, women, and minorities being empowered by access to and use of information in addition to everyone's access and use of a variety of useful or entertaining information. This visionary definition serves the present work: researching the information society means studying everyday uses and implications of information in the general population as well as in subgroups.

In analyzing historical economic development James Beniger (1986) presented a theory of control explaining that the roots of the information society are much deeper than previous scholars have proposed. Beniger describes the information society as the outcome of the industrial revolution. Firms became more automated and larger in size, modern transportation enabled farther reach. These trends necessitated new tools to monitor and control the increased activity. The informatization of production led to a flood of products which necessitated the informational control of distribution via communication systems such as the telegraph, postal service, and telephone. Distribution efforts had to be complemented by information regarding demand, and by communication with consumers. Modern computerized control technologies enabled another phase of rapid growth of the information society as reflected by the progression and convergence of mass media, telecommunications, and computing. Convergence is ultimately intensified by digitalization which creates common grounds for all types of information to be accessible to society via any kind of medium. This pervasiveness of information, according to Beniger, is the essence of the information society.

In a review of a variety of definitions, the communication researchers Steinfeld and Salvaggio (1989) summarized five perspectives of the information society: economic/production, consumption, technological, critical and multidimensional. While the *economic* perspective analyses macro changes in the workforce, the *consumption* approach acknowledges the informational activities of individuals such as reading, communicating, and consuming media. The *technological* viewpoint quantifies the technological infrastructure to show the pervasiveness of information technology in every aspect of the economy and government. Common to the first three perspectives is the strong emphasis on quantification as if the over-powering numbers are in and of themselves sufficient indication of a social and cultural change. The *critical* approach contests technological determinism by saying that technology does not bring about social change even if it is able to support it. Technology, according to this view, is a powerful tool used cynically by large corporations and by government to reinforce their power bringing about greater inequalities rather than helping to bridge gaps. Moreover, new social problems arise such as invasion of privacy and computer crime. Steinfeld and Salvaggio conclude with what they call the *multidimensional* approach suggesting that the information society is multifaceted and requires consideration of economic, social, and cultural aspects and that the term should be in the plural, 'information societies', in order to represent differences among countries and nationalities.

In 1995 Alistair Duff, a prolific researcher of the information society, published the only bibliometric study of the field to date. His findings were that the articles on the information society were dispersed in a large number of journals, publication did not increase in the 10-year window that he examined, and did not warrant the description of the field as a

paradigm, as some researchers have tended to do based on their intuitions (Duff 1995). According to Duff, about thirty years of research have not provided solid ground for the definition of the information society (Duff 2000). Therefore Duff presented the following guidelines for focusing research:

1. The field should be named Information Society Studies.
2. Information Society Studies should be recognized as an interdisciplinary field.
3. Information Society Studies should be accepted as a branch of information science, inter alia.
4. The journal situation should be kept under control.
5. Scholarly conferences should be organized.

The historical overview of the information society suggests that the field is interdisciplinary, as Duff noted. However, it is not clear that it is a branch of information science. Duff's assessment of the paradigmatic state of the field was based on a study of 10 years of literature. The present research will describe the interdisciplinarity of the field, examine the link to information science and analyze the journal situation based on 38 years of publications. Multiple bibliometric methods will be applied for this purpose.

Overall, the definition of the information society evolved from a quantitative observation and assessment to a more holistic approach taking into account the meaning of information, its significance, and its contribution to society in many channels. In trying to tie together the definitions of information society to describe a research domain it seems that *studying the relationship between individuals, groups, or organizations and information* is a broad enough statement to include all the ways in which traditional disciplines deal with information. The study of the information society encompasses multidisciplinary views

including information management and economics, social, cultural and psychological interpretations, and legal and political issues.

In order to cover the variety of approaches identified in the review of definitions our study relies on data representing all the major scientific areas. Bibliometric analysis allows us to track the development of the field by tracking the development of the literature and its internal structure. These methods include the identification of a core and a periphery of the academic literature using the Bradford distribution, analyzing citation patterns at the journal level, and collaboration trends at the author level. Each approach is followed by the proposition we wish to examine.

Core and Peripheral Journals

Bradford's distribution is used to identify the core journals in a field. It is based on the observation that the core for any discipline carries a similar number of articles as the second and third zones of articles; however, these articles are concentrated in a small number of journals which constitute the core. The second zone contains a comparable number of articles spread over more journals, and in the third zone the number of journals that deal with the subject multiplies. The third zone is known as the peripheral zone of the research field (Diodato 1994).

When a field of study has not yet established itself it will not have a well-defined disciplinary core (Gordon 2004). The articles will be diffused in a large number of journals. We believe that the review of the evolution of the term 'information society' shows that the area has reached maturity to a level where a core and a periphery will be identifiable. The first proposition is intended to explore the descriptive data accordingly.

Proposition 1: The information society field is inter- and multidisciplinary and as such is characterized by a paradigmatic core as well as by diversity.

To gain a deeper understanding of the degree of academic maturity we analyze citation patterns as presented in the next section.

Academic Diffusion

In academia ideas diffuse and develop by the norm to cite prior findings. Reasons for citing earlier work include: the reference to previous knowledge, a discovery that leads to specific findings, confirming hypotheses, and comparisons or conclusions about the writing on a subject area. A special case of citation is self-citation which means that an author cites his/her own work, or a journal contains citations to earlier articles from the same journal. Other forms of self-citation include reference to same language, discipline, or country publications (Rousseau 1999).

The focus of the present work is on journal self-citation. Too many or too few citations in an article could indicate lack of knowledge or poor research criteria, or a desire to impress the article readers. It could also indicate an author's "personal agenda" (Glick 2007). The excessive use of self-citations, including journal self-citations, could enter the definition of a personal agenda for citation, especially if this pushes up considerably the journal's impact factor.

The rate of journal self-citations varies by discipline and among researchers and can range between 17-38% when a journal is new in the market and 4-25% after ten years of publication (Rousseau 1999). Generally, the lower performing journals or authors will have a higher proportion of self-citations due to two main reasons: a. self citations demonstrate a

kind of research vacuum, and b. self-citation is a form of advertising which quantitatively appears more in lower impact factor journals (van Raan 2008)

Various studies assume that a reasonable share of self-citations is a natural and essential part of scientific communication (Glänzel, Thijs & Schlemmer 2004). The same authors observe that a high rate of self-citations goes with low visibility: high impact journals have less self-citations than low impact journals do. Other studies warned that a great amount of self-citation could result in a bias in measuring the impact of journals (Garfield 1996).

A well established research field is characterized by a moderate level of journal self-citation of up to 15% based on the range presented earlier and referring to the social sciences.

Another way to examine the cohesiveness of a discipline is by exploring the relations between its intellectual base and research front. The intellectual base is defined as the journals referenced by the core journals. The research front is the citing side: journals citing articles from the core journals identified here. The intellectual base, the list of cited references, is a fixed choice of the authors of each journal under study, while the research front is how various journals refer to the core journals and represents the dynamics and growth of the field. Kuhn perceived the research front of any scientific field as representing the puzzles of this field, and the intellectual base as the field's paradigm (Kuhn 1970). Assuming that the information society is well established the second proposition is:

Proposition 2: The citation relation of information society publications will be stronger with its core journals than with other related disciplines' publications. Within the core journals there will be a significant correlation between the research front and the intellectual base.

After obtaining a map of journal citations a closer look at collaborations among researchers will enhance our understanding of research maturity as explained in the next section.

Scientific Collaboration among Information Society Researchers.

Collaborative scientific papers are those that are produced by more than one author. Scientific collaboration can be between investigators from two or more disciplines or countries, between professors and their students, or between academic and industry researchers.

Scientific collaboration is related to creativity, progress and novelty in scientific work (Dogan, Pahre 1990). It enables the analysis of a problem from different angles, and encourages shared thinking that crosses disciplinary boundaries (Morillo, Bordons & Gómez 2003). In a series of three articles Beaver & Rosen (1979b, 1979a, 1978) studied the history of research collaboration since the 17th century and showed that collaboration in scientific research is related to the professionalism of the scientific community, it generally leads to greater productivity in research and enhances the mobility and visibility of researchers. The growth in the number of coauthored papers usually indicates that the field is approaching disciplinary maturation (Gelman, Gibelman 1999).

The growth in scientific collaboration was observed already in the 1960s and the 1970s (De Solla Price, Beaver 1966, Merton, Storer 1973). Referring to academic journal articles in chemistry covered by the Chemical Abstracts De Solla Price estimated that if this trend continues there would be no single-authored paper by 1980 and that papers with three or more authors would exceed 50% by then (De Solla Price, D. J. 1963). This prediction was not realized, but the rate of multi-authored papers in all disciplines has increased steadily. For example, Garfield (1979b) quoted an unpublished study by D. Lindsey and G.W. Brown

showing the difference in the rate of collaboration in various disciplines where multi-authored papers accounted for 17-25% of all published papers in economics, social work and sociology, and 47-81% of the papers published in gerontology, psychiatry, psychology and biochemistry. The growth rate of collaborative studies increased not just in the exact sciences but in the social sciences as well (Eldersby 1996), and more recently, similar growth was observed by Cronin (2003). Philsom (1999) pointed to the new communication technologies as enhancing scientific collaboration. Further, in a comparative review of studies that cover publications in the years 1961-1990 the different intensity of collaboration, i.e. the mean number of authors per paper, spanned from 1.17 in library sciences to 7.4 in astronomy and physics (Cunningham & Dillon, 1997). The difference in collaboration patterns between the "exact" and technological sciences, the social sciences and humanities can be attributed to the allocation of grants which usually favor multi-authored research (Heffner 1981), economics of the expense on research equipment, and necessity when studying complex problems especially in disciplines that use empirical research methods (Fox, Faver 1982).

The rise in scientific collaboration received its share of criticism too. According to critics it was managed and directed by research grants which reduced research novelty and creativity (Hudson 1996). The quality of collaborative studies is not necessarily better than single author papers (Avkiran 1997, Bridgstock 1991). Results of some studies showed that collaboration is not associated with individual authors' productivity (Braun, Glänzel & Schubert 2001) although more recent studies contested these findings (Hart 2007).

Information society trends such as the ubiquity of computers, networks, and channels of communication, enhance scientific collaboration in various fields. This raises an interesting question: how collaborative is the information society field itself? The aim of this study is

to investigate whether as the field of information society emerges from its pre-paradigmatic state, its scientific collaboration patterns approach those of the fields from which it originated.

Proposition 3: As the Information Society field emerges from its pre-paradigmatic state it will be typified by increasing collaborative work beyond the increase in collaboration in the disciplinary core.

Methodology

This study examines journals and collaborations as indicators of the state of research in the information society field. The units of measurement are the scientific journals, and for several analyses also the journals' articles. The sources for the material examined are the ISI Web of Knowledge (including Science Citation Index (SCI), Social Science Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI)), Journal Citation Report (JCR) and Ulrich's Web Global Serials Directory.

Time Period Covered

The term "information society" was introduced into the scientific literature, in 1972. The results for the year 2010 were omitted as they are partial at the time of writing this manuscript. Therefore the analysis was limited to the years 1972-2009.

Surface Analysis

Proposition 1 was examined using the Web of Knowledge databases to establish the core zone and the periphery of the information society journals. The data for this analysis includes articles that were retrieved by searching the phrase "information society" in the article title. Bradford's distribution was obtained by plotting the cumulative number of

articles versus the cumulative number of journals in which they were published. For established disciplines the core is expected to have up to 12 scholarly journals with zone 2 having about 60 journals.

Using the Journal Citation Report (JCR) the status of each of the journals identified as core within its disciplinary group was established. We expect the core journals to be highly ranked as measured by impact factor.

Ulrich's Web Global Serials Directory provided the life-cycle of the information society journals. By life-cycle we mean the examination of the number journals that ceased to exist and the duration of their publication. Cessation of a science publication implies a discontinuity of research which, for a new research field, could impede the creation of theories, methodologies and other disciplinary tools.

Deep Analysis

Using the short list of core journals identified in the surface analysis Proposition 2 was tested by measuring the citation relations of the core journals among themselves and with other journals. We would expect more citations within the core journals that between the core and journals from other zones.

At this stage, we analyzed the intellectual base and the research front of each of the core information society journals identified (De Solla Price 1965, Persson 1999, Donohue 2007). The relationship between the research front and the intellectual base of each journal indicates the cohesiveness of the publications within the field. Spearman's correlation was conducted between the cited/citing groups of each journal under study, to establish relatedness between the intellectual base and its research front. A positive low correlation

between the two could indicate a possible further dispersion of the field's published material in the future.

Co-authorship Pattern Analysis

To control for the natural growth in collaboration which was identified in all disciplines, the co-authorship pattern in the information society field is compared to the patterns exhibited by its founding disciplines previously identified in the surface and deep analysis: Library & Information Science, Communication and Information Systems.

The sample for examining Proposition 3 consisted of four retrieval sets extracted from the Web of Knowledge database. One set was based on topical search of the idiom "information society", and three sets were retrieved by a publication name search. The journals chosen for each of the three disciplines were: Journal of the American Society for Information Science & Technology (JASIS, JASIST as of 2001), Journal of Communication, Management Information Systems Quarterly (MISQ). All journals were selected based on their leadership position of each of the fields they represent as indicated by their top ranking in the JCR.

The queries were further refined to the types of document that are more inclined to involve collaborative authorship, i.e. journal articles, and conference proceedings.

Table 1 summarizes the raw data for Proposition 3.

Insert Table 1 here.

Two measures were calculated based on data extracted from the Author field (Subramanyam, 1983):

- Degree of collaboration, calculated by N_m/N, where N_m is the number of documents authored by more than one author, and N is the total number of documents
- Mean authors per document, calculated as $1/N*\sum N_a$, where N_a is the number of authors per document and N is the total number of documents.

Results

Surface Analysis

The Web of Knowledge database search by article title yielded four journals that covered the information society more than others, *Journal of the American Society for Information Science and Technology* (JASIST, formerly JASIS), *Journal of Documentation, The Information Society* and *Journal of information Science*. While the three former journals belong to the Information and Library Science category, the latter represents the exact sciences.

The Bradford distribution for our data reveals an interesting picture. If we adhere to the formal definition of the distribution which identifies the lower tail of the distribution of the core zone (Garfield 1980, Chung 1994), we get precisely the same four journals identified above. They represent 8.83% of articles published on this topic and indexed in the Web of Knowledge. If we opt for dividing all information society references in our retrieval set to three approximately equal groups based on the number of articles, we observe that the core group is not focused. Table 2 provides the results of both ways of reading the Bradford distribution.

Insert Table 2 here.

A fifth journal was added to our sample because it was actually founded within the framework of the information society research and because it is a top-ranked journal in JCR in two relevant categories (Information and Library Science, Communication) which indicates its wide acceptance in the relevant scientific community. *Journal of Computer Mediated Communication* focuses on:

"The journal is broadly interdisciplinary, publishing work by scholars in communication, business, education, political science, sociology, media studies, information science, and other disciplines" (JCMC online 2007)[1].

Table 3 summarizes the general descriptive information about the five core journals selected for the analysis of Proposition 1 and Proposition 2.

Insert Table 3 here.

Table 3 displays the categories assigned by the producer of the Web of Knowledge, the Institute for Scientific Information (ISI). The table shows that information and library science category is the "headquarters" of the information society research field followed by the communication and the computer science (information systems sub-category) categories.

A search in the Ulrich's Web Global Serials Directory using 'information society' as title keywords resulted in 104 journals. False drops were omitted by excluding the terms

[1] http://www3.interscience.wiley.com/journal/117979306/home

'engineers', 'biology', and 'chemistry' from the retrieval set. Those terms were observed as not relevant. The final set included 87 serials, 23 of them in 'ceased' status (26%). However, we noticed that all the ceased information society journals ceased by 1986. In other words, during the past 24 years no journal in the field has ceased to publish. This means that the field exhibits continuity.

Deep Analysis

Having identified the five leading information society journals their citation patterns were examined in order to aid in assessing the degree of field maturity. Table 4 presents the number of and percent citations within the core group.

Insert Table 4 here.

Table 4 shows that JASIST, thanks to its diversified nature, is the connecting journal among other information society journals. It has a considerable number of common cited/citing journals with the *Journal of Information Science, Journal of Documentation,* and with *Journal of Computer-Mediated Communication*. The *Information Society* is cited to a lesser extent. This kind of journals' interrelations indicates the three- track structure of the information society literature: the Information and library science course, the communication route, and the computer science-information systems direction.

In Table 5 we present one of the core journals' citation relations with journals from the core and from the second zone of the Bradford distribution. The data reveal some weakness in

the scientific core as the relations with the core journals is uneven. Citations within the core are generally expected to be in the hundreds.

Insert Table 5 here.

Citing previous articles within the same journals can cause a bias if used excessively. Table 6 presents the effect of self-citations on each journal's status. The results indicate how self-citations influence the impact factor. While all journals are within reasonable self-citation rates, JCMC emerges as the strongest journal having the highest impact factor with fairly low self-citation.

Insert Table 6 here.

To further examine the cohesiveness of the leading information society journals a correlation between the research front and intellectual base of each journal was performed and is presented in Table 7. These findings indicate that the *Journal of Information Science* (JIS), which is indexed in the Computer Science-Information Systems category, has the highest cohesiveness between the research front and intellectual base. It is followed by the journals affiliated with the social sciences. The Information Society journal does not exhibit a correlation meaning that it may be quite eclectic and diffuse by nature.

Insert Table 7 here.

The measure of journal self-citation should be viewed with some caution as it tends to change substantially in the short term. Table 7 shows the percent of self citation on a cumulative basis (for all years recorded). Table 6 displays only the years for which the latest impact factor was calculated, that is, 2007 and 2008.

To complement the journal citation analysis the next section presents an exploration of the researchers' collaborative efforts.

Co-authorship Pattern Analysis

The degree of collaboration and mean number of authors per article were calculated. Figures 1 and 2 present the trends of these measures per subject category over the years.

Insert Figure 1 here.

Insert Figure 2 here.

The spike in both figures in 1974 occurred because there were only two articles published in that year, one of them a collaborative study.

A visual comparison of the co-authorship patterns shows that the degree of collaboration for articles in the topic of information society is usually lower than that of the other disciplines, with a tendency towards convergence as the years progress. The degree of collaboration for Information Systems is higher than that of the other disciplines. Similar trends occur for the mean number of authors per paper, though to a lesser extent. Collaboration patterns in Library & Information Science and Communications are similar for both parameters.

Analysis of variance (ANOVA) was performed to compare the co-authorship patterns among the four disciplines. During 1972-1983 the production of papers in the field of information society did not exceed 10 per year, with only one co-authored paper in 1974. Furthermore, in the same period the Management Information Systems Quarterly did not yet exist. Therefore these years were eliminated from further statistical analysis, limiting the statistical analysis to the years 1984-2009.

First, ANOVA was performed on articles produced during the entire period sampled (1984-2009). The results showed that the degree of collaboration in information society was significantly lower than in the other disciplines ($F_{(3,100)} = 52.74$, $p < .001$). A Scheffe post-hoc test of paired comparisons demonstrated a statistically significant difference between information society and each of the other three disciplines. There was no significant difference between Library & Information Science and Communication, but the degree of collaboration in the field of Information Systems was significantly higher than for all other domains.

The analysis of the mean number of authors per paper also resulted in a statistically significant difference among the four disciplines ($F_{(3,100)} = 9.92$, $p < .001$). Information society had the lowest mean number of authors per article and according to the Scheffe post-hoc tests Information Systems was the only contributor to this significant difference, otherwise the difference among the other three disciplines was not statistically significant.

The visual trend of convergence in levels of collaboration over the years, and the non-conclusive results based on the full period sampled led us to split the period into two equal periods: 1984-1996 and 1997-2009. Table 8 summarizes the findings according to three periods.

Insert Table 8 here.

Discussion

The review of the concept "information society" in the literature coupled with the ubiquity of technology in society raised a question concerning the emergence of this term as a distinct academic research discipline. The present research analyzed the grouping and cohesiveness of the scientific literature as indications of the field's maturity and direction. The main finding is that the information society is at initial stages of evolving into a research discipline, in contrast to Duff's findings 15 years earlier (Duff 1995). This is supported by the Bradford distribution, by analyzing the core journals' citation patterns, and by studying researchers' collaboration trends over time. In the following we unpack and contextualize these observations.

The choice of journals which are at the focus of the current study is sound as indicated by the Bradford distribution. Table 2 provides an initial indication that the research on the information society has not yet fully organized into a discipline. Looking at the formal grouping the number of journals in each group increases ten fold while Bradford predicted the number of journals should increase by a factor of about 5. So that we would expect for a core including 4 journals, the next group would contain about 20 journals and the third group should contain about 100 journals. The current figures point toward higher dispersion of research about the information society, meaning that if one wants to study this area, s/he would need to cast a fairly wide search net and access a large number of journals. The names of the four journals identified as the core appear in Table 3 together with JCMC which was added for reasons explained in the Results section.

Producing the Bradford distribution by dividing the articles into three approximately equal groups shows that zone 1 contains a large number of journals. Usually a core of any discipline contains up to 12 journals. Table 2 informs us that the core of the information society is still being formed. It is probably larger than 4 but must be smaller than 19. The area is undergoing evolution. In order to be able to predict whether the information society is likely to form as an independent discipline we need to study patterns over time. We discuss this in relation to Proposition 3. The surface analysis provides some support to the notion of evolution through the findings from Ulrich's Web Global Serials Directory that no information society related journal has ceased publication over the past 24 years. This finding provides further support, albeit indirect, for the continual interest in the area of the information society.

Table 3 reveals that the core journals are ranked among the top third of the journals in the Information Science & Library Science ISI category, *JCMC* is ranked third in this category and first in the Communication category, in terms of its impact factor. While *JCMC* is ranked very high in both subject categories, the *Journal of Information Science* is ranked among the top quarter in the Information Science & Library Science category and top third of Computer Science journals. The *Information Society* approaches the middle range of Information Science & Library Science category.

To summarize our findings for Proposition 1, a paradigmatic core was identified; however, it is not ripe yet. The core journals have medium to high impact factors, yet the area is characterized by fairly large dispersion. It is not clear whether the source is temporal or, possibly, the nature of the subject.

The second proposition stated that citation within the core journals will be stronger than citation of journals from the second and third zones. Table 4 offers partial support for this as only three journals have more than 50% of their citations based on the core journals.

When excluding self-citation we observe just one journal with a majority of core journals used for citations. These outcomes mean that a core is beginning to form but is not yet stable enough in terms of the authors' selection of sources to cite. There is still considerable dispersion in journal citations.

The results in table 4 show that *JCMC* and *JASIST* have high rates of self-citations. In fact, each of them has about 3 times more self-citations than citations by the other four core journals. This observation is stronger for *JCMC* probably because it is a younger journal and the overall number of journals cited in *JCMC* articles is 367 compared to 856 by *JASIST*. The other 3 journals in Table 4 have approximately equal numbers of self-citations and citations coming from the other core journals.

Table 5 contains an example of the information society journals' citation relations with the core as well as the periphery. It shows that the *Journal of Information Science* is related by citations to itself, and to two more core journals, *JASIST* and *Journal of Documentation*. It is less related to the journals *The Information Society* and *JCMC*. In fact, the citation relations of this journal with journals from the second zone are stronger than with these two core journals. Further, *The Information Society* and *JCMC* are more weakly connected to the core of the information society journals. This situation could change for the two journals with time, yet at this point it is indicative of the core's relative weakness.

While a reasonable share of self-citations is a natural and essential part of scientific communication, a high rate of self-citations goes with low visibility (Glänzel, Thijs & Schlemmer 2004). The same study shows that the high impact journals have less self-citations than low impact journals do. The opposite is evident in the results presented here. JASIST and JCMC have the highest impact factors (Table 3) and the highest rates of self-citation (Table 4). The reasons for self-citations, in addition to the reasons given in the

theory section, could be simpler. The authors prefer to publish series of works in the same journal, or they prefer to submit articles to the same journals that previously published works related to their studies (Tsay 2006). Possibly, authors sense that a core is forming for this topic and so they direct new manuscripts to the short list of journals.

A broader examination of self-citation of the core journals in the context of total journals cited is given in Table 6. It shows that three journals used self- citation at a rate that did not inflate their impact factors significantly: *Journal of Information Science, Journal of documentation* and *JCMC*. *JASIST* and *The Information Society* contain excessive self-citations in a way that inflates their impact factors considerably. These findings are in line with Garfield's warning that a great amount of self-citation could result in a bias in measuring the impact of journals (Garfield 1996).

The Spearman rank correlation coefficient for the five journals (Table 7) shows that the *Journal of Information Science* and the *Journal of Documentation* have the highest cohesiveness between the intellectual base (the references) and the research front (the citations). *JASIST* has the lowest correlation. It is worth noting in this respect that *JASIST* has the highest rate of self-citations. The correlation coefficient indicates that *JCMC* is moving towards diversification and *JASIST* is diversified. There is no correlation between the research front and base of *The Information Society*. To summarize this measure, there is a variable degree of dispersion among the five core journals.

The collaboration in research is measured in this study through the number of co-authored papers relative to the total number of articles as well as by the intensity of collaboration, i.e. the mean number of authors collaborating in each paper. The trend of increased collaboration in research and authorship is evident across the board, be it in the sciences, the social sciences or the humanities, and research in the field of information society is no

exception in this matter. However, the rate in which the scientific collaboration in this field increases in comparison to that of its founding disciplines is higher. We see that from low collaboration until the beginning of the 1990s the collaboration levels in both dimensions (Figures 1 and 2) are approaching those found in Library & Information Science and Communication.

These findings confirm our Proposition 3 and show that the field of information society is emerging from its pre-paradigmatic state and is gradually reaching maturity. This confirms and extends the previously cited finding by Duff who in 1995 concluded that the information society could not be considered a scientific paradigm (Duff 1995). It is interesting to note that while the level of collaboration in information society is approaching that of the fields of Library & Information Science and Communication, it is much lower than that of Information Systems. This may hint at the direction of which the research in this field is moving to.

With the understanding of information society collaboration patterns, and considering the importance of collaborative work for a growing research field, it seems that collaboration in this field should be encouraged, and that university researchers are the ones that should lead this trend that eventually could help define better the boundaries of the information society.

Limitations

The stated aim for the current research is very ambitious. The present findings do not provide a comprehensive answer to the question about the information society. Rather, we provide one way of analyzing the current status. This bibliometric study is naturally limited by the breadth and depth of the sources and the searches used to obtain the data. For example, important journals for the information society were excluded because they were

not covered by the ISI databases. To overcome these limitations future research could start with a keyword analysis to determine additional terms that should be searched in addition to "information society" and possibly to identify a changing terminology in this field. Terminology expansion may lead to the discovery of additional core and periphery journals. Further research should also expand the collaboration patterns research and attempt to interview the luminaries of the field.

Conclusion

Research on the information society seems to follow technological developments. As technology became more pervasive, the field has received greater research attention. We have identified the formation of a core and periphery of journals, however, citation patterns revealed that further development and evolution is needed before we can proclaim this area as a mature area of research. Collaboration trends imply that such evolution is underway. Overall, the information society has developed from the conceptual stage, characterized by single scholars, to the more applicative and ubiquitous stage of empirical research characterized by collaboration and the rise of disciplinary characteristics.

References

Avkiran, N.K. 1997, "Scientific collaboration in finance does not lead to better quality research", *Scientometrics,* vol. 39, no. 2, pp. 173-184.

Beaver, D.B. 2004, "Does collaborative research have greater epistemic authority?", *Scientometrics,* vol. 60, no. 3, pp. 399-408.

Beaver, D.B. & Rosen, R. 1979a, "Studies in scientific collaboration Part III. Professionalization and the natural history of modern scientific co-authorship", *Scientometrics,* vol. 1, no. 3, pp. 231-245.

Beaver, D.B. & Rosen, R. 1979b, "Studies in scientific collaboration.Part II.Scientific co-authorship, research productivity and visibility in the French elite", *Scientometrics,* vol. 1, no. 2, pp. 133-149.

Beaver, D.B. & Rosen, R. 1978, "Studies in scientific collaboration", *Scientometrics,* vol. 1, no. 1, pp. 65-84.

Becher, T. 1989, *Academic tribes and territories: intellectual enquiry and the cultures of disciplines (Milton Keynes, Open University Press),* .

Bell, D. 1979, "The social framework of the information society" in *The Computer Age: A 20 Year View*, eds. M.L. Dertoozos & J. Moses, MIT Press, Cambridge, MA, pp. 500-549.

Bell, D. 1973, *The coming of post-industrial society,* Basic Books, New York.

Beniger, J.R. 1986, *The control revolution: Technological and economic origins of the information society,* Harvard University Press, Cambridge, MA.

Borgman, C.L. & Rice, R.E. 1992, "The convergence of information science and communication: A bibliometric analysis", *Journal of the American Society for Information Science,* vol. 43, no. 6, pp. 397-411.

Braun, T., Glänzel, W. & Schubert, A. 2001, "Publication and cooperation patterns of the authors of neuroscience journals", *Scientometrics,* vol. 50, no. 3, pp. 499-510.

Bridgstock, M. 1991, "The quality of single and multiple authored papers; An unresolved problem", *Scientometrics,* vol. 21, no. 1, pp. 37-48.

Chung, Y.K. 1994, "Bradford distribution and core authors in classification systems literature", *Scientometrics,* vol. 29, no. 2, pp. 253-269.

Crawford, S. 1983, "The origin and development of a concept: the information society.", *Bulletin of the Medical Library Association,* vol. 71, no. 4, pp. 380-385.

Cronin, B., Shaw, D. & La Barre, K. 2003, "Visible, less visible, and invisible work: Patterns of collaboration in 20th century chemistry", *Journal of the American Society for Information Science and Technology,* vol. 55, no. 2, pp. 160-168.

De Solla Price, D. J. 1963, *Little science, big science,* Columbia University Press, New York.

De Solla Price, D.J. 1965, "Networks of scientific papers", *Science,* vol. 149, no. 3683, pp. 510-515.

De Solla Price, D.J. & Beaver, D. 1966, "Collaboration in an invisible college", *American Psychologist,* vol. 21, no. 11, pp. 1011-1018.

Diodato, V.P. 1994, *Dictionary of bibliometrics,* Routledge.

Dogan, M. & Pahre, R. 1990, *Creative marginality: Innovation at the intersections of social sciences,* Westview Press.

Donohue, J.C. 2007, "A bibliometric analysis of certain information science literature", *Journal of the American Society for Information Science,* vol. 23, no. 5, pp. 313-317.

Duff, A.S. 2000, *Information society studies,* Routledge.

Duff, A.S. 1998, "Daniel Bell's theory of the information society", *Journal of Information Science,* vol. 24, no. 6, pp. 373.

Duff, A.S. 1995, "The'information society'as paradigm: a bibliometric inquiry", *Journal of Information Science,* vol. 21, no. 5, pp. 390-395.

Eldersby, J.W. 1996, "Collaboration Research in the Social Sciences: Multiple Authors and Publication Credit", *Social Science Quarterly,* vol. 77, no. 2, pp. 375-392.

Ellis, D., Allen, D. & Wilson, T. 2000, "Information science and information systems: Conjunct subjects disjunct disciplines", *Journal of the American Society for Information Science,* vol. 50, no. 12, pp. 1095-1107.

Fox, M.F. & Faver, C.A. 1982, "The process of collaboration in scholarly research", *Scholarly Writing & Publishing: Issues, Problems, and Solutions,* vol. 13, pp. 126-138.

Garfield, E. 1996, "Fortnightly review: How can impact factors be improved?", *British medical journal,* vol. 313, no. 7054, pp. 411.

Garfield, E. 1980, "Bradford's law and related statistical patterns", *Currrent Contents,* vol. 19, pp. 5-12.

Garfield, E. 1979a, "2001: An information society?", *Journal of Information Science,* vol. 1, no. 4, pp. 209-215.

Garfield, E. 1979b, "Is citation analysis a legitimate evaluation tool?", *Scientometrics,* vol. 1, no. 4, pp. 359-375.

Garfield, E. 1971a, "Information science and the information-conscious society", *Journal of the American Society for Information Science,* vol. 22, no. 2, pp. 71-73.

Garfield, E. 1971b, "Science, information science, and the information-conscious society", *Current Contents,* vol. 1, pp. 236.

Gelman, S.R. & Gibelman, M. 1999, "A Quest for Citations? an Analysis of and Commentary on the Trend toward Multiple Authorship.", *Journal of Social Work Education,* vol. 35, no. 2.

Glänzel, W., Thijs, B. & Schlemmer, B. 2004, "A bibliometric approach to the role of author self-citations in scientific communication", *Scientometrics,* vol. 59, no. 1, pp. 63-77.

Glick, M. 2007, "You are what you cite: The role of references in scientific publishing", *The Journal of the American Dental Association,* vol. 138, no. 1, pp. 12.

Gordon, A. 2004, *The status of terrorism in the academy: The comparative aspects and the role of periodicals*, PhD edn, University of Haifa, Israel.

Hart, R.L. 2007, "Collaboration and article quality in the literature of academic librarianship", *The Journal of Academic Librarianship,* vol. 33, no. 2, pp. 190-195.

Hassan, R. 2008, *The Information Society,* Polity Press, Cambridge, MA.

Heffner, A.G. 1981, "Funded research, multiple authorship, and subauthorship collaboration in four disciplines", *Scientometrics,* vol. 3, no. 1, pp. 5-12.

Hudson, J. 1996, "Trends in multi-authored papers in economics", *The Journal of Economic Perspectives,* vol. 10, no. 3, pp. 153-158.

Kuhn, T.S. 1970, *The structure of scientific revolutions,* University of Chicago press Chicago.

Leimu, R. & Koricheva, J. 2005, "Does scientific collaboration increase the impact of ecological articles?", *Bioscience,* vol. 55, no. 5, pp. 438-443.

Leydesdorff, L. & Probst, C. 2009, "The delineation of an interdisciplinary specialty in terms of a journal set: The case of communication studies", *Journal of the American Society for Information Science and Technology,* vol. 60, no. 8, pp. 1709-1718.

Machlup, F. 1962, *The Production and Distribution of Knowledge in the United States,* Princeton University Press, NJ.

Meadows, A.J. 1998, *Communicating Research,* Academic Press, San Diego.

Melin, G. & Persson, O. 1996, "Studying research collaboration using co-authorships", *Scientometrics,* vol. 36, no. 3, pp. 363-377.

Merton, R.K. & Storer, N.W. 1973, *The sociology of science,* Univ. of Chicago Press Chicago:.

Morillo, F., Bordons, M. & Gómez, I. 2003, "Interdisciplinarity in science: A tentative typology of disciplines and research areas", *Journal of the American Society for Information Science and Technology,* vol. 54, no. 13, pp. 1237-1249.

Persson, O. 1999, "The intellectual base and research fronts of JASIS 1986-1990", *Journal of the American Society for Information Science,* vol. 45, no. 1, pp. 31-38.

Philson, R.M. 1999, "Factors affecting academic collaboration via communication technologies (Internet, world wide web)", *Unpublished doctoral dissertation, University of Michigan, .*

Qin, J., Lancaster, F.W. & Allen, B. 1998, "Types and levels of collaboration in interdisciplinary research in the sciences", *Journal of the American Society for information Science,* vol. 48, no. 10, pp. 893-916.

Rousseau, R. 1999, "Temporal differences in self-citation rates of scientific journals", *Scientometrics,* vol. 44, no. 3, pp. 521-531.

Saracevic, T. 1997, "Users lost: Reflections on the past, future, and limits of information science", *ACM Sigir Forum*ACM, , pp. 16.

Sawyer, S. & Huang, H. 2007, "Conceptualizing information, technology, and people: Comparing information science and information systems literatures", *Journal of the American Society for Information Science and Technology,* vol. 58, no. 10, pp. 1436-1447.

Steinfield, C. & Salvaggio, J.L. 1989, "Toward a Definition of the Information Society" in *The information society: economic, social, and structural issues*, ed. J.L. Salvaggio, Lawrence Erlbaum, Hillsdale, NJ, pp. 1-14.

Sugimoto, C.R., Pratt, J.A. & Hauser, K. 2008, "Using field cocitation analysis to assess reciprocal and shared impact of LIS/MIS fields", *Journal of the American Society for Information Science and Technology,* vol. 59, no. 9, pp. 1441-1453.

Tsay, M. 2006, "Journal self-citation study for semiconductor literature: synchronous and diachronous approach", *Information Processing & Management,* vol. 42, no. 6, pp. 1567-1577.

van Raan, A.F.J. 2008, "Self-citation as an impact-reinforcing mechanism in the science system", *Journal of the American Society for Information Science and Technology,* vol. 59, no. 10, pp. 1631-1643.

Discipline	Source	N
Information Society	Search Web of Knowledge by Topic = "Information Society"	1026
Library & Information Science	J. of the American Society for Information Science & Technology	2851
Communication	J. of Communication	1794
Computer Science - Information Systems	Management Information Systems Quarterly	623*

** Published since 1984*

Table 1: A summary of the queries used for Proposition and the number of items retrieved.

Formal Grouping	Journals	Articles	Grouping by Articles	Journals	Articles
Core	4	117	Zone 1	19	306
Straight line	48	379	Zone 2	99	342
Tail	447	474	Zone 3	381	322

Table 2: Two approaches to analyzing the Bradford distribution of the information society articles: formal grouping and grouping by articles.

Journal	Rank in Category	Impact Factor	Subject Category
JASIST	7/65	2.300	Information Science & Library Science
J. of Information Science	16/65 39/116	1.706	Information Science & Library Science Computer Science, Information Systems
J. of Documentation	21/65	1.405	Information Science & Library Science
JCMC	3/65 1/54	3.639	Information Science & Library Science Communication
The Information Society	25/65	1.111	Information Science & Library Science

Table 3: The Journals subject category status (Source: JCR 2009).

Cited: / Citing:	JASIST	J. of Information Science	J. of Documentation	JCMC	The Information Society	% Citations of Core Journals	% Citations of Core Journals Excluding Self-Citation
JASIST (856*)	566	37	39	34	16	81	15
J. of Information Science (214)	55	61	19	2	6	67	38
J. of Doucmentation (208)	117	16	66	2	0	97	65
JCMC (367)	4	0	0	122	11	37	4
The Information Society (133)	6	1	2	6	36	38	11

* The number in parenthesis is the total number of journals cited in 2009 based on articles published in 2000-2009.

Table 4: Common cited/citing journals among the core journals studied (Source: JCR 2009).

The numbers are journal citation counts. The articles cited were dated 2000-2009.

Journals in the Core of Information Society	Citing J. of Info.Sci.
J. Information Science (self)	730.19
JASIST	262.08
J. of Documentation	153.85
The Information Society	30.52
JCMC	4
Journals in the second zone of the information society	
Int'l Journal of Information Management	65.67
Journal of Medical Libraries	65.67
C& R Libraries	48.19
Research Policy	9.84
Organization Science	7.55

Table 5: The Journals that cite Journal of Information Science, 1965-2009 (the research front)

Journals	Impact Factor (IF)	IF without self-citations	Number of items	% of self citations
JASIST	2.300	1.757	851	23%
J. of Information Science	1.706	1.520	174	10%
J. of Documentation	1.405	1.179	118	16%
JCMC	3.639	3.111	393	14%
The Information Society	1.111	0.822	50	26%

Table 6: The elevation of the information society journals' Impact Factor (IF) through self-citations. (Source JCR a 2009 window, calculations for 2007,2008)

Journal	Number of related journals	Spearman's rho Incl. self-citations	Number of related journals	Spearman's rho Excl. self-citations	Number of items	Cumulative % self-citations
JASIST	69	.498	68	.476	5,167	15
J. of Information Science	20	.688	19	.636	939	6
J. of Documentation	23	.602	22	.547	1,063	10
JCMC	38	.515	37	.475	1,279	10
The Information Society	13	ns	12	ns	603	5

Table 7: The intellectual base/research front journals' relations with and excluding self-citations, p<.01 (Source: JCR 2009).

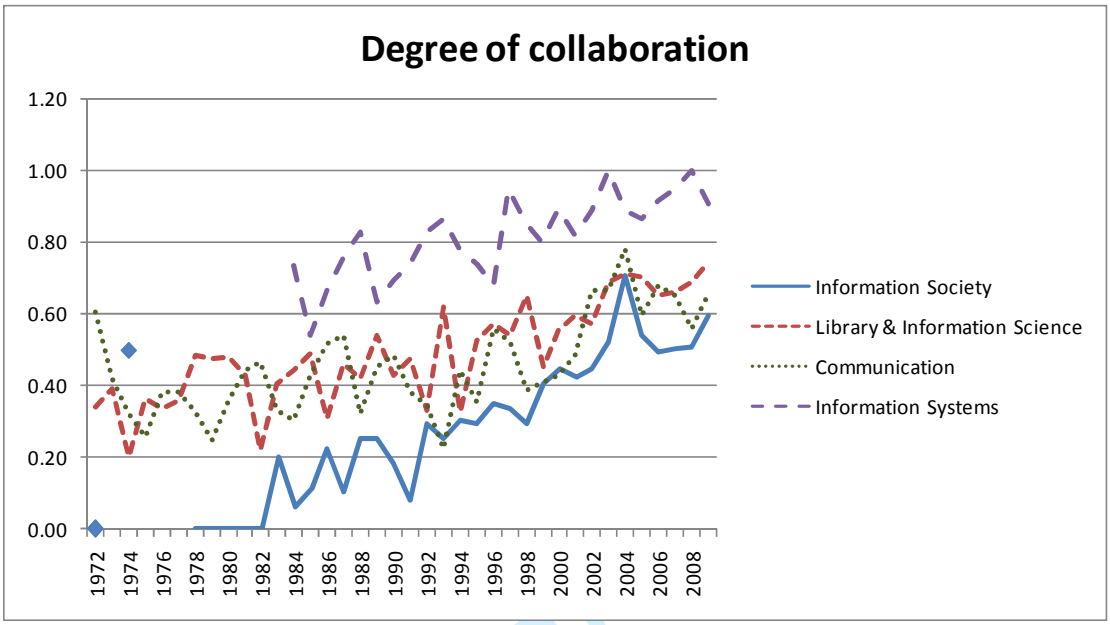

Figure 1: The degree of collaboration in information society compared with its three founding disciplines.

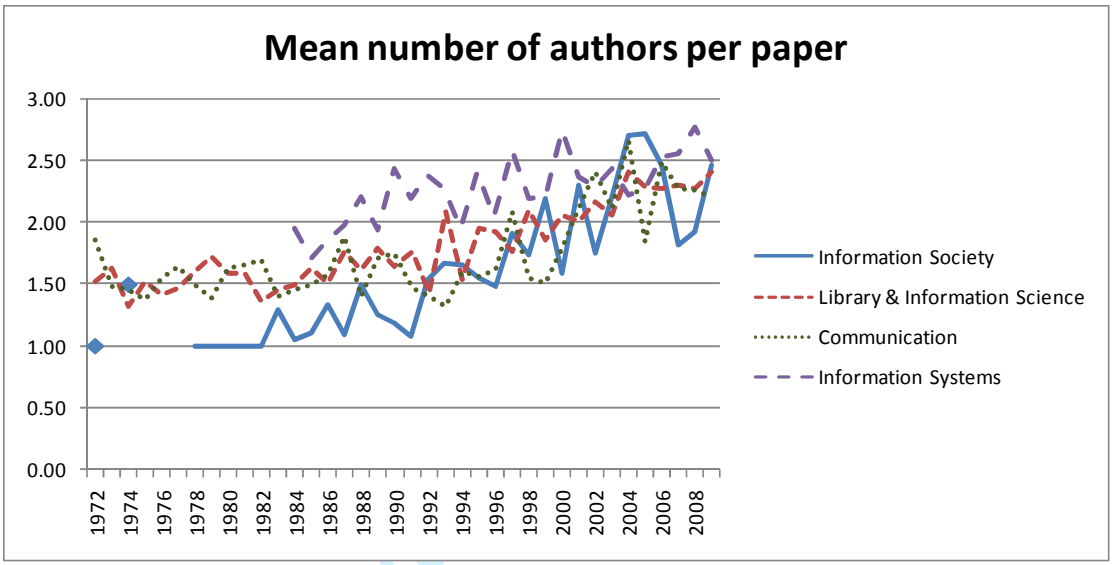

Figure 2: The mean number of authors in information society compared with its three founding disciplines.

Period	Degree of collaboration	Mean authors per paper
1972 – 1983	Collaboration in Information Society hardly existed – one collaborative paper in 1974. In Library & Information Science and Communication the averaged was close to 0.4.	The intensity of collaboration in information society was low, two authors in one collaborative paper. In the other disciplines mean authors averaged close to 1.5 authors per paper.
1984 - 1996	A statistically significant difference was found $F_{(3,48)} = 65.99$, $p < .001$. Post-hoc Scheffe tests show that degree of collaboration in information society is significantly lower than in all other disciplines.	A statistically significant difference was found $F_{(3,48)} = 31.27$, $p < .001$. Post-hoc Scheffe tests show that the mean number of authors in Information Society is significantly lower than in Library & information Science and Information Systems.
1997 - 2009	A statistically significant difference was found $F_{(3,48)} = 46.15$, $p < .01$. Post-hoc Scheffe tests show that the degree of collaboration in Information Society is significantly lower than in Library & information Science and Information Systems.	A statistically significant difference was found $F_{(3,48)} = 3.70$, $p < .05$. Post-hoc Scheffe tests show no significant difference in the mean number of authors per paper among the various disciplines

Table 8: A summary of findings of the collaboration analysis.

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Table 2: Two approaches to analyzing the Bradford distribution of the information society articles: formal grouping and grouping by articles.

Table 3: The Journals subject category status (Source: JCR 2009).

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