

Analyzing the status of theoretical framework by subfields in library and information science research articles

문헌정보학 연구논문의 이론체계 현황분석 연구

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Abstract

Based upon the assumption that both theory building and theory use are intertwined to construct a cohesive body of knowledge in the field, this study attempts to identify the state of theoretical framework by examining the number and the quality of theoretical articles by subfield. Theoretical article is characterized as an incident in which the author contributes to the development or the use of theory in his/her own paper. Theoretical incidents were identified by a content analysis of 1,661 articles in four LIS journals from 1984 to 2003. The findings suggest that the four subfields, such as information seeking/use, information retrieval, library management, and scholar communication had great contributions to both theory building and theory use. Also, two research areas such as bibliometrics and professionals are very likely to be theoretical. Further, the analysis of the name of theories used by subfields could give an insight into the understanding of how the theoretical frameworks of each subfield are related.

국문초록

학문의 지식체계를 형성하는데 있어서 하나의 일련과정으로 밀접하게 상호연관된 이론개발 및 이론활용 연구가 뒷받침되어야 한다는 전제 하에, 본 연구는 문헌정보학 연구논문의 이론개발 및 이론활용 사례의 양적/질적 측면을 조사함으로써 문헌정보학의 이론적 기반을 분석하고자 하였다. 특히, 본 연구는 세부주제영역에 따른 이론개발 및 이론활용 연구의 특성에 주목함으로써 문헌정보학의 이론적 기반 형성에 기여한 세부주제영역을 보다 구체적으로 파악하고자 하였다. 이를 위해 1984년부터 2003년에 출판된 1,661편의 연구논문을 대상으

로 내용분석을 실시하였다. 분석결과, 22개의 세부주제영역 중에서 정보이용탐색, 정보검색, 도서관경영, 학술커뮤니케이션 영역이 이론개발과 이론활용의 모든 측면에 가장 큰 기여를 한것으로 나타났다. 또한 주제영역별로 생산된 논문 수에 따른 이론적 연구의 비율을 살펴 보았을 때, 계량정보학과 전문직 영역에 대한 연구가 매우 이론적인 특성을 보였다. 이 외에 각 세부주제영역별로 사용된 이론을 분석하였을 때, 일부 세부주제영역 간에 유사한 이론적 기반을 공유하고 있는 것으로 나타났다.

Keywords

Theory building, theory use, theoretical framework of library and information science, theoretical research, 이론개발, 이론활용, 문헌정보학 이론적 기반, 이론적 연구

Introduction

A firm theoretical foundation of a discipline reflects its maturity and research seriousness. In order to delineate disciplinary boundaries and build a central body of knowledge, fields such as library and information science (LIS) should construct their own theoretical framework (Pettigrew and McKechnie, 2001). Theoretical ground may be established and be enlarged by researchers' active efforts to build theories and to apply and test them.

Theory building requires continuous research to observe, discover, and explain significant relationships that have been unknown yet. The process of developing a theory will not be accomplished at a time. The published theory is "only a pause in the never-ending process" (Glaser and Strauss, 1967, 40) so that it should be repetitively used and tested by other researchers. Theory development and theory use should be considered as a sequent process to construct discipline's own research ground and make it firm. This intertwined relationship between theory building and theory use implies that disciplines, which actively construct new theories and examine existing theories, have a great possibility to establish their own theoretical base.

Previous self-analysis studies since 1980's have pointed out a weak relationship between research and theory in LIS, reporting that the proportion of theory articles ranged from 13% to 34.1% (Peritz, 1980; Nour, 1985; Feehan et al., 1987; Julien, 1996; Julien and Duggan, 2000; Pettigrew and McKechnie, 2001; Jeong and Kim, 2005). This dearth of contributions to the establishment of theoretical foundation may be explained with a reflection on the nature of its origin. According to Wilson (2000), the reason of a lack of theory to guide research in the information science studies of information users is its multi-disciplinary and the practice of information work.

However, a recent study of the authors (Kim and Jeong, 2006) reported that the proportion of theoretical articles accounted for 41.4% of the 1,661 articles in four LIS journals. This share was higher than findings of previous studies above mentioned, even though it should be interpreted very carefully because of the use of various samples and different data analysis schemes. This increase might be due to the attempts to cover both theory development and theory use incidents and to define them broadly and objectively. But the increase in theoretical incidents was also supported with another finding of the study that the number of theoretical articles has increased by year. Both findings can reflect that researchers have been making more efforts to construct a theoretical base of LIS so that the field can have its own identity as a discipline.

With this good future prospect of theoretical growth of LIS, this study seeks to examine the status of theoretical base, especially focusing on subfields, that is, topics of research articles. The distribution of theoretical articles by subfield simply addressed in the previous study (Kim and Jeong, 2006) showed the possibility for the better understanding of characteristics of LIS theoretical base when trying to focus on theoretical articles by subfield. This study analyzes the number and the quality of theory incidents from both perspectives of theory development and theory use according to a scheme of 22 subfields.

Literature review

There have been earlier efforts to analyze the state of theoretical research in LIS. Most of them addressed the proportion of theoretical articles (Peritz, 1980; Nour, 1985; Feehan et al., 1987; Jeong, 1993; Julien 1996, Julien & Duggan, 2000; Pettigrew & McKechnie, 2001; McGrath, 2002; Jeong & Kim, 2005). The operationalized definition of a theoretical article varies by each research but the goals of all research are consistent with an attempt to examine the theoretical base of the field. Among them, some studies approached by identifying theory use incidents (Julien 1996, Julien & Duggan, 2000; Pettigrew & McKechnie, 2001; Jeong & Kim, 2005), and others by theory building units (Jeong, 1993; McGrath, 2002) or by both aspects of theory building and use (Feehan et al., 1987).

A few studies tried to look into the status of the theoretical base by focusing on narrow subfields of LIS. Feehan, Gragg, Havener, and Kester (1987) found the share of articles which examine or attempt to formulate theories or principles and which apply theories from other disciplines to LIS. Feehan and his colleagues classified the theoretical research in terms of a subject scheme including five broad categories:

general library topic, professional concerns, theoretical topics, applied topics and related fields. Their study showed that just over 50% of all research in the sample was on applied topics and on the other hand the percentage of theoretical topics was only 13% of the sample. The findings implied that library science research is heavily concentrated on topics with immediate practical implication and is not likely to be theoretical. But it needs to be considered here that they may overlook theory incidents incorporated in other articles classified into general, professional concerns, and applied topics.

Pettigrew and McKechnie (2001) operationalized theory as one described as conceptual, framework, grounded or underpinnings in the article by the author and reported that 34.1% of the 1,160 articles incorporated an average of 2.73 theories. In particular, the subfields such as information policy (5.17 theories), general LIS/other (4.17 theories), human information behavior (3.37 theories), and information technology (3.27 theories) employed the most theory incidents among 13 subfields. They also found the theoretical base of LIS depended on the social science when the origin of theories was examined among LIS, social science, science, and humanities.

A previous study of the author (Jeong & Kim, 2005) conducted a content analysis similar to Pettigrew and McKechnie's study in order to analyze the theory use of Korean research articles in LIS but attempted to address the quality as well as the number of theory incidents. This study showed that 20% of the 654 articles employed an average of 1.98 theories and the theories were usually mentioned for the background review of the research papers. Another finding in the study revealed that there was a significant difference among subfields. Among 22 subfields, researchers who write an article on information retrieval incorporated the most theories (147 of a total 261 theory use incidents), followed by articles indexing/abstracting (93 incidents), and bibliometrics (74 incidents). These findings gave an insight into the detailed understanding of characteristics of theoretical framework of LIS. Besides that, other studies such as Warner (1991) and Barkhi and Sheetx (2001) examined the use of theory by putting a focus on a specific subfield, linguistic theory and information system, respectively.

These past studies enabled us to make a sketch of theoretical framework of LIS research but seem to be not enough to draw a picture of it. Most of them did not build on the assumption that the theory building and theory use are an intertwined process of constructing a theoretical base and did address one side of them. Therefore, this study seeks to cover both aspects of theory incidents and to examine not only the number but also the quality of them.

Methodology

Taxonomy of Theory

Theory is defined as a generalized and empirically tested statement to explain and predict significant relationships among phenomena. This study adopts the “taxonomy of theory,” consisting of three categories: substantive theory, formal theory, and grand theory (Glaser & Strauss, 1967; Grover & Glazier, 1986). Substantive theory is defined as “a set of propositions which furnish an explanation for an applied area of inquiry” (Grover & Glazier, 1986). It was developed for an empirical area or somewhat narrow range of subfields. Actually it may not be named as “theory” yet. Rather, it can be likely to be treated as a tested hypothesis or a research finding. But substantive theory has a potential to evolve into “real” theory. The next upper level of theory, formal theory is defined as “a set of propositions which furnish an explanation for a formal or conceptual area of inquiry” at the level of discipline. On the other hand, the top level of theory, grand theory is defined as “a set of theories or generalizations that transcend the borders of disciplines to explain relationships among phenomena” (Grover & Glazier, 1986). It may be helpful to understand both formal and grand theories are what are commonly called as “theory.”

For this study, substantive level theory is considered a target to identify theory development contribution. This study operationalized it as a tested hypothesis or a discovered relationship. On the other hand, both formal and grand level theories are treated as an analysis unit of theory use and defined here as what are described as “theory,” “model”, or “law” by researchers other than the author who proposed it.

This study tries to define theory incidents (that is, operationally defined theory for theory building and theory use in this study) as broadly as possible to understand the widest range of the theoretical base in LIS research and as objectively as possible for the reliability of identifying theory incidents. As others, such as Boyce and Kraft (1985) and Buckland (1991, 17-25), have suggested, a strictly defined standard would not allow for the finding of many theories, even those considered theories within the bounds of LIS, because theories in this field may have “the status of quasi-theories” (Boyce & Kraft, 1985).

Criteria for Quality Assessment

Two criteria, the degree of theory efficiency and the degree of theory use, are adopted to assess the quality of identified theory incidents. The former was devised to measure how precisely and efficiently theory development incidents can explain and/or

predict a significant relationship among variables in a research. It consists of four levels: relatedness, directionality, co-variation, and rate of change. Relatedness is the lowest level of efficiency that states the simple fact whether there are significant relationships. The next higher level is one that expresses the directionality of the relationship, for example, a positive or negative correlation. The third level is co-variation that proclaims the changes of one unit when the other unit alters. The highest level is one that states the rate of change in the relationship.

The model of theory use is devised to understand how deeply (or coherently) theory use incidents are applied to a research. It consists of five categories as the following: *Spot citing* is the lowest level of use that mentions only the name of theory in the background or literature review without any explanations and citing references. The next level is *background review* that explains core concepts of theory with a paragraph or so in the part of introduction or literature review. The third level is *theory discussion* that discusses some theories on a specific topic, especially in a type of a review article. The fourth level is *theory application* that directly applies a theory to a conceptual framework or research design and/or to a discussion of findings. The highest level is *analytical evaluation*, in which a theory is used most heavily as the main theoretical basis throughout the research, for example, an article revisiting an existing theory.

While both criteria are categorical measures, they also have an ordinal dimension in the theoretical depth of theory incidents. Therefore, this study attempts to add the ordinal dimension by coding one to four (or five) in ascending order of the theoretical level (i.e., relatedness and spot citing stages were coded as one, directionality and background review as two, etc.).

Content Analysis

Theory incidents were identified by a content analysis of 1,661 research articles published in four LIS journals during the twenty-year period, 1984-2003. The sources chosen for this study include *Journal of the American Society for Information Science and Technology (JASIST)*, *Library and Information Science Research (LISR)*, *Journal of the Korean Society for Information Management (JKSIM)*, and *Journal of the Korean Society for Library and Information Science (JKSLIS)*. The first two international journals have a high level of SSCI impact factor in LIS area and the two Korean journals are also top-ranked in Korean LIS society. They all contain peer-reviewed articles. It is important to note that the publication frequency of *JASIST* is so high that this study extracted only four issues in March, June, September, and December in order

to harmonize with other quarterly journals. Excluded were editorials, letters to the editor, opinion papers, conference reviews, and advertisements.

The goal of this content analysis is twofold. One is to find theoretical articles in which theories are developed and/or used and then assess the impact of theory incidents on the research article by using two measures explained above. The other is to classify the topic of those articles according to a scheme of 22 subfields.

The logic to look for theory incidents is as follows. Articles related to theory building are identified if any significant relationships are found by a hypothesis testing. This approach might be open to criticism in that qualitative, inductive, or grounded approaches could be ignored even if they generated new substantive theory in ways similar to those in quantitative work. However, this study gives much weight to the objectivity in finding theory incidents contributing to theory development since it would be very subjective to judge that any research findings could be qualified for a substantive level theory. In addition, authors are very likely to refer their findings by using the terms theory or model.

Theory incidents of theory use are also identified only in the case that they are named by other authors as a theory, model, or law. Yet another rule is added here: if even only an author describes a concept as a theory (or model/law), the concept is treated as theory throughout this study. For example, even in the case that an author describes Dervin's (1983) Sense-Making as a methodology, the Dervin's concept could be checked as a theory if the Sense-Making concept has ever been named as a theory in any article in the sample. Repeatedly conducting content analysis procedures required much energy and patience. However, this effort may provide a chance to grab even the case where an author him/herself is proposing a new theory based on a grounded approach. If the newly suggested finding deserves to be a theory, someone would cite it as "theory" in their papers.

Results

General Characteristics

Of 1,661 articles analyzed, the share of articles dealing with information retrieval is largest (9.9%), followed by papers about information seeking/use (9.2%), information system (9.0%), scholar communication (7.9%), classification/cataloging (6.9%), and Internet (6.7%) as shown in Table 1. These six categories seem to be dominant topics in LIS research, accounting for nearly 50%.

Among four journals, *JASIST* published predominantly many articles about information retrieval (25.6%) and relatively many articles on information system (14.1%), and bibliometrics (8.5%). Articles published in *LISR* mainly dealt with information seeking/use (19.5%) and next addressed scholar communication (13.4%). *JKSIM* performed the most research on information system (14.3%), followed by research on information retrieval (9.4%), and classification/cataloging (9.0%). The other Korean journal, *JKSLIS* appears to be concentric on articles about classification/cataloging (12.4%), education (11.2%), and library management (9.8%).

Both *JASIST* and *JKSIM* usually cover research interests within information science, such as information retrieval, information system, Internet, classification/cataloging, and scholar communication. On the other hand, *LISR* and *JKSLIS* usually deal with topics within library science, such as library management, information service, and education as well as a user-centered information science topic, information seeking/use. Besides that, top five topics in international journals include information retrieval, information seeking/use, scholar communication, information system, and Internet. Popular subfields in Korean journals are classification/cataloging, information system, education, information service, and library management.

Table 1 Research topics by journal

Subfield	JASIST		LISR		JKSIM		JKSLIS		Total	
	N	%	N	%	N	%	N	%	N	%
Information retrieval	96	25.6	11	3.2	41	9.4	17	3.3	165	9.9
Information seeking/use	29	7.7	67	19.5	25	5.7	32	6.3	153	9.2
Information system	53	14.1	7	2.0	62	14.3	27	5.3	149	9.0
Scholar communication	28	7.5	46	13.4	31	7.1	26	5.1	131	7.9
Classification/Cataloging	9	2.4	3	0.9	39	9.0	63	12.4	114	6.9
Internet	29	7.7	15	4.4	38	8.7	29	5.7	111	6.7
Library management	5	1.3	35	10.2	18	4.1	50	9.8	108	6.5
Information service	5	1.3	31	9.0	27	6.2	43	8.5	106	6.4
Education	4	1.1	26	4.7	15	3.4	57	11.2	92	5.5
Indexing/Abstracting	26	6.9	6	1.7	37	8.5	10	2.0	79	4.8
Collection development	4	1.1	25	7.3	26	6.0	20	3.9	75	4.5
Professionals	5	1.3	22	6.4	7	1.6	20	3.9	54	3.3
Network	5	1.3	10	2.9	16	3.7	21	4.1	52	3.1
Digital library	5	1.3	6	1.7	15	3.4	25	4.9	51	3.1
Publishing	12	3.2	4	1.2	16	3.7	13	2.6	45	2.7
Methodology	8	2.1	33	9.6	2	0.5	2	0.4	45	2.7
Bibliometrics	32	8.5	2	0.6	2	0.5	3	0.6	39	2.3
General LIS	13	3.5	4	1.2	9	2.1	9	1.8	35	2.1
Oriental materials	-	-	-	-	-	-	20	3.9	20	1.2
Archival studies	1	0.3	-	-	6	1.4	6	1.2	13	0.8
History	3	0.8	-	-	-	-	9	1.8	12	0.7
Others	3	0.8	-	-	3	0.7	6	1.2	12	0.7
Overall	375	100	343	100	435	100	508	100	1661	100

Table 2 represents a change of research interests in LIS literature for twenty years. Such topics as information retrieval, information system, scholar communication, and information seeking/use were most popular during 1984-1988. These subjects have maintained top four until the second period, 1989-1993. A noticeable change for the third period, 1994-1998, is that articles dealing with information seeking/use were more frequently published than articles about information retrieval and system. Another change is the increasing share of Internet research. The Internet research proportion has been a top during the latest five years, 1999-2003. The change of the top-ranked topics by year supports that research on web sites, web resources, and digital library has been actively done with the advent of Internet on 1995, and that research paradigm has definitely changed from a system-centered to a user-centered direction.

Table 2 Research topics by 5-year (%)

Subfield	1984-1988 (n=281)	1989-1993 (n=336)	1994-1998 (n=435)	1999-2003 (n=609)
Information retrieval (n=165)	11.4	12.2	10.1	7.9
Information seeking/use (n=153)	8.5	8.0	10.3	9.4
Information system (n=149)	11.0	10.1	9.7	6.9
Scholar communication (n=131)	10.7	9.2	5.5	7.6
Classification/Cataloging (n=114)	4.6	8.0	7.8	6.6
Internet (n=111)	-	1.2	7.6	12.2
Library management (n=108)	5.7	8.0	7.1	5.6
Information service (n=106)	7.1	4.5	5.3	7.9
Education (n=92)	4.3	6.5	6.2	5.1
Indexing/Abstracting (n=79)	6.8	5.1	4.4	3.9
Collection development (n=75)	5.3	3.6	3.2	5.6
Professionals (n=54)	3.6	4.2	3.7	2.3
Network (n=52)	2.8	2.4	3.9	3.1
Digital library (n=51)	2.1	1.2	2.5	4.9
Publishing (n=45)	2.8	2.7	2.5	2.8
Methodology (n=45)	3.6	3.3	3.0	1.8
Bibliometrics (n=39)	2.8	3.9	1.6	1.8
General LIS (n=35)	2.8	2.4	2.3	1.5
Oriental materials (n=20)	1.1	2.7	1.6	0.2
Archival studies (n=13)	-	-	-	0.2
History (n=12)	1.4	0.6	0.9	0.3
Others (n=12)	1.4	0.3	0.5	0.8
Overall (n=1661)	100	100	100	100

Theory Development by Subfield

Of 1,661 articles, 362 articles (21.8%) contributed to theory building, and the average level of theory efficiency was 1.94 out of 4 points. It represents that the substantive theories in LIS usually have the second level of efficiency so that they may explain a directionality of the relationship among theory units. Overall, only about 20% of theory development incidents could explain *co-variation* and *rate of change* of the relationship and the rest 80% of them were at the level of *relatedness* and *directionality*.

Among 18 subfields, information seeking/use research developed the most theories (66), followed by articles dealing with information retrieval (44), library management (42), and scholar communication (36) (Table 3). As with the number of developed theories per article, the rank slightly varied. Research dealing with professionals built the most theories (0.52), followed by articles about information seeking/use (0.43), library management (0.39), and information service (0.30).

Regarding the quality level of theory efficiency, articles on general LIS showed the highest points (3.60). Followed were articles dealing with bibliometrics (3.00), network (2.38), collection development (2.24), and library management (2.17). The result of ANOVA test shows that the difference of theory efficiency by subfield was statistically significant ($F=2.507$ $p=.001$).

Table 3 Theory development by subfield

Subfield	Number of articles developing theory	Number of developed theories per a article	Level of theory efficiency	SD
Information seeking/use (n=153)	66	0.43	1.94	.96
Information retrieval (n=165)	44	0.27	1.91	.83
Library management (n=108)	42	0.39	2.17	.79
Scholar communication (n=131)	36	0.27	1.58	.55
Information service (n=106)	32	0.30	1.84	.88
Professionals (n=54)	28	0.52	1.86	.71
Education (n=92)	23	0.25	1.87	.69
Collection development (n=75)	21	0.28	2.24	1.00
Internet (n=111)	17	0.15	1.71	.77
Information system (n=149)	16	0.11	1.75	.86
Network (n=52)	8	0.15	2.38	.74
Indexing/Abstracting (n=79)	8	0.10	1.88	.64
General LIS (n=35)	5	0.14	3.60	.89
Digital library (n=51)	5	0.10	2.00	1.22
Publishing (n=45)	3	0.07	1.67	.58
Classification/Cataloging (n=114)	3	0.03	1.67	.58
Bibliometrics (n=39)	2	0.05	3.00	.00
Methodology (n=45)	2	0.04	2.00	.00
Others (n=12)	1	0.08	2.00	-
Overall (n=1661)	362	0.22	1.94	.85

* Three subfields including Oriental materials, Archival studies and History are not shown here.

Theory Use by Subfield

More than a fourth of the 1,661 articles used one or more theories (Table 4). Of the 431 articles that applied theories, very many theory use articles were published in the subfields of information retrieval and information seeking/use. Regarding the proportion of articles that used theories, the research on bibliometrics most frequently incorporated theories. And next, theories were fairly often used in nearly a half share of both studies of information retrieval and information seeking/use. On the other hand, articles about publishing and digital library hardly used theories.

A total 897 incidents of theory use were identified in the 431 articles. It means that theory use articles contained an average of 2.08 theories. Table 4 presents that information seeking/use research most frequently incorporated theories (n=163), followed by articles about information retrieval (n=149), scholar communication (n=110), and bibliometrics (n=84). Considering an average number of theories used, articles about scholar communication employed most theories (3.24), followed by articles about bibliometrics (2.71), indexing/abstracting (2.57), and information seeking/use (2.33).

Table 4 Theory use by subfield (n = number of articles examined)

Subfield	Number of articles using theories	Percentage (%)	Number of theory incidents	Number of theories per articles using theories
Bibliometrics (n=39)	31	79.49	84	2.71
Information retrieval (n=165)	76	46.06	149	1.96
Information seeking/use (n=153)	70	45.75	163	2.33
Methodology (n=45)	15	33.33	29	1.93
Library management (n=108)	34	31.48	54	1.59
Indexing/Abstracting (n=79)	23	29.11	59	2.57
Scholar communication (n=131)	34	25.95	110	3.24
Professionals (n=54)	12	22.22	18	1.50
Information system (n=149)	32	21.48	56	1.75
Network (n=52)	11	21.15	23	2.09
Information service (n=106)	20	18.87	39	1.95
Education (n=92)	17	18.48	27	1.59
Collection development (n=75)	13	17.33	18	1.38
Internet (n=111)	19	17.12	32	1.68
General LIS (n=35)	5	14.29	8	1.60
Classification/Cataloging (n=114)	15	13.16	24	1.60
Publishing (n=45)	2	4.44	2	1.00
Digital library (n=51)	2	3.92	2	1.00
Overall (n=1,661)	431	25.95	897	2.08

The overall quality level of theory use was 2.39 out of 5 points (Table 5). It means that authors in LIS literature are likely to explain theories in introduction or literature review part for the purpose to offer background information of their research. The level of theory use ranges from 1.00 to 3.50. As the result of ANOVA test, this distribution was statistically significant ($F=4.60$, $p=.00$).

The degree in the studies of general LIS was highest (3.50). Beyond the average degree of theory use are such subjects as information service (2.64), library management (2.61), information retrieval (2.60), information seeking/use (2.59), and bibliometrics (2.52). Even though articles about general LIS and digital library incorporated a small number of theories, the theories were usually directly applied to a conceptual framework of research. Of eight theories used in the subfield of general LIS,

four theories were used at the fourth level of *theory application* and a theory was used at the highest level of *analytical evaluation*.

Table 5 The level of theory use

Subfield	Level of theory use	SD
General LIS	3.50	1.07
Digital library	3.00	1.41
Information service	2.64	1.06
Library management	2.61	1.09
Information retrieval	2.60	1.09
Information seeking/use	2.59	1.06
Bibliometrics	2.52	1.51
Education	2.41	1.01
Network	2.39	1.41
Professionals	2.39	1.38
Information system	2.36	1.07
Indexing/Abstracting	2.34	0.96
Internet	2.34	1.10
Collection development	2.28	1.36
Methodology	2.28	1.03
Classification/Cataloging	2.17	1.05
Scholar communication	1.63	1.04
Publishing	1.00	0.00
Overall	2.39	1.17

A total 185 theories were identified in this study. Each theory was used from one time to 39 times. The most frequently cited 20 theories were as follows: Dervin's sense-making theory (39), Zipf's principle of least effort (37), Kuhlthau's model of Information seeking process (35), Bradford's distribution law (33), Salton's vector space model (32), Shannon & Weaver's mathematical theory of communication (29), Lotka's law of author productivity (28), Belkin et al.'s theory of anomalous states of knowledge (25), Taylor's question-negotiation theory (23), and Zadeh's fussy set theory (21).

Most frequently used theories by subfield were enumerated in Table 6. Scholar communication research was inclined to explain the shift of research paradigm using Kuhn's theory and to analyze research trends using some bibliometric theories. Core theories in information seeking/use were Dervin's sense-making theory, Kuhlthau's model, Belkin's ASK theory, and Marchionini's ISP Model. Those in both information retrieval and information system were Salton's vector space model and Zadeh's fuzzy set theory. Theoretical base of library management was formed by some organization theories from the social sciences. Bradford's scattering law, lotka's law of author productivity, and Zipf's law of least effort were core theories in the subfield of bibliometrics.

Table 6 Core theories by subfield

Subfield	Name of theories (frequency)
Scholar communication	Kuhn's Theory of Paradigm Shifts (11) Bradford's Law of Scattering (9) Burton & Kebler's Law of Half-life (8)
Information retrieval	Salton's Vector Space Model (19) Zadeh's Fuzzy Set Theory (12) Shannon & Weaver's Information Theory (9)
Information seeking/use	Dervin's Sense-making Theory (23) Kuhlthau's ISP Model (17) Belkin's ASK theory (11) Marchionini's ISP Model (11)
Library Management	Cameron's Theory of Organization Efficiency (6) Rogers's Diffusion Theory of Innovation (5) Scott's Organization Theory (5)
Information system	Zadeh's Fuzzy Set Theory (7) Salton's Vector Space Model (5) Quillian's Semantic Network Model (4)
Internet	Ellis' ISP Model (2) Ingwersen's Cognitive IR Model (2) Marchionini's ISP Model (2) Zipf's Law of Least Effort (2)
Indexing/abstracting	Salton's Term Discrimination Value Model (9) Luhn's Theory of Term Frequency (7) Spurck Jones' Inverse Document Frequency Theory (7)
Bibliometrics	Bradford's Law of Scattering (17) Lotka's Law of Author Productivity (17) Zipf's Law of Least Effort (12)
Methodology	Kuhlthau's ISP Model (4) Mellon's Theory of Library Anxiety (4) Dervin's Sense-making Theory (3)
Information service	Parasraman's Model of Service Quality (10) Taylor's Question-Negotiation Theory (5) Gronroos's Model of Service Quality (4)
Classification/cataloging	Ranganathan's Classification Theory (5) Bliss' Theory of Knowledge Organization (3) Salton's Vector Space Model (3)
Collection management	Morse' Model of Circulation (3)
Education	Mellon's Theory of Library Anxiety (5) Kuhlthau's ISP Model (5) Eizenberg & Berkowitz's Big 6 Model (4)
Network	Berge's Graph Theory (3) Rouse's Model of Library Network (3) Von Bertalanffy's General System Theory (3)
Professionals	Herzberg's Motivation-Hygiene Theory (7) Maslow's Theory of Need Hierarchy (2) Vroom's Expectancy-Value Theory (2)
General LIS	Shannon & Weaver's Information Theory (3) Taylor's Value-Added Model (2)
Digital library	Eizenberg & Berkowitz's Big 6 Model (1) Scott's Organization Theory (1)
Publishing	Bradford's Law of Scattering (2)

Discussion

The findings of this study have good insights on the theoretical framework in LIS. The overall proportion and quality of theory incidents in both theory development and theory use articles can allow us to understand where the level of theoretical research of LIS is. As well, taking a look at the distribution of theoretical articles by subfield enables us to have an idea about which subfield has a great contribution to the improvement of theoretical base of LIS.

A noticeable finding here is that four subfields, information seeking/use, information retrieval, library management, and scholar communication made great contributions to the theoretical framework of LIS among other subfields. Research on those topics published many theoretical articles in both aspects of theory building and theory use. Their proportion accounted for over 50% of a total 362 theory building articles and for almost a half of a total 431 theory use articles. On the other hand, the subfields like publishing, digital library, and general LIS seldom published theoretical articles.

When we consider the percentage of theoretical articles based on the total number of articles published by subfield, the rank of the leading topics slightly varies. The research on information seeking/use and library management still was in top four but the research on professional and information service newly appeared. Over 50% of the studies on professional and 30% of information service articles are likely to be theoretical, contributing to theory building. On the other hand, in the theory use aspect, bibliometric research showed a very strong tendency to publish theory use articles—about 80% of them employed theory. This change of the rank implies that the subfields, professional, information service, and bibliometrics are more likely to be theoretical than other subfields even though the overall number of theoretical articles on them is not as many as on the information seeking/use, information retrieval, library management, and scholar communication.

The quality aspect of theoretical articles by subfield varied compared to the number of them. The subfields with high quality of theory incidents (over 3 point) were general LIS and bibliometrics in the theory building aspect and only general LIS in the theory use aspect. Although the others of subfields do not have low quality of theory incidents but it could be hard to find significant difference among them. Usually the subfields on which research published only a few theoretical articles showed the high quality. This finding supports that a number of theory incidents can not contribute to the improvement of the quality of theoretical articles.

The list of theories dominantly used at each subfield (as shown in Table 6) could allow for looking at the inside of theoretical base. The dominant theories in each

subfield were very various but there were some theories which were used across subfields. For example, the subfields, information seeking/use, methodology, and education often employed Kuhlthau's information seeking process model, Dervin's Sense-Making theory, and Mellon's theory of library anxiety. The Internet research usually used theories similar to the information seeking/use research. The both information retrieval and information system research used Salton's vector space model and Zadeh's fuzzy set theory. The research on publishing applied one of what the bibliometric research usually used. This distribution of dominant theories by subfield implies that some subfields have a similar theoretical framework with others.

Conclusion

This study attempted to examine the state of theoretical base of LIS research by focusing on the number and quality of both incidents of theory development and theory use by subfield. This study assumed that to take a careful look into the characteristics of the incidents by subfield could give a great insight into the understanding of theoretical background to have guided LIS research. By a content analysis of 1,661 articles published in four journals during twenty years, this study identified theoretical articles (or theory incidents) which contributed to the theory building and/or theory use.

The findings of this study have offered a comprehensive picture of theoretical base of LIS research. The leading subfields in LIS research appeared to vary slightly according to the perspectives, whether the number or the quality of theoretical incidents. However, this study showed that the four subfields, such as information seeking/use, information retrieval, library management, and scholar communication have had a predominant influence on the establishment of theoretical ground of LIS. This study also suggested a great potential of two research area on bibliometrics and professionals. Bibliometric research tended to employ theories frequently and research on professionals published relatively many theory building articles. Besides that, dominant theories by subfield examined in this study could support how the theoretical bases of each subfield are interrelated. It seems that the subfields, for example, information seeking/use, Internet, methodology and education, information retrieval and systems, and bibliometrics and publishing are closely related to each other by sharing some same theories.

This study allowed for understanding the contribution of research articles by subfield to the theoretical base of LIS. However, further analyses need to be conducted to generate a bigger knowledge map of LIS theoretical research. An attempt to focus on

characteristics of theory building incidents (i.e., variables or analysis unit of the substantive theory) could more clearly explain the nature of theoretical base. Other effort to analyze the interdisciplinary nature of theoretical base by specifying the origin of theories used would be very interesting. Additional research that seeks to address the impact of LIS theories on other related disciplines, such as communications, computer science, and management, would also be of value.

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