Team Size Patterns of Korean and International Journal Articles in Library and Information Science

국내외 문헌정보 학술지에 나타난 공동연구자수에 관한 연구

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초 록

The purpose of this study is to measure the extent of collaboration by comparing team size patterns of Korean LIS journals with international LIS journals. For the sample dataset, the top 30 ranked international journals in the field of LIS were selected using the *Scimago Journal Rank* (*SJR*), and 4 Korean LIS journals were selected for the years between 2010-2016. The size of the team who authored Korean journal articles were collected from the *RISS* database, while the size of team who authored international journal articles from the top LIS journals were collected using the *Scopus* database. The result of this study shows that the most common team size ranged from one member team to three member teams. Overall, the collaborative team size in international journals was higher than Korean journals. In particular, one member team was the most common team size in Korean journals, whereas two members team was most common in the international journals. At the subject level, the most common team size was one team member in the subject area of *Library Related*, while the most common team size was three team members in the subject area of *Science/Engineering*. The result of this study suggests that within LIS, the size of teams may vary considerably due to differences in subject areas.

Keywords: authorship, team size, collaboration, co-authorship, subject areas, library and information science

ABSTRACT

본 연구의 목적은 국내외 문헌정보학 학술지들에서 나타나는 협업 범위를 저자수를 이용하여 측정하고 비교하는데 있다. 연구에 필요한 데이터세트를 위해, 2010-2016년도에 발간된 논문으로서 문헌정보분야와 관련된 국외학술지중 Scimago Journal Rank (SJR) 에 기재된 최상위권 30개와 4개의 국내 문헌정보분야와 관련된 학술지를 선택하였다. 국내 학술지 저자 정보들은 RISS 데이터베이스에서 수집하였고 국외학술지 저자 정보들은 Scopus 데이터베이스를 사용하여 수집하였다. 연구결과 학술지의 경우 문헌정보 학술지에서는 단독저자부터 3인 공저자 까지가 가장 흔한 저자협업 정보임을 보여주었다. 국외 학술지는 저자협업이 국내학술지보다 더 다수의 경우가 많았다. 특별히, 국내의 경우 단독저자가 가장 흔했는데 국외 학술지에서는 2인 공저가 가장 흔했다. 연구분야를 살펴보면 도서관 관련 분야에서는 단독저자가 가장 흔하였고 과학/기술 분야는 3인 공저가 가장 흔하였다. 결론적으로 문헌정보 학 분야에서는 연구분야의 다양성으로 인해 저자수도 상당히 다양해 질 수 있음을 제시하고 있다.

키워드: 저자, 팀 규모, 공동연구자수, 저자협업, 공동연구, 공저, 주제 영역, 문헌정보

Ⅰ. Introduction

In academia, collaboration for the purpose of increasing research productivity is an important issue. Before encouraging collaboration among researchers, the extent of collaboration needs to be measured appropriately. For this purpose, measuring the extent of collaboration based on the size of team members who authored research publications seems to be a reasonable approach since only names of team members who made substantial contributions in producing the research are typically mentioned in research articles. Laudel (2002) showed that only 5% of the authors had experienced situations in which collaboration did not result in co-authored journal articles. Such a study demonstrates that researchers generally collaborate in order to produce co-authored journal articles. To this end, the size of the team that authors journal articles is considered to be a reasonable indicator that reflects some degree of collaboration among team members.

Bibliographic databases nowadays maintain a huge types of information on published journal articles in the form of metadata, making it much easier to obtain a large collection of information on the size of teams that authored journal articles. By using collected names of team members who published journal articles, the size of teams that authored the journal articles can be measured in a variety of ways (e.g., journal level) and can be made available in the bibliographic databases for users of bibliographic databases.

There have been studies that have focused on the discovery of the characteristics of team size in the production of journal articles. For example, previous studies have indicated that collaborative works in the fields related to hard science are much more prevalent than in the humanities and arts (Franceschet and Costantini 2010; Milojević 2014; Petersen, Pavlidis and Semendeferi 2014). These studies have been conducted predominantly with the intention of discovering disciplinary characteristics, and in particular, research on whether there is a difference between Korean and international journals in terms of team size has not been studied. In the case of Korea, research on the subject areas of "library" is predominant in LIS (Kim 2017; Seo et al. 2015), although there are many subject areas of LIS. How team size varies depending on the subject areas has not been investigated. A practical advantage of measuring common formation of collaboration is that such information can be useful for novice researchers who need to publish journal articles in the area of LIS.

To this end, the aim of this study is to investigate collaboration characteristics in the production of Korean and international LIS journal articles. This study will compare the team size of journal articles of Korean and international LIS journals at various levels: journal level, macro level (i.e., Korean to international), and subject area level. By analyzing the team size patterns of journal articles, this journal article demonstrates a collaborative pattern of articles published in Korean journals and international journals. By comparing the team size of LIS journal articles at various levels, this study intends to show where collaborations are commonly made and how collaborative patterns vary among LIS Korean and international journals.

Ⅱ. Related Works

Previous research has addressed different aspects of collaboration in the production of journal articles. Collaboration behavior may vary over time across domains, such as institutions, fields, sectors, and countries (Gazni et al. 2012; Katz and Martin 1997). Previous research attempted to characterize how collaboration has changed over time with respect to team size. In this section, we highlight some previous works that can assist in the understanding of team size differences among various disciplines.

Manton and English (2007) reported the team size patterns based on six journals from 1970 to 2002. In their research, they reported that in the years from 2000-2002, the average team size of authors of business journals ranged from 2.12 to 2.28. Fernandes (2014) examined the team size trend in software engineering based on conference and journal articles for the period between 1971 and 2012. The author reported that the average team size of scientific articles in the software engineering domain had increased during this period. In 2012, the average team size per article was 3.23, and the most frequent team size was three member teams. Grossman (2002) examined the size of teams on the basis of journal articles published from 1990 to 1999 in *Mathematical Reviews*. They reported the average team size (2.95) and the most frequent appearing team size (one member teams). Wuchty, Jones and Uzzi (2007) examined team size patterns in disciplines by examining 19.9 million journal articles and 2.1 million patent records using the *Web of Science* database. The authors reported that in 2000, the one member team size accounted for over 90% of the articles in the arts and humanities. In contrast, by the end of 2000,

the mean team size had increased to 3.5 in the area of social science.

Studies suggest that the size of team members may vary depending on journals published in a discipline. Pertaining to radiology, a sub-discipline of the medical discipline, Dang et al. (2015) reported that the average team size of members that author in the journal *Semin Roentigenol* was 2.06 but the average team size of authors for the journal *The Journal of Cardiovascular Management* was 7.01.

There have been some attempts to find team size patterns with respect to the international LIS journals. First, Mani (2014) examined the size of teams who authored articles in the *Malaysian Journal of Library and Information Science* and reported that the average team size per journal article was 2.06. The author reported that journal articles with multiple team members in LIS increased in majority of years between 1999 and 2003. However, the author's study was based on one journal, and the size of teams that authored other LIS journals was not investigated.

Second, Sin (2011) examined collaboration patterns based on the top 7 LIS journals indexed by the ISI's *Social Science Citation Index* (SSCI) for the years from 1980 to 2008. Besides showing the collaboration patterns among domestic and international authors, the author showed that since 1980 collaboration patterns have changed dramatically. Although the average team size and the most common team size were not provided, the author showed that one member teams has decreased dramatically from 60.9% in 1980 to 24.1% in 2008, while multiple team members have increased dramatically from 1.5% in 1980 to 17% in 2008.

Lastly, Han et al. (2014) examined collaboration patterns in LIS at the country and institution levels based on 15 core LIS journals for the years between 2000 and 2011. Their study showed that on average journal articles authored by one member teams changed from 51% in 2000 to 32% in 2011, while journal articles authored by two member teams had increased from 26% in 2000 to 32% in 2011. All of the above mentioned studies based on international LIS journals suggest that multiple team size have increased cover the years.

The overall team size in Korean LIS journals, on the other hand, appear to be smaller than the international LIS journals. Seo et al. (2015) compared three Korean LIS journals ─ *JKBSLIS, JKSLIS*, and *JKSIM* ─ that were published from 2010 to 2014. As a side note, there are four Korean LIS journals that accommodate broad subject areas of LIS. These are:

  1) *Journal of the Korean Biblia Society for Library and Information Science (JKBSLIS),*

  2) *Journal of the Korean Library and Information Science Society* (*JKLISS*),

3) *Journal of Korea Society for Information Management* (*JKSIM*), and

4) *Journal of Korean Society for Library and Information Science* (*JKSLIS*).

According to the authors, no substantial team size difference was found among the LIS journals. In particular, they found that in all of journals over 50% of published journal articles were produced by one member team in all of the journals. In spite of their useful findings, the study only included three domestic LIS journals.

All of the above mentioned studies are summarized in Table 1. As shown in this table, with exception of the health/medical field, the average team size of the discipline ranges from two to three team members. Although previous studies have shown numerous team size patterns

⟨Tab. 1⟩ A Comparison of Previous Study on Team Size of Journal Articles

Reported Discipline	Authors	Source of Data	Average Team size	Most Common Team Size Formation
Radiology	Dang et al. (2015)	49 clinical radiology journals (1946-2013)	2.06 to 7.01 member team	Not Reported
Software Engineering	Fernandes (2014)	Journal articles from 31 journals in Software Engineering (1971-2012)	3.23 member team (in the years of 2012)	3 member team (in the years of 2012)
Industrial and Information Engineering	Franceschet and Costantini (2010)	Journal articles from *Web of Science*	3 member team	Not Reported
Mathematics	Grossman (2002)	Journal articles from *Mathematical Reviews* 1990-1999	2.94 member team	1 member team
Business	Manton and English (2007)	Journal articles from 6 journals in Business	2.12 to 2.28 (in the years of 2000-02)	2 member team
Social Science	Wuchty, Jones and Uzzi (2007)	Journal articles in Web of Science	3.5 member team	Not Reported
Library and Information Sciences	Mani (2014)	Journal articles from *Malaysian Journal of Library and Information Science* (1996 - 2012)	2.06 member team	2 member team (39.79%)
	Sin (2011)	7 Top LIS Journals indexed by ISI	Not Reported	1 member team in 1980 (60.9%), but multiple team members (>= 2) by the end of 2008 (75.9%).
	Han et al. (2014)	15 core LIS journals	Not Reported	1 member team in 2000 (51%); Both 1 and 2 team members in 2008 (32% and 32%, respectively).
	Seo et al. (2015)	Journal articles from Korean LIS Journals: *JKBSLIS, JKSLIS,* and *JKSIM*	Not Reported	1 member team

among disciplines, how the team size varies among journals and subject areas of LIS have not been investigated thoroughly. Moreover, while there have been studies that examined team sizes in LIS, no previous studies have been conducted to compare the collaboration pattern at the macro level; that is, the team member sizes of Korean LIS journal articles being compared to the team member sizes of international LIS journal articles. This study extends the previous studies in this regard by focusing on comparing the team size at a macro level. In this study, an attempt was made to investigate the characteristics of team size in relation to varying subject areas using a much larger number of LIS international journals than in previous studies.

Ⅲ. Methodology

To conduct this study, a total of 4 Korean journals and 30 international journals were selected. As mentioned in the Introduction, these four Korean journals are considered as a mainstream core LIS journal. All of the Korean journals were indexed by the Korean Citation Index (KCI). There were other journals that could be considered as a LIS journal, if the scope of selection was broadened. Only core Korean LIS journals were examined for comparison since the core Korean journals provide a better focus for examining team size in LIS. As shown in Table 3, the top 30 ranked international journals were sampled using the *Scimago Journal Rank* (*SJR*). Instead of using a random sample of international LIS journals, a decision was made to select a reasonable subset of the top LIS journals that were indexed and ranked by *SJR*. Since *SJR* ranks the journals according to the journal's influence, selecting the top 30 ensured the highest quality. Despite using the *SJR* category, unlike Korean journals, some journals in this list have distinctive characteristics and focus on various aspects of LIS. Although an argument can be made as to the scope of these journals, these 30 journals were selected so that further analysis could be done in terms of subject areas.

Once journals were selected for this study, journal article metadata including the team size were downloaded from two bibliographic databases: *Scopus* (http://www.scopus.com) and *RISS* (http://www.riss.co.kr). The international journal article information was used and the Korean journal article information was downloaded from the *RISS* database. As discussed earlier, the overall team sizes of journal articles in a discipline tends to evolve over the years. Since this study focused on revealing only recent team size pattern in LIS publications, the date of the

publications was limited to the years between 2010 to 2016.

A script written with *Linux* based tools was used to count the number of team members. For example, in the author field of *Scopus* database, the strings in the expression "Loiko, V.A., Berdnik, V.V." contain three commas. By utilizing the comma patterns of the author fields, the number of team members could be calculated. Similarly, the team size of Korean journal articles was also calculated by utilizing the comma patterns. At every level of analysis, the resulting data was exported to *Microsoft Excel* for further analysis.

The size of team that authored journal articles was analyzed at the following levels:

- journal level (e.g., *Information Systems Research*)
- macro level (e.g., Korea versus international)
- subject area level (e.g., library)

At the journal level, the team size was examined on an individual journal basis: 4 Korean LIS journals and 30 international LIS journals. At a macro level, the team size was first accumulated using two criteria: "Korea" and "international". Then, the team size of all Korean LIS journals was compared to all LIS international journals. At the subject level, the team size was calculated based on categorized subject areas and then compared to each other. The novel subject areas were devised after reviewing all the sample journals. The journals were grouped together based on finding seminaries among journals, and the main criteria for consideration were the title, scope, and aim of each journal. The scope and aim were available from the individual journal homepage or the journal publisher's page. After reviewing the title, aim, and scope of all 30 journals for the categorization purpose, the journals were qualitatively grouped into the following seven subject areas:

1. Library Related
2. Science/Engineering Related
3. Information Systems/Technology Related
4. Information/Information Management
5. Infometrics
6. Other LIS Specific Subject Area
7. All LIS Subject Areas

The categories #6 and #7 need further explanations. Category #6 includes all journals that fall into the LIS specific subject areas other than the ones mentioned above (e.g., classification). Category #7 includes all journals that accommodates a wide range of topics under the umbrella

of LIS and do tend to be specific to a single subject area. The categorization of LIS journals based on subject categorization schemes such as the one provided by *Scopus* was not used since it was inadequate in terms of revealing the relationship between team size and the subject areas of LIS. In addition, the categorization of LIS subjects is often to prone to controversies as some show inconsistencies among bibliographic databases and indexes (Abrizah et al., 2013). As pointed earlier, the aim and the scope of journals, including the title of the journals, were mainly considered in categorizing the journals. Thus the frequency counts of the type of articles that were actually published was not considered. While the above categorization lacks rigorous validation, the subject areas of LIS journals appear to be adequate for the sample journals, depicting common themes among categorized journals in the particular group.

Ⅳ. Results

1. Team Size Patterns at the Journal Level

The team size can also be measured on a per journal basis. At journal level, the team size was calculated on the basis of each journal, and the team sizes of authors of Korean journals were compared to the International journals on an individual basis. The distribution of the team size for each Korean journal dataset is shown in Table 2. As shown, in all the Korean LIS journals, one member team is the most common occurrence as the percentage of articles written by single team member are the highest in all four Korean journals. This result confirms the team sizes of authors of Korean journals as reported by Seo et al. (2015). As mentioned earlier, Seo et al. (2015) reported a team size formation in *JKBSLIS, JKSLIS,* and *JKSIM.* However, a slight difference among these journals is worth pointing out. The journal articles written by a one member team were highest in *JKSLIS* (63.8%), while journal articles published by only one member teams were the lowest in *JKSIM* (41.2%). In *JKSIM,* journal articles published by two team members (40.8%) were slightly lower than one member teams (41.2%). The last row of this table shows the average team size in the Korean journal dataset in terms of percentage. This average percentage is compared to the international journals at a macro level and reported in the subsequent section.

<Tab. 2> Distribution of the Team Size per Korean Journal

Team Size Journal Names	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	SD (%)	Avg. Team Size
JKBSLIS	51.2	35.7	8.2	4.4	0.5	0.0	0.0	19.8%	1.7
JKLISS	53.5	28.0	11.7	5.0	1.4	0.5	0.0	19.1%	1.7
JKSIM	41.2	40.8	11.5	5.4	1.2	0.0	0.0	18.0%	1.8
JKSLIS	63.6	22.8	10.0	2.1	1.1	0.2	0.2	22.1%	1.6
Average	52.4	31.8	10.4	4.2	1.0	0.2	0.1	19.4%	1.7

Note: The shaded cell represents the team size that have the highest percentage in respect to the team size, indicating the most frequent team size in the journal.

Table 2 also shows the standard deviation (*SD*) and the average team size in all of the journal articles pertaining to each journal. In the right side of the table, the column labeled "Avg # of Authors" indicates the average team size of Korean journals. As shown, the average team size ranges from 1.6 to 1.8. The *SD* is expressed in terms of percentage, ranging from 18.0 to 22.1. The right most column shows that the highest level of collaboration is present in *JKSIM* (team size of 1.8), and the lowest level of collaboration is present in *JKSLIS* (team size of 1.6). However, the overall difference between the average team size is minimal in Korean journals.

In Table 3, the team size per international journal is shown. Unlike the Korean journals, for the international journals, a larger number of journals – a total of 30 – were selected. In this table, the common team size of articles in each journal ranges from one team member to three team members. As shown, eight journals have one team member as the most common team size, 17 journals have two team members as the most common team size, and six journals have three team members as the most common team size. Thus, on average, journal articles written by two team members are most common in international journals. The average team size is lowest in *College and Research Libraries News* (1.6). In contrast, the average team size is highest (4.4) in two journals: *Journal of Cheminformatics* (*SJR* #5) and *Journal of Chemical Information & Modeling* (*SJR* #7). Whether these two journals belong to LIS journals is uncertain. These journals appear to overlap as interdisciplinary areas between the field of LIS and chemistry. Nonetheless, these journals were categorized as LIS journals according *Scimago's SJR*.

The largest team size appears in *Chemical Information and Modeling* (*SJR* #7) as 3.1% of journal articles are written by a team size of 11 or more. This journal has the least number of

journal articles written by one team author (3.0%) and has the lowest *SD* (7.2%). Also, *Chemical Information and Modeling* has one of the highest average team sizes (4.4). In contrast, *Library Quarterly* (*SJR #23*), has the highest percentage of journal articles written by only one author (67.3%) with a *SD* of 19.9. In general, journals with larger team sizes tend to have lower SD. As the name suggests, *Journal of Chemical Information and Modeling* can be considered as a scientific journal due to the interdisciplinary nature of the subject area. In contrast, *Library Quarterly* is focused on the subject area of "library". In any event, the most common team size of LIS research publications ranged from one team member to three team members.

The last rows in Table 2 and Table 3 indicate the averages value of the following: team size and standard deviation. In the subsequent section, a comparison will be made between the average team size of authors of Korean journals and international ones at a macro level.

2. Team Size Patterns at Macro Level

In this study, "macro level" refers to the highest level domain (e.g., country). In this study, Korean LIS journals were compared to international journals at a macro level. Figure 1 shows the overall team size in the production of the journal articles in the Korean LIS journals and in the international LIS Journals. Here, the y-axis represents the percentage of articles in relation to the team size.
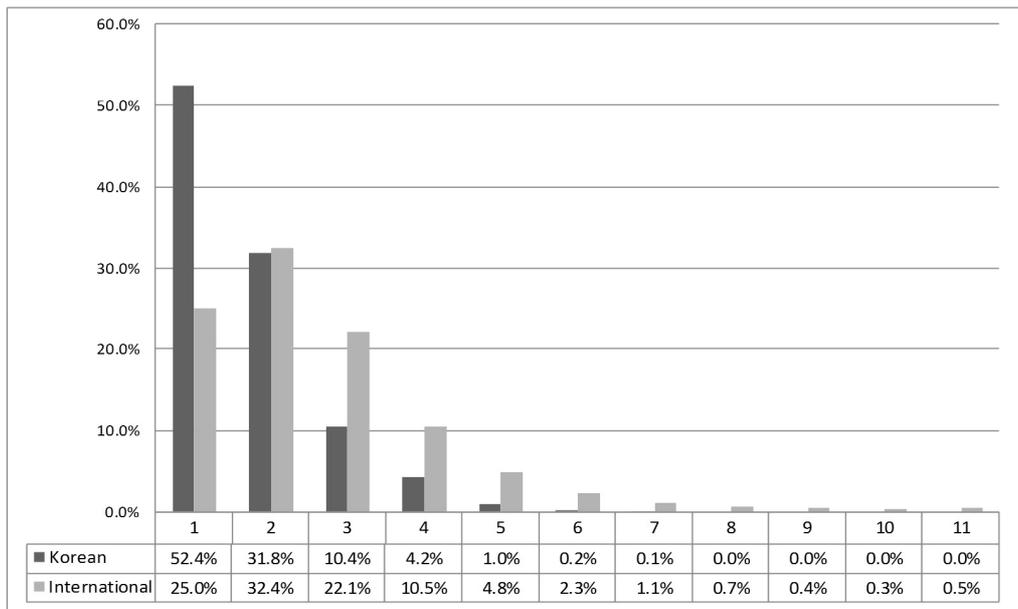
As shown, journal articles written by one or two team members are the most common team formation in Korean and international journals. The difference here between Korean journals and international journals is that journal articles written by one member teams are more common in Korean LIS journals when compared to the international journals. On average, the percentage of Korean journal articles written by one member teams are approximately twice the percentage of international journal articles written by a single team member. The percentage of Korean journal articles written by two member teams are almost same as the percentage of international journal articles written by two team members. More specifically, slightly over 30% of journal articles are written by two team members in both Korean journals and international journals. There is also a distinctive difference between Korean and international journals in terms of the most common team size. Specifically, the most common team size in Korean LIS journals are one member teams, whereas the most common team size in international journals are two member teams.

<Tab. 3> Distribution of the Team Size per International Journal

SJR	Journals	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 (%)	>= 11 (%)	SD (%)	Avg Team Size
1	Information Systems Research	3.2	28.3	45.3	18.9	3.7	0.0	0.3	0.3	0.0	0.0	0.0	15.3	2.9
2	European Journal of Information Systems	15.8	35.3	29.3	17.7	1.4	0.5	0.0	0.0	0.0	0.0	0.0	13.3	2.5
3	College and Research Libraries	48.8	34.6	10.2	4.2	1.1	0.8	0.2	0.2	0.0	0.0	0.0	16.7	1.8
4	Info. Communication & Society	44.0	31.2	15.5	5.8	2.0	0.6	0.5	0.2	0.3	0.0	0.0	15.1	2.0
5	Journal of Cheminformatics	6.4	14.0	22.6	18.0	13.7	11.0	3.4	2.4	3.4	2.1	3.0	7.2	4.4
6	Library and Information Science Research	36.3	37.1	14.6	7.9	2.1	0.4	0.8	0.4	0.0	0.0	0.4	14.4	2.1
7	J. of Chemical Information & Modeling	3.0	18.3	19.9	17.8	14.5	9.8	5.8	4.0	2.1	1.9	3.1	7.2	4.4
8	J. of the Association for Info. Science and Tech.	16.4	33.2	24.3	15.5	6.2	2.1	0.6	0.8	0.6	0.0	0.4	11.6	2.8
9	Reference Services Review	39.8	38.3	15.5	3.8	1.5	0.4	0.8	0.0	0.0	0.0	0.0	15.5	1.9
10	Journal of Information Technology	13.1	36.9	33.6	12.3	0.8	3.3	0.0	0.0	0.0	0.0	0.0	13.8	2.6
11	IEEE Transactions on Information Theory	10.7	40.4	31.3	13.6	3.3	0.6	0.1	0.1	0.0	0.0	0.0	14.2	2.6
12	Journal of Academic Librarianship	44.0	31.8	14.9	6.0	2.1	0.8	0.0	0.2	0.2	0.0	0.0	15.2	1.9
13	Government Information Quarterly	24.9	34.0	26.6	7.2	3.6	2.2	0.5	0.5	0.0	0.2	0.5	12.8	2.5
14	College and Undergraduate Libraries	21.6	48.9	21.6	4.5	2.3	1.1	0.0	0.0	0.0	0.0	0.0	15.6	2.2
15	Information and Organization	21.6	48.9	21.6	4.5	2.3	1.1	0.0	0.0	0.0	0.0	0.0	15.6	2.2
16	Scientometrics	19.9	29.4	26.8	12.9	6.6	2.4	1.1	0.5	0.3	0.1	0.2	11.3	2.7
17	International Journal of Information Management	14.3	30.4	29.8	17.7	6.2	0.6	0.6	0.4	0.0	0.0	0.0	12.1	2.8
18	Journal of Health Communication	6.5	19.9	19.4	19.1	9.6	9.6	6.1	3.9	1.9	2.0	2.1	7.2	4.2
19	International J. of Geographical Info. Sci.	9.2	24.8	26.1	18.5	10.3	6.9	2.1	0.6	0.5	0.4	0.6	9.8	3.4
20	Information Technology and Libraries	45.3	33.7	14.7	3.2	2.1	1.1	0.0	0.0	0.0	0.0	0.0	15.8	1.9
21	Cybermetrics	33.2	22.2	33.4	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	13.9	2.3
22	Journal of Librarianship and Information Science	28.3	44.0	18.2	6.3	1.3	0.6	1.3	0.0	0.0	0.0	0.0	14.9	2.2
23	Library Quarterly	67.3	15.0	8.4	4.8	2.4	0.9	0.6	0.3	0.0	0.0	0.3	19.9	1.7
24	Journal of Classification	18.1	40.2	30.7	8.7	2.4	0.0	0.0	0.0	0.0	0.0	0.0	14.3	2.4
25	Journal of Documentation	48.6	31.6	11.7	3.9	3.1	0.6	0.6	0.0	0.0	0.0	0.0	16.2	1.9
26	Reference and User Services Quarterly	17.5	53.1	12.5	8.8	1.9	2.5	0.0	0.0	0.6	0.6	2.5	15.7	2.6
27	Research Evaluation	16.4	34.9	21.7	12.7	8.5	2.6	1.1	1.1	0.0	0.5	0.5	11.4	2.9
28	Language Resources and Evaluation	10.8	24.7	22.9	18.4	7.2	3.1	4.0	4.0	2.2	0.9	1.8	8.8	3.7
29	College and Research Libraries News	54.8	33.6	7.5	2.8	0.9	0.5	0.0	0.0	0.0	0.0	0.0	18.1	1.6
30	Information Processing and Management	10.7	24.6	31.8	18.7	10.5	1.5	1.3	0.4	0.2	0.2	0.0	11.3	3.1
	Average	25.0	32.4	22.1	10.5	4.8	2.3	1.1	0.7	0.4	0.3	0.5	15.3	2.9

Note: Each cell indicates the percentage of journal articles found with the corresponding team size. The shaded cell represents the most common team size formation.

Also, in Figure 1, journal articles written by more than three team members are slightly higher in the international journals than in the Korean journals. More precisely, approximately 80% of journal articles published in Korean LIS journals are produced by either one member team or by two member team, while 80% of journal articles published in international LIS journals are produced by one, two, or three team members. There is also a notable difference in journal articles written by large team members. This able shows that no Korean LIS journal article is written by 8 or more team members, while some international journal articles are written by an exceedingly large team. As shown in this figure, 0.5% of international journal articles are written by 11 or more team members. Although the journal articles written by 11 or more team members is relatively low, the histogram shows that a small number of journal articles is written by a large team.

	1	2	3	4	5	6	7	8	9	10	11
■ Korean	52.4%	31.8%	10.4%	4.2%	1.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
■ International	25.0%	32.4%	22.1%	10.5%	4.8%	2.3%	1.1%	0.7%	0.4%	0.3%	0.5%

〈Fig. 1〉 Team Size Distribution in Korean LIS Journals and International LIS Journals

As a whole, more collaborative journal articles are evident in the international journals than in the Korean journals. As pointed out earlier, "library" is the most common subject in Korean LIS journals, and this explains why team sizes are smaller when it comes to production of Korean journal articles.

3. Team Size Patterns at Subject Level

As mentioned earlier, LIS journals were categorized into seven subject areas. The result of categorizing journals according to the subject areas is shown in Table 4. The subject area of "Library Related" is found most of the journals (9). In contrast, only three international journals were categorized into "All LIS Subject Areas". As for the Korean journals, three Korean journals ─ *JKBSLIS, JKLISS*, and *JKSLIS* ─ could be placed into this category. Journals in this category

〈Tab. 4〉 Subject Areas of International and Korean LIS Journals

Categories	International Journals		Korean Journals	
	# of Journals	Name	# of Journals	Korean Journals
1. Library Related	9	*College & Research Libraries* *Reference Services Review* *Journal of Academic Librarianship* *Government Information Quarterly* *College & Undergraduate Libraries* *Information Technology & Libraries** *Library Quarterly* *Reference & User Services Quarterly* *College & Research Libraries News*	0	
2. Hard Science/ Engineering Related	5	*Journal of Cheminformatics* *Journal of Health Communication* *Journal of Chemical Information & Modeling* *IEEE Transactions on Information Theory* *International Journal of Geographical Information Science*	0	
3. Information Systems/ Technology Related	5	*Information Systems Research* *European Journal of Information Systems* *Journal of the Association for Information Science & Technology** *Journal of Information Technology* *Information Technology & Libraries**	0	
4. Information /Information Management	5	*International Journal of Information Management* *Information Processing & Management* *Information & Organization* *Journal of Documentation* *Information Communication & Society*	1	*JKSIM*
5. Infometrics	2	*Cybermetrics* *Scientometrics*	0	
6. Other LIS Specific Subject Area	3	*Journal of Classification* *Research Evaluation* *Language Resources & Evaluation*	0	
7. All LIS Subject Areas	3	*Library & Information Science Research* *Journal of the Association for Information Science &Technology** *Journal of Librarianship & Information Science*	3	*JKBSLIS* *JKLISS* *JKSLIS*

Note: The asterisk "*" indicates the journals that were categorized into more than one subject areas.

typically accepts journal articles written on a wide range of subject areas as the scope of these journals are intentionally left broad. Some journals exhibit distinctive individual characteristics but share a common theme among the journals in the same subject area. For example, "informetrics" refers to all studies in information sciences that focus on metrics. Milojević and Leydesdorff (2013) suggested the use of "infometrics" to include other sub-branch areas: "bibliometrics", "scientometrics", and "webometrics". Thus, due to common characteristics among sub-branch areas, the journals that belong to "infometrics" could be categorized with higher level of certainty. Journals that exhibit multi-subject areas were categorized into multiple subject areas by duplicating the instance of categorization. For example, *Journal of the Association for Information Science and Technology* was categorized into both "Information Systems/Technology Related" and "All LIS Subject Areas". These types of journal categorizations were made with less certainty.

Once all the journals were categorized into seven subject areas, the team size distribution of subject areas was obtained. Table 5 shows the distribution of international journal team size per subject area. In this table, the journal articles written by only single team member are the most common in the subject areas of "Library Related" (39.8%). In contrast, journal articles written by only three team members are the most common form of team size formation in both "Science/Engineering" (22.0%) and "Infometrics" (30.1%). The average team size is the largest in the subject area of "Science/Engineering Related" (4.1). In contrast, the average team sizes are the smallest in the subject area of "Library Related" (2.0). Since the average team size ranged

<Tab. 5> Distribution of International Journal Team Size per Subject Areas of LIS

Team Size \ Subject Areas	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 (%)	>= 11 (%)	SD (%)	Avg Team Size
1. Library Related	39.8	36.2	14.7	5.3	2.0	1.2	0.3	0.2	0.1	0.1	0.4	14.9	2.0
2. Science/ Engineering Related	6.3	19.3	22.0	18.4	12.0	9.3	4.4	2.7	2.0	1.6	2.2	7.7	4.1
3. Information Systems/ Technology Related	12.1	33.4	33.1	16.1	3.0	1.5	0.2	0.3	0.2	0.0	0.1	13.1	2.5
4. Information/ Information Management	22.7	33.8	24.7	11.7	5.3	1.0	0.6	0.3	0.1	0.1	0.7	12.3	2.5
5. Infometrics	26.6	25.8	30.1	6.5	8.9	1.2	0.6	0.3	0.2	0.1	0.1	12.2	2.5
6. Other LIS Specific Subject Area	15.1	33.3	25.1	13.3	6.0	1.9	1.7	1.7	0.7	0.5	0.8	11.3	3.0
7. All LIS Subject Areas	27.0	38.1	19.0	9.9	3.2	1.0	0.9	0.4	0.2	0.0	0.3	13.2	2.4

Note: Each cell indicates percentage of journal articles found with the corresponding team size. The shaded cell represents the most common team size formation.

from 2.0 to 4.1, the team sizes differ substantially depending on the subject area.

Table 6 shows that the Korean LIS journals that were selected in the first study fall into the following main categories: "Information/Information Management" and "Inclusive of All LIS Subject Areas". *JKSIM* falls into "Information/Information Management", whereas all remaining Korean LIS journals - namely *JKBSLIS, JKLISS*, and *JKSLIS* - fall into "All LIS Subject Areas". In terms of team size, journal articles written by a single team member are the most common occurrences since the percentage of articles written by a single member are the highest in both "Information /Information Management" and "All LIS Subject Areas".

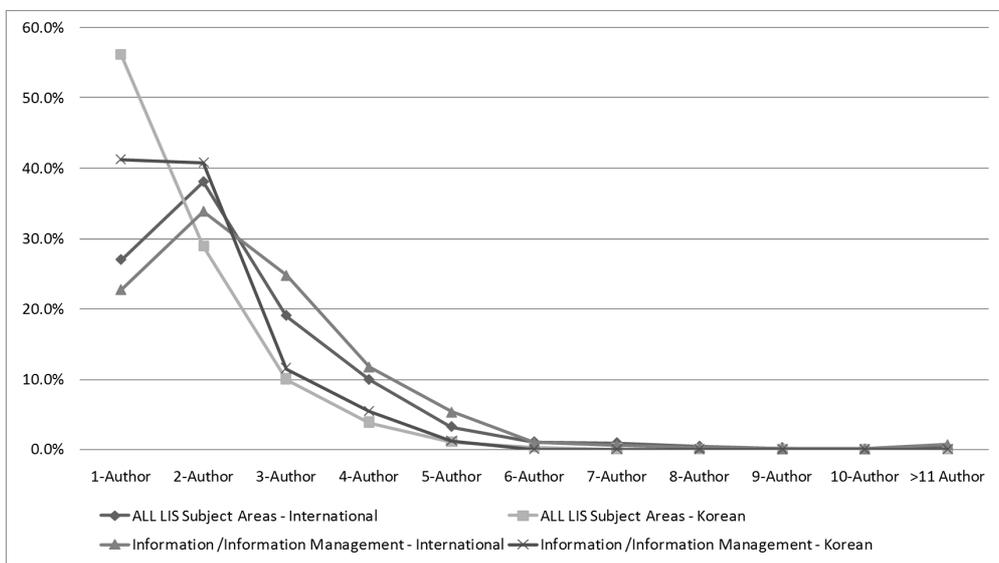⟨Tab. 6⟩ Distribution of Korean Journal Team Size per Subject Areas of LIS

Journals \ Team Size	1	2	3	4	5	6	7	SD	Avg Team Size
4. Information /Information Management	41.2%	40.8%	11.5%	5.4%	1.2%	0.0%	0.0%	28.3%	1.8
7. All LIS Subject Areas	48.7%	34.8%	10.7%	4.6%	1.1%	0.1%	0.0%	34.4%	1.6

Note: Each cell indicates the percentage of journal articles found with the corresponding team size. The shaded cell represents the most common team size formation.

Despite the similarities in terms of common team size, a slight difference between the two subject areas can be noticed. In "Information/Information Management", the difference between journal articles written by one and two team members is only 0.4% (41.2% minus 40.8%). On the other hand, in "ALL LIS Subject Areas", the number of articles written by one and two team members differed greatly. The average team size is also larger in "Information/Information Management" than "ALL LIS Subject Areas". The average team size is 1.8 in "Information/ Information Management", but average team size in "All LIS Subject Areas" is 1.6. *JKSIM* contains more non-library related research work compared to other Korean LIS journals (Kim 2017). This is most likely the reason that *JKSIM* team size is the largest among Korean journals.

Using similar subject areas to the ones that appear in Table 5 and 6, a comparison of team sizes between authors of Korean and internationals at the macro level can be made. Figure 2 depicts the team size pattern of authors of Korean and international journals for "ALL LIS Subject Areas" and "Information/Information Management". In the case of "ALL LIS Subject", one member teams are most common in Korean LIS journals (56.1%), whereas two member teams are most common in international LIS journals (38.1%). In the subject area of

"Information/Information Management", one member team is most common in Korean LIS journals (41.2%), whereas two member teams is most common in international LIS journals (34.0%). For the subject of "Information/Information Management", the team size formation is similar to that of "ALL LIS Subject". However, in both the Korean LIS journals and in the international journals, the team size is higher in the "Information/Information Management" journals than "ALL LIS Subject Areas" journals.

〈Fig. 2〉 Distribution of Korean and International Team Size for All LIS Subject Areas

Ⅴ. Discussion and Conclusion

The comparative analysis of team size of LIS publications at various levels has demonstrated the characteristics and common team size formation in the production of LIS journal articles. To determine important findings in this study, it is useful to highlight notable characteristics of team size at each level of analysis. At the journal level, the common team size of articles in each journal ranges from one to three team members in the international journals. In all of the Korean LIS journals, one member team is the common team size in all four Korean journals. At the subject level, this study showed that one member team was common in the subject area of

"Library Related", and, on the opposite spectrum, three team members was the most common for the "Science/Engineering" and "Infometrics" subject areas. These results seem to suggest that team size tends to be larger in the more technical subject areas of research. At the macro level, the result indicates that, overall, multiple team size across subject areas is slightly higher in the international journals than in the Korean journals.

Despite distinctive characteristics of team size in each level of analysis, limitations with regards to generalizing the result of this study needs to be considered carefully. The generalizability of the team size in LIS may vary, depending on how a journal is selected. This study used the *SJR* as a basis for selecting LIS journals for the sake of convenience, but distinguishing LIS journals and non-LIS journals is subjective. Because what constitutes LIS journals may depend on the subjective view of academics in the disciplines of LIS, the generalization of team size in LIS should not be made without considering this limitation. For the same reason, the outcome of some parts of this study may have been different, if another journal index was used to extract a sample journal list for this study. Note that the top 30 selected journals may not adequately represent all international journals within LIS. The journal selection criterion for the international journals was different from Korean journals, and the international journals covered broader subject areas.

Nevertheless, the result of this study suggests that team size may vary considerably within a discipline due to the diversity of subject areas. Besides collaborating due to publishing in international journals, collaboration is more apparent in the subject areas where greater technical ability is required. Future studies can further examine the subject areas of study in LIS by using varying types of journal articles. It is generally believed in the academic community that collaborative work generally leads to higher quality research work (Hart, 2007). Scientific disciplines may require additional technical knowledge and collaboration may increase the quality of research work. This partly explains the increase in collaboration among the LIS journals that touches upon more or less the hard scientific area. While there should be a positive correlation between the quality of research work and the team size in general, the result of this study suggests otherwise. At least in the field of LIS, it is likely that the subject area of LIS appears to predominantly influence researchers in deciding to collaborate with others in journal publication production. To an extent, the result may signify the efficiency in producing the research articles. The Korean LIS community who plan to conduct research and submit articles to international journals should be aware of the fact that subject areas play a major role in

collaboration, although there are some differences between authors who authored Korean and international journal articles.

Considering the benefits of collaboration, the team size information appears to be a useful attribute that may aid in evaluating the extent of collaboration concerning various domains of interest. The size of teams who author journal articles is not commonly provided in the bibliographic databases. To this end, it is suggested that bibliographic databases should support such features of viewing and analyzing the team size of journal articles at various levels. Such features may encourage researchers to engage in even more collaboration since researchers would become aware of the fact that collaboration is already common in a specific domain.

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