Research status and characteristics of library and information science in Taiwan: a bibliometric analysis

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Abstract This study determines how library and information science (LIS) research in Taiwan has changed between 2001 and 2010. The major research questions address the research status of LIS in Taiwan, how the Taiwanese government supports the field, and the collaborative authorship of LIS journal articles in Taiwan. Bibliometric and content analysis methods were conducted to analyze 2,494 journal articles, 983 theses, and 191 research projects between 2001 and 2010. The results show *LIS and Technology* to be the most popular topics in journal articles. The most well-received thesis topics are *LIS and Technology* and *User Services*, accounting for more than 50 % of graduate theses. The same is true for research projects, with the subjects of *LIS and Technology, LIS Theory and Foundation*, and *User Services* having a ratio of more than 70 %. In government-sponsored research projects, the average amount of funding obtained had no significant differences or tendencies for various subjects over time. In authorship of journal articles, individual researchers conducted 66.11 % of articles in key LIS scholarly journals in Taiwan between 2001 and 2010.

Introduction

Information technology has recently undergone substantial changes. Since the explosive growth of Internet technology and its widespread use in the 1990s, information technology has become a part of daily life. This has meant increased rapid changes for the library and information science field (LIS), both in academia and practice. Several studies have analyzed the variation of the LIS domain from various perspectives, such as researcher ranking, content analyses or bibliometric analyses of particular journals or cross journals,

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bibliometric analysis of a particular country or cross region (e.g. Cano 1999; De Moya Anegón et al. 1998; Kajberg 1996; Khoo 2011; Uzun 2002), content analysis of conference papers, or dissertation examinations. Most previous studies have focused on one type of literature, such as journals, dissertations, or conference papers. This composition may cause bias and limitation when interpreting field development. For a more complete viewpoint, integrating many professional publication types is necessary to clarify the whole picture of research status and characteristics.

Since 2006, the *Library Yearbook of ROC* (*Taiwan*), published by the National Central Library, has included a chapter on LIS research. Monography and conference proceedings, journal articles, research projects and overseas visiting reports, and doctoral and masters theses published in a particular year are all analyzed in the chapter. The scope and contents of the section may be comprehensive; however, the chapter is limited to "yearbook" format, which only includes current year conditions, making it difficult to probe into longitudinal trend analysis.

This study identifies changes in dominant LIS topics in Taiwan between 2001 and 2010 and examines multi-types of professional literature, including journal articles, thesis, and research projects over a 10-year period to provide a more complete view of LIS research status. The content of these documents are investigated and compared based on their different views of the research subjects in an attempt to explore the research status and characteristics. This study also explores the perspective of research funding and collaborative authorship. The compared amount of research grants in different LIS subjects could determine the degree of support that the Taiwanese government provides to the field. Authorship is an important and primary bibliometric descriptor of a scholarly discipline. The trends and patterns characterize the scholarly social and even the cognitive structure of research fields. Collaboration in research is reflected by the co-authorship of publication (Glänzel 2002). Thus, the collaborative authorship of journal articles is examined to explain how Taiwanese LIS researchers publish.

Literature review

Bibliometrics is among the typical research methods used in the field of LIS. Numerous LIS papers have quantitatively analyzed the LIS field, such as researcher ranking (e.g. Li et al. 2010; Meho and Spurgin 2005), analysis of a particular journal (e.g. Bonnevie-Nebelong and Frandsen 2006; Bonnevie 2003; Nisonger 1999; Tsay and Shu 2011), analysis of various journals (Blessinger and Frasier 2007; He and Spink 2002; Raptis 1992; Tsay 2011), measuring a particular country or cross region (e.g. Cano 1999; De Moya Anegón et al. 1998; Kajberg 1996; Khoo 2011; Uzun 2002), and examining dissertations (e.g. Buttlar 1999; Franklin and Jaeger 2007; Sugimoto et al. 2011, 2009).

Studies analyzing LIS research status in a country or regional level are few. Cano (1999) used an earlier classification model of Järvelin and Vakkari (1990) to create an overview of LIS research in Spain and located 354 articles published by two major local journals between 1977 and 1994. The Spanish research output concentrates on information retrieval, description of services, and studies of scientific communication. De Moya Anegón et al. (1998) analyzed publications and author co-citations in journals and conference proceedings between 1985 and 1994 to measure the structure, specificity, and composition of LIS research fronts in Spain. Kajberg (1996) used content analysis to determine the subject focus of Danish LIS literature from 1957 to 1986. Two non-research journals were selected to reveal the concerns of more practical but research-oriented

librarianship. The results show individual libraries/national library systems, and management of people, resources, and systems to be major issues.

Uzun (2002) examined a set of 21 core journals in LIS published from 1980 to 1999 to determine the number of authors or co-authors from developing countries and former socialist Eastern European countries. The study revealed information retrieval, information need, and information use to be the highest interest topics for researchers working in those countries. Khoo (2011) collected journal articles written by Asian authors from the library and information science abstracts (LISA) database to identify areas of strength in Asian LIS research. The results show bibliometrics, information retrieval, automatic text analysis, information and Web technologies, scholarly publications, education, and knowledge management to be the main subjects in these areas. The research also divided the most frequent descriptor terms into local and foreign journals and found that local journals in Taiwan are library science oriented and foreign journals are more information technology (IT)-oriented. This also appears in the other ten countries in Asia.

An analysis of academia thesis of the discipline level shows that some research has been conducted to study the LIS field. Buttlar (1999) studied 61 dissertations in the LIS field to reveal citation patterns and to investigate the gender of authors cited, the nature of the material, cited journals, citing to other fields, currency of literature, and the country of cited publications. Sugimoto et al. (2009) investigated the historical progression and landscape of doctoral degree programs in the United States and Canada between 1930 and 2007 using 3,014 dissertations conferred by 38 ALA-accredited schools. Franklin & Jaeger (2007) examined the number of African American women earning doctoral degrees in LIS, the schools awarding these degrees, and the research areas pursued in these dissertations. They classified all 35 dissertations between 1993 and 2003 into five areas: education, information issues, library/librarianship issues, literature, and technology. The results show that 47 % of the research focused on issues related to librarians and librarianship, followed by information issues (21 %). A recent research identified changes in dominant topics in LIS over time by analyzing 3,121 doctoral dissertations completed between 1930 and 2009 in North American library and information science programs. The findings indicate that the main topics in LIS in the studied period (2000–2009) have changed substantially from those in the initial period (1930–1969). However, some themes occur in multiple periods, which represent core areas of the field (Sugimoto et al. 2011).

In Taiwan, a study by Lo et al. (2001) described a task for constructing a subject classification framework under the background of analyses of topics studied in LIS to investigate and analyze future research development and the paradigm shift in LIS using the proposed subject classification framework and other approaches. Lin (2004) analyzed the publication of research articles in selected journals and authored by Taiwanese librarians, focusing on the number of publications, research topics, authorships, and research methods. Ouyang et al. (2006) used the wiki platform to collect 1,746 articles from 20 journals and 311 theses from nine Taiwan LIS programs. The results of their study indicate that the 20 journals can be separated into five groups, and that the collected articles can be distributed among eight research areas. The study found a decreasing number of articles from Taiwan.

Most studies have focused only on either journals or theses, with only a small number focusing on the entire scope of LIS. To overcome these limitations and obtain large-scale LIS research in Taiwan, this study includes journal articles, theses, and research projects in the analysis to explore the research status and characteristics of LIS in Taiwan.

Research methods

This research includes three document types: journal articles, theses, and research projects. The bibliometric analysis and content analysis methods were conducted to analyze the research data. Eleven key LIS scholarly journals (see Table 1) appointed by the Taiwan National Science Council (NSC) have been selected as sources of journal articles. A total of 2,494 research articles has been confirmed to be published between 2001 and 2010.

Eight institutions offer LIS graduate programs in Taiwan during the period, and most of their master and doctoral theses have been indexed by the National Digital Library of Theses and Dissertations (NDLTD) in Taiwan. Under the period covered by this study, 918 theses were identified in the NDLTD system. For the integrity of the thesis collection, the Electronic Theses System of each institution was also used to compare and confirm the data obtained from NDLTD. Sixty-five extra theses were found in those systems. Hence, 983 theses were analyzed in this study.

Taiwan NSC funded research projects were also collected in this study. A database under the NSC website lists all research projects funded by the same institution. Based on our aims, research projects in the LIS field conducted during the 2001–2010 period were selected. At this stage, 191 research project titles were collected. However, the NSC database was too simple and crude for use in the analysis. Hence, the Taiwan Government Research Bulletin System (GRB) was added as a supplementary resource.

The bibliographic information for most of the project reports funded by the Taiwan government can be found in the system, with some projects even providing full text files for downloading. Bibliographic information, such as keywords and abstracts, were selected and combined with the list of projects provided by the NSC database. A problem was identified in this stage: two different keyword records existed in the GRB system bibliographic information pages: bibliographic information on the projects and the report. This made confirming the bibliographic information of the project difficult because no other record could be found for comparison. Hence, keywords were chosen in the report, particularly in the full text file, as the final data.

Table 1 Journal profile

Journal title	Frequency	Number of research article
Archives Quarterly	Quarterly	415
Bulletin of the Taipei Public Library Quarterly	Quarterly	258
Instructional Technology and Media	Quarterly	266
Interdisciplinary Journal of Taiwan Library Administration	Quarterly	358
Journal of Educational Media & Library Science	Quarterly	279
Journal of Librarianship and Information Studies	Quarterly	266
Journal of Library and Information Science	Semi-yearly	166
Journal of Library and Information Science Research	Semi-yearly	48[a]
Journal of Library and Information Studies	Semi-yearly	94
National Central Library Bulletin	Semi-yearly	171
University Library Journal	Semi-yearly	173
Total		2,494

[a] *Journal of Library and Information Science Research* has been published since 2006

Previous research has adopted literature keywords or descriptor terms to classify topics. (Khoo 2011) This study collected data from different sources and with three document types; therefore, no consistent keyword system fit the analysis request. Thus, the classification task had to be done artificially by the researcher. Thematic characteristics were determined by classifying the literatures according to the LIS classification scheme developed by Lin (2004). All journal articles, theses, and projects were classified by their research subjects into eight subjects. The subjects and notations of each subject are listed in Table 2. For articles, theses, or projects with multiple topics, all the titles, abstracts, keywords, and even content were reviewed to determine the suitable major subject. Subjects with obvious interdisciplinary topics or difficult to identify their principle topic were classified under the subject of *Others*. The manual intensity of content analysis was repeated several times to reduce errors and stumbles.

Results and discussion

Research subjects

Between 2001 and 2010, 11 key scholarly journals published 2,494 articles. Table 3 shows the distribution of journal articles in eight different subjects. For the 10-year period, the most popular topic for journal articles was *LIS and Technology*, with 617 (24.74 %) articles, followed by *Book, Documentation, and Archive* with 533 (21.37 %) articles. Notably, on the subject of *Book, Documentation, and Archive*, numerous articles were published in the *Archives Quarterly*. Most LIS key scholarly journals contain various subjects; however, the *Archives Quarterly* is mostly concerned with the study of archives and has a larger number of articles per issue. This factor may have caused bias in the analysis. The third most popular subject was *User Services* with 357 (14.31 %) articles. The emphasis on *LIS and Technology* is consistent with that revealed by Uzun (2002) and Khoo (2011) who indicated that subjects of library and IT attract most researcher interest.

The ratio distribution of *User Services* is approximately 15 %; however, in 2009, the number was as high as 23.15 %. This could possibly be because the *Interdisciplinary Journal of Taiwan Library Administration* is highly concentrated, and therefore published more than five articles related to user services in each issue in 2009. Another possibility is that the topic on promotion of reading activities has caught increasing attention in recent years. In 2009, 15 articles that focus on reading issues were published, approximately twice the number of articles in previous years, causing the ratio for *User Services* to rapidly

Table 2 Research subjects	Subject	Notation
	Library and Librarianship	G
	Library Management	M
	Technical Services	T
	User Services	U
	LIS Theory and Foundation	L
	LIS and Technology	I
	Book, Documentation, and Archive	D
	Others (Interdisciplinary, Other Subjects)	O

Table 3 Research subjects of journal articles by year

	G (%)	M (%)	T (%)	U (%)	L (%)	I (%)	D (%)	O (%)	Total
2001	17 (7.05)	32 (13.28)	17 (7.05)	37 (15.35)	25 (10.37)	78 (32.37)	27 (11.20)	8 (3.32)	241
2002	14 (5.22)	25 (9.33)	22 (8.21)	32 (11.94)	16 (5.97)	83 (30.97)	61 (22.76)	15 (5.60)	268
2003	21 (7.09)	29 (9.80)	26 (8.78)	45 (15.20)	30 (10.14)	64 (21.62)	73 (24.66)	8 (2.70)	296
2004	22 (7.83)	23 (8.19)	21 (7.47)	38 (13.52)	26 (9.25)	71 (25.27)	65 (23.13)	15 (5.34)	281
2005	20 (7.60)	33 (12.55)	17 (6.46)	31 (11.79)	29 (11.03)	57 (21.67)	67 (25.48)	9 (3.42)	263
2006	13 (5.26)	25 (10.12)	20 (8.10)	33 (13.36)	24 (9.72)	61 (24.70)	60 (24.39)	9 (3.64)	246
2007	16 (6.87)	20 (8.58)	20 (8.58)	31 (13.30)	33 (14.16)	52 (22.32)	42 (18.03)	19 (8.15)	233
2008	6 (2.64)	23 (10.13)	19 (8.37)	28 (12.33)	35 (15.42)	60 (26.43)	50 (22.03)	6 (2.64)	227
2009	5 (2.31)	12 (5.56)	8 (3.70)	50 (23.15)	33 (15.28)	51 (23.61)	40 (18.52)	17 (7.87)	216
2010	3 (1.61)	23 (10.31)	29 (13.00)	32 (14.35)	38 (17.04)	39 (17.49)	48 (21.52)	11 (4.93)	223
Total	137 (5.57)	245 (9.82)	199 (7.98)	357 (14.31)	289 (11.59)	617 (24.74)	533 (21.37)	117 (4.69)	2,494

increase. Library and information science researchers in Taiwan have gradually focused on improving the quality of research on theoretical and fundamental studies. Bibliometrics and informetrics studies have also carried increasing weight in recent years. These phenomena may have caused the articles categorized as *LIS Theory and Foundation* to increase.

In contrast, the ratio of *Library and Librarianship* has continually decreased because related research in Taiwan began focusing on more sophisticated issues rather than on general topics. From 2001 to 2009, *LIS and Technology* was the most important issue of LIS journal articles for each year. This result is consistent with the significant effect of status quo on information technology. In 2010, the ratio significantly reduced. Fewer numbers of articles may be because the *Bulletin of the Taipei Public Library Quarterly* published special issues on library space and library marketing, and the *University Library Journal* published a special issue on institutional repository. The special issues may concentrate attention on *Library Management* and *Technical Services*.

Between 2001 and 2010, eight LIS-related graduate programs produced 983 theses. Table 4 shows the distribution of the theses in eight different subjects. During the 10-year period, the most popular topic was *LIS and Technology*, with 272 (27.67 %) theses, followed by *User Services*, with 236 (24.01 %) theses. These two subjects dominated more than half of the total number of theses analyzed in this study. The third most popular subject was *LIS Theory and Foundation*, with 160 (16.28 %) theses.

Since 2002, *LIS and Technology* and *User Services* were the two most important subjects, with ranking for the two subjects sometimes changing places. Only in the years 2002, 2005, and 2007 did the numbers of theses in *LIS Theory and Foundation* achieve second-place ranking. Between 2007 and 2010, most theses had *LIS and Technology* as the subject.

Technical Services was the second most important topic in 2001; however, its ratio decreased to nearly 40 % in 2002 and 2003. From 2003 to 2009, although the number of thesis increased from 56 to 135, the number of theses focused on *Technical Services* remained steady at five to eight theses. Hence, the ratios remained at a low level. The ratio of theses with *Book, Documentation, and Archive* as subjects remained at a low level for years because of a different reason. Only one graduate program in LIS emphasizes research on documentation and archiving; therefore, the number of theses over the years remained small but steady. Since 2007, the number of thesis focusing on subjects classified as *Others* has increased because of some LIS programs that establish on-the-job master programs, and one program changed their name to Information and Communication. Students from the on-the-job master programs are able to focus on more interdisciplinary topics when they decide on their thesis topic. The program that changed its program name from LIS related to Information and Communication attracted more students with broader research interests, such as game study, industry, and innovation. These topics are no longer directly associated with the LIS field, resulting in an increase in subject of *Others*.

Between 2001 and 2010, the Taiwan NSC funded 191 research projects in the field of LIS. Table 5 shows the distribution of the research projects in eight different subjects. Because all projects have to pass a competitive review process, an irrelevant topic will not have a chance of obtaining a research grant from NSC. Therefore, there were no projects categorized on subjects classified as *Others*. In most years, the subjects of *User Services*, *LIS Theory and Foundation*, and *LIS and Technology* accounted for three of the most popular subjects, with only two exceptions. One quarter of the projects in 2002 were categorized as belonging to the subject of *Library Management*. In 2007, out of a total of seventeen projects, four were classified under *Technical Services*. However, these two exceptions were special cases.

Table 4 Research subjects of theses by year

	G (%)	M (%)	T (%)	U (%)	L (%)	I (%)	D (%)	O (%)	Total
2001	2 (4.26)	5 (10.64)	11 (23.40)	13 (27.66)	5 (10.64)	5 (10.64)	4 (8.51)	2 (4.26)	47
2002	1 (1.41)	9 (12.68)	10 (14.08)	17 (23.94)	17 (23.94)	10 (14.08)	5 (7.04)	2 (2.82)	71
2003	7 (12.50)	6 (10.71)	5 (8.93)	16 (28.57)	6 (10.71)	10 (17.86)	4 (7.14)	2 (3.57)	56
2004	1 (1.19)	6 (7.14)	7 (8.33)	24 (28.57)	13 (15.48)	19 (22.62)	10 (11.90)	4 (4.76)	84
2005	1 (1.20)	13 (15.66)	8 (9.64)	23 (27.71)	16 (19.28)	16 (19.28)	5 (6.02)	1 (1.20)	83
2006	1 (0.99)	10 (9.90)	5 (4.95)	28 (27.72)	16 (15.84)	28 (27.72)	8 (7.92)	5 (4.95)	101
2007	3 (2.83)	10 (9.43)	5 (4.72)	18 (16.98)	18 (16.98)	37 (34.91)	5 (4.72)	10 (9.43)	106
2008	1 (0.76)	10 (7.63)	8 (6.11)	31 (23.66)	23 (17.56)	41 (31.30)	7 (5.34)	10 (7.63)	131
2009	0 (0.00)	12 (8.89)	8 (5.93)	23 (17.04)	19 (14.07)	54 (40.00)	5 (3.70)	14 (10.37)	135
2010	2 (1.18)	10 (5.92)	14 (8.28)	43 (25.44)	27 (15.98)	52 (30.77)	5 (2.96)	16 (9.47)	169
Total	19 (1.93)	91 (9.26)	81 (8.24)	236 (24.01)	160 (16.28)	272 (27.67)	58 (5.90)	66 (6.71)	983

Table 5 Research subjects of projects by year

	G (%)	M (%)	T (%)	U (%)	L (%)	I (%)	D (%)	O (%)	Total
2001	0 (0.00)	2 (11.11)	0 (0.00)	4 (22.22)	3 (16.67)	8 (44.44)	1 (5.56)	0 (0.00)	18
2002	0 (0.00)	5 (25.00)	0 (0.00)	2 (10.00)	2 (10.00)	10 (50.00)	1 (5.00)	0 (0.00)	20
2003	1 (7.14)	2 (14.29)	2 (14.29)	2 (14.29)	3 (21.43)	3 (21.43)	1 (7.14)	0 (0.00)	14
2004	0 (0.00)	3 (16.67)	2 (11.11)	2 (11.11)	6 (33.33)	4 (22.22)	1 (5.56)	0 (0.00)	18
2005	0 (0.00)	1 (7.14)	1 (7.14)	4 (28.57)	4 (28.57)	3 (21.43)	1 (7.14)	0 (0.00)	14
2006	0 (0.00)	1 (6.25)	3 (18.75)	4 (25.00)	4 (25.00)	3 (18.75)	1 (6.25)	0 (0.00)	16
2007	1 (5.88)	1 (5.88)	4 (23.53)	4 (23.53)	3 (17.65)	3 (17.65)	1 (5.88)	0 (0.00)	17
2008	0 (0.00)	3 (15.00)	2 (10.00)	6 (30.00)	4 (20.00)	2 (10.00)	3 (15.00)	0 (0.00)	20
2009	0 (0.00)	2 (9.09)	0 (0.00)	6 (27.27)	7 (31.82)	5 (22.73)	2 (9.09)	0 (0.00)	22
2010	1 (3.13)	4 (12.50)	1 (3.13)	8 (25.00)	11 (34.38)	6 (18.75)	1 (3.13)	0 (0.00)	32
Total	3 (1.57)	24 (12.57)	15 (7.85)	42 (21.99)	47 (24.61)	47 (24.61)	13 (6.81)	0 (0.00)	191

Over time, researchers whose research interest was *Book, Documentation, and Archive* have been very few. This status resulted in one or two projects conducted in this subject. In contrast, the ratio *Library and Librarianship* was the lowest among the subjects. This phenomenon is similar with the case in journal articles and theses, and is a result of LIS research projects in Taiwan tending to focus on more sophisticated issues, rather than on general or fundamental topics.

To examine the difference of subject emphasis in three document types, the current study takes the Spearman's rho coefficients of ranking and separately calculates the 10-year total amount of articles, thesis, and research projects. The data of year 2010 are analyzed together with the 10-year amount to explore the coefficient of trends in different time scopes. Table 6 displays the Spearman's rho coefficient in all 10-year rankings and year 2010 reaches 0.905, or 0.933 at a statistical significance level of 0.01 in all types of literatures, showing a high correlation. For the ranking of different literature in various subjects, the Spearman's rho coefficient for thesis and research projects in the 10-year amount reaches 0.886 at a statistical significance level of 0.01, showing a high correlation. This thesis and research project relationship can be interpreted as the close connection of research interests between student and professor. However, no significance correlation exists between article and thesis or article and research project in the research subject. Because each document type has a unique function and publication characteristic, the result seems reasonable.

Research project funding

Between 2001 and 2010, the Taiwan NSC funded NT\$ 92,613,700 for research projects in the field of LIS. The total funding amount has continued to increase since 2006, demonstrating governmental emphasis on LIS studies. Table 7 shows the distribution of the seven subjects and their ratios. The subjects of *LIS Theory and Foundation*, *LIS and Technology*, and *User Services* received most of the funding support.

Table 6 Spearman's rho coefficients of rankings by document type/subject

	Article		Thesis		Research project	
	10 year total	2010	10 year total	2010	10 year total	2010
Article						
10 year	1.000					
2010	0.905[**] 0.002	1.000				
Thesis						
10 year	0.595 0.120	0.452 0.260	1.000			
2010	0.452 0.260	0.405 0.320	0.905[**] 0.002	1.000		
Research project						
10 year	0.707 0.050	0.587 0.126	0.886[**] 0.003	0.695 0.056	1.000	
2010	0.610 0.108	0.464 0.247	0.781[*] 0.022	0.586 0.127	0.933[**] 0.001	1.000

** $p < 0.01$, * $p < 0.05$

Table 7 Taiwan NSC funded research project by year/subject

	G	M	T	U	L	I	D	Total/year
2001	0	811,700	0	1,380,000	1,255,900	3,017,400	352,000	6,817,000
	0	11.91%	0	20.24%	18.42%	44.26%	5.16%	
2002	0	1,816,700	0	860,300	1,119,000	4,146,700	446,100	8,388,800
	0	21.66%	0	10.26%	13.34%	49.43%	5.32%	
2003	120,000	999,100	871,600	724,900	2,016,600	1,506,900	508,800	6,747,900
	1.78%	14.81%	12.92%	10.74%	29.88%	22.33%	7.54%	
2004	0	1,386,900	959,000	914,200	3,465,900	1,733,000	604,000	9,063,000
	0	15.30%	10.58%	10.09%	38.24%	19.12%	6.66%	
2005	0	418,000	370,000	1,903,000	1,839,000	1,366,000	403,000	6,299,000
	0	6.64%	5.87%	30.21%	29.20%	21.69%	6.40%	
2006	0	681,000	1,298,000	2,040,000	2,351,000	1,429,000	420,000	8,219,000
	0	8.29%	15.79%	24.82%	28.60%	17.39%	5.11%	
2007	189,000	872,000	2,432,000	1,601,000	2,342,000	1,551,000	385,000	9,372,000
	2.02%	9.30%	25.95%	17.08%	24.99%	16.55%	4.11%	
2008	0	1,712,000	847,000	2,837,000	2,511,000	1,464,000	1,043,000	10,414,000
	0	16.44%	8.13%	27.24%	24.11%	14.06%	10.02%	
2009	0	1,068,000	0	2,971,000	4,099,000	3,055,000	749,000	11,942,000
	0	8.94%	0	24.88%	34.32%	25.58%	6.27%	
2010	571,000	2,321,000	316,000	3,747,000	4,788,000	3,185,000	423,000	15,351,000
	3.72%	15.12%	2.06%	24.41%	31.19%	20.75%	2.76%	
Total/subject	880,000	12,086,400	7,093,600	18,978,400	25,787,400	22,454,000	5,333,900	92,613,700

New Taiwan dollar (NT$)

Table 8 Average amount of Taiwan NSC funded research project by year/subject

	G	M	T	U	L	I	D	Average amount[a]
2001	0	405,850	0	345,000	418,633	377,175	352,000	378,722
2002	0	363,340	0	430,150	559,500	414,670	446,100	419,440
2003	120,000	499,550	435,800	362,450	672,200	502,300	508,800	481,993
2004	0	428,850	479,500	457,100	577,650	433,250	604,000	503,500
2005	0	418,000	370,000	475,750	459,750	455,333	403,000	449,929
2006	0	681,000	432,667	510,000	587,750	476,333	420,000	513,688
2007	189,000	872,000	608,000	400,250	780,667	517,000	385,000	551,294
2008	0	570,667	423,500	472,834	627,750	732,000	347,667	520,700
2009	0	534,000	0	495,167	585,571	611,000	374,500	542,818
2010	571,000	580,250	316,000	468,375	435,273	530,833	423,000	479,719
Subject average	293,333	503,600	472,907	451,867	548,668	477,745	410,300	484,888

[a] *New Taiwan dollar* (NT$)

Table 8 illustrates the average amount for each year and various subjects. In 2007, *Library Management* had the highest average grant amount. This is because only one project was classified into the subject and the research grant was particularly high; however, this is not the normal condition. Apparently, the average amount for various subjects does not indicate any tendency. Certain subjects may obtain relatively high funding one year, but may receive less funding the next year.

Collaborative authorship

Among the 2,494 journal articles, 1,649 articles were written by single authors, and 845 articles were written by multiple authors or group authors. Hence, 66.11 % of the articles in key LIS scholarly journals in Taiwan between 2001 and 2010 were written by individual authors. However, 33.89 % of the articles were collaboratively authored by two or more individuals. This finding is similar to the study by Cano (1999) for 68 % in Spain. Table 9

Table 9 Single/multiple authored article by year

	Single-author (%)	Multiple-authors					
		2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7–9 and group (%)
2001	183 (75.93)	41 (17.01)	12 (4.98)	3 (1.24)	0 (0)	0 (0)	2 (0.83)
2002	209 (77.99)	44 (16.42)	7 (2.61)	6 (2.24)	2 (0.75)	0 (0)	0 (0)
2003	214 (72.30)	63 (21.28)	13 (4.39)	4 (1.35)	2 (0.68)	0 (0)	0 (0)
2004	180 (64.06)	68 (24.20)	25 (8.90)	7 (2.49)	1 (0.36)	0 (0)	0 (0)
2005	197 (74.90)	52 (19.77)	12 (4.56)	1 (0.38)	1 (0.38)	0 (0)	0 (0)
2006	161 (65.59)	58 (23.48)	24 (9.72)	3 (1.21)	0 (0)	0 (0)	0 (0)
2007	139 (59.66)	79 (33.91)	9 (3.86)	2 (0.86)	2 (0.86)	0 (0)	2 (0.86)
2008	132 (58.15)	64 (28.19)	18 (7.93)	7 (3.08)	2 (0.88)	1 (0.44)	3 (1.32)
2009	115 (53.24)	73 (33.80)	20 (9.26)	6 (2.78)	1 (0.46)	1 (0.46)	0 (0)
2010	118 (52.91)	80 (35.87)	20 (8.97)	3 (1.35)	1 (0.45)	1 (0.54)	0 (0)

Table 10 Single/multiple authored article by subjects

Subject	Number of article	Single-author article (%)	Multiple-authors article			
			2 (%)	3 (%)	4 (%)	5–9 and group (%)
G	137	118 (86.13)	17 (12.41)	1 (0.73)	0 (0.00)	1 (0.73)
M	245	181 (75.10)	47 (19.18)	8 (3.27)	5 (2.04)	1 (0.41)
T	199	128 (64.32)	51 (25.63)	15 (7.54)	3 (1.51)	2 (1.01)
U	357	251 (70.31)	85 (23.81)	15 (4.20)	2 (0.56)	4 (1.12)
L	289	161 (55.71)	100 (34.60)	19 (6.57)	8 (2.77)	1 (0.35)
I	617	292 (47.33)	219 (35.49)	77 (12.48)	19 (3.08)	10 (1.62)
D	533	434 (81.43)	78 (14.63)	17 (3.19)	3 (0.56)	1 (0.19)
O	117	81 (69.23)	24 (20.51)	8 (6.84)	2 (1.71)	2 (1.71)

shows that the ratio of single authored articles decreased yearly. In 2001, more than three-fourths of the articles were written by a single author, whereas in 2010, approximately 45 % articles were written by two or three authors. The trend of collaborative authorship is clear and definite.

Dividing the articles by eight subjects, Table 10 shows the relationship between authorship and article subject. In most subjects, the ratios of single-author articles were over 50 %, with *LIS and Technology* as the only exception. In studies focusing on *LIS and Technology*, authors tended to conduct research with others; thus, regardless of the number of authors in the group, articles focusing on *LIS and Technology* had the highest ratio. *Library and Librarianship* and *Book, Documentation, and Archive* had the highest ratios for single-author articles; researchers of these topics tended to write their articles by themselves.

Conclusion

This research examines the professional literature, including journal articles, theses, and research projects between 2001 and 2010 to contribute to a better understanding of the research status and characteristics of LIS in Taiwan. Of the 2,494 journal articles published by eleven key scholarly journals, 983 theses from eight LIS graduate programs, and 191 research projects supported by NSC were analyzed. Three document types were investigated and compared from the perspective of the research subject. The amount of grants was calculated to inspect the level of support from the Taiwanese government to the LIS field. The co-authorship of journal articles was also analyzed to explain the collaboration of Taiwanese LIS authors.

The results for journal articles show that *LIS and Technology* and *Book, Documentation, and Archive* were the most popular topics, whereas the ratio of *Library and Librarianship* became increasingly small due to related research in Taiwan focusing more on sophisticated issues rather than on general topics. For thesis, the most well-received topics were *LIS and Technology*, *User Services,* and *LIS Theory and Foundation*, which accounted for more than 65 % of the graduate theses. The same is true for research projects, with the three subjects having a ratio of more than 70 %. The consistency of important subjects in student thesis and faculty research projects can be interpreted as professor and student having similar research interests. This observation has not appeared in any previous study.

In government-sponsored research projects, the average amount of funding obtained had no significant difference or tendency for various subjects over the years. The numbers of project and total amount of funding have continued to increase since 2006. A substantial increase in both the project and grant amount in 2010 is also evident. The total amount increased by 28.5 % in 2010 from the amount in 2009. The question of whether this status will continue to be a trend is worthy of closer observation.

In the authorship of journal articles, 66.11 % of the articles in key LIS scholarly journals in Taiwan between 2001 and 2010 were conducted by individual researchers. This is particularly true for the articles focusing on *Library and Librarianship* and *Book, Documentation, and Archive,* with more than 80 % of the articles written by individual authors. However, co-authorship is becoming a common trend, particularly for articles focusing on *LIS and Technology*.

Because of time constraints, this research only focused on articles and disregarded the references. For further study, an in-depth cross-citation analysis for journal articles, theses, and research projects is recommended. The document type can also be extended to conference papers and manuscripts to broaden the study scope and obtain a deeper understanding of the status of LIS research in the entire country.

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