INTERNATIONAL PERSPECTIVES

• Assessing Asian Scholarly Research in Library and Information Science: A Quantitative View As Reflected in *Web of Knowledge*

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This paper highlights the quantitative performance of scholarly LIS research in Asian countries based on articles published during 2001–2007 in journals indexed by the Social Science Citation Index of Web of Knowledge. The quantitative performance of Asian countries has been judged and compared on the basis of various quantitative indicators: (a) size of scientific activity measured by volume of production in various types of publications during the period of study, (b) authorship pattern and collaboration of scientific activity measured by co-authorship and the amount of national and international collaboration, (c) the pattern of citations measured by counting the cited and citing references of published articles, and (d) a newly developed metrics-research performance. The results show that during the last seven years, the publication rate has increased twofold and, among the Asian countries, the authors of the People's Republic of China contributed the greatest number of articles, followed by Taiwan and South Korea. There is also an increasing trend toward collaborative research among Asian authors, with most of the collaboration occurring either among authors from the same country or with authors of non-Asian origin. The research performance analysis indicates that articles written by authors from South Korea received the highest number of citations, followed by Taiwan. Although the quantity of articles published by authors of Taiwan and South Korea is higher than Singapore and Israel, the articles contributed by authors from these latter two blocks appear in higher-impact journals. These findings show the increasing contribution made by Asian scholars to the international LIS literature, and the quality of that research.

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Introduction

Asia is the largest continent by surface area and the most populous region in the world, containing over 60.5 percent of the world's population. It consists of six sub-regions: East Asia, Southeast Asia, South West Asia, South Asia, Central Asia, and North Asia. These sub-regions are of different geographic proximity to each other, with differing cultural and linguistic affinities. There is also a great deal of diversity in their education systems Although libraries flourished in Asia, with the establishment of University of Taxila and Nalanda Libraries during the fifth and seventh centuries, respectively, in the majority of the countries, scholarly research in library and information science (LIS) started during the 20th century. Initially, research in this region was mostly characterized by isolated researchers or small groups working without any collaboration.[1–4] The limitations in communications technologies inhibited formal and informal communication with the international community, and authors from Asian countries published overwhelmingly in local journals only.

Over the last few years, there has been a steadily growing interest in scientific research in the Asian region. Modern information and communications technology (ICT) has catalyzed a paradigm shift in terms of quality and quantity of research. Electronic mail has brought

wider international exposure of researchers in these countries and greater communication and collaboration.[5] This ease of communication and increased access to international journals has led to a significant shift of publications by Asian region authors from national journals to international peer-reviewed journals. As a result, there are an increasing number of scholarly publications originating from Asian countries in every discipline, including LIS. This paper measures the growth and pattern of scholarly LIS research in this region during last few years. The empirical results discussed in this paper demonstrate the recent improvement in Asian international publishing, citation patterns, and participation in the global research community. The performance of LIS research in the Eastern, Western and Southern blocks of Asia is considerably greater than that emerging form other parts of the region.

Over the last few decades, there have been a number of studies of the research productivity of various world regions, mostly in medical science[6,7] physics,[8] astrophysics[9], and biological science.[10] In general, the United States and Western Europe are the leaders of global research in various fields, although their relative contributions varies for different fields of research[11,12] Several studies have also focused on the scientific production of library and information science (LIS).[13–16] On the other hand, there has been an increasing interest in using bibliometric information for assessing or monitoring research activities.[17–19] Assessment of research activity is considered one of the main instruments necessary for maintaining high standards of research performance in research centers and universities.[20,21] Several studies have assessed the scientific production of various world regions using indicators of 'quantity' of articles in various international databases.[22,23] There is also literature relating to LIS research productivity in China[24,25] China and Taiwan,[26] South Korea,[27] Japan,[28,29] Turkey and China,[30] Malaysia[31,32] Iran,[33] and Bangladesh.[34] In a few cases, particularly in medicine[35,36] quality and quantity have been jointly considered as an indication of research performance. However, the are no comprehensive studies estimating the total quantity of Asian LIS research activity over last few years. The purpose of this study is to explore the quantity of LIS scholarly research output from the Asian continent in order to measure the extent of the development of this field in this region.

Objectives and Scope of the Study

The specific objectives of the paper are

- to track the growth of LIS scholarly publications from the Asian region from 2001 to 2007;
- to explore the type of publications in which Asian authors published their work;
- to determine the authorship pattern, collaborative research pattern and amount of inter-continental and international collaboration of authors in the Asian region;
- to identify the quantity of articles by Asian authors in various ISI indexed scholarly journals; and
- to compare the research output, in terms of the number of citations given and received, and the research performance of Asian countries over a five year period.

Methodology

The survey method was used to assess the quantity of LIS scholarly literature by the Asian authors from 2001 to 2007. We gathered factual data from the *Social Science Citation Index* (SSCI Expanded) database of the *Web of Knowledge* published by Thomson Reuters. This reliance on SSCI databases is partially due to the fact that, for decades, these databases were the only comprehensive citation data sources that allowed large-scale analyses of and between authors, journals, disciplines, and countries.[37,38] We used the advanced search option of the *Web of Knowledge*, employing a phrase consisting of two parts viz. Publication Year (PY) and Country (CU) joined together by the Boolean operators "AND." For example, for searching all the publications from India we used PY = 2001–2007 AND CU = India. The search results were first limited only to the top 100 prominent subjects of each Asian country, and further limited to the information science and library science subject category by using the "refine" function. All the refined results were first saved in tab-delimited text files and then imported into Microsoft Excel for analysis.

In order to discover the quantitative performance and other bibliographic phenomena, the factual data were processed following the procedure specified in the research plan, which was designed to ensure that all relevant data for making comparisons and analysis was collected. Processing included editing, classifying, and tabulating collected data so that they were amenable to analysis. A normal count procedure was employed for giving weight to each variable. The analysis included computation of certain measures, along with searching for patterns of relationship among data groups. The collaboration coefficient was calculated as the ratio of the number of collaborative papers to the total number of papers published during the period.

To judge the quality of the research output, we first counted the total citations given as well as the total citations received by the articles published during 2001–2007. Next we measured the research performance of an individual Asian region over the last five years on the basis of two criteria: the quantity of articles as well as the mean impact factor. The number of articles published during 2001–2005 in various ISI indexed journals by individual Asian countries was considered as an index of the quantity of research productivity. The mean impact factor of these contributing journals during 2002–2006 was considered as a quality indicator. Finally, the product of the number of articles published in a journal multiplied by the mean impact factor of the journal was considered as a combined indicator of the quantity and quality of research productivity. The sum of the above products from all journals for each Asian region within the sample years was considered a "total research performance" for that region. We also measured the publication density of each individual Asian region as the ratio of the total number of papers published to the total number of sources.

Prior to analysis, we also checked the validity of our search results by collating the articles retrieved from our search for all Asian regions in a specific journal and comparing them to the total number of articles published in the print version of the same journal for a specific year. Although the total number of publications was identified, we did not include articles classified as 'Review,' 'Book review,' 'Bibliography,' 'Editorial materials,' 'Meeting abstract,' 'Book review,' etc. in our study. We were only interested in the articles indexed in the SSCI database because indexing in this database indicates that the associated research work has merit for the scientific community at large.

Results and Discussion

Growth of LIS Literature

Table 1 presents the quantity of scholarly research produced by authors of six different sub-regions from 2001 to 2007 in all fields of the social sciences covered by SSCI, and the relative contribution in the LIS field. This table ranks these sub-regions and countries according to the decreasing quantity of LIS research. A comparison of the publication totals given in this table shows that the share of LIS articles in Asia's total social sciences publications output is only 2.48 percent.

Using the methodology described above, we retrieved 1885 items contributed by Asian authors in the information science and library science category of the SSCI for the seven year period. The distribution

Table 1
Distribution of Asia's Scholarly Literature in Social Sciences and LIS

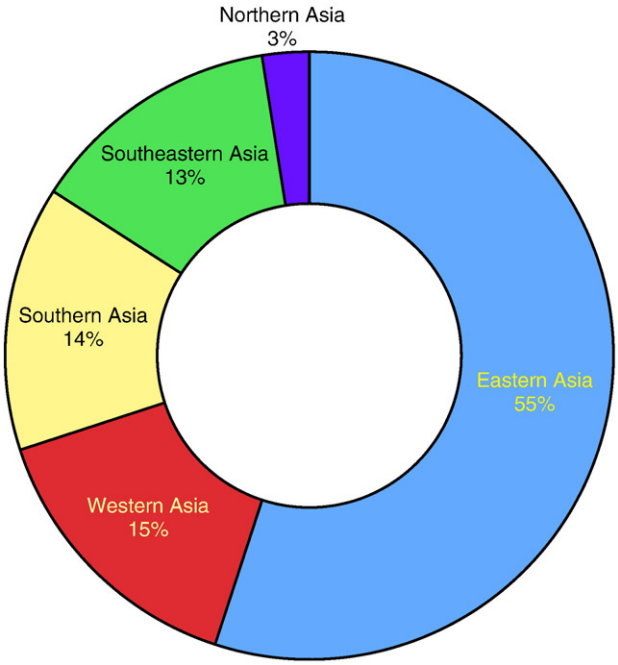
Country	Scholarly literature in social sciences field	Most prolific subject in social science (quantity of publications)	Quantity of LIS research
Eastern Asia			
China	13,847	Psychology, Multidisciplinary (2462)	384
Taiwan	6408	Economics (731)	5677
South Korea	5024	Economics (747)	4277
Japan	13,612	Economics (1,664)	11,948
North Korea	3	Environmental Sciences (1)	0
Mongolia	24	Anthropology (6)	0
			22,286
Western Asia			
Israel	11,763	Psychiatry (1,687)	143
Turkey	4514	Psychiatry (671)	3843
Kuwait	332	Psychology, Multidisciplinary (74)	258
Saudi Arabia	299	Medicine, General and Internal (52)	247
Jordan	191	Nursing (48)	8
Lebanon	357	Public, Environmental and Occupational Health (57)	6
Cyprus	452	Economics (79)	4
UAE	138	Psychology, Social (17)	4
Armenia	94	Public, Environmental and Occupational Health (35)	2
Iraq	40	Nursing (9)	1
Oman	74	Psychiatry (12)	1
Qatar	45	Environmental Studies (4)	1
Syria	44	Public, Environmental and Occupational Health (14)	1
Azerbaijan	19	Education and Educational Research (3)	0
Bahrain	53	Public, Environmental and Occupational Health (8)	0
Georgia	91	Psychology (22)	0
			4519
Southern Asia			
India	4959	Psychiatry (549)	4410
Iran	1151	Public, Environmental and Occupational Health (204)	947
Pakistan	349	Public, Environmental and Occupational Health (71)	278
Bangladesh	399	Public, Environmental and Occupational Health (123)	9
Sri Lanka	217	Psychiatry (34)	8
Bhutan	6	Information Science and Library Science (2)	2
Nepal	168	Public, Environmental and Occupational Health (36)	2
Maldives	8	Psychiatry (3)	1
Afghanistan	26	Medicine, General and Internal (5)	0
			5657
Southeastern Asia			
Singapore	3372	Economics (465)	2907
Thailand	953	Public, Environmental and Occupational Health (132)	821
Malaysia	517	Economics (66)	451
Philippines	387	Economics (72)	5
Indonesia	498	Economics (107)	3
Vietnam	298	Public, Environmental and Occupational Health (90)	2

Table 1 (*continued*)

Country	Scholarly literature in social sciences field	Most prolific subject in social science (quantity of publications)	Quantity of LIS research
Brunei	31	Public Administration (8)	1
Cambodia	56	Public, Environmental and Occupational Health (22)	0
Timor-Leste	5	Geriatrics and Gerontology (2)	0
Laos	20	Health Policy and Services (6)	0
Myanmar	2		0
			253
Northern Asia			
Russia	4791	Sociology (1,124)	47
			47
Central Asia			
Kyrgyzstan	36	Psychiatry (12)	0
Kazakhstan	65	Psychology, Multidisciplinary (15)	0
Tajikistan	8	Public, Environmental and Occupational Health (6)	0
Turkmenistan	3		0
Uzbekistan	39	Public, Environmental and Occupational Health (11)	0
Total	75,803		1885

of LIS research by sub-regions is also presented in Fig. 1. Judging by the numbers in the last column of Table 1, among the 49 countries, LIS research activity is largely concentrated (more than 100 research papers in scholarly journals) in only seven Asian countries, as they jointly produced 71.35 percent of Asia's total LIS research. These countries are the People Republic of China (henceforth China), Taiwan, South Korea, and Japan in the eastern region; Israel in the western region; India in the southern region; and Singapore in the southeastern region. The majority of items were contributed by authors from China (384 items or 20.37 percent) followed by Taiwan (275 items or 14.58 percent), South Korea (216 items or 11.45 percent), India (195 items or 10.34 percent), Singapore (193 items or 10.23 percent), Japan (162 items or 8.59 percent), and Israel (143 items or 7.58 percent). There were another eight countries that contributed at least ten articles during the last seven years and jointly contributed 13.58 percent of the total LIS publications. For the purposes of the present study, we will consider publications from these top fifteen countries. The present finding differs to some extent from earlier findings by Uzun[39] that the numbers of articles by authors from China, Saudi Arabia, Turkey, Botswana, Ghana, Kuwait, and Taiwan had considerably increased and those of India, Nigeria, Pakistan, Brazil, and Poland decreased.

Figure 1
Distribution of LIS research in Asian Sub-regions.



The top fifteen countries, ranked by their contribution to the total number of publications in library and information science from Asia, from 2001 to 2007 accounted for 96.76 percent of Asia's LIS papers. Table 2 ranks them according to the quantity of items in LIS, displaying the growth of LIS literature from 2001 to 2007.

Fig. 2 displays the continuous increase of LIS research papers from the top fifteen Asian countries over the last seven years. Overall, in 2001 (the starting year of the study), 185 items were published. This number rose to 194 items in 2002, 220 items in 2003 and 2004, respectively, 290 items in 2005, 346 items in 2006, 369 items in 2007, that is, nearly double in seven years. From 2001 to 2007, the greatest growth, i.e., seventy items more than the previous year, was shown in 2005, followed by 2006 (56 more items) and 2003 (26 more items). China ranks first throughout these years, except in 2003, when Taiwan's production exceeded that of China. More interestingly perhaps, although the total number of LIS publication figures increased during these years, there were falls in publication in 2002 compared to the preceding year in China, South Korea, Singapore, and Japan, and in 2004 compared to 2003 in Taiwan, India, Japan, Thailand, etc. The reason for this is not clear. However, rapidly growing investment in science and

Table 2
Quantity of Publication from Asian Countries by Year (More than Ten Articles)

Country	2001	2002	2003	2004	2005	2006	2007	Total	Rank
People's Republic of China	43	37	40	46	61	78	79	384	1
Taiwan	16	21	47	32	42	59	58	275	2
South Korea	24	17	22	26	37	39	51	216	3
India	21	26	26	25	32	36	29	195	4
Singapore	25	21	18	22	31	28	48	193	5
Japan	20	18	24	17	18	34	31	162	6
Israel	12	17	17	20	26	27	24	143	7
Turkey	3	10	5	9	13	16	16	72	8
Russia	11	8	5	5	4	12	2	47	9
Iran	0	3	2	4	8	6	14	37	10
Thailand	3	6	4	2	9	4	7	35	11
Kuwait	4	6	2	6	1	3	1	23	12
Saudi Arabia	2	2	5	1	2	2	2	16	13
Malaysia	1	2	2	2	3	0	4	14	14
Pakistan	0	0	1	3	3	2	3	12	15
Total	185	194	220	220	290	346	369	1824	

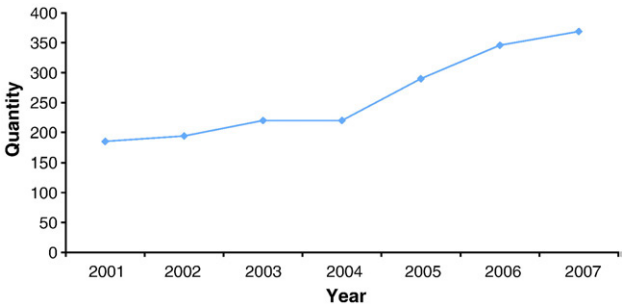
technology by governments, increased access to world literature, and increased demand for publishing due to greater production of research data may be the major factors behind the increases.

When categorizing the pattern of publication according to forms of publication, it is clear from Table 3 that, of the total of 1824 items, the most common form of publication was the journal article, i.e., 1638 (89.98 percent). It is important to note that of these articles, twenty-three appeared in the Proceedings of ASIST (2001, 2002, and 2003). Next to articles, the authors of these regions also contributed in the forms of book reviews (3.67 percent) and reviews (2.63 percent). The fact that the higher number of publications from 2001 to 2007 appeared as scholarly periodical articles indicates that the authors from these regions were sufficiently involved in various meaningful research activities to be able to disseminate their research findings through scholarly journals. Our research analyzes the authorship pattern, citation pattern, and research productivity of individual regions of the journal articles only.

Authorship Pattern

Next, the authorship pattern was analyzed to determine the percentage of single and multiple authorship. As Subramanyam[40] has pointed out, the last few decades have been witness to a collaborative endeavor. According to Qiu,[41] there is also a strong trend towards borrowing from and interpenetration across disciplines. The collaboration pattern is presented in Table 4.

Figure 2
Distribution of LIS Research by Year.



Our author data consist of 3826 authors for 1638 articles. Needless to say, not all co-authors are necessarily from the Asian region. However, at least one of the authors in each title comes from one of the fifteen Asian countries named above. As indicated in Table 4, the trend of LIS research in this region is toward multiple authorship, and the majority of articles published from this region have two authors. In some cases (e.g., Japan, Turkey, Iran, Saudi Arabia, and Pakistan), the majority of authors contribute articles individually. The number of authors per article ranges from one to eight. Not one of the articles was published by corporate authors. Of the 1638 articles designated in this study, 449 articles (27.41 percent) were by single authors. The number of articles written by two authors, three authors, and four authors was 551 (33.63 percent), 403 (24.60 percent), and 151 (9.21 percent), respectively. The collaborative coefficient (percentage of article by joint authors/total articles) 0.73 also supports the trend towards collaborative research.

Prolific Authors

Table 5 lists the fifteen most prolific authors of this region, along with the total number of articles they contributed and their authorship pattern. Each of these authors has contributed at least ten articles over the sample period. The authors are named here in decreasing order of the articles they contributed. Of these fifteen, five are from China, four from Singapore, two from Turkey and South Korea each, and one from Israel and Japan.

As indicated above Judith Bar-Ilan, Bar Ilan University, Department of Information Science, Israel occupies the foremost position with a contribution of twenty-four articles; of these, twenty-one articles were published by single authorship and three articles by joint authorship. She is followed by KK Wei, City University of Hong Kong, Department of Information System, China with fifteen articles—all of which were published under joint authorship. KY Tam, Hong Kong University of Science and Technology, School of Business and

Table 3
Pattern of publications in various forms

Country	Articles	Book reviews	Review	Editorial matter	Letter	Biographical items	Others
People's Republic ofPeople R China	356	6	7	9	2	0	4
Taiwan	267	1	6	0	0	0	1
South Korea	200	0	5	5	0	0	6
Singapore	168	9	10	4	1	1	0
India	158	25	2	1	9	0	0
Japan	145	1	5	6	2	0	3
Israel	121	5	6	6	4	0	1
Turkey	69	2	1	0	0	0	0
Russia	35	6	2	2	0	1	1
Iran	34	0	2	0	0	0	1
Thailand	23	11	1	0	0	0	0
Kuwait	22	0	0	0	1	0	0
Saudi Arabia	16	0	0	0	0	0	0
Malaysia	13	0	1	0	0	0	0
Pakistan	11	1	0	0	0	0	0
Total	1638	67	48	33	19	2	17

Management, Dept Information and System Management, China and Christopher C. Yang, Chinese University Hong Kong, Department of System Engineering and Engineering Management, China both have contributed fourteen articles. Most of the articles by these authors appeared under joint authorship. The other top contributors, along with their authorship pattern, are given in the table.

Nature of Collaborative Research

From Table 4, it is clear that the trend of Asia's LIS research is toward joint authorship. Our next step was to investigate the pattern of collaborative research and the level of internationalization of 1189 articles contributed by joint authors. For this, we analyzed the

Table 4
Authorship pattern

Country	Quantity of articles under different authorship pattern							
	Single	Two	Three	Four	Five	Six	Seven	Eight
People's Republic of People R China	68	121	101	42	16	5	1	2
Taiwan	75	84	71	29	6	2	0	0
South Korea	36	76	60	20	6	1	1	0
India	63	57	20	12	4	1	1	0
Singapore	24	65	63	10	1	4	1	0
Japan	61	33	23	14	8	4	2	0
Israel	37	44	25	9	3	2	1	0
Turkey	24	21	18	3	3	0	0	0
Russia	14	4	8	5	0	2	1	0
Iran	17	13	3	1	0	0	0	0
Thailand	2	10	3	4	3	0	1	0
Kuwait	8	11	3	0	0	0	0	0
Saudi Arabia	11	3	2	0	0	0	0	0
Malaysia	2	7	2	2	0	0	0	0
Pakistan	7	2	1	0	0	0	1	0
Total	449	551	403	151	50	21	10	2

Table 5
Prolific Asian Authors and Authorship Pattern (First Fifteen)

Name	Total contributions	Authorship					
		1st	2nd	3rd	4th	5th	6th
Bar-Ilan, J, Bar Ilan Univ, Dept Informat Sci, Israel	24	21	3	–	–	–	–
Wei, KK, City Univ Hong Kong, Dept Informat Syst, Peoples R China	15	–	2	12	1	–	–
Tam, KY, Hong Kong Univ Sci and Technol, Sch Business and Management, Dept Informat and Syst Management, Peoples R China	14	4	3	4	3	–	–
Yang, Christopher C, Chinese Univ Hong Kong, Dept Syst Engn and Engn Management, Peoples R China	14	7	6	1	–	–	–
Foo, S, Nanyang Technol Univ, Sch Commun and Informat, Div Informat Studies, Singapore	12	1	7	4	–	–	–
Liang, LM, Liang, LM, Henan Normal Univ, Inst Sci Technol and Soc, Xinxiang, Peoples R China	12	8	4	–	–	–	–
Aoe, Jun-ichi, Univ Tokushima, Fac Engn, Dept Informat Sci and Intelligent Syst, Japan	11	–	–	–	5	3	3
Ozmutlu, HC, Uludag Univ, Dept Ind Engn, Gorukle Kampusu, Bursa, Turkey	11	2	6	3	–	–	–
Ozmutlu, S, Uludag Univ, Dept Ind Engn, Gorukle Kampusu, Bursa, Turkey	11	9	2	–	–	–	–
Goh, DHL, Nanyang Technol Univ, Sch Commun and Informat, Div Informat Studies, Singapore	10	4	3	2	1	–	–
Khoo, CSG, Nanyang Technol Univ, Div Informat Studies, Sch Commun and Informat, Singapore	10	6	3	1	–	–	–
Lee, Gary Geunbae, Pohang Univ Sci and Technol, Dept Comp Sci and Engn, Pohang, South Korea	10	–	5	3	2	–	–
Lee, SYT, Hanyang Univ, Coll Informat and Commun, Seoul, South Korea	10	2	2	6	–	–	–
Tan, Bernard C. Y, City Univ Hong Kong, Dept Informat Syst, Hong Kong, Peoples R China	10	–	8	2	–	–	–
Teo, TSH, Natl Univ Singapore, NUS Business Sch, Dept Decis Sci, Singapore	10	6	2	2	–	–	–

geographical affiliations of the contributing authors. Table 6 indicates the pattern of collaboration. Here we categorized the pattern of collaboration into three major categories: Category A: all authors from the same country; Category B: any of the authors from different Asian countries; and Category C: any of the authors from countries other than in Asia.

Table 6 shows that of the total 1189 joint-authored articles, the majority, i.e., 770 (64.76 percent) of the articles were published by authors from the same country, followed by 345 (29.01 percent) articles by authors from at least one non-Asian country. Only seventy-four (6.22 percent) articles were published by authors from same continent. It is important to note that authors of these regions mostly preferred to collaborate with authors either from the same nation or from international organizations. The percentage of intra-continental collaboration is only 6.22 percent. The highest percentage of same continent collaboration is in Malaysia (18.18 percent), followed by Thailand (14.29 percent), and Singapore (11.11 percent), whereas the highest percentage of collaboration with colleagues in other countries was observed in Russia (61.90 percent), followed by Saudi Arabia (60 percent) and Iran (47.06 percent). One might expect that because of e-mail, it has become easier for authors to communicate regardless of where they are located, and journals in particular have benefited from this development. He and Spink[42] have suggested that the growth of collaborative research and the flow of information over the Web have contributed to the increasingly transnational nature of scholarly publishing. As this study attests, transnational scholarship is now evident among Asian authors. However, there is still room for the LIS field to be further internationalized.

In the next step, we verified the nature of the institutions of the contributing authors. Although this has not been subject to detailed analysis, academics were the dominant group, with almost 98 percent of the total publications. There was minimal participation by commercial, government, and other corporate authors during 2001–2007. The predominance of academic authors is likely due to the fact that publishing in a recognized journal is regarded as evidence of scientific quality. University committees weigh the importance of such publications when evaluating the achievements of candidates for promotion or tenure.

Journal Spread

In the next step, we identified the quantity of articles published in various ISI-indexed journals by Asian authors. Table 7 lists the names of these journals, arranged in decreasing order by the mean impact factor during 2001 to 2006, the quantity of articles published by international authors from 2001 to 2007, and the quantity of articles contributed by Asian authors during the same period. This table also identifies the top three Asian countries according to the quantity of their contribution to these journals.

The data in Table 7 clearly show that Asian authors contributed scholarly articles to fifty-two different ISI-indexed journals. There are at least two ISI indexed journals (*Law Library Journal* and *Library Journal*) that Asian authors have not yet published in. *Library and Information Science* (96.30 percent) is the most favored journal among Asian authors. Other favored journals are *Information Processing and Management* (37.97 percent), *Information and Management* (35.31 percent), *Scientometrics* (28.03 percent), *Journal of Information Science* (27.85 percent) and *Online Information Review*

Table 6
Nature of collaborative research

Country	(A) With authors of same country		(B) With authors of another Asian countries		(C) With authors of non-Asian countries		Total
	Count	Percentage	Count	Percentage	Count	Percentage	
People's Republic of People R China	150	52.08	24	8.33	114	39.58	387.99
Taiwan	160	83.33	6	3.13	26	13.54	292
South Korea	112	68.29	12	7.32	40	24.39	264
India	67	70.53	3	3.16	25	26.32	195.01
Singapore	92	63.89	16	11.11	36	25.00	244
Japan	63	75.00	4	4.76	17	20.24	184
Israel	51	60.71	1	1.19	32	38.10	184
Turkey	24	53.33	2	4.44	19	42.22	144.99
Russia	8	38.10	0	0.00	13	61.90	121
Iran	8	47.06	1	5.88	8	47.06	17
Thailand	11	52.38	3	14.29	7	33.33	121
Kuwait	12	85.71	0	0.00	2	14.29	14
Saudi Arabia	2	40.00	0	0.00	3	60.00	5
Malaysia	6	54.55	2	18.18	3	27.27	11
Pakistan	4	100.00	0	0.00	0	0.00	4
Total	770	64.76	74	6.22	345	29.02	2188.99

(23.64 percent). Overall, during the last seven years, 13.06 percent of world scholarly LIS literature was contributed by Asian authors. The table shows that correlating the number of contributions with the journals' impact factors, of the 1645 articles, 896 (54.46 percent) were published in journals with a mean impact factor of equal to or more than 1.000, while 276 articles (16.77 percent) were published in journals with mean impact factors of 0.5 or above, and 456 articles (27.72 percent) were published in journals with mean impact factors of less than 0.5. Authors from China, Singapore, Taiwan, Israel, South Korea, and India mostly contributed to higher impact journals, while authors from the rest of the countries contributed to other journals.

In the next step, we measured the quality of LIS research by Asian authors using two indicators: citations and research performance. In fact, the quantity of articles does not convey much information as they are confounded by the sizes of countries and/or their LIS communities. For example, India had many more articles than Israel, Turkey, and Japan, but what inferences can we draw from these figures? Can we say that India gave more priority to LIS research than Israel? As described below, the situation is just the opposite. Table 8 explores the quality in terms of citations given by the authors in their references list and citations received by the articles published during 2001–2007, while Table 9 measures the research performance of the individual countries for articles published during 2001–2005.

From Table 8, it is clear that 1638 articles contained 47,397 references with an average of 28.93 references per article. The greatest number of references (10,225 references) was observed for articles contributed by authors from China, followed by Taiwan (9.48 references) and South Korea (6173 references). However, the tendency to cite greater numbers of references is highest among authors from Singapore (36.52 references per article), followed by Israel (33.95 references per article), Taiwan (33.89 references per article), and South Korea (30.87 references per article). Indian authors tended to use the fewest number of citations (17.52 references per article). If the number of references is taken as an indicator of scientific quality, articles contributed by authors from Singapore, Israel, Taiwan, and South Korea would be considered of higher scientific quality than other Asian countries Fig. 3.

On the other hand, these articles received 4487 citations, with an average of 2.73 citations per articles. It is interesting to note that although the articles by Chinese authors received the highest number of citations overall, the average number of citations per articles was highest among articles written by authors from South Korea (4.21 citations per article), followed by Taiwan (3.96 citations per article) and Kuwait (3.50 citations per article). This may be an indication that articles contributed by authors from these Asian regions are more popular and widely read by international scholars than from other regions.

Next we determined the research performance of the individual Asian regions. It is worth noting that although we have calculated the total number of articles published from 2001 to 2007, the research performance is based on articles published from 2001 to 2005 in various ISI-indexed journals and the impact factor of these journals from 2002 to 2006.

As shown in Table 9, 1008 articles were published by authors from the fifteen sampled countries during 2001–2005. Throughout the region, these articles were published in fifty-one different journals, with an overall publication density of 19.76 articles per journal. Of all the countries covered in the present study, the highest number of articles was contributed by authors from China, and these were published in thirty-two different journals, with an average of 6.78 articles per journal. Although the quantity of articles contributed by authors from Taiwan and South Korea is higher than that of Singapore and Israel, authors from the former two regions contributed to fewer numbers of journals than those from the latter two regions. Authors from Singapore and Israel also contributed to higher-impact journals than those from Taiwan and South Korea. Based on the number of publications multiplied by the mean impact factor of the journals,

Table 7
Journal-Wise Contribution (Articles from 2001–2007, Mean IF 2001–2006)

Name of the journal	Mean IF (2001–2006)	Total articles	Articles by top 15 Asian authors		Top three contributing country
			Count	Percentage	
MIS Quarterly	3.3453	141	16	11.35	7 SG, 5 CH, 3 SK
Journal of the American Medical Informatics Association	2.5107	635	27	4.25	14 IS, 5 SG, 5 SK
Information Systems Research	2.0867	141	19	13.48	7 CH, 5 SG, 4 SK
Journal of the American Society For Information Science and Technology	1.6852	870	172	19.77	49 CH, 26 SG, 25 IS
Information and Management	1.6168	422	149	35.31	56 TI, 36 CH, 27 SK
Information Processing and Management	1.4325	474	180	37.97	48 SK, 37 JP, 17 CH
Journal of Documentation	1.2047	191	12	6.28	4 SG, 3 IS, 2 JP, 2 TK
Journal of Management Information Systems	1.1807	246	40	16.26	17 CH, 7 SG, 5 SK, 5 TI
Scientometrics	1.1672	717	201	28.03	56 CH, 49 ID, 20 TI
International Journal of Geographical Information Science	1.1450	313	62	19.81	36 CH, 9 JP, 3 ID, 3 SK, 3 SG
College and Research Libraries	1.1287	215	5	2.33	5 CH
Journal of Information Technology	1.0130	152	13	8.55	5 SK, 2 CH, 2 SG
Journal of Health Communication	0.9605	291	8	2.75	3 TI, 2 IS
Journal of Information Science	0.8920	298	83	27.85	28 TI, 16 CH, 12 SG
Information Society	0.8230	179	10	5.59	2 SG, 2 SK, 2 IS
Library and Information Science Research	0.7348	153	19	12.42	6 SK, 2 IS, 2 SG
Journal of Academic Librarianship	0.6877	396	29	7.32	8 CH, 5 IS, 5 SK
Information Systems Journal	0.6372	109	12	11.01	4 CH, 4 TI
Journal of the Medical Library Association	0.6270	325	6	1.85	2 CH
International Journal of Information Management	0.6153	218	39	17.89	13 TI, 7 IN, 7 SG
Social Science Computer Review	0.6123	238	6	2.52	2 TI
Government Information Quarterly	0.5982	190	19	10.00	7 TI, 4 SK, 2 CH, 2 TK
Library Quarterly	0.5977	115	1	0.87	1 TI
Telecommunications Policy	0.5668	278	38	13.67	14 SK, 8 CH, 4 TI
Library Trends	0.5513	310	5	1.61	2 CH
Library Resources and Technical Services	0.5230	124	1	0.81	1 CH
Online Information Review	0.4980	275	63	22.91	18 TI, 7 CH, 5 IS, 5 SG
Library and Information Science	0.4970	27	26	96.30	26 JP
Law Library Journal	0.4362	185	0	0.00	
ASLIB Proceedings	0.4175	243	21	8.64	11 SG, 3 IS
Information Research-An International Electronic Journal	0.4020	170	9	5.29	2 SG, 2 IR, 2 IS
Interlending and Document Supply	0.3977	178	10	5.62	3 CH, 3 SK, 2 IS
Restaurator-International Journal For the Preservation of Library and Archival Material	0.3932	127	15	11.81	4 IN, 4 JP, 3 RS
Online	0.3817	247	1	0.40	1 IR
Knowledge Organization	0.3680	90	19	21.11	5 IN, 3 IS, 3 SG, 3 TI
Journal of Librarianship and Information Science	0.3620	109	7	6.42	
Research Evaluation	0.3362	136	15	11.03	6 IN, 4 CH, 2 JP
Program-Electronic Library and Information Systems	0.3253	160	23	14.38	13 IN, 4 SG
Portal-Library Academic	0.2947		2		
Library Collections Acquisitions and Technical Services	0.2910	191	10	5.24	4 CH, 2 SK, 2 TK
Information Technology and Libraries	0.2840	163	7	4.29	2 IN
Social Science Information	0.2613		4		

Table 7 (*continued*)

Name of the journal	Mean IF (2001–2006)	Total articles	Articles by top 15 Asian authors		Top three contributing country
			Count	Percentage	
Library Journal	0.2405	955	0	0.00	
LIBRI	0.2290	163	28	17.18	5 CH, 4 IR, 3 KU, 3 TI, 3 TK
Electronic Library	0.2258	336	105	31.25	28 IN, 23 TI, 16 CH,
Journal of Scholarly Publishing	0.2035	117	5	4.27	3 CH
Journal of Government Information	0.1832	69	3	4.35	
Zeitschrift fur Bibliothekswesen und Bibliographie	0.0853	173	3	1.73	2 IS
International Information and Library Review	NA	30	14	46.67	6 IN, 3 TK, 2 CH
Journal of Computer-Mediated Communication	NA	162	15	9.26	6 JP, 5 IS, 2 SG
Journal of Global Information Management	NA	44	16	36.36	6 CH, 6 JP, 5 IS
Journal of the Association For Information Systems	NA	50	6	12.00	4 IS
Learned Publishing	NA	238	18	7.56	14 CH, 2 JP
Publishing Research Quarterly	NA	86	11	12.79	7 CH, 3 JP
		12,465	1628	13.06	

Legend: SG = Singapore, IS = Israel, CH = China, TI = Taiwan, SK = South Korea, SG = Singapore, ID = India, PK = Pakistan, RS = Russia, JP = Japan, TK = Turkey, ID = India, KU = Kuwait, IR = Iran.

China had the best performance after adjusting for these variables within the sample study period. So on the basis of impact factors, the quantity and quality of articles produced by Chinese authors are highest among all Asian countries. Taiwan ranks second; South Korea third; Singapore fourth, while Japan and India rank fifth and sixth, respectively, at a considerable distance from the others. It might seem remarkable that the research performance of Singapore or even Israel should be better than India despite the quantity of articles published by these two regions being lower than India. This is due to the fact that although the quantity of articles produced by authors from India is higher than that of Singapore or Israel, most of the articles produced by these latter two regions are published in comparatively higher-impact journals.

Conclusion

A detailed analysis of the relative contributions of Asian countries to international LIS research has important implications for strategic planning in research and research policy in these countries. The data on the library and information science publications of Asia demonstrate that scholarly research among Asian countries in LIS disciplines

Table 8
Citation Given Versus Citations Received

Country	Articles	Citation Given		Citation received	
		References	References per article	Citations	Citations per article
People's Republic of People R China	356	10,225	28.72	1056	2.97
Taiwan	267	267	33.89	1056	3.96
South Korea	200	200	30.87	430.87	4.21
India	158	158	17.52	333.52	1.28
Singapore	168	168	36.52	372.52	2.45
Japan	145	3431	23.66	188	1.30
Israel	121	4109	33.95	304	2.51
Turkey	69	1939	28.10	179	2.59
Russia	35	712	20.34	65	1.86
Iran	34	854	25.12	33	0.97
Thailand	23	596	25.91	41	1.78
Kuwait	22	517	23.50	77	3.50
Saudi Arabia	16	330	20.63	22	1.38
Malaysia	13	363	27.92	8	0.62
Pakistan	11	196	17.82	2	0.18
Total	1638	24,065	28.93	4167.91	2.73

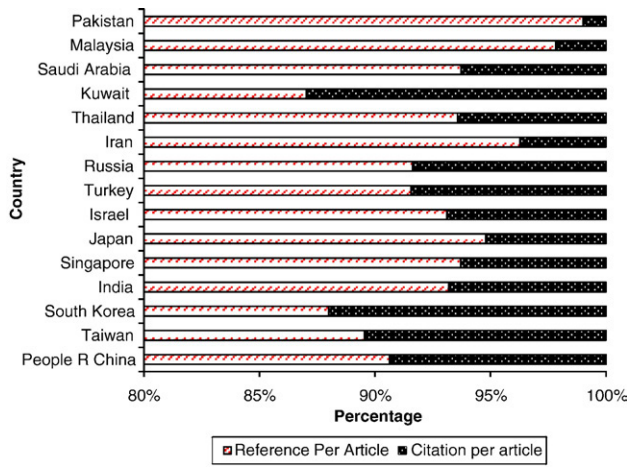
Table 9
Five years' research performance (publication year 2001–2005, mean impact factor year 2002–2006)

Country	Number of journals contained articles	Total articles	Publication density	Total impact factor of contributing journals	Research performance
People's Republic of People R China	32	217	6.78	28.981	239.532
Taiwan	28	155	5.54	22.757	168.322
South Korea	26	116	4.46	25.767	144.747
India	25	109	4.36	17.496	81.032
Singapore	30	102	3.40	26.792	114.237
Japan	28	87	3.11	19.458	75.286
Israel	32	78	2.44	25.330	83.673
Turkey	20	38	1.90	14.464	33.511
Russia	15	26	1.73	10.514	23.589
Iran	9	16	1.78	4.743	8.658
Thailand	12	18	1.50	9.949	18.048
Kuwait	14	18	1.29	9.818	10.446
Saudi Arabia	9	12	1.33	7.469	8.044
Malaysia	8	9	1.13	4.229	5.934
Pakistan	4	7	1.75	1.848	2.422
Total	51 [a]	1008	19.76	229.615	1017.481

[a] In total column, the number is not the sum of the column, it is the actual number of unique journals in where articles published.

is very uneven. A quantitative analysis of publications shows that of the forty-nine countries, there are only seven countries with a research output of more than a hundred; there is one country with a research output of more than fifty, and seven with a research output of more than ten over the period from 2001 to 2007. The rest of the forty-four countries jointly contribute only 3.24 percent of Asia's LIS literature and rate no comments in this respect because their relevant numbers are too small to draw any reliable conclusions. Despite having the largest population, Asia is unable to compete with other less populated communities. A possible reason for this may be Asia's uneven and inadequate finance and research infrastructure, or it may reflect an uneven LIS education system. It should be noted that to make a fairer assessment of a country's productivity, one needs to know the size of the LIS profession in each country, but a lack of reliable data on the number of scientists in the Asian region makes this impossible for the present analysis. Another important point to be considered here is that our study collected and interpreted data on the basis of SSCI indexed journals. Articles published in non-JCR-cited journals were not included, although they contribute to scientific production.

Figure 3
References Given Versus Citation Received.



However, over the last seven years, the publication rate of scholarly research by Asian authors in journals of non-Asian origin and indexed in SSCI has increased twofold. China, Taiwan, South Korea, Singapore, India, Japan, and Turkey are the seven leading Asian countries in terms of their quantity of research output. The state of research activity among Asian authors indicates that team research is more prominent in this region; however, there is a lack of intra-continental research in LIS discipline. This raises questions about how to increase such cooperation among the most productive people and groups. This issue deserves further analysis.

At the very least, this investigation can be taken as a symbolic announcement of the fact that the scholarly communities of at least seven countries in the Asian region are publishing at the international level. Further studies are needed to explore the GDP of each individual country and its relationship to productivity and impact as measured by citation counts.

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