

## CITATION ANALYSIS OF ISI - INDEXED PUBLICATIONS FROM THAILAND

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### ABSTRACT

*Publications with a Thailand address(es) during 1981-1995 found in the Institute for Scientific Information (ISI) database were analyzed. The present work emphasizes (i) number of citations and cites/paper of top - ranked research institutions which include more than state universities : the top three are Mahidol University, Ministry of Public Health and Chulalongkorn University ; (ii) citation performance of subdivisions of these institutions : faculties of medicine are the major contributors ; (iii) number of 65 - most cited authors (together with their affiliations) in each citation category ; (iv) citation distribution of research institutions, i.e., percentage of papers vs. number of citations : 70% of Thailand papers have 0-2 cites ; (v) type of publications and the respective citations : 74% of them are research articles with an average cites/paper of 4.16.*

*The dependence on foreign authors and the latter's contribution to citation performance is discussed. It is recommended that number of papers and citations/paper should be used more seriously in bestowing awards, prizes and ranks to relatively independent Thai authors.*

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### INTRODUCTION

Research and development capability of an institution as reflected by publication output has 2 important aspects : number of papers published and number of citations received by these papers<sup>1,2</sup>. Ranking of Thai research institutions by number of publications in Science Citation Index (a printed database published by ISI) during 1977-1981 has been reported<sup>3</sup>. The performance of Thailand during 1989-1993 in all sciences and in certain areas in terms of number of citations and papers has recently been ranked with respect to the rest of the world<sup>4,5</sup>. In our previous work<sup>6</sup>, the main emphasis was on the number of SCISEARCH - based publications (as well as those in 3 other additional electronic databases) of only 15 state universities of Thailand over 10 years from 1985-1994. Here we expand our coverage to all research institutions in Thailand over a 15 - year period, January 1981 - June 1995. However, an emphasis will be put on citation : the number of times a published work with an address(es) in Thailand has been referred to by SCISEARCH - based papers. Simplistically, the frequency of reference to a piece of work may be construed as the usefulness of that work to the professional community. There is a high correlation between professional recognition of science and technology achievement and the number of cites per paper of the researchers<sup>7</sup>. The overriding reason for utilizing ISI - electronic database (covering a slightly larger database than SCISEARCH, an ISI database), besides its coverage of high standard journals, is its unique feature of citations of published

papers. Data presentation will cover research institutions and their subdivisions, authors, type of papers and citation distribution.

## **MATERIALS AND METHODS**

The ISI database covering 1981-1995 was the only one employed for this work ; unlike our previous publication<sup>6</sup> in which 4 databases covering 1985-1994 were used. Also the present paper covers all research institutions in Thailand and not only Thai state universities as in the earlier one. Number of citations and number of papers published for universities, ministries, main research institutions and top - ranked authors were obtained directly from the database. However, the numbers for subdivisions of these authors' research places, e.g., faculties, institutes, departments were counted manually. Published papers analyzed here appeared in journals cited by SCISEARCH journals, i.e., papers in SCISEARCH - indexed journals, which cite among themselves, plus non - SCISEARCH journals with papers cited by SCISEARCH - indexed journals. Therefore, the list of journals in this work is slightly larger than the SCISEARCH - indexed journals used in the earlier study. The citation mentioned here is the actual number of cites of papers and not the impact factor of the journals where the articles appeared in as used in the previous work.

## **RESULTS**

All results in this study were obtained from a survey of ISI listed papers published and cited between January 81 - June 95. During this period, Thailand published 7,745 papers (SCISEARCH - indexed papers and those papers cited by SCISEARCH - indexed papers), and the citations per paper averaged for all papers was 3.71. To focus on the most - cited institutions in Thailand, only institutions publishing more than 60 papers and having more than 300 citations during January 81 - June 95 were ranked. Table 1 shows the 12 most - cited institutions selected by these criteria. Mahidol University (MU) tops the Table with 50% of total cites and 38% of total papers. Ministry of Public Health (MOPH), Chulalongkorn University (CU) and the American - run Armed Forces Research Institute for Medical Sciences (AFRIMS) accounted for 14-12% of total citations ; CU has highest number of publications (14%) among these institutions of similar citation. In terms of number of average cites/paper, the top 3 institutes were AFRIMS, MOPH and Thai Red Cross Society which published only in medical area.

Results in Table 2 show the performance of subdivisions of each institution. The Faculties of Medicine in most universities account for the highest percentage of both citations and papers. For MU, Faculty of Science has highest percentage of papers, but the percentage of citation is second to Faculty of Tropical Medicine which ranks first. For MOPH, most citations came from Department of Communicable Diseases in which the Malaria Division produced a high proportion of citations and papers. In agricultural sciences, Department Agriculture of the Ministry of Agriculture and Cooperatives (MOAC) is the leading contributor of citation, followed by Faculty of Agriculture of Kasetsart University (KU) and Division of Agricultural and Food Engineering of Asian Institute of Technology (AIT).

TABLE 1. Most - Cited Institutions in Thailand During January 81 - June 95.

Institutions*	Cites	Papers	Av.cites/paper
1. Mahidol Univ	14,360	2,961	4.85
2. Min Pub Hlth	3,990	553	7.22
3. Chulalongkorn Univ	3,501	1,076	3.25
4. A F Res Inst Med Sci	3,317	295	11.2
5. Asian Inst Tech	1,163	743	1.57
6. Chiang Mai Univ	1,158	533	2.18
7. Khon Kaen Univ	799	277	2.88
8. Kasetsart Univ	672	260	2.59
9. Min Agr Coop	638	273	2.34
10. Thai Red Cross Soc	407	68	5.98
11. Prince of Songkla Univ.	358	243	1.47
12. Min Sci Tech Env	313	102	3.07

\* Institutions with more than 300 cites during January 81 - June 95

Total cites of Thailand	=	28,718
Total papers of Thailand	=	7,745
Average cites/paper of Thailand	=	3.71

TABLE 2. Publication Performance of Subdivisions of Some Most - Cited Institutions.

Institution	Percentage of Total of Each Institution		Av.cites/ paper
	% citation	% paper	
<b>Mahidol University</b>			
Fac Trop Med	41	18	11.30
Fac Sci	25	31	4.10
Fac Med (Siriraj)	19	25	3.16
Fac Med (Rama)	15	18	3.55
<b>Ministry of Public Health</b>			
Dept Comm Dis	28	21	10.30
Children's Hosp	17	11	11.80
Dept Med Sci	8	13	5.33
<b>Chulalongkorn University</b>			
Fac Med	40	41	3.12
Fac Sci	34	27	4.15
Fac Pharmaceut	15	10	4.87
<b>Asian Institute of Technology</b>			
Div Env Eng	25	15	2.67
Div Ind Eng & Manag	17	12	2.28
Div Agr & Food Eng	14	14	1.51
<b>Chiang Mai University</b>			
Fac Med	58	44	2.86
Fac Sci	9	14	1.44
Fac Agr	6	10	1.18
<b>Khon Kaen University</b>			
Fac Med	68	61	3.17
Fac Agr	13	16	2.42
Fac Sci	9	9	3.23
<b>Kasetsart University</b>			
Fac Sci	40	30	3.29
Fac Agr	30	32	2.39
Fac Vet Med	14	9	3.96
<b>Ministry of Agric &amp; Coop</b>			
Dept Agr	56	43	3.00
Dept Fisheries	26	24	2.56
Dept Livestocks	8	7	2.65
<b>Thai Red Cross Soc</b>			
Div Sci	70	58	6.55
<b>Prince of Songkla University</b>			
Fac Med	46	42	1.63
Fac Sci	33	31	1.55
Fac Nat Res	12	13	1.13
<b>Ministry of Science Tech &amp; Env</b>			
Thai Inst Sci Tech Res	46	40	3.51
Natl Env Board	32	16	6.37
Off Atom En Peace	17	21	2.56

To rank the most - cited Thai authors, a threshold of 100 cites and 14 papers was set yielding 65 most - cited Thai authors (if foreign authors were also considered, the list included 95 names). Among the 65 most - cited Thai authors are 8 of a total of 17 Thailand outstanding scientists. As shown in Table 3, 77%, 11% and 8% of the 65 most - cited authors were from MU, CU and AFRIMS respectively. Most of the authors in Table 3 were also the most productive paperwise. Considering papers with more than 50 cites during January 81 - June 95, the top 69 most productive authors published 20 to 131 papers, with citation range of 50 to 2,448. Among these, 77% were from MU and 13% from CU and the percentage for CMU, AFRIMS, AIT and SU(Silpakorn U) were 4, 3, 1.5 and 1.5 respectively.

TABLE 3. Number of Most - Cited Thai Authors in Each Citation Range and Paper Range and Their Affiliations During January 81 - June 95

Rank	Cite	Paper	Affiliation (Number of Au)
1-20	298-2488	14-131	Mahidol (16) AFRIMS (3) Chulalongkorn (1)
21-40	157-296	16-50	Mahidol (14) Chulalongkorn (3) AFRIMS (2) Min Publ Hlth (1)
41-65	101-156	14-56	Mahidol (20) Chulalongkorn (3) Asian Inst Tech (1) Min Publ Hlth (1)

When citation distribution was considered, 46% of papers from Thailand had never been cited (Table 4). For the citation performance of the 12 most - cited institutions in Thailand, except for AFRIMS and Thai Red Cross Society and MOPH, about 90% of their papers fell within the citation range of 0 to 10 and 70% of Thailand papers fell within 0-2 citations.

TABLE 4. Percentage of Papers in Each Citation Range for Thailand and Individual Institutions During January 81 - June 95.

Institution*	Citation Range				
	0	1-10	11-30	31-50	>50
Thailand (0-225)	46.2%	45.2%	6.0%	1.9%	0.7%
Mahidol U (0-225)	42.3%	46.7%	8.3%	1.6%	1.1%
Chulalongkorn U (0-115)	31.4%	47.3%	17.0%	1.8%	2.5%
Min Pub Hlth (0-104)	45.8%	47.0%	5.6%	0.9%	0.6%
AFRIMS (0-225)	19.3%	46.9%	21.3%	9.0%	3.5%
Asian Inst Tech (0-35)	55.9%	41.2%	2.8%	0.1%	-
Chiang Mai U (0-48)	52.1%	43.7%	2.8%	1.4%	-
Khon Kaen U (0-45)	44.4%	47.8%	7.1%	0.7%	-
Kasetsart U (0-32)	43.9%	48.6%	5.1%	0.4%	-
Min Agr. Coop (0-43)	41.4%	50.0%	7.9%	0.7%	-
Thai Red Cross Soc (0-37)	26.9%	51.9%	19.2%	1.9%	-
Prince Songkla U (0-21)	56.8%	41.0%	2.1%	-	-
Min Sci Tech Env (0-47)	53.7%	43.3%	1.5%	1.5%	-

\*numbers in brackets are ranges of citations of each institution

For publication type, about 74% of total papers were research articles ; 8.3, 5.5 and 4.2% were notes, proceeding papers and meeting abstracts respectively (Table 5). Publication types that received highest citations were reviews (8.38) and research articles (4.16). Book reviews received no citations at all because these are not citable items.

TABLE 5. Type of Publications in Thailand During January 81 - June 95.

Type	Total papers	Total cites	Ac. cites/paper
Article	5,754	23,956	4.16
Book review	76	0	0
Editorial	98	118	1.20
Letter	255	634	2.48
Meeting Abstract	329	58	0.17
Note	640	1,890	2.95
Proceeding paper	429	1,052	2.45
Review	120	1,006	8.38

## DISCUSSION

It is pleasing to learn that there are research places, besides state universities, that produce respectable research papers. The presence of some state universities among the top - ranked ones (citationwise) must also come as a pleasant surprise for them. Papers considered here embrace not only physical, life, medical, engineering, agricultural sciences and technologies but also the social sciences and humanities, the latter contributed a very small share as established in our earlier work<sup>6</sup>.

Results from this study clearly show that more than half of the total cites of the countries came from publications on medical sciences and life sciences, since Faculties of Medicine and Ministry of Public Health are the major contributors of total citation. This is in agreement with our previous report<sup>6</sup> in which Faculties of Medicine contributed 47% of papers in SCISEARCH. Data<sup>8</sup> from ISI during 1981-1992 have shown that, among the Pacific Rim Countries, Thailand topped in the life sciences with average cites/paper of 5.8, and second in clinical medicine with average cites/paper of 3.8 (Taiwan was in first place with av.cites/paper of 3.9). These figures are above the value of average cites/paper of all fields of 3.71 for Thailand which is 67% of world average<sup>9</sup>. Thailand ranked 48 among top 50 nations which have produced more than 1000 ISI - indexed publications during 1989-1993, with 0.05% of world share in total publications and 0.03% of world share in citations<sup>4</sup>. Nevertheless, in general medicine and public health, Thailand ranked number 30 and 38 among the 50 nations, with 0.09% and 0.12% of world share in citation respectively, while USA received about 50% world share in both cases<sup>5</sup>. The scientific output of Thailand

seemed to underperform slightly the total the GDP output, ranking globally in the high forties for the former and high twenties for the latter<sup>10</sup>.

Only the 12 most - cited institutions in Thailand listed on Table 1 have total citations of over 300 during the period covered. Although 3.71 is the average cites per paper, the institutions should not be ranked simply by their cites/paper being above or below this number because different fields and their subfields have different average cites/paper : currently material sciences and life sciences tend to have high average cites/paper than physical sciences than agricultural sciences and engineering. Relative performance of research institutions and their subdivisions should therefore be further analyzed by taking into consideration of such factors as expected cites of specific research areas, Thailand's average cites, global or regional average cites, etc. Another aspect worth mentioning here is assessing indigenous strength of a place in terms of contribution by local workers vs that of protagonistic foreign workers who may have raised the publication standards and/or lent credence to the publications by virtue of their names. Institutions may be analyzed as to the degree of dependence/independence of Thai authors in publishing research work, e.g., percentage of papers with all Thai authors, percentage of citations with all Thai authors, citations/paper of all Thai - authored papers vs those with foreign authors, who are not students nor postdoctoral fellows. Some foreign authors might be students or postdoctorals, e.g., in Asian Institute of Technology and Faculty of Tropical Medicine, MU ; but these would contribute less than 5% of the total foreign authors who had played their part in the papers.

Since our database begins the coverage from 1981, the ranking of most - cited authors would favor those authors on the rise during the period than those that had done their best works earlier, i.e., authors older than 50 may be less favored than those in their early forties this year. When criteria were set such that only authors with 14 papers (most 1995 papers have not been cited yet) and 100 cites (i.e., cites/paper of 7.2 which is about twice that of country's average of 3.7) were picked, only 65 Thai authors qualified and of these only 8 out of 17 outstanding scientists of Thailand qualified. Top 15 most - cited authors are there because of the foreign factors ; this is not to detract from the dedication and potential ability of these Thai workers in the joint efforts.

Recognizing that some institutions and subdivisions in Table 2 are not equal in terms of status on the Thai Civil Service hierarchy, they are compared for convenience as research places and subdivisions thereof.

Seventy - four percent of papers published from Thailand were research articles, receiving 4.16 cites/paper, which is above the country's average , and 83% of total cites. Our review articles performed as well as those from elsewhere receiving high average cites/paper of 8.4.

It is surprising perhaps alarming to some that the country's citation distribution is skewed so much to the lower numbers, i.e., 70% of papers with 0-2 citations. The low citation should not solely be attributed to Thailand papers' concentration on local problems of no interest to the world because many similar papers on similar Thai topics have received higher citation. Perhaps more efforts should be spent on carrying out more novel and



definitive works, and also their better presentation in higher standard journals. About 46% of our publications have received no citation at all : this is not too different from the world's figures. The comment here is that even papers appearing in journals listed by high standard databases are very frequently neglected!

It is recommended that research prizes, rewards and academic positions bestowed in Thailand should at least partially be based on criteria of number of papers published and, more importantly, on number of citations. The substantive role played in these works by the nominees should also be established at a more personal level.

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### บทคัดย่อ

การศึกษานี้เป็นการวิเคราะห์ถึงจำนวนcitation(จำนวนครั้งที่สิ่งตีพิมพ์ได้รับการอ้างอิง)ของผลงานตีพิมพ์ที่มีมาตรฐานสูง คือ ที่ได้รับการรวบรวมโดย ISI (Institute for Scientific Information) โดยเป็นข้อมูลระหว่าง ม.ค.24 ถึง มิ.ย.38 รายงานนี้ได้แสดงถึง (1) สถาบันในประเทศไทยที่มีค่า citation สูงสุด 12 อันดับแรก ซึ่งมีค่า citation เกิน 300 ระหว่างช่วงเวลาที่ศึกษา และ 3 สถาบันแรก คือ มหาวิทยาลัยมหิดล กระทรวงสาธารณสุข และจุฬาลงกรณ์มหาวิทยาลัย (2) คณะหรือหน่วยงานที่ได้รับค่า citation สูง ในแต่ละสถาบันวิจัยซึ่งส่วนใหญ่เป็นคณะแพทยศาสตร์ (3) ผู้แต่งชื่อไทยจากประเทศไทยที่ได้รับค่า citation สูงสุด จำนวน 65 คน คือผู้ที่มีค่า citation เกิน 100 และมีจำนวน paper เกิน 14 ขึ้นไป (4) ค่า citation distribution ของแต่ละสถาบัน ซึ่งพบว่าส่วนใหญ่ 70% มีค่าระหว่าง 0-2 cites (5) ชนิดของ publication ซึ่งในที่นี้แบ่งเป็น 8 ชนิด ชนิดที่เป็น research article มีสัดส่วนสูงสุดคือ 74% และมีค่า citation 4.16