SJIF IMPACT FACTOR: 2.996 CRDEEP Journals
International Journal of Social Sciences Arts and Humanities Saibi & Avakian Vol. 6 No. 3 ISSN: 2321 – 4147
International Journal of Social Sciences Arts and Humanities. Vol. 6 No. 3. 2018. Pp. 49-56

Full Length Research Paper

Earth and Planetary Sciences Education and Research in Asia during 1996-2017– An Overview

Hakim Saibi[1] and Robert W. Avakian[2]

[1] *Department of Geology, College of Science, United Arab Emirates University, Al-Ain, P.O. Box 15551, United Arab Emirates.*

[2] *Oklahoma State University Institute of Technology, USA.*

Article history

Received: 27-08-2018

Revised: 29-08-2018

Accepted: 16-09-2018

Corresponding Author

Hakim SAIBI

College of Science, United Arab Emirates University, Al-Ain, P.O. Box 15551, United Arab Emirates

Abstract

This study is an assessment of published research results in the field of Earth Sciences in the Asian region. The share of the Asian region in the total number of publications in the World, in the 21 years from 1996 to 2017, was about 27.14%. The adopted methodology is based on analyses of higher education research output from the Asian region in earth sciences using Scimago technology and database. Five countries: China, Japan, India, South Korea and Taiwan accounted for 97.43% of the publications during that period. In almost all sub-disciplines of Earth sciences, China occupies the first rank for number of publications except in oceanography and paleontology where Japan is the leader. For the Hirsch Index (h-index) of the publications, China and Japan occupy the first and the second places, respectively. We recommend to update this study in the future to monitor trends developing in the different countries of the Asian region as many factors (economical, political) will be affecting such research and education development in the region.

Keywords: *Scimago, Scopus, Geosciences, Subdisciplines, Hirsch Index, Asia*

Cite this article as: Saibi H. & Avakian R. W (2018). Earth and Planetary Sciences Education and Research in Asia during 1996-2017 – An over view. *International Journal of Social Sciences Arts and Humanities*, 6(3), 49-56. Retrieved from www.crdeepjournal.org/ijssah

Introduction and methodology

The Asian region comprises 48 countries and is the largest regional economy in the World led by China, Japan, India, South Korea and Taiwan (Wikipedia, 2018a). As geoscientists, we are interested to see how the research and education in earth and planetary sciences is this region is developed at regional and international levels at universities since 1996. This paper is not an historical review of geosciences research in the Asian region, but an estimation of the status of research activities in the field of Earth and Planetary Sciences during the 21-year period from 1996 to 2017. A similar study was carried out by El-Hinnawi (2015) for the Middle East region. The Asian region is one of the most complex and diverse geological settings in the world. Tectonic activities (convergence and divergence tectonic plates), high mountains (Himalayas mountains), geothermal manifestations, volcanoes, earthquakes, tsunamis are some geological and natural hazards observed in this region. The Asian region is populated by people from different countries (60% of world population) and cultures, who live in this region. This region is also known for

its natural resources especially coal and minerals and need a special attention and exploitation to avoid environmental hazards and avoid climatic changes (reduce CO_2 emission). Consequently, a development of good educational programs in earth sciences at different levels and especially at university level (researchers, teachers, students, university curriculums) will bring benefits to the economy of the country and good life to people of this region.

For the present assessment, data for the period from 1996 to 2017 were retrieved from the database of Scimago Lab (http://www.scimagojr.com/) on 1st June 2018. Scimago Lab is a Spanish organization specializing in scientific information management (databases, bibliometrics, scientometrics, etc.). Scimago compiles data from different sources, especially from Elsevier's Scopus system, which listed about 34,346 peer-reviewed journals in all fields of science by mid 2018 (Wikipedia, 2018b). Fifteen hundred forty seven (1547) Earth and Planetary science journals are listed in the database with 166 journals being from Asian region. The Annual Review of Astronomy and Astrophysics is among the high impact factor (IF) journals in the field of Earth and Planetary Sciences (IF=37.8 and SJR=18.04) and the Journal of the Meteorological Society of Japan is the top journal in Earth and Planetary Sciences in Asian region with an IF of 2.90 and SJR of 2.76. Scimago's database also includes publications from famous journals like Nature Geoscience (IF=13.94, SJR=6.75) and Reviews of Geophysics (IF=12.34, SJR=8.74). There are some scientific magazines and periodicals, which are not included in Scimago database, though they are minor and will not have a significant impact on the general result to be derived from the Scimago database. The database also breaks out the different sub-disciplines of the Geosciences such as: Atmospheric Science, Computers in Earth Sciences, Earth and Planetary Sciences, Earth-Surface Processes, Economic Geology, Geochemistry and Petrology, Geology, Geophysics, Geotechnical Engineering and Engineering Geology, Oceanography, Space and Planetary Sciences, Paleontology, Space and Planetary Sciences, Stratigraphy, Energy, Renewable Energy, Water Science and Technology.

Earth sciences are important for people living in the Asian region as it helps them to find energy resources (fossil fuels and renewable), minerals, and fresh water through geoscientific investigations and explorations in on-shore and offshore zones. This study will help universities and department chairs and those responsible for earth sciences programs in the Asian region to develop their curriculums and programs in order to achieve a sustainable and economy growth in the region.

Presentation of Data

Publications in Earth and Planetary Sciences

The total number of publications from 1996 to 2017 in the field of Earth and Planetary Sciences is 535,915 papers (Table 1).

Table 1: Ranking of top 10 countries in the Asiatic region according to the number of publications in Earth and Planetary sciences (1996-2017), source (Scimago, June 2018).

	Country	↓ Documents	Citable documents	Citations	Self-Citations	Citations per Document	H index
1	China	315640	312814	2440570	1770393	7.73	293
2	Japan	90806	89001	1553591	440127	17.11	286
3	India	57707	56242	536726	233463	9.30	161
4	South Korea	24826	24397	321003	69540	12.93	162
5	Taiwan	18775	18417	284515	69084	15.15	155
6	Hong Kong	7961	7709	164024	22033	20.60	147
7	Malaysia	7206	7095	49798	12983	6.91	79
8	Indonesia	4586	4520	40643	7287	8.86	79
9	Singapore	4515	4375	59890	8695	13.26	95
10	Thailand	3893	3809	43611	8098	11.20	81

China, Japan and India are the top-three countries in the Asian region in Earth and Planetary sciences with China's output being over three times that of Japan, its nearest competitor. In the world, China is ranked second after United States; Japan is ranked 9th and India is ranked 12th worldwide in these fields.

Table 2: Ranking of the top 10 countries in the Asiatic region according to the h-index or value of research in Earth and Planetary Sciences in the period 1996 to 2017, source (Scimago, June 2018).

	Country	Documents	Citable documents	Citations	Self-Citations	Citations per Document	↓ H index
1	China	315640	312814	2440570	1770393	7.73	293
2	Japan	90806	89001	1553591	440127	17.11	286
3	South Korea	24826	24397	321003	69540	12.93	162
4	India	57707	56242	536726	233463	9.30	161
5	Taiwan	18775	18417	284515	69084	15.15	155
6	Hong Kong	7961	7709	164024	22033	20.60	147
7	Singapore	4515	4375	59890	8695	13.26	95
8	Thailand	3893	3809	43611	8098	11.20	81
9	Indonesia	4586	4520	40643	7287	8.86	79
10	Malaysia	7206	7095	49798	12983	6.91	79

Based on h index (Table 2), a measure of quality, China is still the leader over Japan, but the gap is much closer than that based simply on volume. Another interesting result is the virtual tie between India and South Korea.

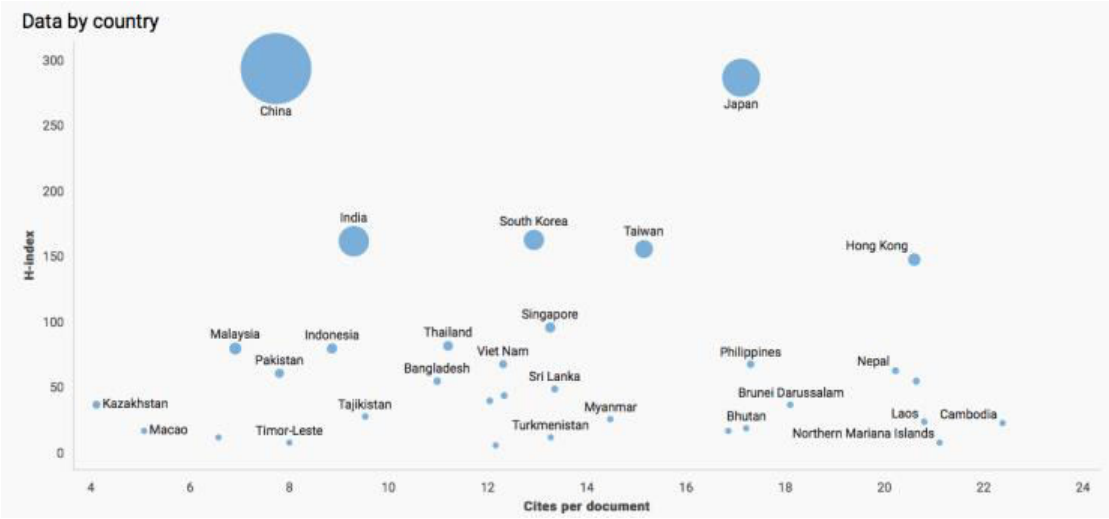

Fig 1: Bubble chart of citation per document vs. H-index of papers published in Earth and Planetary Sciences in Asian region. (Scimago, June 2018)

This plot (Figure 1) explains the results cited above. Even though China is the leading country in H-indexed papers published in the field of Earth and Planetary Sciences. Japanese authors garner more citations for each published journal in the same field compared to China. This is also the case for the virtual tie between India and South Korea. The high citation rates for Taiwan and Hong Cong both of which have h indexes close to South Korea and India is also of interest.

Journals in Earth and Planetary

Asian region is sharing about 11.68% of all international journals in Earth and Planetary Sciences. The open access journals account for 1.59% for all international journals in the same field (Figs 2, 3, 4).

Fig 2: Open access journals in Asian region in Earth and Planetary Sciences. There are nine indexed open access journals. The nod size depends on the SJR value of the journal. (Scimago, June 2018)

Fig 3: Shape of science plot showing the total number of journals of Earth and Planetary Sciences existing in Asian region. There are 66 journals. The nod size depends on the SJR value of the journal. (Scimago, June 2018).

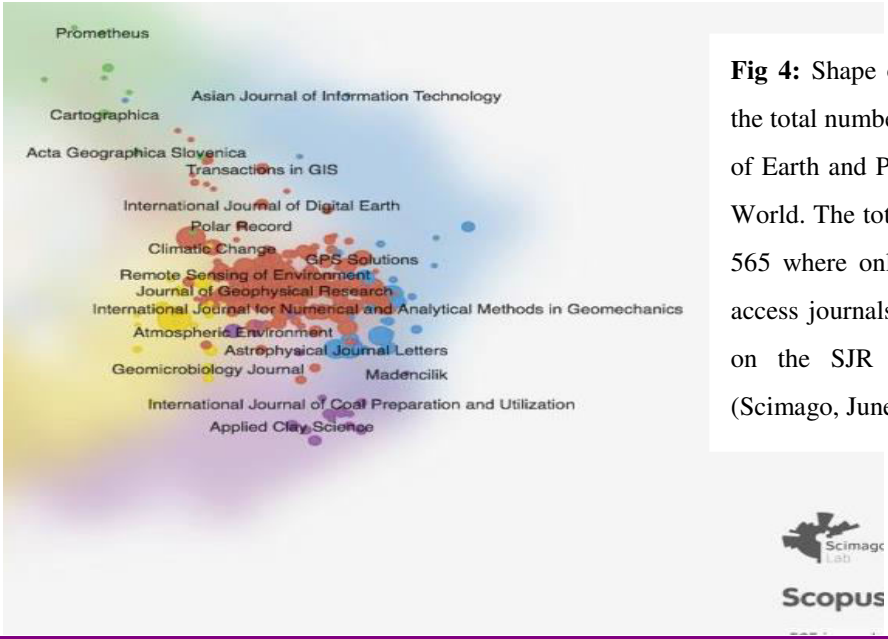

Fig 4: Shape of science plot showing the total number of journals in the field of Earth and Planetary Sciences in the World. The total number of journals is 565 where only 85 journals are open access journals. The nod size depends on the SJR value of the journal. (Scimago, June 2018)

Development of Earth and Planetary Sciences in top Asian countries

In view of the massive increase in articles origination in China (PRC) (Figure 5) the regional percentage decrease in in India and Japan's output is to be expected even though the two country's outputs compared to the world are essentially flat or slightly increasing. What is notable is the percentage increase of South Korea both area and world-wide over the same period.

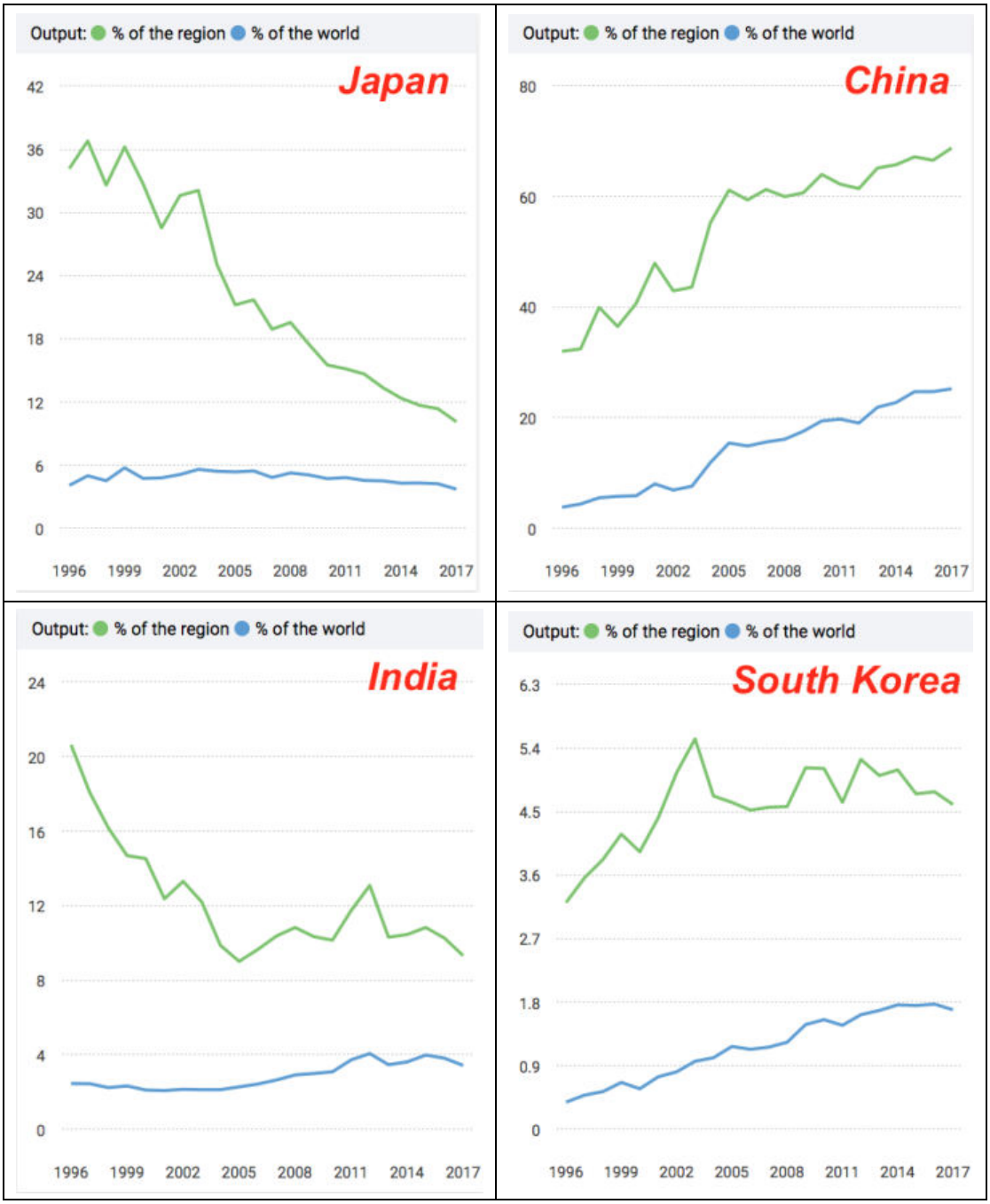

Fig 5: Development in the number of publications in the four leading countries in the Asiatic region in the period 1996 to 2017, source (Scimago, September 2014).

International Collaborations

Figure 6 shows that Japan's trend in international collaboration in the field of Earth and Planetary Sciences is increasing year by year, this can be explained by the starting of national program called G30 since 2010 (MEXT, 2018). The relatively low percentages for India and China are in contrast to Korea. This high level of international cooperation may be one reason for the growth in Korea's share of the world's publication volume.

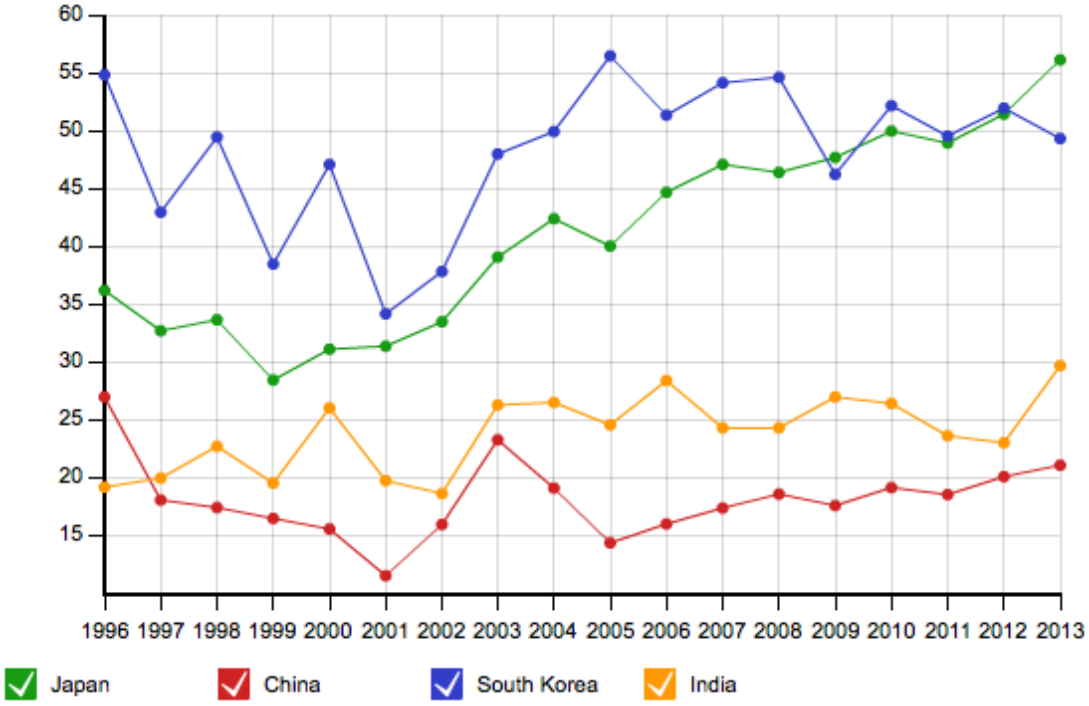

Fig 6: Percentage of research documents with more than one country, showing the international collaboration in Earth Sciences for the period 1996-2013, (Scimago, September 2014).

Strength of Asian countries in different specialties in Earth and Planetary Sciences

As expected, China, Japan and India lead in all categories with South Korea firmly locked into fourth place in most categories (Table 3).

Table 3: Leading countries in the different specialties of Earth and Planetary Sciences for the period of 1996-2013.

Sub-discipline	First		Second		Third		Fourth		Fifth	
	A	B	A	B	A	B	A	B	A	B
Atmospheric Science	CH	CH	JP	CH	IN	SK	SK	HK	TW	IN
Computational Geosciences	CH	CH	JP	JP	IN	IN	TW	TW	SK	HK
Earth and Planetary Sciences	CH	JP	JP	CH	IN	IN	TW	TW	SK	SK
Earth-Surface Processes	CH	CH	JP	JP	IN	IN	TW	TW	SK	SK
Economic Geology	CH	CH	IN	JP	JP	IN	SK	SK	HK	ID
Geochemistry and Petrology	CH	CH	JP	JP	IN	IN	SK	TW	TW	HK
Geology		CH		JP	IN	TW	SK	IN	TA	HK
Geophysics	CH	JP	JP	CH	IN	TW	TA	IN	SK	SK
Geotechnical Engineering and Engineering Geology	CH	JP	JP	CH	IN	HK	SK	SI	TA	IN
Oceanography	JP	JP	CH	CH	IN	TW	TA	IN	SK	SK
Paleontology	JP	JP	CH	CH	IN	IN	SK	TW	TA	SK
Space and Planetary Sciences	CH	JP	JP	CH	IN	SK	SK	IN		TW
Stratigraphy	CH	CH	JP	JP	IN	IN	SK	SK	TA	HK
Renewable Energy	CH	JP	JP	CH	IN	SK	SK	IN	TA	TA

Energy	CH	CH	JP	JP	IN	IN	SK	SK	TA	SI
Water Science and Technology	CH	JP	IN	CH	JP	IN	SK	TA	TA	SK

CH: China, JP: Japan, SK: South-Korea, HK: Hong-Kong, IN: India, ID: Indonesia, TW: Taiwan, SI: Singapore, TA: Thailand

A: Number of publications (1996-2013)

B: h-index of publications (1996-2013)

Discussion

For Japan, re-inventing new earth science programs is necessary and may need many international partners in developing research and education in earth sciences. In 2014, a new program started under the name of SGU (Super Global University), which will play an important role in increasing and developing research and education in all fields. There are many available scholarships in earth sciences at Japanese universities such as: MEXT (Ministry of Education, Culture, Sports, Science and Technology of Japan), ABE initiative (focusing on African countries), PEACE (Project for the promotion and Enhancement of the Afghan Capacity for Effective Development), Japan International Cooperation Agency (JICA) and many others from Japanese companies to support students to get their Bachelors, Masters and PhD degrees in earth sciences. The total number of publications in Japan is not that high compared to China, This may be explained by the low budget given to the earth sciences programs compared to China, as earth sciences is not very attractive area in Japan, unlike information technology (IT) and engineering. However Japanese authors are producing journal papers of higher impact as compared to Chinese. The other explanation is language as many Japanese scientists are publishing in proceedings and Japanese language journals, which are not counted by Scopus database. The number of research collaborations in Japan increased since 1999, which represents the year where many Japanese universities started to care more about the university ranking and looked to international cooperation to improve the ranking and increase the number of foreign students in Japan. Also, from the late 80's, the number of Japanese who got degrees outside Japan has drastically increased due to governmental financial support and these students could have promoted such international collaborations. The solutions for Japan are to increase the number of foreign students by providing scholarships and increase the number of permanent research positions. Until now, the total number of Japanese PhD students is very low as many Japanese students do not obtain a PhD due to the difficulty in finding academic positions after obtaining a PhD. In India IITs are indeed the best institutions, produce the best students/engineers and in these institutes there is little Earth & Planetary science research. The outcome in terms of the number of research papers/quality research (enhanced h-index) seems to depend on the percentage of GDP of a nation being spent on Science and Technology/(R&D).

Conclusions

The conclusions of this study are summarized as follows:

1. *Over the sample period, there has been a marked increase in Chinese authored papers on both on a regional and worldwide basis.*

2. Chinese authors receive fewer citations per paper than any of the area leaders and have the highest rate of self-citation.

3. South Korea has increased its international share in publications four fold, despite losing slightly to China regionally.

4 While losing ground regionally to China, India and Japan have maintained or slightly increased their rate of contribution worldwide.

5 China's dominance of publication in the region does not reflect the increase (5 fold internationally and double regionally) in the volume of papers.

6. A low rate of international collaboration and a high rate of self-citation may indicate a Chinese focus on internal geological questions, but the number alone does not suffice to confirm this conclusion.

Acknowledgments

The authors acknowledge Prof. Narasimman Sundararajan (Sultan Qaboos University, Oman), Prof. H. Fujii (Akita University, Japan) and Prof. K. Watanabe (Kyushu University, Japan) for their constructive comments which improved the paper.

References

El-Hinnawi, E. (2015). Earth and planetary sciences research in the Middle East. Arab J Geosci. 8: 5459–5463. https://doi.org/10.1007/s12517-014-1629-y

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output, Proceedings of the National Academy of Sciences of the United States of America, Vol. 102, No. 46, 16569-16572.

MEXT .(2018). http://www.mext.go.jp/en/policy/education/highered/title02/detail02/sdetail02/1373894.htm

Scimago Lab. (2014). Accessed on June 1, 2018 from http://scimagojr.com

Wikipedia. (2018a). https://en.wikipedia.org/wiki/Economy_of_Asia

Wikipedia. (2018b). https://en.wikipedia.org/wiki/Scopus