Scientometric analysis of Iraqi-Kurdistan universities' scientific productivity

Alireza Noruzi
Department of Knowledge and Information Science, University of Tehran, Tehran, Iran

Mohammadhiwa Abdekhoda
Health Management and Economics Research Center, Iran University of Medical Sciences, Tehran, Iran

Abstract

Purpose – This purpose of this study is to examine research performance of Iraqi-Kurdistan universities, using the number of papers appearing in journals and proceedings, and the number of citations received by those papers as covered by Scopus, 1970-2012. This study also identifies subject coverage (domain/field) of publications and determines the preference of research communication channel within the research community?

Design/methodology/approach – A total of 459 papers published by Iraqi-Kurdistan universities and indexed by Scopus during the given time period were considered. The source items (i.e. records of publications by the faculty members of the Iraqi-Kurdistan universities) were all the documents published in international journals and proceedings indexed by Scopus (an Elsevier bibliographic database) from the time period ranging from 1970 to 2012. All papers having an authorship or a co-authorship associated with the Iraqi-Kurdistan universities were included and the number of citations received by them was counted for the period.

Findings – The study found that major journals used by Iraqi-Kurdistan universities were Eastern Mediterranean Health Journal, Journal of Chinese Clinical Medicine, Asian Journal of Chemistry, Hemoglobin and Journal of Applied Sciences Research. Additionally, three older institutions (Salahaddin University-Hawler, University of Sulaimani and University of Duhok) were the most productive universities. Moreover, the study revealed that 237 of 459 (52 per cent) of publications have international collaborations. It is further evident that among the 459 publications, 211 (40 per cent) have been cited 1,020 times; while 248 (60 per cent) of the papers have not been cited even once, so about 60 per cent of the papers were invisible to world science during the study period. This study also noted that the 25 highly cited papers were cited 484 times, representing 47 per cent of all the citations (484 of 1,020). This indicated a concentration effect, whereby a relatively small number of papers earn most of the citations and research impact generated by the faculty members of Iraqi-Kurdistan universities.

Originality/value – This is the first scientometric research to analyse Iraqi-Kurdistan universities' scientific productivity.

Keywords: Research productivity, Scientometrics, Iraq, Publication productivity, Bibliometrics, Kurds

Paper type: Research paper

Introduction

Kurdistan, also known as the Land of the Kurds, refers to portions of Iraq, Turkey, Iran and Syria; however, only the Iraqi region of Kurdistan is discussed here. Iraqi-Kurdistan refers to the three Kurdish northern Iraqi provinces, which are autonomous of the central Iraqi government and ruled by the Kurdistan regional government. These provinces achieved de facto

independence after an uprising in 1991, and their autonomy has now been enshrined into the Iraqi federal constitution. The three Kurdish provinces are: Duhok, Erbil and Sulaymaniyah (Wikitravel, 2012).

Kurdistan is becoming a major "gateway to Iraq" with high levels of foreign investment, development of infrastructure and tourism (Wikitravel, 2012). The Iraqi-Kurdistan region is an autonomous region of Iraq (Viviano, 2006). The region is relatively calm compared to other parts of the country. It is among the most politically stable of Iraqi's regions and enjoys relative security. Kurdistan-Iraq is now focused on education and research and development to fulfil the regional demand for sustainable development – something that has been missing in many areas of study over the past decades.

Iraqi-Kurdistan has been, perhaps, the greatest beneficiary of Iraq's liberation. Today, the Iraqi Kurds enjoy the country's highest living standard, level of foreign investment and security (Rubin, 2008). Since the USA-led invasion of Iraq in 2003, thousands of Iraqi students have fled north to the much more stable Kurdish area. As a result, universities have proliferated throughout the region – a great boost for the local economy. Over the past ten years, many universities have opened in the area. Universities in this region, controlled by the Kurdistan regional government, allow students from Baghdad and other unstable parts of Iraq to complete their education without leaving the country, a factor that has reversed the brain-drain that typically comes with conflict (Anderson, 2011).

There are several public and private universities and colleges in the Kurdistan region of Iraq. They offer studies in various subjects leading to specialized diplomas, bachelor's and master's degrees and doctorates. There are also a growing number of licensed private universities in Kurdistan. Salahaddin University was established in 1968 in the city of Sulaymaniyah, and was moved to the city of Erbil in 1981. After the Ba'ath party withdrew its administration in the aftermath of the Persian Gulf War in 1992, the Kurdistan regional government established the University of Sulaimani and the University of Duhok. The three more recently established institutions are: the University of Koya, Soran University and Hawler Medical University.

Kurdistan also has two universities that teach exclusively in English. The University of Kurdistan-Hawler started its first academic year in September 2006. The only language of instruction at the university is English. The American University of Iraq – Sulaimani is a private university where all instruction is in English. Some of the private universities in the Kurdistan region include: Cihan University, Sabis University and Ishik University (Kurdistan Regional Government, 2010).

"To assess the size of research activities within a university, it is appropriate to consider the volume of an institution's article output" (Moed, 2006, p. 2). Until now, very little attention has been spent to evaluate the research performance of Iraqi-Kurdistan universities. This scientometric study provides an assessment of the research activities at Iraqi-Kurdistan universities. The purpose of this paper is to introduce such assessments, as research is becoming increasingly important for the faculty evaluation process in Iraqi-Kurdistan universities and research institutes.

Literature review

There is a growing academic and industrial interest in the impartial evaluation of scholarly research and global ranking of universities. Publication and citation counts have been used to assess the scientific production of countries and regions. While publication data have always formed a key component of research evaluation, they do not give any indication as to the quality

of scientific research. On the other hand, although citation data have some inherent biases, especially towards publishing in English, it is often stated that a well-cited paper is used more by researchers, and it is probably considered more relevant to their scholarly work.

Scientific literature is a reflection of scientific activity and productivity (Garfield, 1979). The number of publications is considered to be an indication of the scientific output of a group, while the impact is assessed by using data regarding the number of times these publications are cited in subsequent years (Martin and Irvine, 1983). Scientometric analysis can be used to identify emerging research areas, to evaluate the research performance of individual researchers, research groups, universities and countries, and to study the relations between authors, institutions and journal papers. Much of the world literature on the scientific productivity of different nations is on science in the developed countries. Comparatively little attention has been given to the research output of scientifically mid-level countries and the production of their institutions (Kim and Kim, 2000).

Scientometric techniques have become tools to evaluate the scientific productivity of nations, academic institutions, departments and individual researchers. In recent years, the evaluation, classification and ranking of universities has become increasingly important at regional, national and international levels throughout the world. However, van Raan (2005, p. 133) suggests that the "ranking of research institutions by bibliometric methods is an improper tool for research performance evaluation, even at the level of large institutions". Middle Eastern countries, including Iraq, want universities for the new knowledge they generate, with an eye on replacing oil money with high technology employment. They would like universities that are good enough for their elites not to assume that their children have to go to Harvard or Oxford to complete their education (TopUniversities.com, 2011).

Iraqi-Kurdistan has chosen a variety of ways of developing its higher education. Iraqi-Kurdistan is also home to the Iraqi higher education, a development zone that houses local branches of the American University of Iraq, the British Royal University for Science and Technology, BMU Lebanese French University and other American and European educational institutes. It is difficult to characterize this development in scientometric analyses such as ours.

The Iraqi-Kurdistan region has slowly begun to emerge in the overseas education front. It appears that significant changes are being made in the universities across Iraqi-Kurdistan with an objective of inviting the international and regional students, and taking their education to a global level. With an objective to ensure that the students from Iraq and the Middle-East do not find the need to go to Cambridge or Harvard, new measures are being taken. With such a broad, multi-objective goal, it is necessary to evaluate scientific productivity of Iraqi-Kurdistan universities and improve their current rankings among similar universities on the world university rankings.

Waast and Rossi (2010) investigated the trends and the small amount of local scientific output (in terms of internationally recognized publications) in West Asia and North Africa. Their micro bibliometric study showed that in each country very few "research establishments" generated the bulk of research; and even in these cases, only one out of five to ten staff is actually devoted to research. The results of this study also revealed that most of the West Asian and North African countries' research efforts are concentrated in a small group with modest contributions in wide ranging international programmes and undersized networks. It is noteworthy that in their study, the scientific productivity of Iraq was not evaluated.

Sadkhan (2010) analysed the quality of scientific research in Iraqi universities and addressed the main challenges they are facing. He stated that the scientific research in Iraqi universities

faces many challenges that may affect its establishment and progress. These obstacles or challenges can be summarized as follows: funding problems, strategy challenges, organizational and management challenges, information technology challenges, unavailability of research infrastructures and so forth.

The most related research to our study was conducted by Majeed (2007), who compared the research production and publications of faculty members inside and outside Iraq before and after the occupation, during the period starting 1999/2000 and ending 2005/2006. He also evaluated the performance of Iraqi universities during this same time period. The main drawback of this research is that the author ignored the Iraqi-Kurdistan universities.

Objectives of this study

The main purpose of this research is to present a survey of publications by Iraqi-Kurdistan universities from the period 1970-2012 and to describe their impact in terms of citations in the Scopus database.

The current study has been undertaken with the objective of analysing the following aspects:

(1) Analysis of publications:

- To determine the research productivity of the academic and research community working in Iraqi-Kurdistan universities.
- To identify the number of contributions published during the time period of the study.
- To compare the annual distribution of research publications.
- To find out the ranking of leading contributors.
- To study the subject coverage (domain/field) of publications.
- To determine the preference of research communication channel among the research community.

(2) Analysis of citations:

- To learn the number of cited documents.
- To discover the highly cited papers.
- To identify the core journals publishing papers from Iraqi-Kurdistan universities.

Materials and methods

The source items (records of publications by the faculty members of Iraqi-Kurdistan universities) were all the documents published in international journals and proceedings indexed by Scopus (an Elsevier bibliographic database) for the years 1970-2012. All papers having an authorship or a co-authorship associated with Iraqi-Kurdistan universities were included and the number of citations received by them was counted for the period. The searches and examination of papers was carried out on 15 October 2012.

In the current study, we have used online directories of universities and colleges in an attempt to identify all the Iraqi-Kurdistan universities. The distribution of publications with respect to journals, the type of co-authorships and the scientific fields are identified. Additional characteristics are investigated, such as highly cited papers, prolific authors, distribution of papers by discipline, research communication channels, international collaborators and document types. The results of our comparison are listed in Table I and have been used to investigate the population. The Scopus Affiliation search was used to gather the raw data required to study the scientific productivities of each university (for example, University of Sulaimani).

Results

Table I shows the numbers of papers and their corresponding citations for Iraqi-Kurdistan universities and colleges. In this analysis, 459 papers published by the faculty members associated with the Iraqi-Kurdistan universities and indexed by Scopus during the time period 1970-2012 were considered.

The scientific publications contributed by the faculty members associated with the Iraqi-Kurdistan universities indicates that only five universities (Salahaddin University-Hawler, University of Sulaimani, University of Duhok, Kirkuk University and University of Koya) have publications indexed in Scopus.

The research publications contributed by the academic community between 1970 and October 2012 reveals that the University of Salahaddin has the highest number of research publications with 170 documents appearing in Scopus (see Table I).

Table I. Research Productivity of the Iraqi-Kurdistan Universities

University	URL	Year of establishment	No. of papers	No. of citations
Salahaddin University–Hawler (SUH)	www.suh-edu.com	1968	170	412
University of Sulaimani (UOS) (Sulaymaniyah)	www.univsul.org	1968	150	234
University of Duhok	www.uod.ac	1992	96	343
Kirkuk University	www.uokirkuk.edu.iq	2003	22	13
University of Koya	www.koyauni.ac	2003	21	18
American University of Iraq – Sulaimani	www.auis.edu.iq	2007	0	0
BMU Lebanese French University	www.lfu-bmu.net	2007	0	0
The British Royal University for Science and Technology	www.broyalu.net	2009	0	0
Cihan (Jihan) University	www.cihanuniversity.org	1992	0	0
Hawler Medical University	www.hmu.edu.iq	2005	0	0
Ishik University	www.ishikuniversity.net	2008	0	0
Kurdistan University of Science and Technology (KUST) - Sulaymani	www.kusts.com	2009	0	0
Nawroz University	www.nawrozuniversity.com	2004	0	0
Sabis University	www.sabisuniversity.net	2009	0	0
Soran University	www.soranu.com	NA	0	0
University of Garmain	NA	2010-2011	0	
University of Halabjah	NA	2010-2011	0	0
University of Kurdistan – Hawler	www.ukh.ac	2006	0	0
University of Ranya	NA	2010-2011	0	0
University of Raparin	www.raparinuni.org	2010-2011	0	0
University of Human Development in Sulaimani	NA	NA	0	0
University of Zakho (UOZ)	www.uoz-krg.org	2010	0	0
Total			459	1024

Figure 1 represents the annual distribution of publications. Although the number of publications contributed by the research community of Iraqi-Kurdistan universities started in 1972, since 2004, they have been steadily increasing. The study found that 379 of 459 publications appeared between 2004 and October 2012 (82.57 per cent).

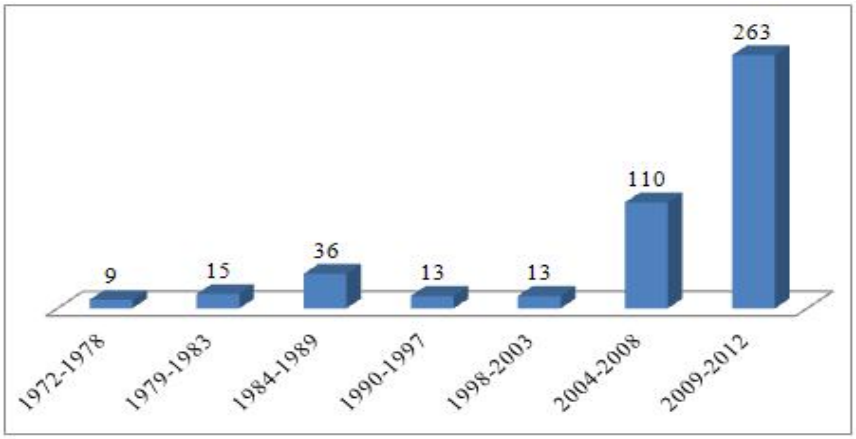

Figure I. Year-wise research productivity

Research publications published in various subject fields have been reported. Figure 2 shows the scientific field distribution of published papers from Iraqi-Kurdistan universities. This figure indicates that Medicine, Engineering, Chemistry, Agricultural and Biological Sciences, Computer Science and Earth and Planetary Sciences dominated the areas of research contributions by the Iraqi-Kurds academicians.

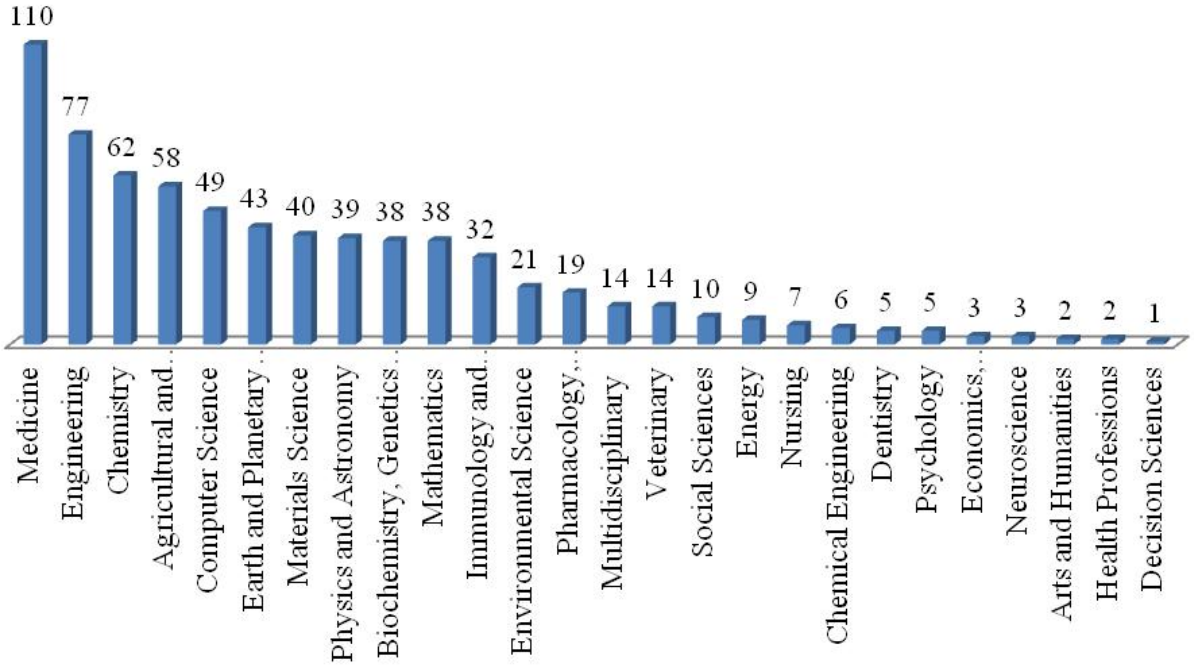

Figure II. Distribution of papers by discipline

Table II presents major journals used by the faculty members of Iraqi-Kurdistan universities. Among the various scientific communication journals, the top 22 journals in which 22 per cent of the papers have appeared are shown in Table II. Eastern Mediterranean Health Journal and Journal of Chinese Clinical Medicine placed in the top 22 journals with 9 and 8 papers, respectively, followed by Asian Journal of Chemistry (7), Hemoglobin (6) and Journal of Applied Sciences Research (6). Of the 459 papers, 99 (22 per cent) appeared in the top 22 journals.

Table II. Research communication channel

Rank	Journal title	No. of papers	Percentage (%)
1	Eastern Mediterranean Health Journal	9	1.96
2	Journal of Chinese Clinical Medicine	8	1.74
3	Asian Journal of Chemistry	7	1.53
4	Hemoglobin	6	1.31
5	Journal of Applied Sciences Research	6	1.31
6	Arabian Journal of Chemistry	5	1.09
7	European Journal of Scientific Research	5	1.09
8	Materials Research Bulletin	5	1.09
9	World Academy of Science Engineering and Technology	5	1.09
10	Acta Crystallographica Section E Structure Reports Online	4	0.87
11	Arabian Journal of Geosciences	4	0.87
12	Japanese Journal of Parasitology	4	0.87
13	Jordan Journal of Applied Sciences Natural Sciences	4	0.87
14	Arpn Journal of Engineering and Applied Sciences	3	0.65
15	Australian Journal of Basic and Applied Sciences	3	0.65
16	Folia Parasitologica	3	0.65
17	Geological Magazine	3	0.65
18	Iraqi Journal of Veterinary Sciences	3	0.65
19	Lasers in Medical Science	3	0.65
20	Rawal Medical Journal	3	0.65
21	Reproduction in Domestic Animals	3	0.65
22	Systematic Parasitology	3	0.65
	Total	99	22

Research collaboration and co-authorship is an increasing phenomenon in research and development (R&D). Co-authorship may increase scientific productivity, citedness and research impact. Table III presents the distribution of national and international collaborators used by the faculty members of Iraqi-Kurdistan universities for publications according to the affiliation of authors. This table shows that 52 per cent of the Iraqi-Kurdistan publications were co-authored with foreign countries.

Table III. Distribution of collaborators used for papers of the faculty members of the Iraqi-Kurdistan universities according to the affiliation of co-authors

Country	Frequency	Country	Frequency
Iraq	444	Denmark	2
Sweden	30	Finland	2
Malaysia	27	Lebanon	2
United Kingdom	27	Libyan Arab Jamahiriya	2
United States	15	Qatar	2
Turkey	13	Spain	2
Iran	12	Syrian Arab Republic	2
Germany	11	United Arab Emirates	2

Jordan	9	Belgium	1
Saudi Arabia	8	Brunei Darussalam	1
Bangladesh	7	Bulgaria	1
Egypt	6	China	1
Australia	5	Costa Rica	1
Austria	4	Greece	1
India	4	Hungary	1
Switzerland	4	Kuwait	1
Yemen	4	Mexico	1
Canada	3	Morocco	1
Czech Republic	3	Netherlands	1
Italy	3	New Zealand	1
Japan	3	Pakistan	1
Poland	3	Portugal	1
Russian Federation	3	Romania	1
Bahrain	2		

Note: The total number of collaborations is greater than the total number of publications of Iraqi-Kurdistan universities because some of them may be contributed by authors from several countries.

The citedness of a scientific publication has for decades been regarded as an indicator of its research impact (González-Pereira et al., 2009). Therefore, based on this argument, the citedness of publications of faculty members of the Iraqi-Kurdistan universities was assessed. For each of the 459 papers contributed by the faculty members of the Iraqi-Kurdistan universities, citations were counted using the Scopus database. Table IV shows that among the 459 publications, 211 (40 per cent) have been cited 1,020 times; while 248 (60 per cent) of the papers have not been cited even once, so about 60 per cent of the papers were invisible to world science during the study period. Table IV shows that more than half of the papers published by the Iraqi-Kurdistan universities were invisible to world science. One of the major reasons for performing the study was to look at the citedness of the Iraqi-Kurdistan universities' publications.

Table IV. Citations to Iraqi-Kurdistan universities papers according

	No. of papers	Total No. of citations	No. of Cited Papers	No. of Un-cited Papers	Percentage of cited papers (%)	Percentage of un-cited papers (%)
University of Salahaddin	170	412	83	87	49	51
University of Sulaimani	150	234	68	82	45	55
University of Duhok	96	343	48	48	50	50
University of Koya	21	18	5	16	24	76
Kirkuk University	22	13	7	15	32	68
Total	459	1020	211	248	49	51

Highly cited papers are important to the reputation of a university (Zhu et al., 2004). Table V presents highly cited papers contributed by Iraqi-Kurdistan authors. This table shows that the majority of highly cited papers contributed by Iraqi-Kurdistan authors were in the field of medicine. It is interesting that all of the highly cited papers were published in journals. The table presents the papers that received 10 or more citations. Twenty-five papers were cited 484 times, representing 47 per cent of all the citations (484 of 1,020), with an average of about 19.36 citations per paper. This indicates a concentration effect, whereby a relatively small number of papers earn most of the citation and research impact generated by the faculty member of the

Iraqi-Kurdistan universities. Numerous studies found that highly cited papers have a major impact on research performance (e.g. Garfield, 1998; Kim and Kim, 2000; Martin et al., 1987; Nederhof and Noyons, 1999).

The result from the correlation between the h-index and citation counts demonstrates that the total number of citations (with or without self-citations) is a reliable indicator of research impact and influence (Cronin and Meho, 2006). The most productive Iraqi-Kurdistan authors (i.e. those who authored at least five papers as first author or co-author) are listed in Table VI. It is worth noting that among the 18 most prolific authors, eight have at least one highly cited paper.

Table VII shows the document type of the publications of Iraqi-Kurdistan universities. The table indicates that 356 of 459 (78 per cent) of publications were articles published in journals, followed by conference papers with 60 papers (13 per cent).

Table V. Highly-cited papers of Iraqi-Kurdistan authors

Title	Authors	Year	Source	No. of Citations
A New Helicobacter pylori Vacuolating Cytotoxin Determinant, the Intermediate Region, Is Associated With Gastric Cancer	Rhead, J.L., Letley, D.P., Mohammadi, M.,Hussein, N., Mohagheghi, M.A., Eshagh Hosseini, M., Atherton, J.C.	2007	Gastroenterology 133 (3).	103
Differences in virulence markers between Helicobacter pylori strains from Iraq and those from Iran: Potential importance of regional differences in H. pylori-associated disease	Hussein, N.R., Mohammadi, M., Talebkhan, Y.,Doraghi, M., Letley, D.P., Muhammad, M.K.,Argent, R.H., Atherton, J.C.	2008	Journal of Clinical Microbiology 46 (5).	46
The threat simulation theory of the evolutionary function of dreaming: Evidence from dreams of traumatized children	Valli, K., Revonsuo, A., Pälkäs, O., Ismail, K.H., Ali, K.J., Punamäki, R.-L.	2005	Consciousness and Cognition 14 (1).	26
Epidemiology of Echinococcus granulosus in Arbil province, northern Iraq, 1990-1998	Saeed, I., Kapel, C., Saida, L.A., Willingham, L., Nansen, P.	2000	Journal of Helminthology 74 (1).	25
Heterobimetallic complexes of palladium(II) and platinum(II) bridged by the ligand 5-phenyl-1,3,4-oxadiazole-2-thione	Amin, O.H., Al-Hayaly, L.J., Al-Jibori, S.A., Al-Allaf, T.A.K.	2004	Polyhedron 23 (11).	22
Identification of novel mammalian caspases reveals an important role of gene loss in shaping the human caspase repertoire	Eckhart, L., Ballaun, C., Hermann, M.,VandeBerg, J.L., Sipos, W., Uthman, A., Fischer, H., Tschachler, E.	2008	Molecular Biology and Evolution 25 (5).	21
Physiological tests and bioassays: Aids or superfluities to the diagnosis of phytoplankton nutrient limitation? A comparative study in the Broads and the Meres of England	Hameed, H.A., Kilinc, S., McGowan, S., Moss, B.	1999	European Journal of Phycology 34 (3).	21
Helicobacter pylori dupA is polymorphic, and its active form induces proinflammatory cytokine secretion by mononuclear cells	Hussein, N.R., Argent, R.H., Marx, C.K., Patel, S.R., Robinson, K., Atherton, J.C.	2010	Journal of Infectious Diseases 202 (2).	17
H1 histamine receptor antagonists induce genotoxic and caspase-2-dependent apoptosis in human melanoma cells	Jangi, S.-M., Díaz-Pérez, J.L., Ochoa-Lizarralde, B., Martín-Ruiz, I., Asumendi, A., Pérez-Yarza, G., Gardeazabal, J., (...), Boyano, M.D.	2006	Carcinogenesis 27 (9).	15
Leachate characterization in semi-aerobic and anaerobic sanitary landfills: A comparative study	Aziz, S.Q., Aziz, H.A., Yusoff, M.S., Bashir, M.J.K., Umar, M.	2010	Journal of Environmental Management 91 (12).	15
A novel matrix metalloprotease-like enzyme	Karim, A.Y., Kulczycka, M.,	2010	Biological	14

(karilysin) of the periodontal pathogen Tannerella forsythia ATCC 43037	Kantyka, T., Dubin, G., Jabaiah, A., Daugherty, P.S., Thogersen, I.B., (...), Potempa, J.		Chemistry 391 (1).	
A 2-year follow-up of orphan's competence, socioemotional problems and post-traumatic stress symptoms in traditional foster care and orphanages in Iraqi Kurdistan	Ahmad, A., Qahar, J., Siddiq, A., Majeed, A.,Rasheed, J., Jabar, F., von Knorring, A.-L.	2005	Child: Care, Health and Development 31 (2).	13
Description of Pomphorhynchus spindletruncatus n. sp. (Acanthocephala: Pomphorhynchidae) from freshwater fishes in northern Iraq, …	Amin, O.M., Abdullah, S.M.A., Mhaisen, F.T.	2003	Systematic Parasitology 54 (3).	13
The colonization of periphytic diatom species on artificial substrates in the Ashar canal, Basrah, Iraq	Hameed, H.A.	2003	Limnologica 33 (1).	13
Clinical, bacteriological, and histopathological study of toxic puerperal metritis in Iraqi buffalo	Azawi, O.I., Omran, S.N., Hadad, J.J.	2007	Journal of Dairy Science 90 (10).	12
Distribution and chemotaxonomic significance of glucosinolates in certain Middle-Eastern cruciferae	Al-Shehbaz, I.A., Al-Shammary, K.I.	1987	Biochemical Systematics and Ecology 15 (5).	12
Lattice thermal expansion for normal tetrahedral compound semiconductors	Omar, M.S.	2007	Materials Research Bulletin 42 (2).	12
Nitroimidazoles. V. Synthesis and anti-HIV evaluation of new 5-substituted piperazinyl-4-nitroimidazole derivatives	Al-Soud, Y.A., Al-Masoudi, N.A., Hassan, H.Gh.,De Clercq, E., Pannecouque, C.	2007	Acta Pharmaceutica 57 (4).	12
Machinery selection modeling: incorporation of weather variability	Danok, A.B., McCarl, B.A., White, T.K.	1980	American Journal of Agricultural Economics 62 (4).	11
Monogenoids from the gills of spiny eels (Teleostei: Mastacembelidae) in India and Iraq, …	Kritsky, D.C., Pandey, K.C., Agrawal, N., Abdullah, S.M.A.	2004	Folia Parasitologica 51 (4) , pp. 291-298	11
Exchange rates and stock prices interaction during good and bad times: Evidence from the ASEAN4 countries	Hatemi J, A., Roca, E.	2005	Applied Financial Economics 15 (8).	10
Medical education and training in Iraq	Amin, N.M.M., Khoshnaw, M.Q.	2003	Lancet 362 (9392).	10
Oxidation and nitrosylation of cysteines proximal to the Intermediate Filament (IF)-binding site of plectin: Effects on structure and vimentin binding and involvement in IF collapse	Spurny, R., Abdoulrahman, K., Janda, L., Rünzler, D., Köhler, G., Castañón, M.J., Wiche, G.	2007	Journal of Biological Chemistry 282 (11).	10
Trauma, dreaming, and psychological distress among kurdish children	Punamäki, R.-L., Ali, K.J., Ismahil, K.H., Nuutinen, J.	2005	Dreaming 15 (3).	10
Palladium(II) and platinum(II) complexes with mixed ligands of tertiary monophosphines and 5-phenyl-1,3,4-oxadiazole-2-thione or 4,5-diphenyl-1,2,4- triazole-3-thione	Qadir, A.M., Abdullah, A.I., Al-Jibor, S.A., Al-Allaf, T.A.K.	2004	Asian Journal of Chemistry 16 (2).	10

Table VI. Comparison between the prolific authors

Prolific authors	No. of papers
Omar, M.S.	12
Al-Windi, A.	8
Hussein, N.R.	8
Karim, M.R.O.	8
Abdullah, B.H.	7
Al-Masoudi, N.A.	7
Jubrael, J.M.S.	7

Azawi, O.I.	6
Hadad, J.J.	6
Molan, A.L.	6
Saeed, R.K.	6
Abdullah, S.M.A.	5
Al-Allawi, N.A.S.	5
Atherton, J.C.	5
Ibrahim, M.A.	5
Majeed, A.R.	5
Minaei, S.	5
Omran, S.N.	5
Yuce, E.	5

Key findings

- The scientific publications contributed by the faculty members associated with the Iraqi-Kurdistan universities indicates that only five universities (Salahaddin University-Hawler, University of Sulaimani, University of Duhok, Kirkuk University and University of Koya) have publications indexed in Scopus.
- The number of publications contributed by the research community of Iraqi-Kurdistan universities started in 1972, but since 2004, they have been steadily increasing. The study found that 379 of 459 publications appeared between 2004 and October 2012 (i.e. 82.57 per cent).
- Analysis of the subject areas indicated that Medicine, Engineering, Chemistry, Agricultural and Biological Sciences, Computer Science and Earth and Planetary Sciences are the dominate areas of research contributions by Iraqi-Kurds academicians.
- Evaluation of research communication channels indicated that Eastern Mediterranean Health Journal and Journal of Chinese Clinical Medicine placed in the top 22 journals with 9 and 8 papers, respectively, followed by Asian Journal of Chemistry (7), Hemoglobin (6) and Journal of Applied Sciences Research (6). Of the 459 papers, 99 (22 per cent) appeared in the top 22 journals.
- The co-authorship patterns suggest that 52 per cent of Iraqi-Kurdistan publications were co-authored with foreign countries. Citation analysis provides evidence that among the 459 publications, 211 (40 per cent) have been cited 1,020 times; while 248 (60 per cent) of the papers have not been cited even once, so about 60 per cent of the papers were invisible to world science during the study period.
- Citation analysis also reveals that all of the highly cited papers were published in journals, rather than proceedings.

Discussion and limitations of the study

This study reveals certain limitations to using the Scopus citation database as an assessment tool that may have biased the findings. For instance, international databases have an English language bias. Language bias and other technical problems in publication data should also be considered. In addition to the percentage of publications, other indicators may also be used, including the percentages of academic staff, undergraduate students, graduate students and degree programs. Moreover, the number of the Iraqi journals indexed in Scopus is very low. Only two journals are covered by Scopus (i.e. New Iraqi Journal of Medicine and Iraqi Journal of Veterinary Sciences). Although Scopus covers the journals published from the international

perspective, Iraqi journals might have been left out, and this is a limitation of the study. Additionally, Scopus is the only major source used in the current study that was undertaken to reveal the scientific productivity of Iraqi-Kurdistan universities. This may have implications for the future of scientific research in Iraq.

It is evident that the majority of Iraqi-Kurdistan universities are "new" universities, whilst only three can be classified as "old" (Salahaddin University-Hawler, the University of Sulaimani and the University of Duhok). This study found that the American University of Iraq, the British Royal University for Science and Technology and BMU Lebanese French University (a private institution of higher education based in Erbil, northern Iraq) have no publications listed in Scopus. It seems that these three foreign universities are educational-oriented universities, rather than research-oriented. Generally, there are three types of universities:

(1) research universities;
(2) educational universities; and
(3) occupation-oriented universities.

Briefly, research universities are research-oriented; educational universities are teaching/education-oriented; while occupation-oriented universities provide vocational training (or applied occupation-based training) education and enrichment for different occupations, and are often based in areas that are easy to reach.

The results of the present study confirm the findings of previous studies, such as Aksnes and Sivertsen (2004), that citation distributions are extremely skewed. In other words, a large part of the scientific papers are never or seldom cited in subsequent scientific literature. Aksnes and Sivertsen (2004, p. 222) found that "the average citation rates in major subfields are highly determined by one or only a few highly cited papers".

Conclusion and suggestions

This investigation gives a scientometric description of the research performance of Iraqi-Kurdistan universities. Scientific productivity of Iraqi-Kurdistan universities can be measured by the counting of research publications in journals and proceedings, and the number of citations received in those publications. Although leading faculty members of Iraqi-Kurdistan universities contribute much of their work in international journals covered by Scopus, a significant number of publications of Iraqi-Kurdistan universities appear in national journals and are not covered by Scopus.

Seeking international recognition and visibility, faculty members of the Iraqi-Kurdistan universities publish many of their papers in international journals, including Eastern Mediterranean Health Journal, Journal of Chinese Clinical Medicine, Asian Journal of Chemistry, Hemoglobin and Journal of Applied Sciences Research.

As shown by this study, as well as others, international research collaboration generally leads to publication in mainstream journals rather than in national journals. This study reveals that 237 of 459 (52 per cent) publications have international collaborations. It is shown that among the 459 publications, 211 (40 per cent) have been cited 1,020 times; while 248 (60 per cent) of the papers have not been cited even once, so about 60 per cent of the papers were invisible to world science during the study period. Therefore, more than half of the papers published by Iraqi-Kurdistan universities were never cited by other research. It is interesting that all of the highly cited papers were published in journals. In other words, this study found that papers published in conference proceedings are not highly cited. This study also discovered that the 25 highly cited papers were cited 484 times, representing 47 per cent of all the citations (484 of 1,020). This

indicates a concentration effect, whereby a relatively small number of papers earn most of the citation and research impact generated by faculty members of Iraqi-Kurdistan universities.

This research suggests that Iraqi-Kurdistan universities should pay special attention to policy-relevant aspects of their research. In other words, Iraqi-Kurdistan universities must develop a suitable research policy:

- to guide the conduct of research in the universities;
- to encourage the conduct of research on high priority issues;
- to improve the quality of research in the universities; and
- to establish strong linkages with industry for effective research result utilization.

To increase scientific productivity of Iraqi-Kurdistan universities, policymakers should develop more effective approaches. Iraqi-Kurdistan universities should give a high priority to publish in international journals, by increasing research funding, as well as improving research facilities and equipment at universities. This should also be standard for the publications of PhD candidates and faculty members of universities at the following levels:

- *PhD candidates*: Submission of at least one substantial, original paper based on the dissertation research should be required. They should be required to submit a first-author paper related to their education and research for publication in an international peer-reviewed journal prior to the defence of the PhD dissertation.
- *Assistant Professors*: A minimum of three peer-reviewed journal papers should be required.
- *Promotion to Associate Professor*: A minimum of five peer-reviewed journal papers should be required for this promotion.
- *Promotion to Full Professor*: A minimum of ten peer-reviewed journal papers should be required for this promotion.

To increase citations and visibility of publications from Iraqi-Kurdistan universities and to improve their research impact, we suggest establishing repositories at the regional or institutional level. The main purpose of digital repositories is to increase the availability, accessibility and visibility of knowledge that has been produced by academic staff in the host university. Open access repositories can significantly increase research and citation impact of publications contributed by the faculty members of Iraqi-Kurdistan universities. Iraqi-Kurdistan university websites can announce the existence and promote the achievements of research groups, departments, institutes and faculty members. They can also disseminate research findings, either by hosting digital repositories or by publishing electronic journals.

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