

Research productivity of Gulf Cooperation Council (GCC) countries in science and social sciences

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Abstract

Objective: To investigate the research progress of Gulf Cooperation Council countries in science and social sciences.

Methods: This study was conducted in the Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia, from June 2014 to February 2015. All research documents related to the 1996-2013 period having an affiliation with Gulf Cooperation Council countries, including Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Bahrain and Oman, were tracked. The main source for data-gathering was World Association of Universities, Sci-mago Journal and Country ranking and Web of Science Institute of Scientific Information (ISI) Thomson Reuters.

Results: Of the 544 institutions produced research papers, 141(25.92%) were universities or degree-awarding institutes, 372(68.38%) were research institutes and 31(5.7%) were Institute of Scientific Information-indexed scientific journals. The number of degree awarding institutes were 68(48.23%) in Saudi Arabia, 33(23.4%) in the United Arab Emirates and 12(8.51%) in Qatar. The total number of publications contributed by the region was 133638 (Mean \pm SD: 22273 \pm 26302.20); citable documents 127739 (Mean \pm SD: 21289.83 \pm 25241.22); self-citations 105,716 (Mean \pm SD: 17619.33 \pm 23328.44); total citations 756141 (Mean \pm SD: 126023.5 \pm 143260.95) and citations per documents 33.22 (Mean \pm SD: 5.53 \pm 1.09). The overall and mean Hirsch index was 513 and 85.5 \pm 35.39.

Conclusion: Among Gulf Cooperation Council countries, Saudi Arabia was the most productive country producing adequate number of research publications, citations and holding the highest Hirsch index value.

Keywords: GCC, Research papers, Indexed journal. (JPMA 66: 1307; 2016)

Introduction

The Gulf Cooperation Council (GCC) was established in May 1981. The countries included in the GCC are Saudi Arabia, United Arab Emirates (UAE), Kuwait, Qatar, Bahrain and Oman.¹ These countries are brimming with natural resources containing oil and gas with elevated income advantages. GCC states are trying to promote high-quality education for their citizens and higher education and research in the region.²

Research in science and social sciences is essential to recognise the emerging issues, capitalise on prospects and minimise the menaces. Scientific research plays a significant role in the country's fiscal growth along with long-term viable development, and eventually contributes to the improvement of living standards and quality of life.³ Investment in education and research is more vital for the advancement and affluence. To identify and compute the research progress of a country in any subject, bibliometric indicators are essential tools to understand the growth and global extent of research.³ These indicators are mainly based on the amount of scientific research published and its visibility in global science.⁴ Scientific publications are key indicators in measuring the research output that forms the basis of strategic decisions and in the development of states.⁵ The

research-pursuing approach is important in economic success of a country. Scientific research establishes the mechanisms, decisions, standards, policies and regulations in various aspects of life.^{6,7} There is a close association between the research and the progress of individual nations.³ The current study was planned to investigate the research progress of the GCC countries in sciences and social sciences.

Materials and Methods

This study was conducted at the Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia, from June 2014 to February 2015.

Research publications published from GCC countries in various global science journals during the period 1996-2013 were reviewed. We documented the total number of research documents having an affiliation with GCC countries. The main source for retrieving the information was Sci-mago Journal and Country ranking, and Web of Science, Institute of Scientific Information (ISI) Thomson Reuters. The information about the number of universities was obtained from the World Association of Universities.⁸ The information about scientific journals indexed in the ISI was obtained from the Web of Science.⁹

For the recording of bibliometric indicators, research outcome in global science, the Middle East region and GCC countries were selected, detailed information regarding the bibliometric

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indicators including total number of published research papers (documents), total citations, citation per documents and Hirsch Index (h-index) in science and social science sectors published during the period 1996-2013 was recorded from Sci-mago Journal and Country ranking.¹⁰ For getting information about ISI-indexed journals, we logged on to the Web of Science, the territory was selected by inserting a GCC country name, e.g. "Saudi Arabia" or "Kuwait", and the names of journals along with impact factors for each journal were retrieved.

In the present study, no direct interactions with animal or human participants were involved. We thoroughly examined the databases to gather the bibliometric information of GCC countries, hence ethical approval was not required.

SPSS 18 version was used for data analysis. Data were expressed as mean \pm standard deviation (SD). The Pearson correlation coefficient was calculated to find the strength of relation between different variables. $P < 0.05$ was considered significant.

Results

Of the 544 institutions having produced research papers, 141 (25.92%) were universities or degree-awarding

Table-1: Total number of universities, research institutes and ISI indexed journals in GCC countries (1996-2013).

Country	Total Number of Universities	Research Institutes	ISI Indexed Journals
Saudi Arabia	68	168	9
United Arab Emirates	33	84	16
Kuwait	6	50	5
Qatar	12	30	0
Bahrain	11	31	1
Oman	11	9	0
Total	141	372	31
Mean \pm SD	23.5 \pm 23.75	62.0 \pm 57.72	5.16 \pm 6.36

Ref: The data was recorded from universities worldwide,⁸ ISI-web of Science.⁹

Note: We recorded the number of universities and degree awarding institutes.

ISI: Institute of Scientific Information. GCC: Gulf Cooperation Council.

Table-2: Total number of documents, citable documents, self-citation, total citations, citations per document and Hirsch-index of GCC countries in science and social sciences during the period 1996-2013.

Country	Total Documents	Citable Documents	Self-citation	Total Citations	Citations per document	h-Index
Saudi Arabia	74210	71129	63995	403827	5.44	144
United Arab Emirates	22874	21785	14245	131259	5.74	100
Kuwait	15446	14933	14771	113984	7.38	92
Oman	9663	9076	6914	56077	5.8	74
Qatar	7692	7326	4056	34654	4.51	60
Bahrain	3753	3490	1735	16340	4.35	43
Total	133638	127739	105716	756141	33.22	513
Mean \pm SD	22273 \pm 26302.20	21289.83 \pm 25241.22	17619.33 \pm 23328.44	126023.5 \pm 143260.95	5.53 \pm 1.09	85.5 \pm 35.39

H-index: Hirsch index. GCC: Gulf Cooperation Council.

Table-3: Comparison of research contribution of GCC countries in percentage of world scientific publications during the period 1996-2013.

Year	Saudi Arabia	UAE	Kuwait	Oman	Qatar	Bahrain
1999	0.15	0.03	0.06	0.02	0.01	0.01
2000	0.15	0.04	0.05	0.02	0	0.01
2001	0.13	0.04	0.05	0.02	0.01	0.01
2002	0.14	0.04	0.04	0.02	0.01	0.01
2003	0.15	0.05	0.05	0.03	0.01	0.01
2004	0.14	0.06	0.05	0.03	0.01	0.01
2005	0.13	0.07	0.05	0.03	0.01	0.01
2006	0.13	0.07	0.05	0.03	0.02	0.01
2007	0.14	0.07	0.05	0.03	0.02	0.01
2008	0.15	0.08	0.05	0.03	0.03	0.01
2009	0.19	0.09	0.05	0.03	0.03	0.01
2010	0.26	0.1	0.05	0.04	0.03	0.01
2011	0.37	0.11	0.05	0.04	0.04	0.01
2012	0.46	0.12	0.05	0.04	0.05	0.01
2013	0.55	0.12	0.05	0.05	0.07	0.02
Mean \pm SD	0.216 \pm 0.13	0.072 \pm 0.03	0.05 \pm 0.003	0.030 \pm 0.008	0.023 \pm 0.018	0.010 \pm 0.002

Note: GCC countries produce 0.401% of the world scientific publications. GCC: Gulf Cooperation Council; UAE: United Arab Emirates.

Table-4: Comparison of research progress of GCC countries in percentage of regional scientific publications of other regional countries during the period 1996-2013.

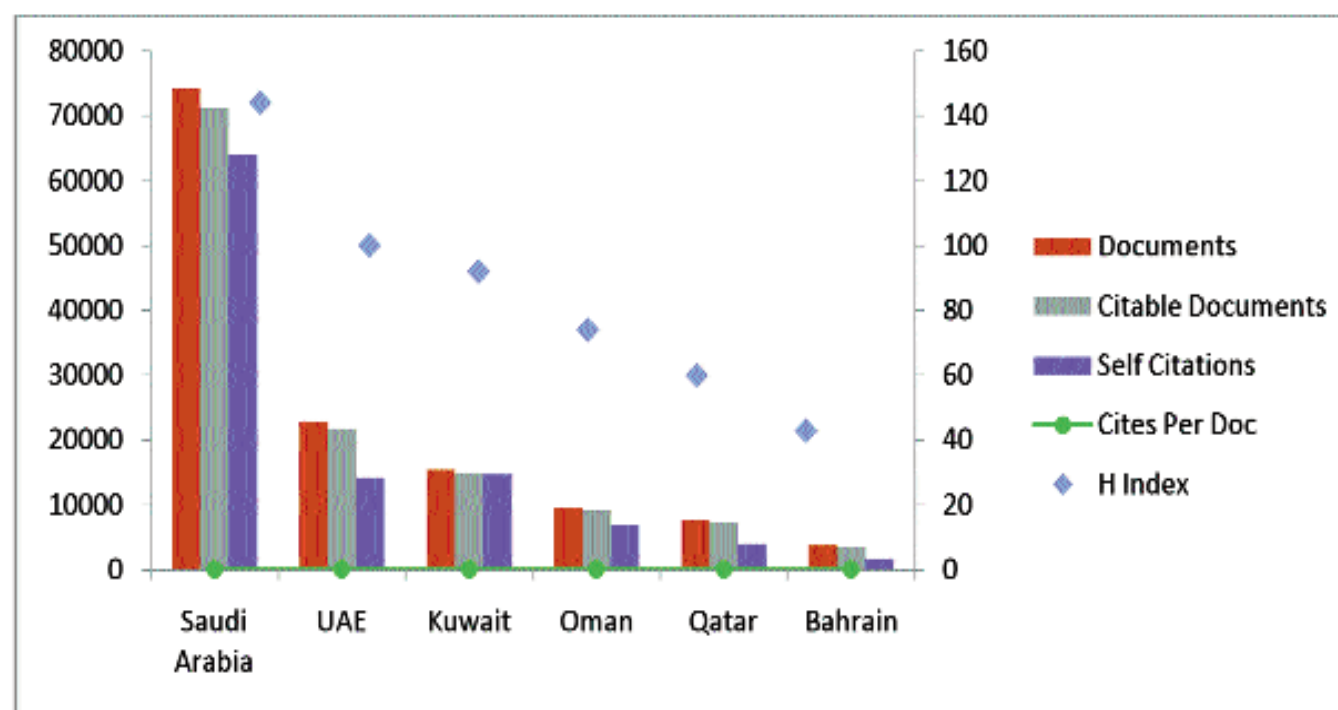
Year	Saudi Arabia	UAE	Kuwait	Oman	Qatar	Bahrain
1999	6.77	1.35	2.55	0.86	0.24	0.41
2000	6.65	1.55	2.07	0.95	0.22	0.33
2001	5.94	1.64	2	1.01	0.36	0.33
2002	5.54	1.53	1.7	0.9	0.35	0.23
2003	5.38	1.9	1.64	0.97	0.37	0.39
2004	4.69	1.86	1.59	0.9	0.43	0.41
2005	4.38	2.18	1.57	0.9	0.48	0.43
2006	4.1	2.19	1.48	0.87	0.47	0.43
2007	3.95	1.99	1.38	0.85	0.6	0.38
2008	4.17	2.1	1.4	0.8	0.69	0.35
2009	4.73	2.13	1.26	0.82	0.69	0.34
2010	6.07	2.24	1.11	0.87	0.77	0.31
2011	7.83	2.21	1.02	0.9	0.79	0.29
2012	9.36	2.36	0.98	0.89	1	0.24
2013	10.85	2.29	0.97	0.9	1.3	0.32
Mean \pm SD	6.027 \pm 2.01	1.968 \pm 0.31	1.514 \pm 0.44	0.892 \pm 0.05	0.584 \pm 0.29	0.346 \pm 0.06

Note: GCC research progress in percentage of other regional countries including Turkey, Israel, Iran, Egypt, Jordan, Lebanon, Iraq, Syrian Arab Republic, Palestine and Yemen.

GCC countries produce total 11.331% of the regional scientific publications

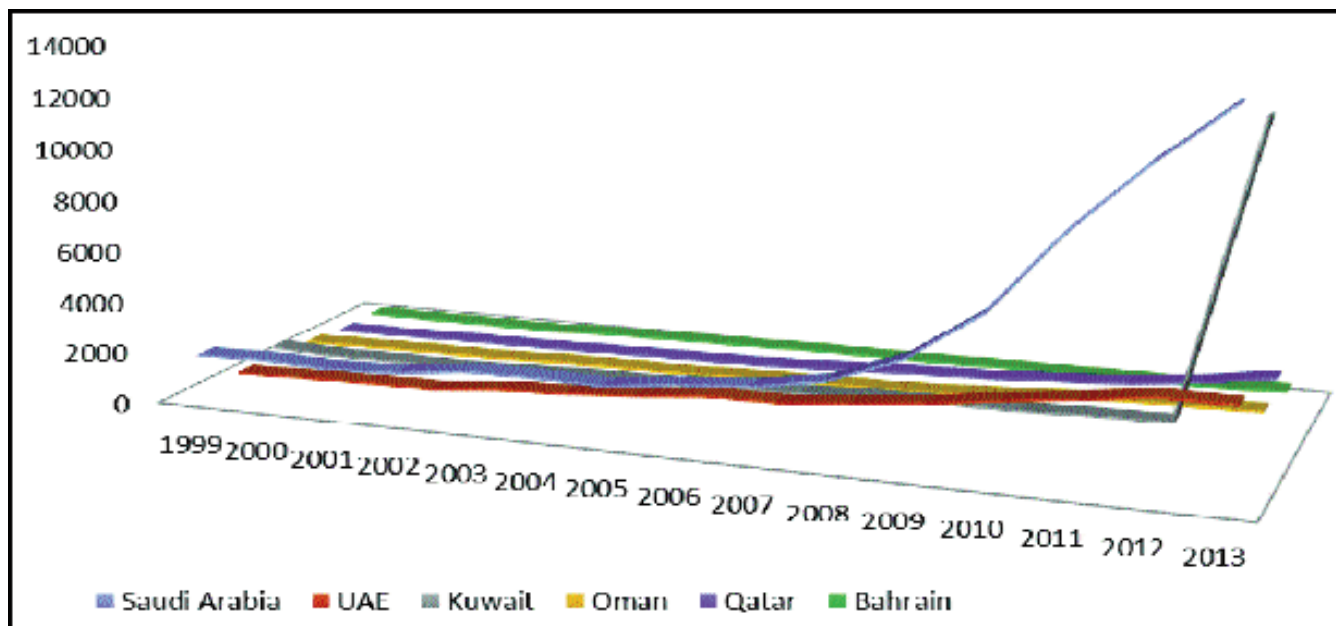
GCC: Gulf Cooperation Council

UAE: United Arab Emirates.



GCC: Gulf Cooperation Council. UAE: United Arab Emirates. H-index: Hirsch index

Figure-1: Total number of documents, citable documents, self-citations, total citations, citations per document and Hirsch-index in various science and social sciences of GCC countries during the period 1996-2013.



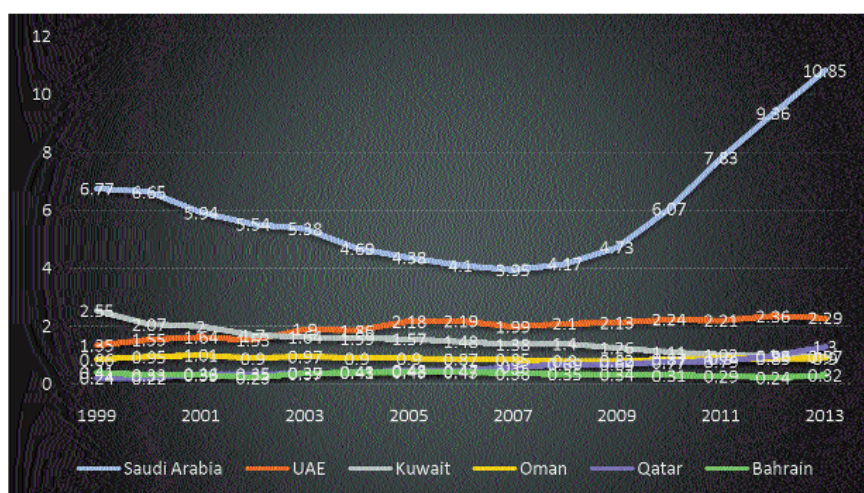
GCC: Gulf Cooperation Council. UAE: United Arab Emirates.

Figure-2: Yearly research progress of GCC countries in various science and social sciences during the period 1996-2013.

institutes, 372(68.38%) were research institutes and 31(5.7%) were ISI-indexed scientific journals. The number of degree-awarding institutes were 68(48.23%) in Saudi Arabia, 33(23.4%) in the UAE and 12(8.51%) in Qatar, while that of research institutes was 168(45.16%) in Saudi Arabia, 84(22.58%) in the UAE and 50(13.44%) in Kuwait. The number of ISI-indexed scientific journals was 16(51.61%) in the UAE, 9(29.03%) in Saudi Arabia, 5(16.13%) in Kuwait and 1(3.23%) in Bahrain, whereas

Qatar and Oman had no ISI-indexed journals (Table-1).

The total number of publications contributed by the region was 133638 (Mean \pm SD: 22273 \pm 26302.20); citable documents 127739 (Mean \pm SD: 21289.83 \pm 25241.22); self-citations 105716 (Mean \pm SD: 17619.33 \pm 23328.44); total citations 756141 (Mean \pm SD: 126023.5 \pm 143260.95) and citations per documents 33.22 (Mean \pm SD: 5.53 \pm 1.09). The overall h-index was 513 and mean \pm SD was 85.5 \pm 35.39 (Table-2; Figure-1).

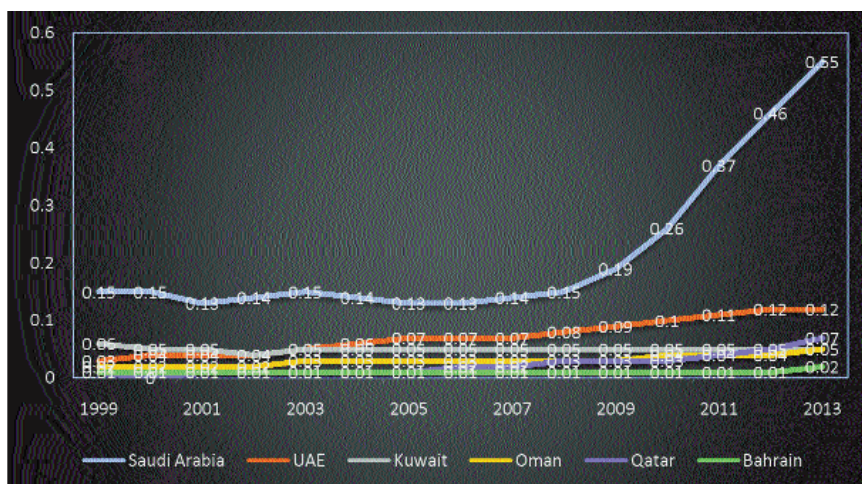


GCC: Gulf Cooperation Council. UAE: United Arab Emirates.

Figure-3: GCC countries contribution in science and social sciences in percentage of regional scientific publications during the period 1996-2013.

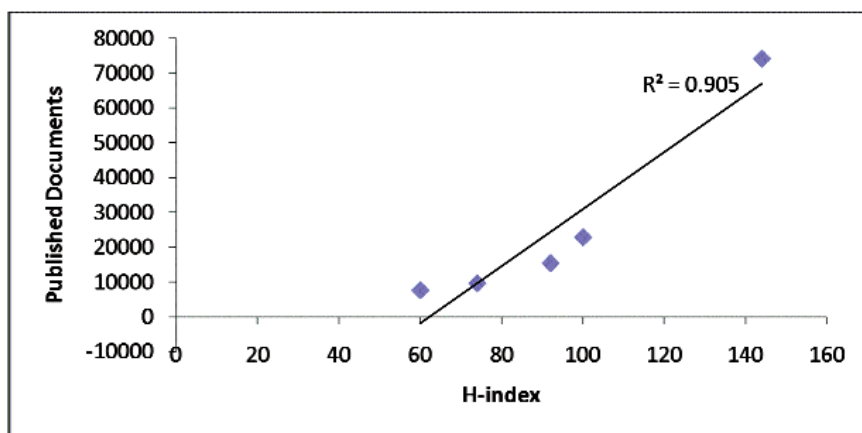
The mean contribution of Saudi Arabia in world scientific publication was 0.216; UAE 0.072; Kuwait 0.050; Oman 0.030; Qatar 0.023; and Bahrain was 0.010. Saudi Arabia holds the first place in GCC countries in contribution of world scientific publications in percentage during the period 1996-2013. The yearly research progress was also noted (Table-3; Figure-3).

The mean contribution of Saudi Arabia in the regional scientific publications was 6.02; UAE 1.96; Kuwait 1.51; Oman 0.89; Qatar 0.58; and Bahrain was 0.34 (Table-4, Figure-4). There was a significant correlation between the number of publications and



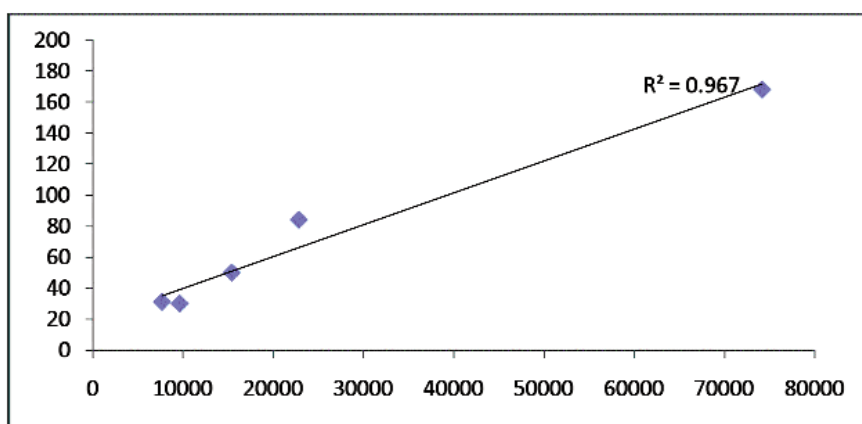
GCC: Gulf Cooperation Council. UAE: United Arab Emirates.

Figure-4: GCC countries contribution in science and social sciences in percentage of world scientific publications during the period 1996-2013.



GCC: Gulf Cooperation Council. H-index: Hirsch index.

Figure-5: Correlation between total number of published documents and h-index of GCC countries.



GCC: Gulf Cooperation Council.

Figure-6: Correlation between Research Centres/Institutes and published documents in GCC countries during the period 1996-2013.

universities, research institutes and with h-index (Figures-5-6).

Discussion

Among GCC countries, Saudi Arabia was the highest contributor in publishing research papers, citable documents, total citations and h-index, followed by the UAE, Kuwait, Oman, Qatar and Bahrain (Table-2, Figure-1). In GCC, the current trend in science and social science reflects major modifications in educational paradigms in the context of swift shifting and increasing demands in research and its delivery system. For the last few years, GCC countries have been continuously increasing funding for education and research. The education budget of Saudi Arabia was \$32.62 billion in 2009, \$36.63 billion in 2010, \$45.18 billion in 2011, and \$54.50 billion in 2012. Moreover, a supplement of \$21.8 billion was also injected to establish new universities, research labs and scholarship programmes for higher education. In December 2013, the budget reached the highest level of \$56.56 billion.²

The GCC countries with the highest per capita gross domestic product (GDP) are Qatar (\$75,175.82); Kuwait (\$50,566.56), the UAE (\$44,544.27); Saudi Arabia (\$24,246.52); and Bahrain (\$18,867.55). The spending on research and development (R&D) in Qatar is 2.7% of GDP; Saudi Arabia 0.3%; the UAE 0.15%; Bahrain 0.2% and Kuwait 0.09%.²

Hamdy et al.¹¹ reported that in the GCC countries there is a swift and major social, cultural and economic transformation. However, the development of education, especially the medical education, in the region is comparatively new. They reported that there is lack of faculty development, shortages of faculty and training facilities. We believe that because of these factors there is lack of research in medical education, science and social science sectors in GCC countries.

In agreement to our findings, Khalid bin Abdulrehman¹² reported that Saudi Arabia has made obvious contributions in scientific research, but it still needs improvement. They reported numerous factors which hamper research in Saudi Arabia. The factors limiting research include: lack of funding in science and social sciences; industries have little commercial interest; lack of research skills; limited numbers of peer-reviewed journals; and lack of an academic recognition in promotions and hiring. Our findings are in agreement to another study by Khalid bin Abdulrehman¹³ according to which Saudi Arabia contributed enough number of research publications in sciences and social sciences in comparison to other GCC countries. However, in science and social science sector Saudi Arabia contributed 0.216% research as a percentage of global publications and 6.027 on regional level.

Choung and Hwang¹⁴ reported that universities and research institutes play an important role in increasing the number of research documents in the ISI web of science database and the related research activities. In the current study, the number of universities in GCC countries was 141 and that of research institutes was 372. Since the number of universities was higher in Saudi Arabia, the number of research papers from the country was also significantly higher (Figures 3-4). This is an established fact that universities are the birthplace of research publications.

Zyoud et al.¹⁵ reported that in the GCC countries the highest h-index in toxicology sciences was for Saudi Arabia, followed by the UAE, whereas the lowest h-index was for Bahrain. In the present study, we found that in science and social sciences the highest h-index was for Saudi Arabia, followed by the UAE and the lowest was for Bahrain.

Meo et al.¹⁶ reported that the GCC countries with more universities were producing more research papers. Similarly, in the present study, we found that in the GCC countries, Saudi Arabia increased the number of universities and degree awarding institutes over time and, consequently, the research outcome also increased (Table-2, Figure-1). In another study, Meo et al.¹⁷ reported that countries which spent more on R&D produced better research outcomes. In GCC countries, Saudi Arabia is spending more on education and research¹⁸ and produced more research papers in science. Saudi Arabia's research performance has markedly increased during the last few years. The research documents and their citations are on the rise. The country improved its h-index and regional as well as international research rankings. The results of the present study are in agreement with the

findings of Meo et al.^{16,17}

Among the strengths of this study was that we recorded the information regarding GCC countries performance in research from very reliable sources. On the flip side, a major limitation of the study was that citation count tools were not perfect and may mis-cite or re-cite a paper, inflating the number of documents or citation counts.

In the light of our findings, we propose that GCC states should establish collaboration with reputable research-rich institutes. The higher authorities should provide more research grants, rewards for researchers and also extend it to the student levels. Universities should enhance enrolment of postgraduate and PhD students and engage both undergraduate and postgraduate students in scholarly research activities. They should offer research elective and obligatory research projects for their graduation. Students should be provided with an opportunity to present their research results in paper or poster presentation in science conferences. It will provide foundations for strong approach to learning and understanding of the challengeable issues in science and social sciences sectors to solve the problems along with socialising the students in science community where the scholarship of discovery is acknowledged and valued.

Conclusion

GCC countries' progressive impact on research is still marginalised. However, in GCC only Saudi Arabia produced adequate number of research publications, and enhanced its citations, h-index, and overall ranking in global science. GCC countries must develop policies to enhance the research in the region and improve science- and technology-based invention standards.

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Conflict of Interest: None.

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