Research Publications by the Arab Countries (1996–2023): An Overview

Omar F. Bizri

Consultant on Science, Technology and Development, Beirut, Lebanese Republic
Email: omarbizri@gmail.com (O.F.B.)
Manuscript received December 5, 2024; accepted February 24, 2025; published August 18, 2025

***Abstract*—This paper presents a brief outline of Research Development and Innovation (RDI) systems in the Arab countries, before presenting a more detailed account of human resources and expenditure dedicated to Research and Development (R&D) and the quality of research publications they produced during the period 1996-2023. The quality of research publications is examined through reviewing their citations, self-citations and average Hirsch-index values they managed to attain in comparison to some of their close neighbors as well as averages for the world and selected country groups. The paper concludes that, on average and in terms of both quantity and quality, published research articles by Arab countries trail behind many other countries. The paper's conclusions emphasize the need for adoption of policies that enhance human resource allocations and financial resources as well as wider collaboration both within and among the Arab countries. Apart from several other negative outcomes, failure to do so would certainly jeopardize attempts at attaining Sustainable Development Goals (SDGs) to which the Arab countries have repeatedly committed themselves over the past decades.**

***Keywords*—science, technology and innovation, Arab countries, quality of research publications, citations, self-citations, Hirsch-index**

I. Introduction

Effective Research, Development and Innovation (RDI) systems are critical to sustainable development in all countries across the world. The need to combat poverty, deal with climate change and ensure food security for all may not be answered without RDI systems capable of the acquisition, adoption of novel technologies and their adaptation to local conditions.

However, in order for national RDI systems to fulfil these roles they would need to possess several attributes, including experienced and dedicated human resources, access to adequate financial means, a good measure of independence as well as the ability to communicate and collaborate with national, regional and international stakeholders and partners. It is only when such requirements are available that a research community is able to: 1) publish original research within domains of interest national, regional or international, 2) expose possibilities for promoting positive change, and 3) inform socioeconomic development policies.

Devoid of the ability to conduct relevant research within priority areas for its own socioeconomic development, will ultimately turn a country into a passive customer for a wide range of goods and services, eventually retarding its sustainable and equitable development. This is especially true in domains such as industrial, agricultural and food production, all of which are impacted by numerous interrelated and complex variables.

Based upon such considerations, governments around the world, including a few in the Arab region, have increased their funding for research carried out at universities and research centers and adopted practices that induced qualified personnel to join various research institutions. However, measuring the effectiveness of enhanced research funding and increased number of researchers remains an issue in need of considerable attention. Thus, while the number of research publications produced by a given country, institution or author, in a certain domain may be taken as a preliminary indicator of creative activity within that domain, other criteria are often needed in order to evaluate the impact and ultimate worth of such publications. The following paragraphs will look at such criteria in reference to research publications Arab countries in all subject categories, as monitored and maintained by a reputable database [1] while concluding remarks at the end of this paper address the need to adopt proactive policy schemes aimed at enhancing research, development and innovation capabilities in the Arab countries

II. Research, Development and Innovation in the Arab Countries

Several Arab countries established research facilities as far back as the first half of the last century. By the early seventies almost all the Arab countries had acquired research centers often manned and directed by national cadres, with more or less regular output of research reports, a few of which found their way into reputable journals, while most were published by their institution's research bulletins. In concrete terms, however, variable levels of human resources, funding as well as a variety of regulations that constrained their activities have often limited the impact of Arab RDI systems upon national development. Fig. 1 presents scores gained by fourteen Arab countries and five of their close neighbors based on estimates made by the Global Competitiveness

[1] Country and Journal Rank portal (SJCR) is a publicly accessible database with information that enables analysis of research publications and world rankings of countries and journals in a variety of research domains based upon Elsevier's Scopus database. The SJCR portal covers research documents published by nearly 28,000 journals covering around 310 subject categories, including several that impact agricultural and food production. Citation data rests upon over 34 thousand titles from more than 5,000 international publishers, while country performance metrics include 239 countries worldwide. Indicators provided by SJCR, in terms of the numbers of publications within a given research subject category and the extent to which they were later cited, by their original, as well as other authors, may be used to assess and analyze a country's or region's research performance within that category [1].

Report in 2019 (GCR-19), regarding their research and development (R&D) capabilities[2] [2]. Fig. 1 indicates that in ten of the Arab countries for which scores were available, R&D capabilities stood well below those of their neighbors; Malta, Cyprus, Turkey and Iran, while R&D capabilities within all of the fourteen Arab countries, for which scores were available stood far below those of Israel. It is worth noting that less populous Arab countries, such as Saudi Arabia, the United Arab Emirates and Qatar, scored higher than the rest of the Arab countries in terms of their research scores, while scores for eleven Arab countries, presently home to around 80 percent of the entire Arab population were inferior to those of Iran.

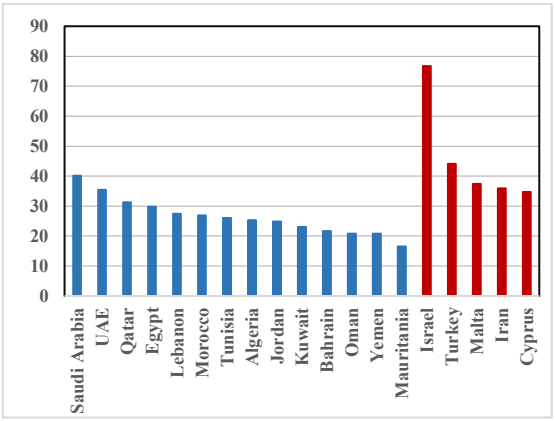

Fig. 1. Research and development scores for Arab countries and five of their close neighbours [3].

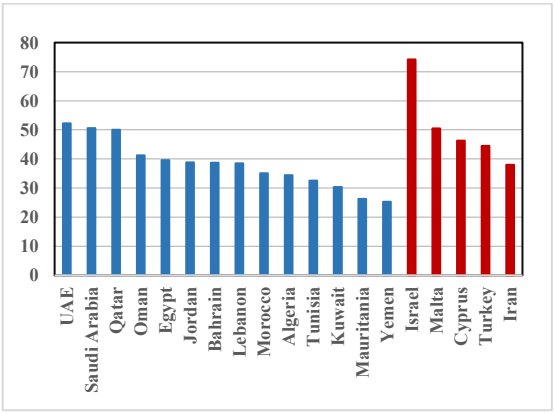

Fig. 2. Innovation capacity scores for Arab countries and five of their close neighbors.

Fig. 2 presents scores listed in the same report for innovation capabilities gained by the same group of Arab countries and their close neighbors [1]. It is to be noted that assessment of innovation capabilities by (GCR-19) were based on scores obtained by a given country with regard to three principal attributes; namely: Interaction and Diversity, Research and Development and Commercialization. In turn, scores regarding Interaction and Diversity rest upon performance within the following four domains: Diversity of workforce, State of cluster development, International co-inventions per million of the country's population and multi-stakeholder collaboration.

Disparities in RDI capabilities among the Arab countries are particularly worrisome since RDI cooperation among the Arab countries is essentially limited, while conditions in countries of the region may vary, similarities, in terms of environmental conditions, water availability, soil quality among many other attributes are widespread within the regions, which would normally be conducive to much closer collaboration. Thus, a recent report by the Federation of Arab Scientific Research Councils (FASRC) indicates that the number of joint research efforts undertaken by the Arab countries during 2013–2022 was estimated at just over 16 percent of all recorded Arab research efforts [3].

III. Researchers in the Arab Countries

Reliable figures on the number of active researchers in countries around the world are relatively hard to come by. In fact, recent data within relevant databases kept by UNESCO and the World Bank on the number of researchers per million inhabitants covering the years 2016–2022 did not include figures for nearly 40 percent of the world's countries during the past two decades. With specific regard to the Arab countries, figures were available for only twelve, or just over half of the Arab countries, during the same period. Additionally, data on the number of researchers per million inhabitants was missing for several Arab countries almost half the years during 2016–2022. This is undoubtedly due to limited attention by concerned government agencies within the Arab countries to the collection and updating of relevant data, signifying the level of importance accorded to endogenous research and development activities by concerned authorities.

Despite the above shortcomings, figures provided by international agencies such as UNESCO and the World Bank are valuable for indicating that rates of growth in the number of Full-Time Equivalent (FTE)

researchers per million inhabitants in the Arab countries have generally been inferior to corresponding average growth rates of several country groups and the world at large. Thus, as presented in Fig. 3, average growth rate for Arab researchers per million inhabitants during 2016–2021, was around 33 percent of the world's average and under 9 percent of that achieved by Turkey, as shown in Fig. 4 [4]. Furthermore, while growth in the average number of FTE researchers per million inhabitants in the Arab countries remained superior to those maintained by low and low-middle income countries during 2016–2021, it consistently maintained levels lower than that achieved by middle-income countries during the same period. Furthermore, since the Arab countries for which no figures are available include countries with even more limited resources, thereby limiting numbers of FTE researchers per million inhabitants, present

[2] Scores on research and development capabilities are based upon scientific publications, patent applications per million of population, R&D expenditure as a percentage of GDP and prominence of research institutions. All of the Arab countries, for which data was available, appeared to underperform their closer neighbors. Moreover, while Arab countries such as the United Arab Emirates, Saudi Arabia and Qatar possess world rankings for innovation capacity estimated at 33, 36 and 38, respectively, more populous countries, including Egypt, Morocco, Algeria and Tunisia, attained much lower rankings, at 65, 81, 86 and 92, respectively.

[3] Scores and world rankings provided by source for only fourteen Arab countries. Thus, scores and rankings, for Comoros, Djibouti, Iraq, Libya, Palestine, Somalia, Sudan and Syria are not included in the above bar charts.

overall Arab averages are rendered overestimates, driving actual average growth rates far lower than their present levels. Hence, consideration of average number of researchers per million inhabitants in the entire group of Arab countries may be of limited utility. Instead, it may be more worthwhile simply to discuss growth rates in countries for which almost complete records are available for the period 2016–2022.

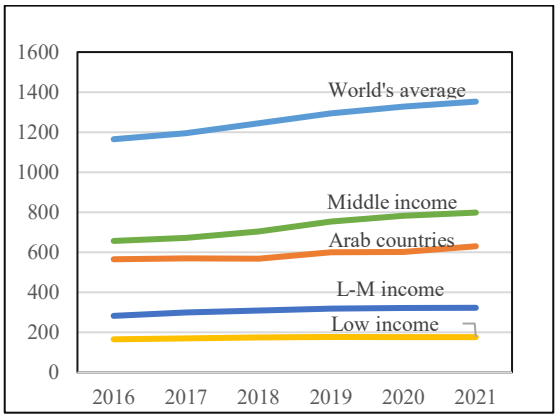

Fig. 3. Average numbers of FTE researches per million inhabitants for the world and selected country groups.

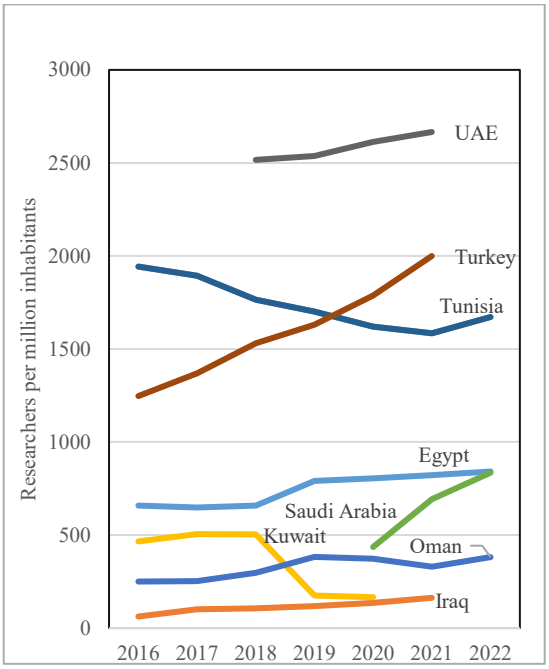

Fig. 4. Number of researchers per million inhabitants for the Arab countries and Turkey.

Fig. 4 presents averages growth in a number of such Arab countries as well as the average growth in the number of FTE researchers in Turkey, for comparison. Fig. 4 also indicates that several Arab countries suffered significant cutbacks in the number of researchers per million inhabitants over the past decade. Such is the case in Kuwait, for example, in which the number of researchers per million inhabitants dropped from over 500 in 2017 down to 166 in 2020. Tunisia provides another example, in which the number of researchers per million inhabitants went down from 1,943 in 2016 to 1,548, before witnessing a limited rise of 88 researchers per million inhabitants in 2022. On the other hand, figures for countries such as Egypt and Iraq indicate somewhat steady growth, in the case of the former country from around 660 to over 840 researchers per million inhabitants during 2016–2022, and in the latter from around 60 to over 160 researchers per million inhabitants during 2016–2021.

IV. Expenditure on Research and Development

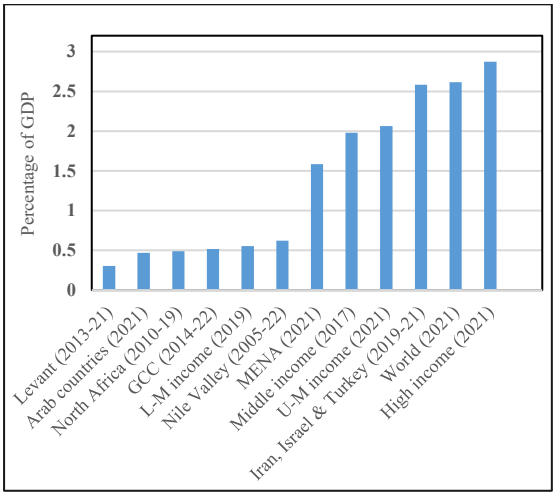

Fig. 5. R&D expenditure on research and development as a percentage of GDP for Arab country groups, the world and selected country groups.

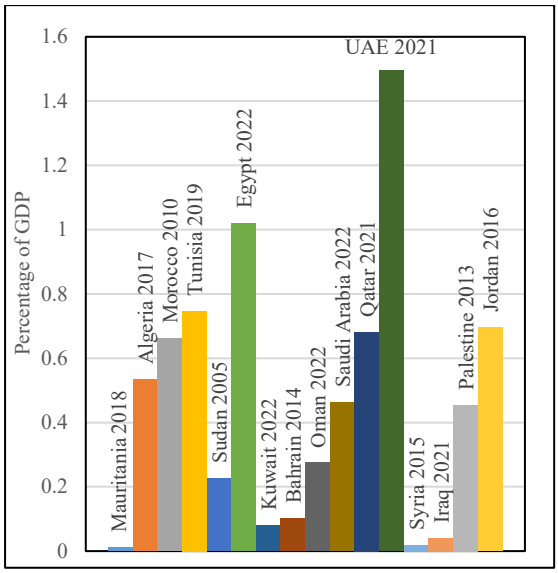

Fig. 6. R&D expenditure as a percentage of GDP for Arab countries during 2005–2022.

Fig. 5 presents a view of average expenditure on R&D by Arab countries, the World and selected country groups, during the past two decades as a percentage of GDP[4] [5]. This Figure clearly indicates that, average annual R&D spending by Arab countries for which reasonably reliable data is available, was less than a quarter of the annual average spent by middle-income countries and around 18 percent of average spending by countries around the World. Fig. 6, on the other hand, enables comparison of annual R&D expenditure by individual Arab countries as a percentage of each country's GDP, indicating that the United Arab Emirates comes first, among all other Arab countries, having spent around 1.5 percent in 2021 [5]. The Emirates is followed by Egypt, which was estimated as having spent 1.0 percent of its GDP

[4] As indicated above, figures on overall spending by the Arab countries on research and development as a percentage of GDP, are quoted by UNESCO while no figures were available for ten of the Arab countries.

on R&D activities in 2022. Within the Arab countries of North Africa, Tunisia, Morocco and Algeria annually spent 0.75, 0.66 and 0.55 percent of their GDP, respectively, exceeding the average annual expenditure by the entire group of Arab countries. Saudi Arabia's annual spending was quite close to the Arab countries average, having spent 0.463 percent of its GDP during the second decade of the current century. On the other hand, in 2016, Jordan spent around 0.7 percent of its GDP on R&D activities, considerably in excess of the average for the entire group of the Levant Arab countries, while Iraq and Syria lagged behind Jordan and Palestine, having spent 0.04 and 0.02 percent of their GDP, in 2015 and 2021, respectively.

V. Research Publications by the Arab Countries

Assessing endogenous research capabilities ought to provide insight into a country's abilities to institute, and adapt to change in order to enhance its productive capabilities and socioeconomic development, in quantitative and qualitative terms. Examples, from many countries across the World bear witness to the fact that lack of effective endogenous research capabilities, capable of responding to socioeconomic policies, exposes societies to damaging exploitation by a variety of actors, including multinational firms, and may often result in serious socioeconomic problems and environmental deterioration. While several measures may be used in evaluating national research capabilities, the most readily accessible relates to assessing the quality of research output as embodied in published research documents, essentially as indicated by the number of research documents published and the extent to which they were cited.

Thus, the frequency with which a research publication has been cited is often used as a measure of its contribution to its domain of research activity. However, the total number of citations per research document includes self-citations, made by their own authors, which might exaggerate the extent to which a paper has contributed to its own field of research. Thus, while self-citation is a legitimate means of referring to an author's earlier publications, they are sometimes made in order to inflate an individual scientist's reputation. On the other hand, self-citations might be positively interpreted and quoted as an indicator of the extent to which a research discipline has taken roots within a given country or institution, giving rise to the creation of solid research capabilities within that discipline. Nevertheless, the fact that self-citations are usually counted among total citations received by a research document could lead to a distorted view of the topical nature or inherent quality of research documents. It would hence, be helpful to also look at citations of a given paper made by authors less those accorded by its own authors.

Such were the considerations that led to the development of the Hirsch-index (H-index); [5] intended to represent both the productivity and the impact of a particular scientist, or a group of scientists, within a given research group, country or region. The H-index is calculated by counting the number of publications for which an author has been cited by other authors at least that same number of times. Thus, an H-index of 12 would mean that the author has published at least 12 papers with each cited at least 12 times. However, if the author's 13th most cited publication was cited only 9 times, then the H-index would maintain its previous value of 12. On the other hand, if the author's 13th most cited publication have been cited 13 or more times, then the H-index would go up to 13. Hirsch-index values tend to eliminate a skewed image of an author's impact within his or her field. Thus, if an author published many years ago a single paper that was cited over hundreds of times, but then went on to publish papers that were cited 3–4 times each, a simple citation count for that scientist would indicate that the author's work over the years was quite significant. However, the H-index value for that same author would be rather low, indicating that the author's overall work was not necessarily as significant as the simple average citation count indicates.

While their numbers and the extent to which published research papers are cited may provide a measure of research activity and the quality of its outcome, detailed and in-depth analyses are still essential for estimating the actual impact of research publications on the adoption of effective policies and practices contributing towards sustainable and equitable development. This is especially the case at present times, given the wide proliferation of national and international research periodicals, and the ease with it is possible to publish research papers on a variety of Internet sites.

Using the above-mentioned indicators, the following paragraphs attempt an overall assessment of research activities undertaken by Arab countries in all subject categories during the period 1996–2022.

VI. Growth in the Arab Countries' Research Publications

The Arab countries' research publications in all subject categories grew steadily from around 0.8 percent of the entire World's output in 1996 to just under 3.8 percent in 2022. On the other hand, as indicated by Fig. 7, three of the Arab countries' close neighbors, namely Iran, Israel and Turkey published around 1.5 percent of the World's research documents in 1996 and continued to exceed the Arab countries output for more than two decades before they were overtaken by the Arab countries around 2019 [6]. Most of this growth is due to the large increase of the number of research publications by a limited group of the Arab countries, with Egypt and Saudi Arabia contributing most. Taken all together, the Arab countries produced just under 2.1 percent of the entire World's research publications in all subject categories between 1996 and 2022, while their three close neighbors, Iran, Israel and Turkey managed around 2.9 percent. The Arab countries appear to have published 7 percent of all countries in Western Europe, 46.7 percent of all countries in the Middle East and just under 73 percent of three of their close neighboring countries, namely, Iran, Israel and Turkey. See Annex Table (A1).

Fig. 8 depicts the shares of research documents published by the five principal groups of Arab countries during 1996–2022. At, 38 percent, the GCC Arab countries clearly possess the largest share followed by Egypt and Sudan, at around 23.3

[5] Named after Jorge E. Hirsch, a physicist at the University of California, San Diego, who suggested its usage in 2005 as a tool for determining theoretical physicists' relative quality. The index is sometimes referred to as the Hirsch index or Hirsch number.

percent.[6] The high percentage for these Nile Valley countries is essentially due to the large number of research documents published by Egypt. In fact, Sudan contributed just under 1 percent of the total number of research documents published by the entire group of Arab countries [6].

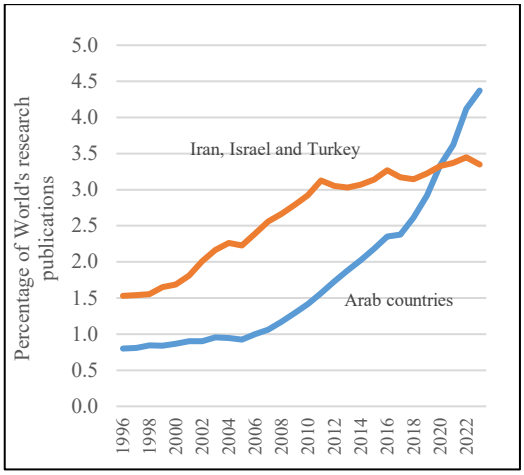

Fig. 7. Growth of research publications in all subject categories by Arab countries and their three closest neighbors as a percentage of the world's (1996–2023).

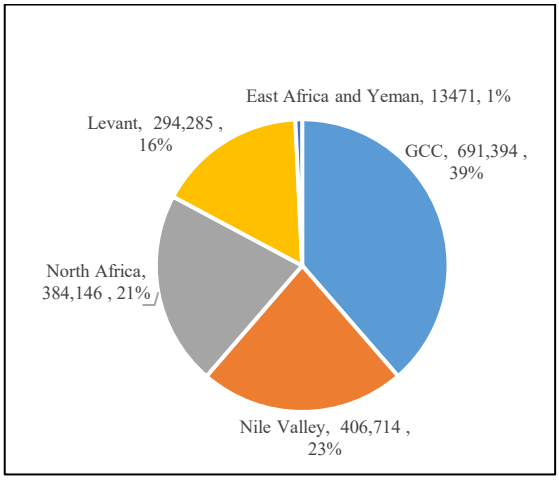

Fig. 8. Shares of Arab country groups out of total publications in all subject categories by Arab countries during 1996–2023 (%).

The relatively large proportion of research documents published by the GCC countries is largely due to contributions by Saudi Arabia, which produced around 63 percent of all GCC publications, with the Emirates coming second, at just under 18 percent of the GCC countries' total.

The Arab countries of the Levant produced 15.8 percent of all Arab publications, with Iraq leading within this group at 6.4 percent of the total, and Syria coming last at just over 0.7 percent. Among the countries of East Africa and Yemen, Comoros, Djibouti and Somalia together managed only 0.1 percent of all publications by the Arab countries, while Yemen produced around 0.6 percent; a proportion approaching that attained by Syria in the Levant.

Looking at relative research contributions by individual Arab countries within all subject categories, Saudi Arabia ranks first with almost 23 percent of all publications produced by the entire group of Arab countries. The leading position taken by Saudi Arabia, with regard to the number of its research publications, may at least be partly attributed by the fact that, several Saudi universities took the initiative to elicit affiliations by highly productive and well-regarded authors, in exchange for generous reimbursements [7].

Saudi Arabia is closely followed by Egypt at around 22 percent of the Arab countries publications. Tunisia, Morocco and Algeria follow in third, fourth and fifth positions having produced around 8.0, 6.9 and 6.7 percent of all Arab research publications, respectively.

Interestingly, the number of Iraq's research documents published in all subject categories grew gradually, from around 600 documents in 2009, to over 4,450 in 2017, then spiked during 2019-2022 to reach almost 20,000 documents in 2022. Logical explanations for such growth would be difficult to make. Several Iraqi experts were approached in pursuing reasons for this sudden growth. While some referred to the fact that research allocations were increased around that period, others provided negative explanations, including a rise in plagiarism and other malpractices at some of Iraq's universities.[7] [8] See Fig. 9.

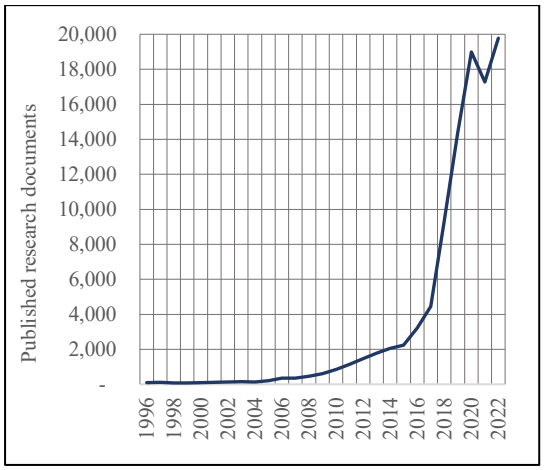

Fig. 9. Research Documents Published by Iraqi researchers in all subject categories during 1996–2022.

At 6.2 and 168, respectively, both citations per document as well as the H-index value for Iraq's research documents published in all subject categories would seem to support the idea that this country's research output was essentially of poor quality.

Arab countries that performed poorly in terms of the volume of their research output included Palestine, Bahrain, Sudan and Libya, which published between 0.8 and 0.6 percent of all research documents produced by the Arab countries. Mauritania, on the other hand, managed 0.07 percent, while together, Comoros, Djibouti and Somalia produced even smaller percentages, of between 0.015 and 0.062 percent of all Arab research output.

[6] As percentages of the entire World's output, figures for published research documents published by the GCC and Nile Valley countries translate into 0.8 and 0.49 percent, respectively. The latter percentage is mainly due to Egypt's research output. The Arab countries of North Africa come third with almost 0.47 percent of the World's research output in all subject categories, followed by the Levant countries at 0.33 percent. Yemen and East Africa's Arab countries come last with a mere 0.02 percent of the World's research output, essentially due to Yemen's research publications, adding up to 0.013 percent of the entire World's.

[7] Private communication.

VII. Citations per Research Document

The number of citations received by a given research document constitutes a measure of interest in its contents and a possible reflection upon its topical nature and inherent quality. Table 1 presents citation and H-index figures for research documents published by groups of the Arab countries in comparison with corresponding data for the World at large as well as selected country groups. At 13.9, the average number of citations per research document attained by the Arab countries' research documents published during 1996 – 2023, falls considerably below the World's average, estimated at around 20 citations per research document as well as that of the average value of their three close neighbors, Iran, Israel and Turkey, estimated at 18.6. In fact, the African countries, which appear to have performed less satisfactorily than the Arab countries based upon their mean H-index, gained 16.8 citations per research document, as opposed to the Arab countries' 13.9. On the other hand, Western Europe's top ranking 15 countries, in terms of their research output, attained an average number of citations per document of 28.9, while the entire group of 30 Western European countries, attained an average of 25.8 citations per document.

Table 1. Average citations per research document published in all subject categories and H-index values for the World, Arab and selected groups of countries (1996–2023) [6]

	Average citations per document		Average H-index values [8]
	Values	Variance	
Arab countries			
GCC countries	15.9	6.09	293
Levant	14.1	15.00	208
Nile Valley	14.8	0.02	275
North Africa	12.1	0.68	188
East Africa and Yemen	12.6	6.65	56
Arab countries [1]	13.9	8.76	205
World and other country groups			
World	19.9	93.71	277
Top 15 Western European countries	28.9	21.49	1168
Western Europe	25.8	53.84	667
Iran, Israel and Turkey	19.8	54.50	668
MENA countries [9]	15.6	17.04	318
Africa [10]	17.9	44.83	133

That the number of citations per research document indicates the existence of well-established research facilities, producing quality research output that elicits more citations by other researchers is supported by figures for the variance in numbers of citations in both groups of Western European countries. Thus, as indicated by Table 1, variance among citations per document for the top 15 Western European countries is 21.5, while that for the entire groups as well as the World at large.

group of Western European countries was 53.8.[11] On the other hand, as shown by Table 1, variance of citations per published research document is lowest in the case of the Arab countries, underscoring prevalence of low numbers of citations per research document published across the Arab group of countries compared to those within other country

As shown in Table 1, during 1996–2023, the GCC countries took the lead among other Arab country groups, with 15.9 citations per document. The Nile Valley countries; Egypt and Sudan, and the Levant countries; which include Iraq, Jordan, Lebanon, Palestine and Syria, came in second and third positions, at 14.8 and 14.1 citations per document, respectively. The Arab countries of Arb countries of East Africa and Yemen came fourth at 12.1, marginally ahead of the Arab North African countries, despite the fact that the latter group's average H-index score was almost four times that of the latter.[12] Thus, while Yemen and East Africa's Arab countries scored lowest in terms of their average H-index value among all the Arab country groups,[13] their average citations per research document were only 3.0 less than the GCC countries.

As to citations per document produced by individual Arab countries, Qatar came first with nearly 20.3 citations per document, while Saudi Arabia ranked second at 17.6 citations per document. However, Qatar attained around 50 percent of Saudi Arabia's average H-index, based upon both countries' entire research output during 1996–2023, diminishing the significance of its higher ranking based on the number of citations per document.

VIII. Self-Citations of Research Document

Self-citations of research documents published by a given author, research institution or country within a certain domain are indicative of continued research activity that is building upon earlier achievements within the same or related domains. On the other hand, excessive self-citation by authors is a negative sign, indicating possible biases and adoption of a narrow scope in accessing relevant research documents as valid sources for knowledge.[14]

Table 2 presents figures on self-citations per citable research document published during 1996–2023. Figures presented by Table 2 suggest that the Arab countries somewhat lagged behind a number of country groups as well as the World's average number of self-citations per document,

[8] The average value of citations per published research document is calculated from figures for individual Arab countries rather than the regional averages quoted above. See Annex Table (1), below.

[9] Nineteen countries are considered as belonging to the MENA region; namely: Algeria, Bahrain, Egypt, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, Turkey and the United Arab Emirates.

[10] Excluding North and East Africa's Arab countries as well as Egypt.

[11] While the entire group of Western European countries include the United Kingdom, France, Germany and other countries with well-established research facilities, they also include smaller countries, such as the Faroe Islands, Andorra, Monaco, with fewer and more modest research facilities, eliciting fewer citations.

[12] The fact that a given pair of countries, or groups thereof, might possess considerably differing H-index values, while their average number of citations per document are somewhat close signals the need for more detailed analysis. In principle, however, H-index values may be a better measure of research quality, than the mere number of citations per document.

[13] Yemen and the Arab countries of East Africa attained only 17.6 percent of the corresponding average for the GCC countries and around 27 percent of the average value for the entire group of Arab countries.

[14] Clearly excessive self-citation might indicate that research undertaken is self-serving and/or takes a narrow view of available research results.

scoring 1.65 as opposed to 1.96 and 3.76 self-citations per research document made, respectively, by all the World's countries and their three close neighbors, Iran, Israel and Turkey.

As for self-citations by groups of Arab countries, Table 2 indicates that Egypt and Sudan take the lead with an average of 2.26 self-citations per document, followed by the Arab countries of North Africa at 1.75 self-citations per document, with the GCC and the Levant countries taking fourth position, attaining an average of around 1.7 self-citations per document. Yemen and the Arab countries of East Africa take fifth position with an average of just over one self-citation per research document.

Table 2. Self-citations per citable document in all subject categories by authors in the Arab countries, the world and selected country groups (1996–2023) [6]

	Self-citations per document	
	Average	Variance
All the World's countries [1, 2]	1.96	2.74
World's top ranking 50 countries	4.11	4.48
World's least ranking 50 countries	0.45	0.27
All 30 Western European countries	3.14	3.67
Top 15 Western European countries	4.71	1.33
All African countries	1.76	1.13
MENA countries	2.12	0.97
Arab countries	1.65	0.48
GCC	1.72	0.45
North Africa	1.75	0.57
Nile Valley	2.26	1.03
Levant	1.69	0.06
East Africa and Yemen	1.08	0.12
Iran, Israel and Turkey	3.76	0.34

(1) Research documents of fourteen of the lesser productive 243 world countries were not available from source.

(2) All 243 countries included by source. [8]

Egypt and Saudi Arabia head the entire group of Arab countries, with averages of around 3.3 and 3.0 self-citations per document, respectively. Three of the Arab countries of North Africa, namely Morocco, Tunisia and Algeria had more than two self-citations per document published during 1996–2023; at 2.5, 2.3 and 2.2, respectively, while all the rest of the Arab countries had less than two self-citations per document. Notably, three Arab countries, namely Bahrain, Somalia, and Libya, had less than one self-citations per document, estimated at 0.83, 0.68 and 0.63, respectively.

Table 2 enables comparison of variance among the number of self-citations per document for the Arab countries taken all together with averages for the World at large as well as selected country groups. Average self-citations for Western Europe's top ranked 15 countries, compared to all of Western European countries seem to support the notion that the number of self-citations per research document indicates that a given country possesses well-established research facilities engaged in building upon their past output. The top scoring 15 countries of Western Europe averaged 4.7 self-citations per document, with a rather low value for variance within this group; estimated at 1.3. However, the entire group of Western European countries averaged 3.1 self-citations per document with a much higher variance, at 3.7.

As indicated by Table 2 at 1.65, the Arab countries scored the lowest average number of self-citations per research document, compared to the world's average as well as averages for country groups, such as the countries of Western Europe, their three neighboring countries, Iran, Israel and Turkey as well as all the countries of the African continent. Table 2 also indicates low variance among average values for self-citations per research document published by researchers in the Arab countries, indicating that they generally made self-citations close to their collective average.[15]

IX. H-Index Values of Research Documents

The Arab countries' research documents published in all subject categories during 1996–2023 gained an average H-index value of 205, which comes to less than one third of the average attained by their close neighbors, Iran, Israel and Turkey and the countries of Western Europe. See Table 3.

Table 3. Average H-index values for Arab countries and selected other groups of countries 1996–2023 [6]

Arab country groups	
GCC countries	293
Nile Valley	275
The Levant	208
North Africa	188
East Africa and Yemen	56
Arab countries	205
World and selected country groups	
World	277
Western Europe	667
Top 15 Western European countries	1168
MENA countries	317
Neighboring countries	668
Africa*	133

* Including North and East Africa's Arab countries as well as Egypt.

The GCC countries head the list of Arab country groups with 293 as an average H-index for their collective research output during the years 1996–2023. Next to the GCC countries, come Egypt and Sudan with an average of 275, trailed at 208 and 188, respectively, by the Arab countries of the Levant and North Africa. On the other hand, taken together, the Arab countries of East Africa and Yemen come last with an average of 56 for their collective H-index.

With regard to H-index values achieved by individual Arab countries in relation to their research publications during the period 1996–2023, Saudi Arabia heads the list with 562, followed by Egypt, the United Arab Emirates and Lebanon with H-index values estimated at 369, 295 and 272, respectively. The Arab North African countries, Algeria, Morocco and Tunisia, together with Jordan in the Levant achieved comparable values of the H-index, ranging between 244, for Tunisia and 222 for Algeria.

Arab countries whose average H-index values during the period 1996–2023 might have been expected to be higher, based upon the history of higher education and research, and their immense needs include Syria, Palestine, Sudan and Bahrain. These countries scored average H-index values between 136, for Syria and 114, for Bahrain, far below corresponding values for the entire group of Arab and Middle Eastern countries, which came up to 185 and 304, respectively.

[15] Other groups of countries reported by (SCJR) included the Asiatic countries and the countries of the Pacific region, which had average self-citations per research document at 2.2 and 1.4, respectively, with variances of 1.9 and 1.7, in that order [6].

X. Conclusion

The need for action with view to enhancing research, development and innovation capabilities in the Arab countries has been evident for several decades now. However, a number of recent challenges, including climate change and widespread socioeconomic crises, render such action more urgent than at any time in the past. Priority would have to be accorded to action aimed at the revision and reformulation of past policies changes and related implementation strategies.

In conclusion, it is well to note that research output by the Arab countries in all subject categories did experience significant improvements over the past two decades. Nevertheless, it is yet to improve, in both quality and quantity if it is to face up to current and future challenges. Emphasis upon improved quality will need to be embedded within future policies. This is particularly since, while the number of Arab research publications have increased, their quality, particularly as manifested by indicators such as the frequency of their citations, self-citations and H-index values signify that their quality falls behind that for many other countries and country groups across the world, including some of their closer neighbors. Those same indicators also lead to the conclusion that only a few Arab countries have in fact advanced towards the establishment of effective research schools, engaged in building upon available knowhow while also expanding their knowledge frontiers. As revealed by the experience of many research institutions around the world, enhancing spending, acquiring fresh physical facilities and recruiting higher numbers of research personnel, on their own, are unlikely to result in vast improvements. On the other hand, intensive training, personal and institutional incentives, attracting fresh talent, enhanced collaboration with well-established partners have been shown to bring about valuable outcomes far more often.

Appendix

Table A1. Publications in all subject categories during 1996–2023 by Arab countries, some neighboring countries, the World and selected country groups [6]

Country	Documents	Citable documents	Citations	Self-citations	Citations per document	H-index
Arab countries[1]						
Saudi Arabia	419,090	402,188	7,363,450	1,214,704	17.6	568
Egypt	389,675	374,770	5,816,259	1,228,129	14.9	409
Tunisia	134,434	127,012	1,719,289	290,297	12.8	271
Morocco	122,005	114,496	1,364,140	288,190	11.2	261
Algeria	116,123	112,604	1,257,462	252,730	10.8	239
UAE	124,488	114,062	1,797,970	186,576	14.4	329
Iraq	126,881	124,059	887,934	232,916	7.0	199
Jordan	82,514	79,424	1,095,944	153,686	13.3	251
Lebanon	57,050	51,845	1,025,295	86,535	18.0	295
Qatar	55,757	50,990	1,129,202	98,383	20.3	295
Kuwait	39,905	37,702	624,954	53,242	15.7	220
Oman	37,402	33,945	562,959	50,047	15.1	217
Sudan	17,039	15,937	250,146	19,895	14.7	140
Bahrain	14,752	13,340	183,677	11,037	12.5	127
Palestine	15,201	14,352	253,715	24,845	16.7	147
Syria	12,639	11,960	197,101	14,647	15.6	146
Yemen	11,585	11,149	168,784	17,940	14.6	119
Libya	10,360	9,921	133,118	6,293	12.9	112
Mauritania	1,224	1,150	15,747	1,231	12.9	58
Somalia	1,108	1,014	9,497	685	8.6	38
Djibouti	497	474	6,083	528	12.2	39
Comoros	281	262	4,250	240	15.1	27
Totals and averages [2]	1,790,010	1,702,656	25,866,976	4,232,776	13.9	205
Three closest neighbors						
Turkey	919,863	852,300	13,171,771	2,603,646	14.32	601
Iran	886,359	857,630	13,089,835	3,851,805	14.77	490
Israel	514,345	465,525	15,531,596	1,741,362	30.2	914
Totals and averages [2]	2,320,567	2,175,455	41,793,202	8,196,813	19.8	668
World's and selected country groups' sums and averages						
World	80,091,790	73,254,291	1,882,711,431	523,150,386	19.9	277
Western Europe	23,620,937	21,081,868	669,222,718	117,502,072	25.8	667
Africa	1,878,160	1,743,291	29,806,066	5,226,743	17.9	133
Middle East	3,707,506	3,495,241	62,900,446	11,569,500	15.9	333

Notes: (1) Ordered according to their world rankings; which translate into ranking with regard to the number of publications per country during 1996-2023. (2) Totals for the number of research documents, citable documents, citations and self-citations and averages for rankings, citations per document, H-index values.

Conflict of Interest

The author declares no conflict of interest whatsoever.

References

[1] SCJR Journal and Country Rank Portal. (2024). [Online]. Available: www.scimagojr.com/journalrank.php

[2] The World Economic Forum's Global Competitiveness Report 2019, ISBN-13: 978-2-940631-02-5

[3] M. R. Abdulsalam and F. Bensaid. "Scientific research and innovation in the Arab homeland," Report in Arabic by the Federation of Arab Scientific Research Councils (FASRC). December 2023.

[4] Researchers per million inhabitants, United Nations Educational, Scientific and Cultural Organization, (UNESCO) Statistics, November 2024.

[5] Research and development expenditure as a percentage of GDP, The World Bank, World Development Indicators, January 2024.

[6] (September 2023). SCJR; Ranking of countries' publications in all subject categories during 1996–2022. [Online]. Available: https://www.scimagojr.com/countryrank.php

[7] O. F. Bizri, *Science, Technology, Innovation and Development in the Arab Countries*, Academic Press, 2018, ISBN: 978-0-12-812577-9.

[8] SCJR; Ranking of countries' publications in the agronomy and crop science, during 1996–2023. (August 2024). [Online]. Available: https://www.scimagojr.com/countryrank.php?category=1102