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Statistical Bulletin No. 8



Scientific Research in the Arab Countries (compared to other regions of the world)

December 2022

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-DECEMBER 2022-

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Introduction

The scientific progress of countries is generally measured by the degree of importance attached to scientific research, and the effort made to leverage scientific knowledge in all development sectors. While some countries are allocating significant funding for scientific research, others still lack the needed will and resources, and are accordingly investing little effort in this regard.

Scientific research is a key driver of sustainable development, and a means to measure the degree of society's advancement. There is, in fact, a strong correlation between scientific research and societal progress, with all countries devoting attention, albeit to varying degrees, to promoting research and development (R&D) and building R&D-based knowledge societies. Accordingly, researchers and graduate students, whatever their field of research, are called on to leverage modern technology and digital transformation to promote scientific research in the service of sustainable development.

Target 9.5 of the Sustainable Development Goals aims to “*enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people, and public and private research and development spending*”.

With this Target in mind, the present Statistical Bulletin sheds light on the state of scientific research in the Arab countries and around the world, and its role in achieving sustainable development. The data and indicators provided in this Bulletin are drawn from reliable sources, including the UNESCO Institute for Statistics, the World Bank, and the International Telecommunications Union.

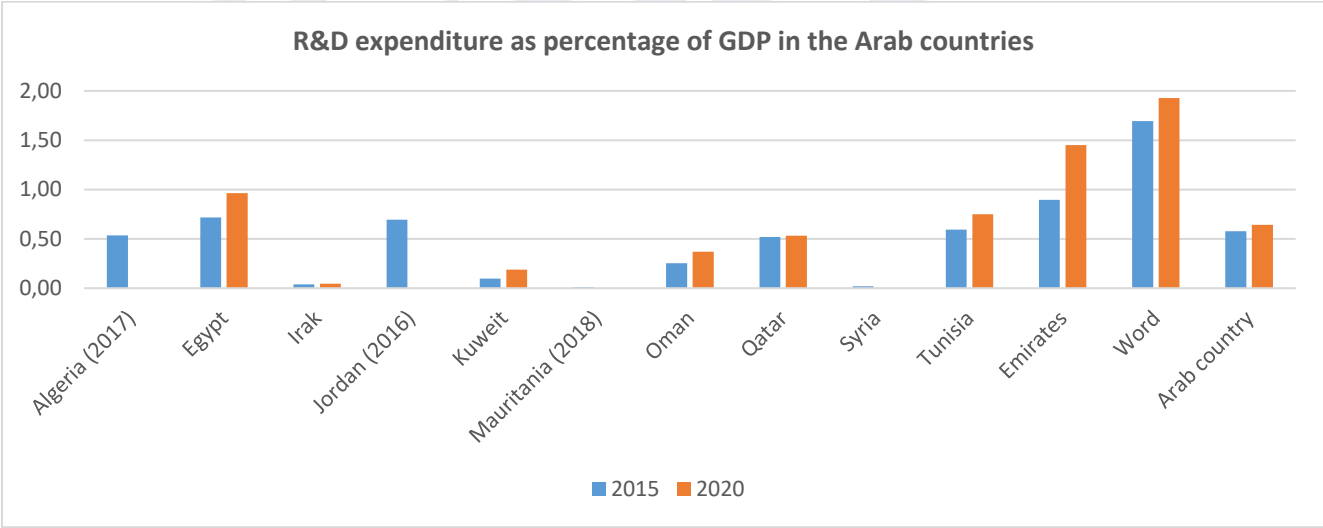
The present Bulletin uses relevant data and indicators to monitor the current situation and future prospects in the vital field of research and development. However, it should be pointed out that the data available are not sufficient to draw a complete picture of R&D expenditures and the number of R&D personnel, as very few Arab countries produce data in line with global standards. This might impede the ability to gain an accurate understanding of the true role of scientific research in achieving sustainable development across the Arab world.

1 – R&D EXPENDITURES :

1-1. R&D expenditure as percentage of GDP in the Arab countries (2015 – 2020) :

Figure 1 shows that spending on R&D as percentage of the GDP (% of GDP) has increased in all Arab countries in varying proportions. There has been significant evolution in UAE, Egypt, Tunisia, Qatar, Oman and Kuwait, contrary to other Arab countries where the level of spending on R&D still falls short of expectations.

Figure 1



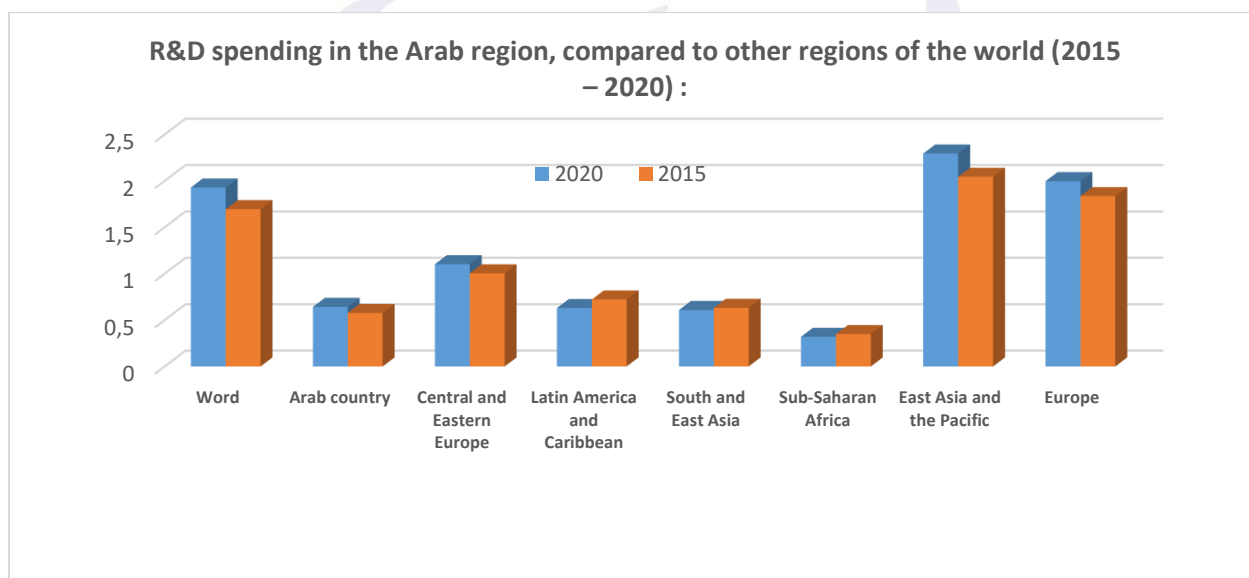
Source : IUS

1-2. R&D spending in the Arab region, compared to other regions of the world (2015 – 2020) :

The data available for the years 2015 and 2020 show that R&D expenditures (as % of GDP) have increased in most regions, except for sub-Saharan Africa, South Asia and Latin America, where the indicator has slightly decreased, compared to 2015. The Arab average increased by only 0.06 points, from 0.58% in 2015 to 0.64% in 2020, while the global average went up by 0.64 points, from 1.69% in 2015 to 1.93% in 2020.

The data available by country show some disparity in terms of R&D expenditure. The indicator increased in the UAE by 0.55 points between 2015 and 2020. More significant increases were recorded in other countries, such as South Korea (+0.84 points) and the USA (+0.67 points). In contrast, the indicator fell significantly in Slovakia (-0.25 points) and Ukraine (-0.21 points).

Figure 2

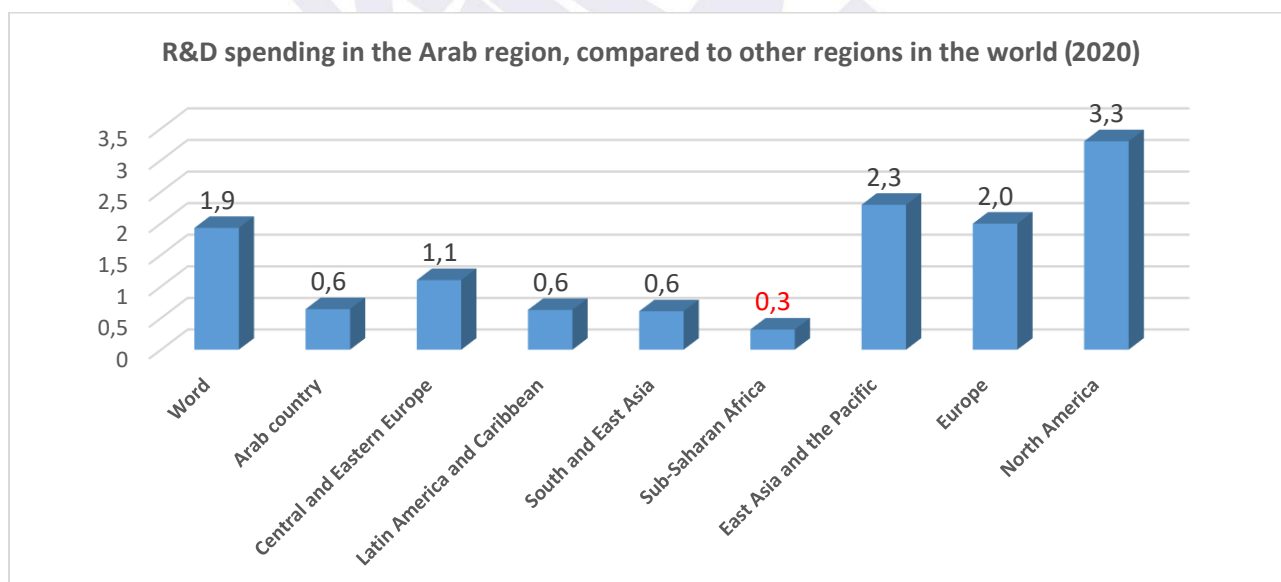


Source : IUS

1-3. R&D spending in the Arab region, compared to other regions in the world (2020):

The available data show that the regions with the highest R&D spending (as % of GDP) are North America (3.3%), followed by East and Southeast Asia (2.3%), and then Europe (2.0%). The percentage is 1.1% in Central Asia and West Asia, compared to an average for the Arab world not exceeding 0.6%, as is the case in South Asia and Latin America and the Caribbean. The average for sub-Saharan African countries does not exceed 0.3%.

Figure 3

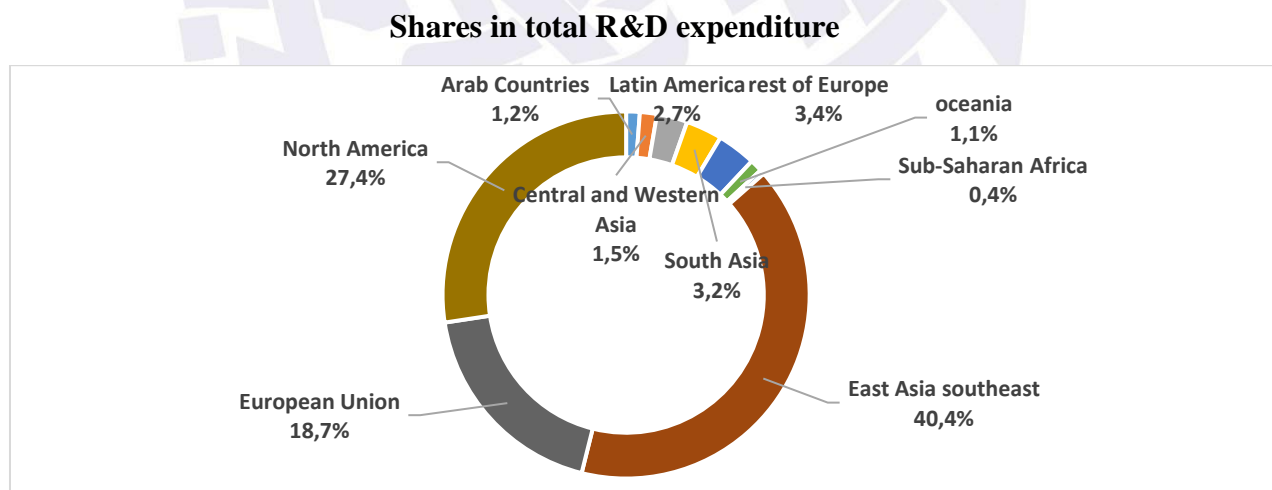


Source : IUS

1-4. Shares in total R&D expenditure (by region) :

As shown by Figure 3, three regions accounted, in 2019, for 86.5% of global spending on R&D, namely : East and Southeast Asia (Korea, China and Japan) with 40.4%, North America with 27%, and the European Union with 19%. The average for the Arab countries, taken together, did not exceed 1.2% of the total global spending. The lowest percentage of spending was recorded in Oceania, with 1.1%, and in sub-Saharan Africa, with 0.4%.

Figure 4



Source : IUS

2 – R&D HUMAN RESOURCES :

2-1. Number of R&D personnel per million inhabitants in the Arab countries

The latest data released by the UNESCO Institute for Statistics for the period 2015-2020 reveal a disparity between Arab countries in terms of R&D personnel, due perhaps to political, economic and social factors. The UAE recorded the highest indicator in 2020 with over 2424 R&D personnel per million inhabitants, compared to 1980 R&D personnel in 2015.

In Tunisia, the indicator went down from about 1800 R&D personnel per million inhabitants in 2015 to 1659.9 in 2020. The same holds true for Kuwait, with 395.8 R&D personnel in 2015, against 173.5 in 2020.

Egypt and Saudi Arabia recorded, respectively, 838 and 453.2 R&D personnel per million inhabitants in 2020. The number is below 400 in the other Arab countries (Table 1).

There is still significant potential to enhance the R&D sector in the Arab countries, but this requires providing the needed infrastructure and scientific research centers, allocating adequate budgets to meet research needs, and developing policies and legislations regulating and stimulating research and innovation.

Table 1

Number of R&D personnel per million inhabitants in the Arab countries

Country	2015	2016	2017	2018	2019	2020
Algeria	..	..	819,3	..	..	..
Egypt	672,9	689,2	677,1	686,7	825,0	838,0
Irak	65,8	64,8	105,9	111,1	122,6	141,4
Jordan	252,4	592,4	596,0	..	..	..
Kuwait	395,8	478,2	501,6	513,9	184,2	173,5
Morocco	..	1073,5	..	..	..	..
Oman	212,5	239,8	242,4	281,2	354,9	334,9
Qatar	584,0	..	..	577,3	..	..
Saoudia	..	..	..	..	..	453,2
Syria	91,0	..	..	..	..	..
Tunisia	1800,1	1997,4	1945,5	1812,3	1744,9	1659,9
Emirates	1980,5	2383,1	..	2378,9	2382,1	2442,5
World	545,5	573,7	579,0	578,4	612,0	614,1
Arab countries	1160,0	1182,8	1215,1	1265,0	1317,4	1341,8

Source : IUS

2-2. Number of R&D personnel per million inhabitants, by region (2015-2020):

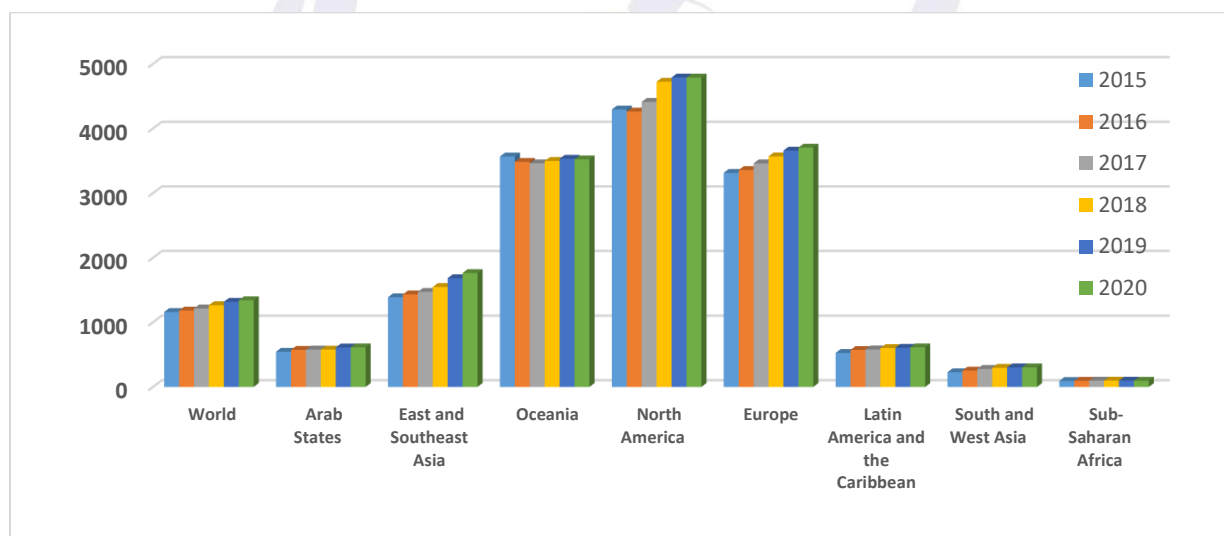
Figure 5 shows a significant increase, in recent years, in the average for the Arab World, which went up from 546 R&D personnel per million inhabitants in 2015 to over 614 in 2020. The same holds true for all other regions in the world, but in varying proportions. This shows that all countries of the world, including the Arab region, are investing efforts to enhance research and development, as part of implementing the Sustainable Development Goals.

Figure 5 also indicates that the highest percentages were recorded in the countries of North America, Europe, East Asia and the Pacific. The average for the countries of North America and Western Europe was higher than that for other regions of the world.

Though the average recorded for the Arab world in 2020 (614 R&D personnel per million inhabitants) exceeded that of the countries of Latin America, the Caribbean, South and West Asia, and sub-Saharan Africa, it remained low compared to the global average (1342 R&D personnel per million inhabitants).

Figure 5

Number of R&D personnel per million inhabitants



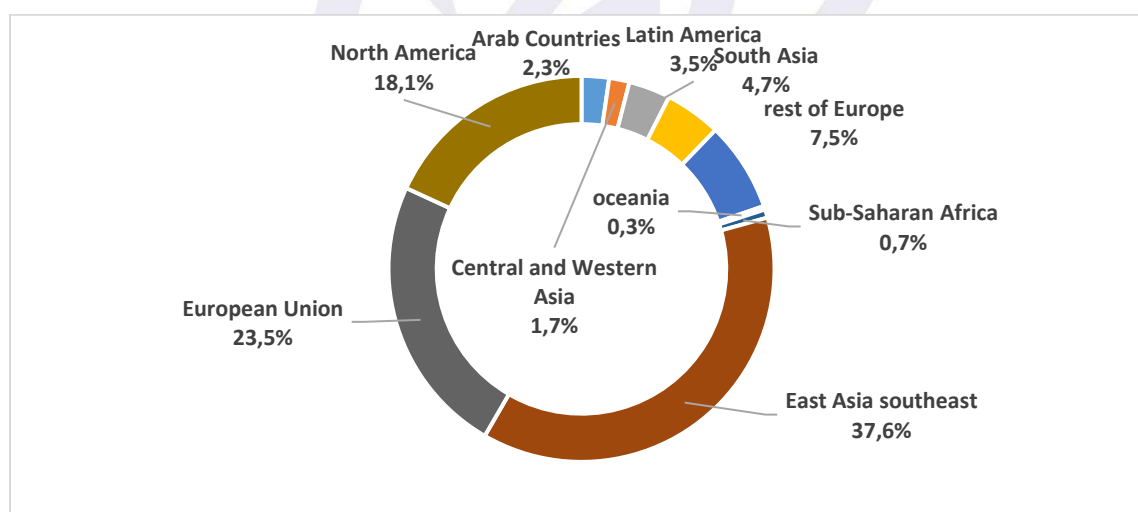
Source : IUS

2-3. Shares in total R&D personnel (by region):

According to data released by the UNESCO Institute for Statistics, three regions accounted, in 2019, for 79.3% of the total number of R&D personnel, namely East and Southeast Asia with 37.6% (Korea, China and Japan), the European Union with 23.5%, and North America with 18.1% (Figure 6). The percentage for the Arab countries, taken together, was only 2.3% of the global total. The lowest percentages were recorded in sub-Saharan Africa (0.7%) and Oceania (0.3%).

Figure 6

Shares in total R&D personnel (by region)

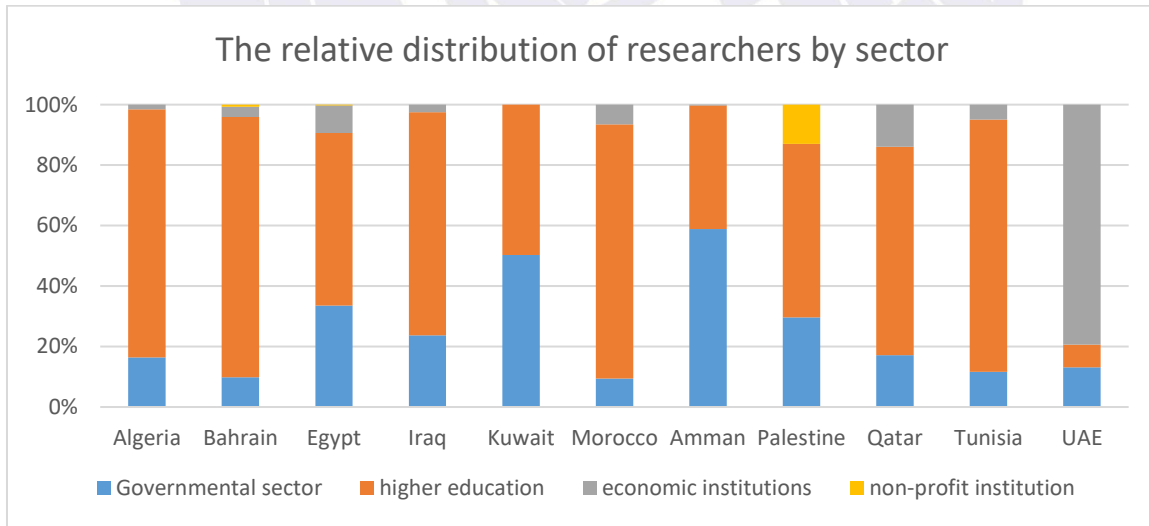


Source : IUS

2-4. R&D personnel in the Arab countries, by sector :

Figure 7 shows that most R&D personnel are in higher education institutions or in the government sector. In most Arab countries, economic institutions do not have a significant contribution in this regard, with a percentage ranging between 0 and 13% of the total number of R&D personnel. In the UAE, however, the percentage is as high as 80%, which is close to the percentages recorded in reference countries in terms of research and development.

Figure 7

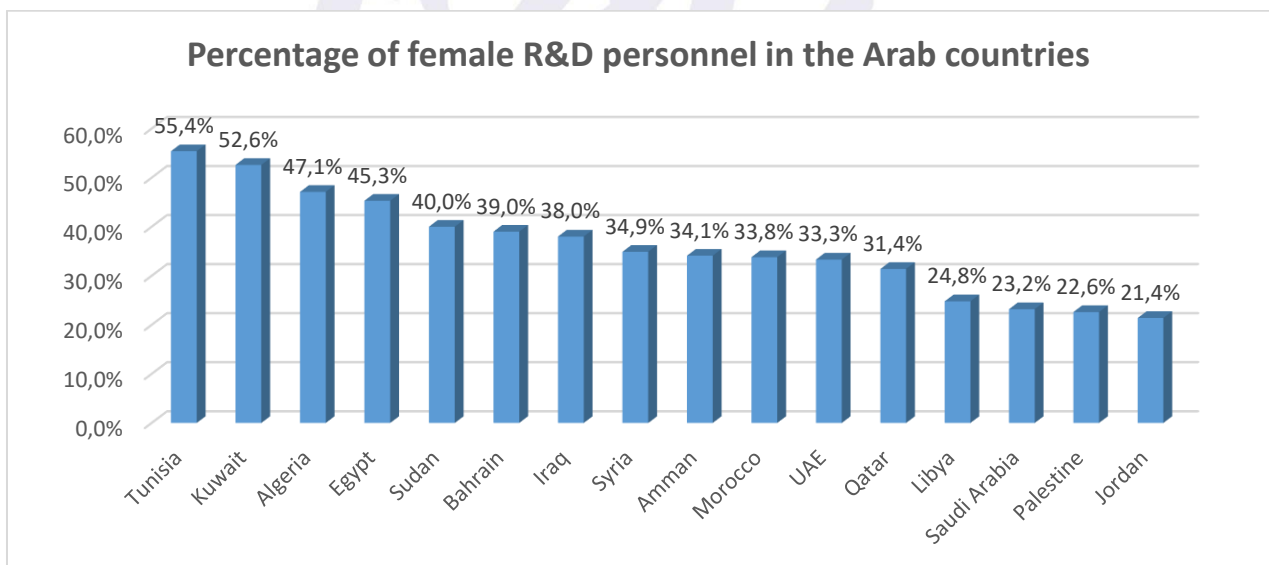


Source : IUS

2-5. Percentage of female R&D personnel in the Arab countries:

Several Arab countries have high percentages in terms of women's involvement in the R&D sector. As shown by Figure 8, the percentage exceeds 50% in Tunisia (55.4%) and Kuwait (52.6%), and exceeds 45% in Algeria (47.1%) and Egypt (45.3%). In addition, 12 Arab countries (out of the 16 countries where relevant data is available) have higher percentages of female R&D personnel than the global average which amounts to 29.3%.

Figure 8



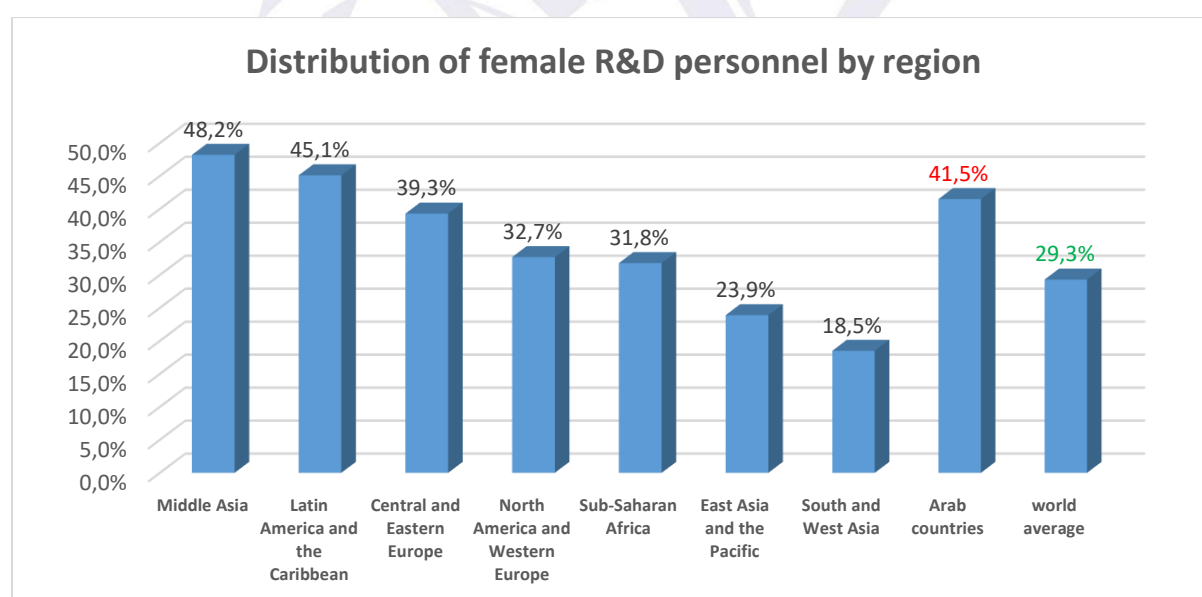
Source : IUS

2-6. Distribution of female R&D personnel, by region:

The presence of women in the R&D sector still falls short of expectations in most countries of the world, including in developed countries. Figure 9 shows low percentages of women's involvement in research and development, with the global average not exceeding 29.3% in 2018. The percentage recorded in developed countries was not much different from the global average, with 32.7% in Western Europe and North America. The average for the Arab world stood at 41.5%, a respectable percentage in comparison with that of other regions of the world.

A statistical study issued by UNESCO in 2014 showed that female R&D personnel represented the majority only in 14 of the 127 countries covered by the study. There was balance with male R&D personnel (45 to 55% of female R&D personnel) only in one out of every five countries. In half of the world's countries, the percentage of female R&D personnel did not exceed 30%.

Figure 9



Source : IUS

3 – SCIENTIFIC RESEARCH IN THE ARAB COUNTRIES:

Table 2 shows two indicators : the number of R&D personnel per million inhabitants and the number of scientific publications per million inhabitants. A disparity between the two indicators can be noticed in some Arab countries, such as Algeria (819.34 R&D personnel and 191 scientific publications per million inhabitants), Morocco (1073.54 - 274), Tunisia (1945.52 - 731), and Egypt (677.1 - 309).

This disparity between the number of R&D personnel and that of scientific publications may be explained by the fact that all university teachers are counted as scientific research workers, which is often not the case.

An “inverse disparity” was recorded in other countries where the number of publications per million inhabitants is high compared to that of R&D personnel. This is the case for Iraq (106 R&D personnel - 309 publications), Oman (242.4 - 543), Qatar (584 - 1881), and Saudi Arabia (453 - 1085).

According to the data available in Iraq, the percentage of R&D expenditures in the GDP is 0.04%, the lowest in the Arab region. Despite the limited financial resources allocated, Iraq

produces a respectable number of scientific publications. The number will certainly increase if a larger budget is allocated to research and development.

In comparison with reference countries in the world, China produces the largest number of scientific publications (770825). The number of scientific publications per million inhabitants in China is nearly 546, which is close to the indicator recorded in some Arab countries.

Britain, Germany, and the USA rank first among the world's countries in terms of number of publications per million inhabitants, followed by South Korea and France.

Table 2

Expenditure, R&D publications in the Arab countries and reference countries - 2020

Country	D&R expenditure as percentage of GDP	Number of D &R personnel per million inhabitants	Number of publications	Population	Number of publications per million residents
Algeria	0,53	819,34	8 397	43 851 043	191
Bahrain	-	-	1 151	1 701 583	676
Comoros	-	-	-	869 595	-
Djibouti	-	-	-	988 002	-
Egypt	0,96	677,1	31 582	102 334 403	309
Iraq	0,04	105,92	19 250	40 222 503	479
Jordan	0,7	595,96	6 758	10 203 140	662
Kuwait	0,19	501,57	2 501	4 270 563	586
Lebanon	-	-	4 557	6 825 442	668
Libya	-	-	709	6 871 287	103
Mauritania	-	-	91	4 649 660	20
Morocco	-	1 073,54	10 126	36 910 558	274
Amman	0,37	242,41	2 771	5 106 622	543
Palestine	-	-	1 265	4 803 269	263
Qatar	0,53	583,98	5 419	2 881 060	1 881
Saudi Arabia	0,52	453,15	37 788	34 813 867	1 085
Somalia	-	-	-	15 893 219	-
Sudan	-	-	1 273	43 849 269	29
Syria	0,02	90,96	782	17 500 657	45
Tunisia	0,75	1 945,52	8 638	11 818 618	731
UAE	1,45	2 442,54	10 887	9 890 400	1 101
To whom	-	-	1 094	29 825 968	37
Arabic countries	0,64	579	-	436 080 728	-
World	1,93	1 215,12	-	7 763 932 702	-
China	2,4	1 584,87	770 825	1 411 100 000	546
USA	3,45	4 821,23	706 000	331 501 080	2 130
Britain	1,71	4 683,77	225 108	67 081 000	3 356
Germany	3,14	5 393,15	191 424	83 160 871	2 302
France	2,35	4 926,19	124 460	67 379 908	1 847
Korea	4,81	8 713,59	95 889	51 836 239	1 850

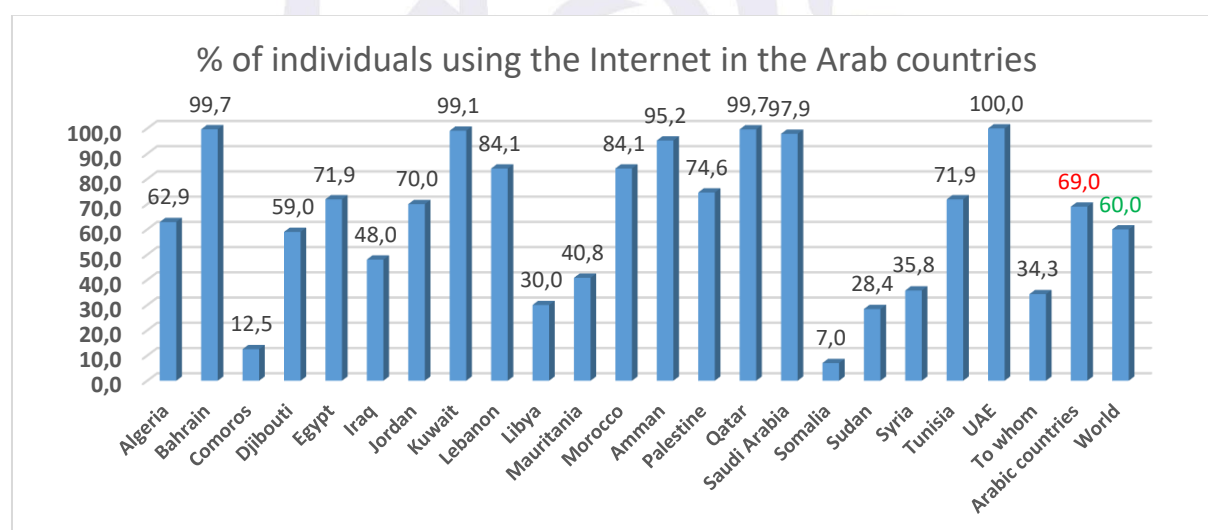
4 – SCIENTIFIC RESEARCH AND THE USE OF MODERN TECHNOLOGY:

As shown by Figure 10, the Arab region, which includes 22 member States of the League of Arab States and has a population of 436 million people (2020), witnessed, during the period 2015-2020, a significant increase in the percentage of individuals using the Internet, going up from 38.2% in 2015 to about 69% at the end of 2020.

Considerable efforts have been made in recent years in the Arab countries to develop Internet infrastructure, enabling a significant increase in the percentage of individuals using the Internet, which ranged between 95 and almost 100% in the Gulf countries in 2020. This percentage also increased in other Arab countries, reaching 80% in Lebanon and Jordan, 77% in Iraq, 74.4% in Morocco, and 70.6% in Palestine. Conversely, Somalia and Comoros still have low percentages whose improvement necessitates more intensive action.

The most significant increase occurred in Djibouti where the percentage of individuals using the Internet soared from 12% in 2015 to over 59% in 2020, a respectable percentage compared to other countries in the same economic and social situation.

Figure 10



Source : ITU

5 – EFFORTS TOWARD STRONGER RELATIONS BETWEEN UNIVERSITIES, RESEARCH LABORATORIES AND ECONOMIC BUSINESSES:

A survey conducted by the UNESCO Institute for Statistics in 2013 on innovation in 53 countries showed that business firms are not very willing to cooperate with public universities and research institutes. A study conducted in 2018 on trends in New Zealand indicated that scientific publications co-produced by the academic and commercial sectors represented no more than 5.1% of total publications. An independent study on the same topic indicated a similar percentage in China during the period 2015-2017. The percentage of joint production of scientific publications was higher in the EU and Brazil (4.2%), USA (8.2%), Korea (9.3%), Germany (4.4%), and France (5.4%).

In Canada, the percentage of industrial research in the GDP decreased from 78% to 63% in the period between 2014 and 2019. In this regard, the Canadian government is urging local firms to establish collaborative partnerships with public research institutions, in order to develop

“bold and ambitious” innovation strategies. In 2017, the government allocated CAD 950 million to support innovation super clusters over the next five years. Under this plan, the private sector is required to contribute amounts matching Government funding.

In the Philippines, under the Cooperative Research and Development Program (2016), a research institution or university that establishes a collaborative research partnership with at least one firm received government funding of up to \$100,000.

In South Asia, the process of infrastructure development and industrialization is going hand in hand with R&D promotion, with both mutually nurturing each other. Several countries are seeking to incentivize public research institutions to establish partnerships with industrial institutions.

In the Arab countries, most research centers and institutions publish books, journals, and periodicals to promote their scientific productions. Some of them have refereed scientific journals that deal with specific issues, and tend to adopt an academic methodology to which scientific theories are applied. They sometimes address issues that may not be useful to decision-makers.

Still, some Arab countries are working to bring their research centers closer to business firms, but the results achieved so far remain modest.

In the same context, the Arab Strategy for Scientific Research, Technology and Innovation, which was prepared by the General Secretariat of the League of Arab States at Summit level, and whose implementation follow-up has been entrusted to ALECSO, underlined the importance of research, development and innovation in promoting development, and encouraged the establishment of mechanisms to link research, development and innovation to economic development.

The proposed mechanisms include the following:

- Establish collaborative research centers involving the three relevant actors : universities, R&D institutions, and production/service businesses;
- Create technology and business incubators which help graduates and investors to build new partnerships with high added value, by using the technological and administrative capabilities provided to them by the incubators for a period of two years before they can join the market. Incubators are usually established in cooperation between the three relevant actors;
 - Establish centers for providing science and technology services (information, standards, measurements, analyses, and other services);
 - Build effective and useful links with scholars abroad.

With regard to the implementation of the Strategy and the establishment of coordination and follow-up mechanisms, the following is proposed:

- Set up of a Higher Coordination Committee, including the General Secretariat of the League of Arab States, ALECSO, the Federation of Arab Scientific Research Councils, and the Association of Arab Universities, to be in charge of implementing the Strategy and submitting periodic progress reports to the competent authorities;

- Support and cooperate with the ALECSO Observatory by providing it with updated data and information, which it uses to follow up on implementation;
- Adopt initiatives, programs and projects, with adequate human, administrative and financial resources, for achieving the goals of the Strategy, while giving special attention to the issue of funding through an executive plan to be implemented under the supervision of the General Secretariat of the League of Arab States;
- Encourage international organizations, institutions and centers to actively participate in the implementation of the Strategy, through joint technology transfer and expertise-sharing projects. International cooperation and regional cooperation among the Arab countries involved in the Strategy are both of key strategic importance in this regard.

Analysis of the available data and indicators on scientific research and development clearly shows that Arab countries generally lack a science and technology policy with specific goals and means. They have not developed an “information industry”, nor have they established information networks, mechanisms for coordination among research institutions and centers, and special funds for R&D financing. Poor infrastructure for theoretical and applied research, low spending on R&D, the Arab brain drain, and dependence of R&D activities on government funding are among the main characteristics of the current situation in the Arab region.

Relevant statistical reports indicate that the Arab countries’ spending on R&D is still below the required level and does not produce strong and competitive outputs. This does not, therefore, qualify the Arab countries to play an active and leading role in global scientific decision-making.

In view of the foregoing, Arab States are called on to strengthen their R&D policy, by increasing the level of R&D spending, providing more care and attention to researchers, and raising the level of educational performance. In this regard, it is proposed to :

- Update laws and legislations regulating scientific research and publishing in the Arab countries;
- Strengthen the institutional capacity and competitive advantage of Arab universities and scientific research institutions/centers;
- Spread awareness of the importance of distinguished electronic scientific publishing;
- Enhance the movement of research, authorship, translation and scientific publishing, and motivate researchers financially and morally;
- Increase government support to research activities, and involve the private sector in financing scientific research in the Arab countries;
- Enhance the global presence of Arab universities, and increase their participation in scientific events;
- Establish the “Arab Fund for Scientific Research” to support outstanding Arab research works/institutions;
- Conduct a study to evaluate the state of Arab scientific research in accordance with the ISI & Scopus standards;
- Conduct a comparative study on scientific research in the Arab region and in other neighboring and developed countries.

The promotion of scientific research in the Arab region follows two parallel tracks :

- The first track involves establishing a digital database for all Arab journals in accordance with proper standards; publishing and publicizing research works written in Arabic, which have not been included in the ISI databases, the latter being limited to research in English; and abolishing fees for Arab scientific publishing so that they do not constitute an obstacle to research activity ;
- The second track involves going beyond the failures of the previous stage, incorporating a number of Arabic journals into international digital databases, encouraging Arab competencies, and developing their capacities in the English language and in digital technology; thereby enabling and promoting their access to international scientific publishing.

The reviewer :

- ✓ A study on the topic “Scientific Research in the Arab World: Reality and Proposals for Development.” Prof. Dr. Abdel-Qader Mohamed Abdel-Qader El-Sayed - Professor of Curricula and Teaching Methods of Mathematics, Benha University, Egypt, Dhofar University, Sultanate of Oman, December 20, 2017.
- ✓ A descriptive and analytical study on "The Reality of Scientific Research in the Arab World (2008-2018)". Dr. Khalil Muhammad Al-Khatib - Higher Education Department - Sana'a University / Yemen - June 28, 2020.
- ✓ The reality of scientific research in Arab countries: obstacles and proposals for development - the situation in Tunisia - Dr. Hadia Al-Awd Al-Bahloul - researcher in sociology - The Future of Social Sciences Journal, fifth issue, April 2021.
- ✓ The Arab Strategy for Scientific and Technological Research and Innovation - League of Arab States, ALECSO - Tunisia 2017.
- ✓ Indicators of scientific research in the Arab world in the third millennium - Saleh bin Muhammad Khair Al-Koud - researcher and doctoral student in human resource development - International Islamic University Malaysia - 07/10/2021. UNESCO Science Report - The race against time for smarter development Executive Summary - UNESCO 2021.
- ✓ Global Research and Development Investments - Information Bulletin No. 54 - June 2019 - UNESCO Institute for Statistics.
- ✓ Global trends in research spending, 2014-2020 - UNESCO Institute for Statistics - 2021.
- ✓ The reality of research and think tanks in the Arab region - needs, effectiveness and impact - Arab Institute for Research and Policy - 2021.

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