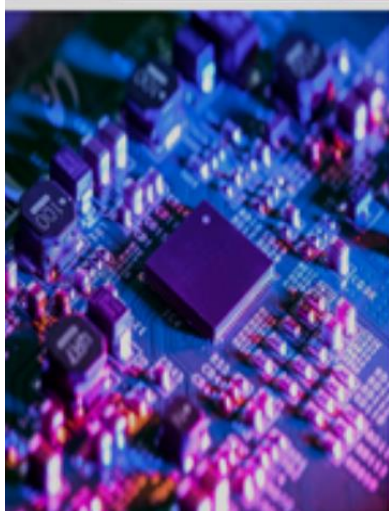
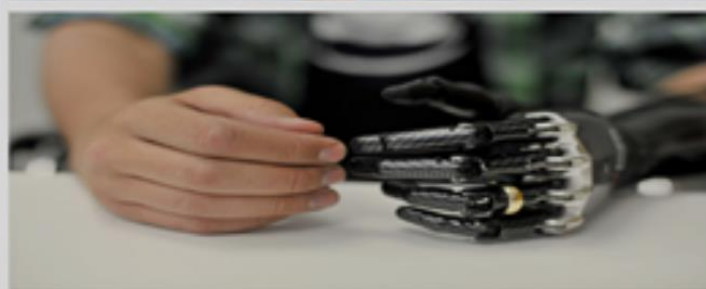
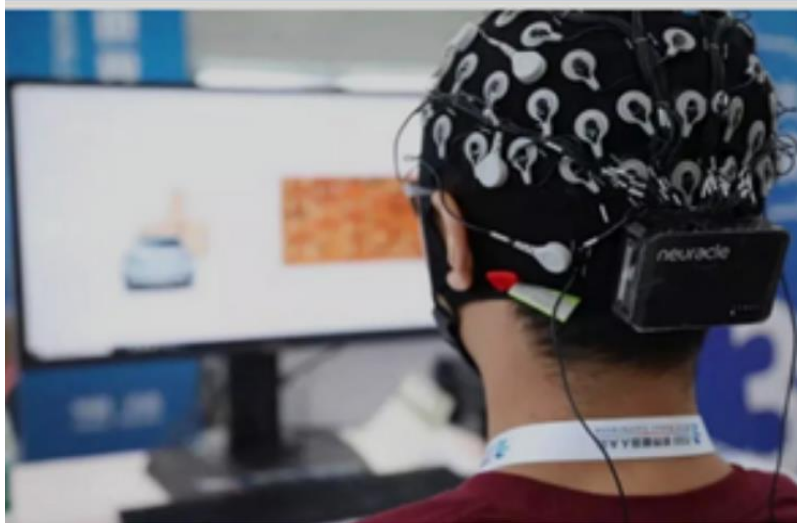




The Republic of Lebanon

STI Profile of the OIC Member State

Science, Technology and Innovation Indicators



COMSTECH

Editor:

Prof. Dr. S. Khurshid Hasanain
Adviser COMSTECH

Data Collection & Layout:

Mr. Umer Ali
Programme Officer COMSTECH

Mr. Muhammad Jamil
PS COMSTECH

Dr. Waseem Hassan
Associate Professor, University of Peshawar

FOREWORD

It gives me great pleasure to share the *Science, Technology and Innovation Profiles of OIC Member States*, as prepared by COMSTECH. These profiles of member states are being printed, as well as shared on the COMSTECH website. A few words are therefore presented to explain the wider aims and purposes of this exercise.

The member countries of the OIC are vigorously engaged with science, technology and innovation, both as a pursuit of knowledge and in harnessing the forces of nature for human betterment. Depending on their circumstances they have advanced to different levels, but much needs to be done, in general, to catch up with the attainments of the more advanced countries. However, there exists a well-defined need to catalogue national efforts in this direction. In particular, to identify respective strengths, achievements and shortcomings, as well as the institutions and policies that are shaping the scientific research and development profiles of OIC member states.

It is with the above goals and purposes that COMSTECH has ventured on this ambitious task viz. preparing a summarized version of the science, technology and innovation landscape of each member state. We have initiated this effort starting with the profiles of countries leading in this area, and will be continuing and sharing as we proceed onwards.

Undoubtedly much more could be said about each country than the summary that we have presented, but our emphasis is on the essentials and on maintaining brevity. COMSTECH welcomes feedback from member states on this effort and will be happy to update the website profiles on the basis of information received officially.

I hope that the scientific community as well as the planners and administrators of member states will find these profiles both useful and inspiring.

Prof. Dr. M. Iqbal Choudhary
Coordinator General COMSTECH
UNESCO Chair

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LEBANON

Officially the Republic of Lebanon or the Lebanese Republic, is a country in Western Asia. It is located between Syria to the north and east and Israel to the south, while Cyprus lies to its west across the Mediterranean Sea. Its location at the crossroads of the Mediterranean Basin and the Arabian hinterland has contributed to its rich history and shaped a cultural identity of religious diversity. It is part of the Levant region of the Middle East. Lebanon is home to roughly six million people and covers an area of 10,452 square kilometres (4,036 sq mi), making it the second smallest country in continental Asia after Maldives. The official language of the state is Arabic, while French is also formally recognized; the Lebanese dialect of Arabic is used alongside Modern Standard Arabic throughout the country.



The earliest evidence of civilization in Lebanon dates back over 7000 years, predating recorded history. As part of the Levant, it was part of numerous succeeding empires throughout ancient history, including the Egyptian, Assyrian, Babylonian, Achaemenid Persian, Hellenistic, Roman and Sasanid Persian empires. After the 7th century Muslim conquest of the Levant, it was part of the Rashidun, Umayyad, Abbasid Seljuk and Fatimid empires. Lebanon was conquered by the Ottoman Empire in the

16th century and remained under its rule for the next 400 years. Following the empire's collapse after World War I, the five Ottoman provinces constituting modern-day Lebanon came under the French Mandate. Upon gaining its independence from Free France in 1943, Lebanon established a unique confessionalist form of government, with the state's major religious sects being apportioned specific political powers.

Lebanon is a developing country, ranking 112th on the Human Development Index. It has been classified as an upper middle income state. Despite the country's small size, Lebanese culture is renowned both in the Middle East and globally, primarily powered by its extensive diaspora. Lebanon is a founding member of the United Nations and is a member of the Arab League, the Non-Aligned Movement, the Organization of Islamic Cooperation (OIC), and the Organisation internationale de la Francophonie.

The population of Lebanon was estimated to be 5,592,631 in 2021, with the number of Lebanese nationals estimated to be 4,680,212 (July 2018 est.); however, no official census has been conducted since 1932. Lebanon is the most religiously diverse country in the Middle East. There are 18 state-recognized religious sects – four Muslim, 12 Christian, one Druze, and one Jewish.

Source: <https://en.wikipedia.org/wiki/Lebanon>





A. ECONOMIC OVERVIEW

❖ General Overview

Lebanon's constitution states that 'the economic system is free and ensures private initiative and the right to private property'. Lebanon's economy follows a laissez-faire model. Most of the economy is dollarized, and the country has no restrictions on the movement of capital across its borders. The Lebanese government's intervention in foreign trade is minimal.



The Lebanese economy went through a significant expansion after the war of 2006, with growth averaging 9.1% between 2007 and 2010. After 2011 the local economy was affected by the Syrian civil war, growing by a yearly average of 1.7% on the 2011–2016 period and by 1.5% in 2017. In 2018, the size of the GDP was estimated to be \$54.1 billion. However, very large debt levels have slowed down the economy and reduced the government's spending on essential development projects.

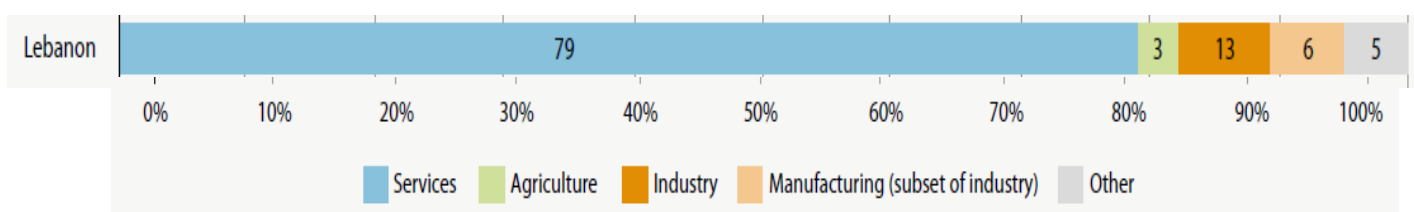
The urban population in Lebanon is noted for its commercial enterprise. Emigration has yielded Lebanese "commercial networks" throughout the world. Remittances from Lebanese abroad total \$8.2 billion and account for one-fifth of the country's economy. Lebanon has the largest proportion of skilled labor among Arab States.

The agricultural sector employs 12% of the total workforce. Agriculture contributed to 5.9% of the country's GDP in 2011. Lebanon's proportion of cultivable land is the highest in the Arab world. Major produce includes apples, peaches, oranges, and lemons. The commodities market in Lebanon includes substantial gold coin production.

Oil has recently been discovered inland and in the seabed between Lebanon, Cyprus, Israel and Egypt and talks are underway between Cyprus and Egypt to reach an agreement regarding the exploration of these resources. The seabed separating Lebanon and Cyprus is believed to hold significant quantities of crude oil and natural gas.

Industry in Lebanon is mainly limited to small businesses that reassemble and package imported parts. In 2004, industry ranked second in workforce, with 26% of the Lebanese working population, and second in GDP contribution, with 21% of Lebanon's GDP.

❖ GDP per economic sector in Lebanon, 2019 (%)

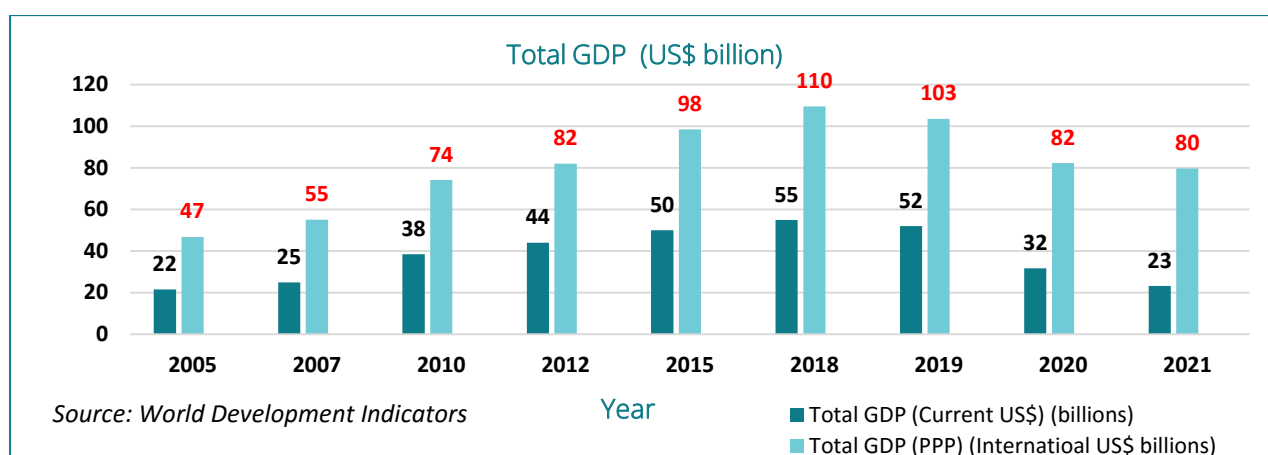


In 2019, seventynine (79%) percent of the Lebanese GDP contributed by the services sector, with industry contributions of 13%. At least 70% of workforce was employed in the services sector. However, dependence on the tourism and banking sectors leaves the economy vulnerable to political instability.

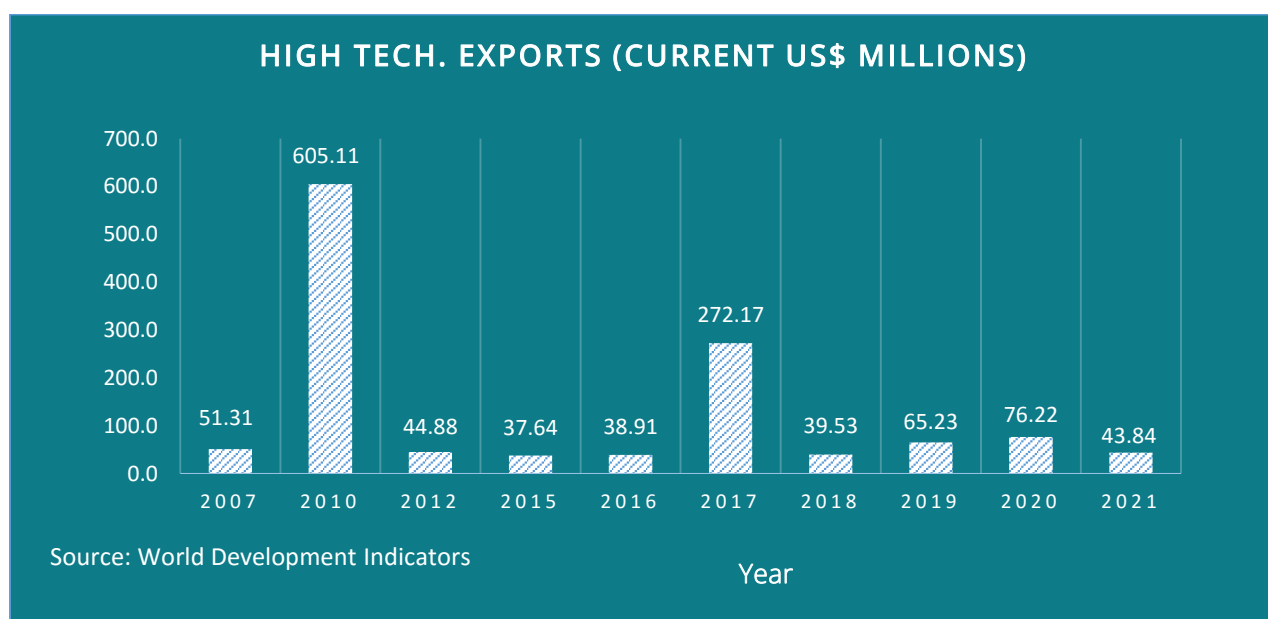
Source: [UNESCO Science Report 2021](#)

❖ GDP Trend in Recent Years

Lebanon's GDP increased systematically between 2005 and 2018 reaching a peak of US\$ 55 billion (current US\$) in 2018, but has subsequently come down to US\$ 23 billion in 2021 reflecting the internal political and economic challenges facing the country. The per capita GDP of the country also reflects the same trend, increasing from US\$ 7802 in 2015 to US\$9225 in 2018, but declining consistently thereafter to US\$4136 by 2021.



❖ High Technology Exports



The high technology exports of Lebanon are small and have generally remained between US\$ 76 and 37 million in the period between 2007 and 2021. There are two exceptional years namely 2010 and 2017 where the high technology exports of Lebanon have touched 605 and 272 million US\$, respectively. It appears that an increasing trend in high tech exports between 2018 and 2020, presumably linked with the reported export of medical technology and ICT, may have been interrupted by the onset of the COVID19 pandemic in 2020. Some of the high tech exports are related to dental products (CYNOPROD). Similarly regenerative medicine, a medical technology project that focuses on the use of stem cells for therapeutic, cosmetic, and banking purposes is another high tech area.



The development, manufacture, and sale of cards embedded with integrated circuits, microprocessors, and memory chips and separately, diamond segment and tools are other high tech areas where progress has been reported.

(Technology Report 2018)



B. SOCIAL AND HUMAN DEVELOPMENT

Series Name	2016	2017	2018	2019	2020	2021
Life expectancy at birth, total (years)	78.8	78.83	78.88	78.93	..	..
Literacy rate, adult total (% of people ages 15 and above)	..	..	95.07	..	..	..
Labor force with advanced education (% of total working-age population with advanced education)	..	..	..	60.78	..	..
Labor force with intermediate education	..	..	..	41.68	..	..
Mortality rate, infant, male (per 1,000 live births)	7.1	6.9	6.6	6.4	6.2	..
Mortality rate, infant, female (per 1,000 live births)	6.5	6.3	6.1	5.9	5.7	..
Individuals using the Internet (% of population)	76.11	78.18	..	..	..	..
Mobile cellular subscriptions (per 100 people)	63.70	64.51	64.50	61.82	62.83	..
Mobile cellular subscriptions	4277043	4399085	4424185	4237962	4288221	..

❖ Human development

Lebanon was classified among countries with “high human development” in the 2022 Human Development Report, ranking 112th globally and 13th among its Arab peers with an **HDI score of 0.706**. Life expectancy was almost 79 years in the last data available. Literacy for both males and females is comparable at about 95%. According to a 2018 report more than 30% of the country's workforce is employed in knowledge intensive activities. Majority of the labor force is trilingual, and possesses one of the most competitive technical skills in the region. Lebanon ranked 8th

in the MENA region in 2015 on the ICT Development Skills Index (IDI), which measures ICT capabilities and skills. Broadband penetration had reached 79% while mobile subscription was at 63% of the population in 2020.

❖ Quality of Education

According to the World Economic Forum, Lebanon in 2022 is ranked globally as the 4th best country for math and science education, hence setting Lebanon in a leading position as the only Arab country who made it to the five top in the list. The same report ranked Lebanon as the 10th best country overall for quality of education. The Organization for Economic Co-operation and Development (OECD) report compiled from an amalgamation of international assessments, including the OECD's Pisa tests, the TIMSS tests run by US-based academics, as well as the TERCE tests in Latin America, ranked Lebanon 13th globally in mathematics and sciences.





❖ Lebanon, National Council for Scientific Research (CNRS-L)

The CNRS fulfils an advisory function, drawing up the general outline of Lebanon's national science policy. It also initiates, encourages and co-ordinates research projects. It is also responsible for managing the Centre for Geophysics, the Centre for Marine Sciences, the Centre for Remote Sensing and the Lebanese Atomic Energy Commission (LAEC).

In 2006, the CNRS finished drafting the national *Science, Technology and Innovation Policy* with support from UNESCO and ESCWA. The policy

introduced new funding mechanisms for research and encouraged researchers from various institutions to work together under the umbrella of an associated research unit on major multidisciplinary themes. It also introduced new programmes to boost innovation and capacity-building, joint PhD programmes, and established the basis for Lebanese participation in key Euro-Mediterranean projects.

The policy also identified a series of national priority research programmes inspired by the work of specialized task forces:

- Information technology (IT) deployment in the enterprise sector;
- Web and Arabized software technologies;
- Mathematical modelling, including financial/economic applications;
- Renewable energy sources: hydro-electric, solar, wind;
- Material/Basic sciences for innovative applications;
- Sustainable management of coastal areas;
- Integrated water management;
- Technologies for new agricultural opportunities, including the medicinal, agricultural and industrial use of local plant biodiversity;
- Nutritional food quality;
- Research in subfields of molecular and cellular biology;
- Research in clinical sciences;
- Forging links between practitioners of medical and health sciences, social sciences and paramedical professions.

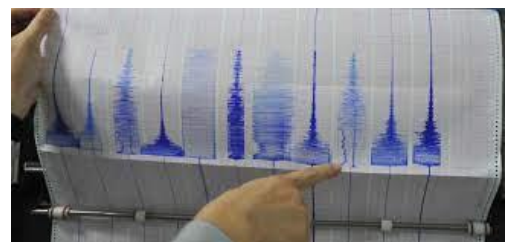
❖ **National Strategic Framework for Technical Vocational Education and Training 2018-2022**

This framework is the culmination of year-long deliberations led by the Government of Lebanon, with the support of the United Nations Children's Fund (UNICEF) and the International Labour Organization (ILO). Based on the preceding UNICEF-ILO initiative "Support of Technical and Vocational Education Systems in Lebanon", the 4 main characteristics resulting from this initiative are:

- Involvement of and high interest among all governmental, private and international stakeholders.
- Building on existing national strategies and local plans approved by each line ministry.
- Use and adaptation of international, regional, and/or national standards and tools including emerging good practices as a reference.
- Engagement of employers' and workers' organizations in the TVET system.

❖ **Lebanon's energy strategy**

In November 2011, the Lebanese Council of Ministers officially adopted the National Energy Efficiency Action Plan for the years 2011–2015. This plan had been developed by the Lebanese Centre for Energy Conservation, the technical arm of the Ministry of Energy and Water in the areas of energy efficiency, renewable energy and 'green' buildings. This is the first comprehensive strategy in energy efficiency and renewable energy for a country that depends on imports for 95% of its energy requirements. The plan is a Lebanese version of the Arab Energy Efficiency Guidelines developed by the League of Arab States and comprises 14 national initiatives designed to help Lebanon reach its target of 12% renewable energy by 2020.



In 2022, Lebanon committed to achieve 20% renewable energy and 10% energy efficiency by 2030 under its Nationally Determined Contributions (NDC) under the Paris Climate Change Agreement.

❖ **Research Centres**

➤ **The National Centre for Geophysics (CNG):**

The CNG was established in 1975 and is the oldest among the four CNRS centres. The CNG is both an observatory and a research laboratory continuing the studies initiated in 1920 in the Levantine region by the Observatory of Ksara. Besides other activities it conducts all geophysical

studies that may help alleviate the impact of seismic hazards in the Lebanese tectonic environment. The Centre also pursues geophysical investigations that may help in a better understanding of available natural and mineral resources. The main foreign long-time partner of CNG is the Institut de Physique du Globe de Paris IPGP. The following constitute its main activities and projects:

- *Early warning systems*
- *The national seismic network*
- *Monitoring crustal deformation*
- *Marine Studies*
- *Seismological Bulletins*



- **The National Centre for Marine Sciences-CNRSL:** It was established in 1977. The centre is a recognized institute within the Mediterranean network of marine centres and is integrated in a number of regional and international activities.

Research activities at the centre focus on the following themes:

- Monitoring of the entire coastal zone in the framework of a national monthly monitoring program.
- Bio-geochemical measurements and time-series surveys in the context of the climate change and ocean acidification.
- Detection of the pollution sources on the coastline and assessment of the transfer and bio-accumulation of chemical compounds in the coastal and marine ecosystems.
- Evaluation of the marine species (from plankton to cetaceans) and their habitats, and assessment of the migratory species and their influences on local ecosystems.
- Ichthyological studies and fishery stock evaluation.

- **The Remote Sensing Centre (RSC)** established in 1995, results from the wish and will to concentrate efforts and establish a leading agency on most recent insights in remote Sensing and GIS technology. Conceived as support for decision making, the RSC has proven its role as a revolving platform among various ministries. The Remote Sensing mandate concerns:

- The use of advanced technology to achieve needed research and studies
- The application of Remote Sensing and GIS to produce reports and studies on land resources in Lebanon
- The emphasis on environmental and development concerns
- The structure of databases from satellite imagery on timely basis in different areas and disciplines and making the information available to the public and private sector
- The development of decision support tools such as warning systems and long term observatories.

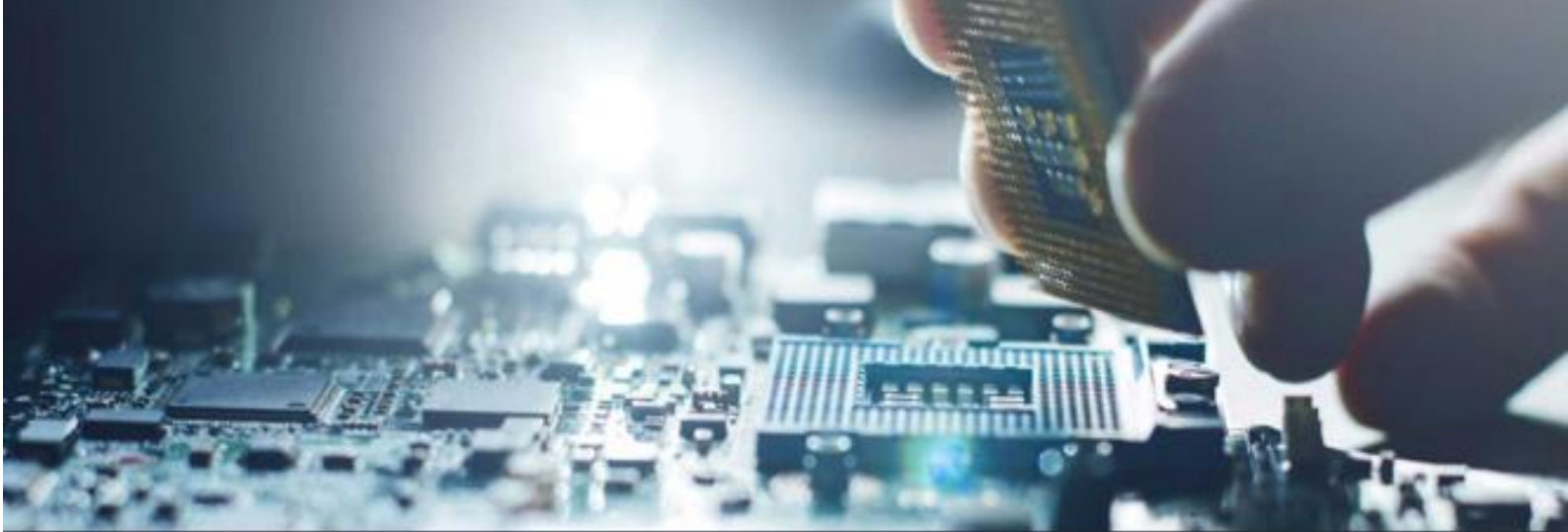
Over the past years, the Remote Sensing Centre has successfully implemented more than 40 projects either through bilateral programs with France, Italy and Syria; or International programs (NOSTRUM, TERCOM, INCAM) and projects funded by international agencies such as IDRC, FAO, EU, WB/ GEF.



- **Lebanese Atomic Energy Commission (CNRS):** The CNRS established the Lebanese Atomic Energy Commission (LAEC) in 1996 with the full support of the IAEA for preparing the national legal and technical infrastructures allowing an effective implementation of a comprehensive radiation safety scheme in the country.

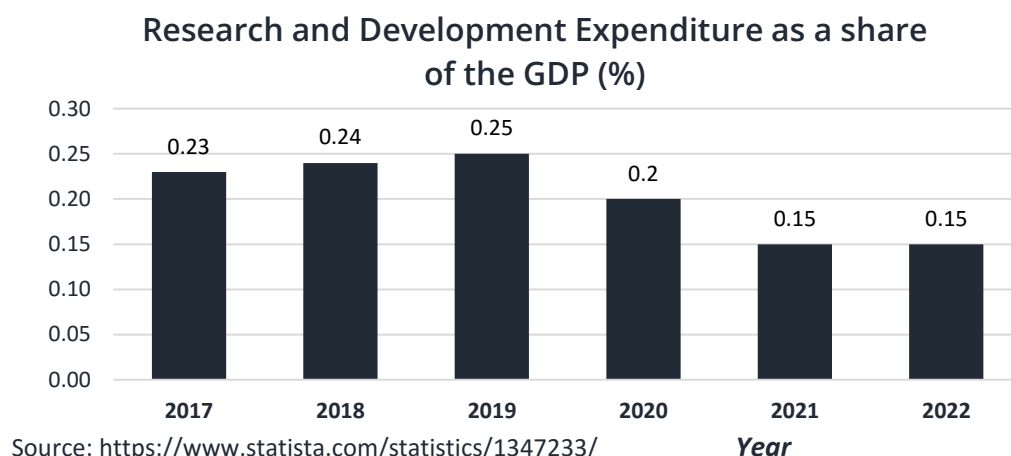


- **Lebanese Agricultural Research Institute (LARI):** In 1964, the Department of Agricultural Scientific Research was reorganized as an autonomous public institution and became the Lebanese Agricultural Research Institute (LARI) working under the supervision of the Minister of Agriculture. LARI has at its disposal eight experimental stations (Tel Amara, Tourbol, Kfardan, Kfarchakhna, Abdeh, Sour, Fanar, Lebaa) in an area of 280 hectares of agricultural land. The stations are located in agricultural areas where subtropical and temperate crops are produced. In these stations research projects are conducted to solve problems facing the agricultural sector in this area. It has cooperation with international organizations (ICARDA, FAO. UNDP. ISNAR. CIHEAM. IPGRI, UPOV, World, Bank, AARINENA. IDRC. CIMMYT, ACSAD. etc..). Research findings are directly transferred to the farming community in the following areas: cereals, root crops, pastures, grain legumes, veterinary medicine, plant nutrition and pest management. Hybrid seed, Tissue culture and biotechnology output are also reaching the farmer via the multi-channel system available in the country
- **The Industrial Research Institute (IRI):** The Industrial Research Institute is a publicly owned institution that conducts extensive research and testing across various fields in the industrial sector in an effort to enhance the latter's performance. The IRI offers services including lab testing, certifications, techniques and equipment development (testing, measurement, analysis and calibration), industrial studies as well as the organization of fairs, seminars and conferences for local professionals.



D. RESEARCH AND DEVELOPMENT

Lebanon's Research and Development Expenditure as a share of the GDP from 2020 to 2021, with a forecast for 2022, is shown below.



Total R&D expenditure in Lebanon amounted to 0.23%, 0.24% and 0.25% of GDP, respectively, in 2017, 2018 and 2019, which is below the average national target of 1%, and lower than Arab States average at: 0.63 (2017) and 0.65 (2018). It is also significantly below the world averages of 1.71 (2017) and 1.73 (2018). A significant decline is observed after 2019.

❖ R&D Policies

- Lebanon's Science, Technology and Innovation Policy (2006) continues to serve as the country's main strategic plan in related areas. Through its Grant Research Programme, the CNRS-L allocated an estimated US\$2.5 million to support 249 projects over 2014–2016. The number of projects varied little for the call covering 2018–2019 (239) but the

amount of funding doubled to US\$ 5 million. The bulk of the budget allocation was evenly distributed between basic sciences and engineering, on the one hand, and medical sciences, on the other.

- **National Charter for Research Ethics:** In July 2016, Lebanon became one of the first Arab countries to adopt a national charter for research ethics, when the CNRS-L released the *Charter of Ethics and Guiding Principles of Scientific Research in Lebanon*. The *Charter* states that research should comply with international standard-setting instruments like the *Helsinki Declaration* on medical research. It also calls upon institutions to ensure that research projects targeting human subjects directly receive special approval from the host institution's ethical committee.
- In March 2019, the CNRS-L and the Lebanese National Commission for UNESCO launched the National Observatory for Women in Research to boost women's participation in scientific research and, thereby, help build a knowledge society.

Source: [UNESCO Science Report 2021](#)

❖ R&D Highlights

- **ICT Manufacturing:** The Lebanese ICT sector is a fast-growing sector having reached a market size of US\$ 436.2 million in 2016 and is projected to reach a value of US\$ 543.5 million by 2019. Opportunities are now emerging in the manufacturing and design of hardware components. At present, activities in the hardware industry include systems concepts and infrastructure software, semiconductor design, design and production of circuit boards, fiber optic cables, electronic components and power supply systems.
- **Medical Devices R&D:** Fundamental biology and medical research are among the top 3 disciplines that have witnessed the biggest increase in the number of scientific publications over the past years. In 2014, the local medical devices market was estimated at US\$ 240.3 million and forecasted to grow at a CAGR of 7.1% for the next 4 years, to reach a value of US\$ 339.4 million by 2019. Innovators do not only rely on the domestic sector activities, but also export their innovations to both regional and global markets.

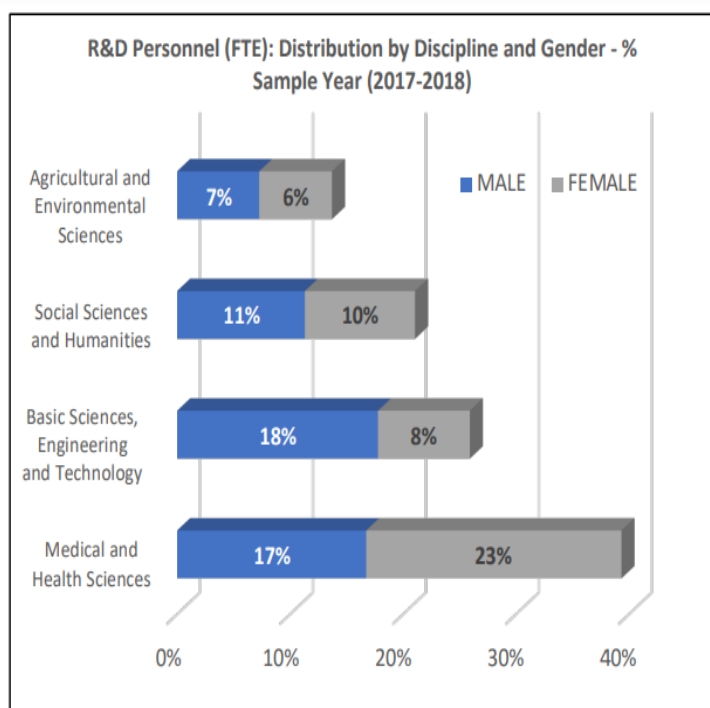
- **Photovoltaics:** Lebanon experienced “exponential growth in the solar PV and battery energy storage segments” in 2022. However, the country does not keep any official records of its installed solar capacity. The Lebanese government approved a distributed renewable energy production law, allowing renewable energy producers to directly sell electricity to end users, distributors, or other electricity suppliers through on-grid or off-grid PPAs.

Source: “Solar Outlook Report 2023,” The Middle East Solar Industry Association (Mesia).

- **R&D Human Capital:** Around 10,000 R&D Personnel (Headcount) are involved in R&D sector in Lebanon. There were 740 FTE (Full Time Equivalent) researchers per million inhabitants (2017) with a slight decrease to 681 in 2019. Comparatively, the number of researchers per million inhabitants worldwide is 1,198 (2017).

❖ Researchers Distribution by Major Fields (HC)

Distribution of Headcounts by Discipline and Gender (permanent staff) reveals that Medical and Health Sciences employ about 40% of all researchers, while basic Sciences, Engineering and Technology encompass about 26%, and Agricultural and Environmental Sciences include 13%. Women have a higher percentage (%) representation in disciplines of Medical and Health Sciences while males are more strongly present in basic and engineering sciences.



Source: National Database of R&D in Lebanon,

Link: <http://www.cnrs.edu.lb/ContentFiles/2559PDF.pdf>



E. HIGHER EDUCATION

❖ Tertiary Enrollment in Lebanon:

Tertiary education in Lebanon is composed of Technical and Vocational Institutes, University colleges, University Institutes and Universities. The Lebanese University is the only public institution. The Ministry of Education and Higher Education administers the private and public sectors and Technical while Vocational Institutes are under the Directorate General of Technical and Vocational Education Directorate General of Higher Education has responsibility for University Colleges, University Institutes and Universities.

According to the World Bank database, gross enrollment rate of tertiary education (the percentage of students who go on to tertiary education within five years of completing secondary education) was 48% in 2013.

Following is the list of national and global ranking of leading Lebanon universities:

University Name	National Ranking	Global Ranking
American University of Beirut	1	713
Lebanese American University	2	1774
Université Libanaise	3	1837
Université Saint Joseph de Beyrouth	4	1956
Beirut Arab University	5	2525

University of Balamand	6	3255
Notre Dame University Lebanon	7	3551
Lebanese International University	8	3624
Université Saint Esprit de Kaslik	9	3827
Rafik Hariri University	10	6202
American University of Science & Technology	11	6375
Université Antonine	12	6665

Source: <https://www.webometrics.info/en/Asia/Lebanon%20>



American University of Beirut



Lebanese American University



Université Libanaise



Université Saint Joseph
de Beyrouth



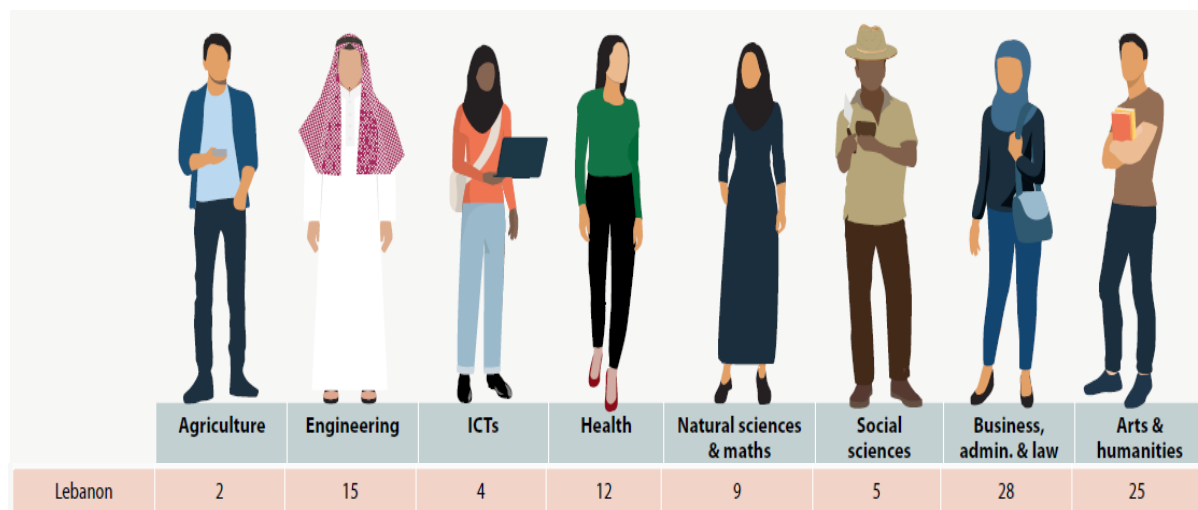
Beirut Arab University



Lebanese International
University

Source: <https://news.jugaadin.com/top-universities-of-lebanon-education-in-lebanon/>

❖ **Distribution of students in Lebanon by programme, 2018 or closest year (%)**



Majority of students are enrolled to study arts, humanities, business and law, while a smaller percentage (15%) is in engineering, 12% in health and 13% in natural sciences, maths and ICTs combined.

Source: <http://www.cnrs.edu.lb/ContentFiles/2559PDF.pdf>

❖ TVET Education

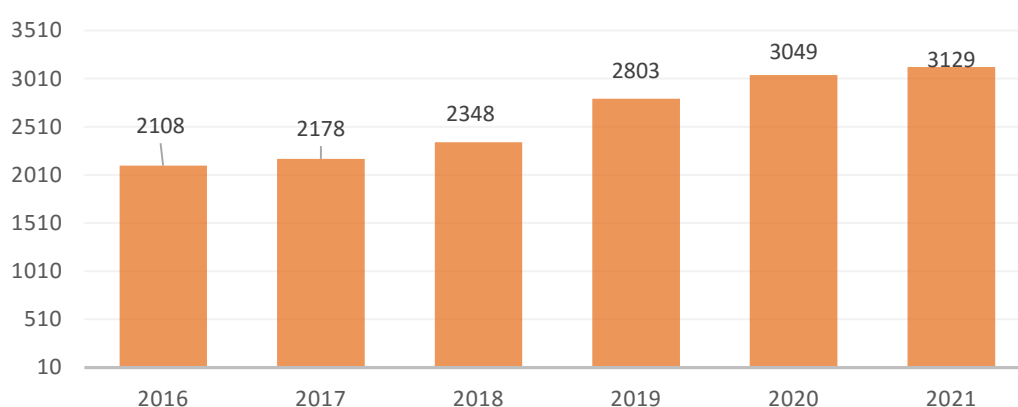
There are 162 public and 398 private vocational and technical schools in Lebanon offering TVET, and approximately 83,168 students were registered in such programmes in the 2016–2017 academic year. There are several pathways from general education to the vocational stream. Students may opt to join the technical/vocational stream in lower secondary school. Students who choose the vocational track attain the Certificat d'Aptitude Professionnel (CAP) at the end of their intermediate schooling, which is a prerequisite for the Brevet Professionnel (BP). Almost half (24189) of all the students enrolled in the public TVET institutions (48924) are enrolled in the Technical Baccalaureate Program.

Source: *National Strategic Framework for Technical and Vocational Education and Training in Lebanon, Minister of Education and Higher Education.*



F. RESEARCH PUBLICATIONS

Research Publications (Science and Technology)



Source: Web of Science Core Collection | Document type: Articles

Years

Lebanon ranks 13th amongst the OIC countries in terms of the number of scientific publications. The trend of its publications (articles only) in all fields of science and technology is shown in the above figure. It is clear that there is a slow increase in the total number between 2016 and 2021, displaying a net increase of 48% over this period and an average annual increase of about 9.68% per annum.

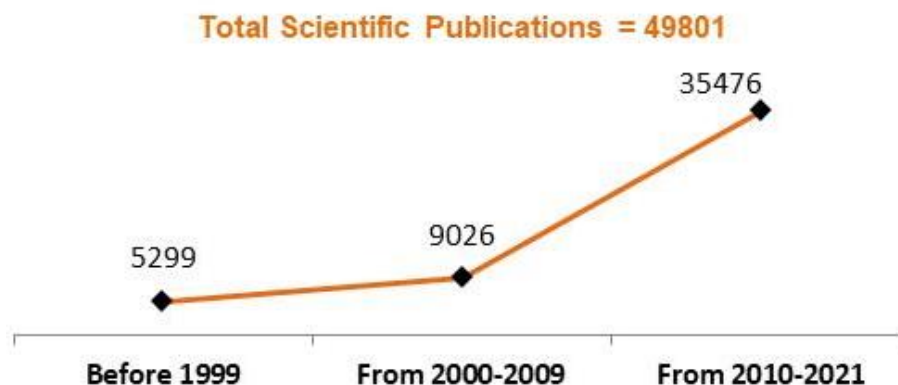
We aim to present the numerical details about the total research publications of Lebanon. Furthermore, for the last ten years (from 2012 to 2021) we will present;

❖ Detailed Analysis (All Published Material):

1. The per year publications.
2. The quality of publications as assessed by;

- a) The per year citations, citations per publications and field weighted citation impact).
- b) The source or journal ranking.
3. The number of papers in different subject areas e.g. medicine, chemistry and social science etc....
4. The top ten most productive universities (on the basis of number of publications).
5. The percent (%) international collaboration &
6. The top ten collaborating countries with Lebanon.
7. The top ten major funding sponsors for publications.

The data was retrieved from Scopus (database). Over the full period, Lebanon published 49801 research documents. They comprised articles (n=33695), conference papers (n=7681), reviews (n=3737), book chapters (n=1655), letters (n=1382), editorials (n=557), notes (n=509), errata (n=200), short surveys (n=183), books (n=168), data papers (n=22), retracted (n=7), reports and (n=2), and 3 documents were not undefined. The highest number of documents (n=35476 or 71.24%) were published from 2010 to 2021. The trend of total number of publications over this period is presented in the following figure.



1. In the table no. 1, the per year (from 2012 to 2021) number of publications or scholarly output (SO), citations, and citations per publications (CPP) of 32306 documents are presented.
2. The highest documents are published in 2021 (n=4649), followed by 2020 (n=4578) and 2019 (n=3998).
3. The total number of citations were recorded at 579455 while the CPP was 17.9.

4. Article Field Weighted Citation Impact (FWCI) was found to be 1.45 which indicates that on average, the articles received 45% higher citations as compared with global average for similar publications.

Table No. 1

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Scholarly Output	32306	1963	2248	2382	2524	3004	3259	3701	3998	4578	4649
2	Citations	579455	39380	41458	56083	61363	92228	79267	74162	50338	55147	30029
3	Citations per Publication	17.9	20.1	18.4	23.5	24.3	30.7	24.3	20	12.6	12	6.5
4	Field-Weighted Citation Impact	1.45	1.13	1.16	1.32	1.69	1.74	1.75	1.55	1.22	1.61	1.2

❖ Research Quality Indicators

Scopus has categorized all journals in seven quartile (Q) groups (from Q1 to Q7) on the basis of cite score. For example, Q1 is occupied by the top 1%, while Q7 is occupied by journals in the 75 to 100% group.

A total of 6137 papers in the last ten years were published in those journals/sources, which do not have cite score data. The per year breakup for the remaining 26169 papers are presented in the table.

Table No. 2

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Pub in top 1% Sources (Q1)	687	43	52	60	56	76	78	85	68	68	101
2	Pub in top 5% Sources(Q2)	3072	172	189	242	257	332	303	322	342	433	480
3	Pub in top 10% Sources(Q3)	6170	309	391	428	475	616	642	701	725	913	970
4	Pub in top 25% Sources(Q4)	12651	671	801	868	932	1178	1263	1385	1490	1952	2111
5	Pub in top 50% Sources(Q5)	19893	1028	1224	1376	1465	1773	1986	2157	2415	3120	3349
6	Pub in top 75% Sources(Q6)	24234	1288	1470	1719	1782	2134	2403	2709	2998	3773	3958
7	Pub in top 100% Sources(Q7)	26169	1447	1614	1885	1947	2287	2578	2923	3250	4059	4179

In the following figure the distribution of publications in respective Q-groups are described. The highest number of documents were published in Q5, followed by Q4 and Q6.



The number of publications in twenty-six (n=27) major subject areas are presented in the table. The highest documents were published in;

1. Medicine (n=12284)
2. Engineering (n=6158) and
3. Computer Science (n=4766)

While the highest citations were noted for;

1. Medicine (n=321512)
2. Biochemistry, Genetics and Molecular Biology (n=65492) and
3. Engineering (n=62944)

The number of authors, citations per paper (CPP) and field weighted citation impact (FWCI) for all 26 areas are described in the following table no 3.

Table No. 3

S#	Subject Area	SO	Citations	Authors	CPP	FWCI
1	Medicine	12284	321512	10318	26.2	2.12
2	Engineering	6158	62944	4369	10.2	1.12
3	Computer Science	4766	44482	3405	9.3	1.06
4	Biochemistry, Genetics and Molecular Biology	3170	65492	3958	20.7	1.09
5	Social Sciences	2936	26782	2769	9.1	1.09
6	Physics and Astronomy	2169	29079	1754	13.4	1.06
7	Mathematics	2161	14540	1796	6.7	0.96
8	Environmental Science	1787	32205	1960	18	1.18
9	Materials Science	1713	22880	1439	13.4	0.97
10	Chemistry	1652	31406	1622	19	1.06
11	Agricultural and Biological Sciences	1499	23267	1769	15.5	1.15
12	Business, Management and Accounting	1309	18600	947	14.2	1.33
13	Energy	1302	21016	1419	16.1	1.28
14	Pharmacology, Toxicology and Pharmaceutics	1144	20820	1729	18.2	1.24
15	Immunology and Microbiology	1086	23350	1692	21.5	1.18

16	Arts and Humanities	1019	8016	851	7.9	1.17
17	Chemical Engineering	921	18783	1152	20.4	1.17
18	Economics, Econometrics and Finance	844	14497	556	17.2	2.16
19	Earth and Planetary Sciences	841	13107	736	15.6	1.17
20	Nursing	778	11475	1297	14.7	1.43
21	Neuroscience	693	13423	1039	19.4	1.22
22	Psychology	622	12829	731	20.6	1.57
23	Decision Sciences	606	4742	737	7.8	1.06
24	Dentistry	461	4125	541	8.9	0.99
25	Health Professions	414	3450	759	8.3	1.17
26	Veterinary	101	947	181	9.4	1.18

NOTE: The total scholarly output (SO) may be different from the sum total of publications (sorted according to Journal classification) because the same publication may be appearing under various classifications, concurrently.

Table No. 4

S#	Institution	SO	Citations	Authors	CPP	FWCI
1	American University of Beirut	13148	293287	6307	22.3	1.8
2	Lebanese University	6730	72734	3782	10.8	0.92
3	Saint Joseph University	3585	44041	2143	12.3	1.02
4	Lebanese American University	3486	53914	1719	15.5	1.37
5	Beirut Arab University	1791	20142	880	11.2	1.19
6	University of Balamand	1379	34029	871	24.7	2.03
7	Hotel-Dieu de France Hospital	1257	11484	853	9.1	0.73
8	Lebanese International University	1030	9265	580	9	1.12
9	Notre Dame University, Lebanon	1000	13156	458	13.2	1.02
10	Holy Spirit University of Kaslik	979	14106	590	14.4	1.6

The list of top ten universities is provided in the table no 4. The highest documents are published by

1. American University of Beirut (n=13148)
2. Lebanese University (n=6730) and
3. Saint Joseph University (n=3585)

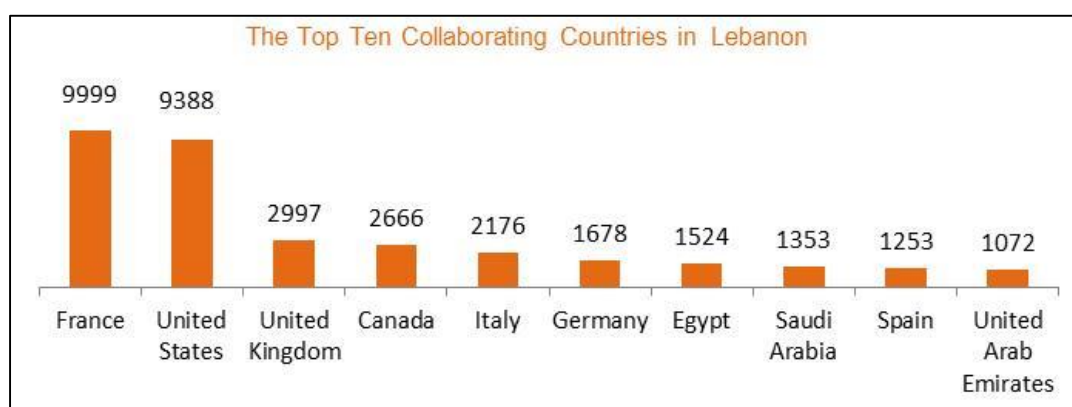
Lebanon has published 62% (average of the last ten years) documents in strong international collaboration. The percentage of publications per year produced in collaboration (from 2012 to 2021) is presented in the following figure.



The data of the top ten collaborating countries is presented in the figure.

The highest number of documents were published in collaboration with

1. France (n=9999),
2. USA (n=9388) and
3. UK (n=2997).



The list of the top ten major research sponsor is given in the following table.

Table No. 5

S#	Funding Sponsor	NoP
1	American University of Beirut	1718
2	Conseil National de la Recherche Scientifique	1112
3	Université Libanaise	793
4	National Institutes of Health	715
5	Centre National de la Recherche Scientifique	526
6	National Science Foundation	394
7	European Commission	337
8	Agence Nationale de la Recherche	318
9	National Cancer Institute	300
10	Agence Universitaire de la Francophonie	239



G. International Cooperation and Support Initiatives (selected)

❖ **CNRS-L International Cooperation**

Recognizing the importance of cooperation to tackle challenges with a regional and global nature, the CNRS-L has worked to enhanced its cooperative links by joining existing networks, implementing regional projects financed by the European Commission, The World Bank, the United National Environment Programme, the United National Development Programme, the Food and Agricultural Organization, as well as other regional and international organizations.

❖ **EU Framework Programmes**

The EU Framework Programmes are the EU's main instrument for funding research in Europe, open for regional and international participation. The CNRS-L is the Coordinating National Contact Point (NCP) for the EU Framework Programmes since 2011. In 2013, a Network of National Contact Points was established to cover the following EU Framework Programme thematic: Health, Environment, ICT, Energy & SMEs. Thematic National Contacts Points are located at various universities in Lebanon.

As follow-up to the *Science, Technology and Innovation Policy*, the CNRS embarked on establishing the Lebanese Observatory for Research,

Development and Innovation (LORDI) in 2014 in order to monitor key indicators of R&D input and output. Lebanon participates in a platform linking Mediterranean observatories of STI. This co-operative platform was set up by the Mediterranean Science, Policy, Research and Innovation Gateway (Med- Spring project) within the EU's Seventh Framework Programme for Research and Innovation (2007–2013).

Source: <http://www.cnrs.edu.lb/site/LandingPage.aspx?pageid=58>

❖ **The EU 7th Framework Programme**

It ran from 2007 to 2013 and saw Lebanese Participation in 23 Projects with 26 Lebanese Partner Institutions. Lebanon was the coordinator of 2 Projects; a-INCAM: Improving National Assessment and Monitoring Capacities for Integrated Environmental and Coastal Ecosystem Management (Coordinated by the CNRS-L), b-LEB'IN: Lebanon-Europe "on boarding" to innovate and enhance research links in health. (Coordinated by the Berytech Foundation)

- In 2014, the EU Launched the New Framework Programme, Horizon 2020, which is the biggest EU Research and Innovation programme with nearly €80 billion of funding available over 7 years (2014 – 2020). While the Horizon 2020 Programme is the EU's research funding Programme, it is fully open to researchers from public and private organizations from across the world.

❖ **Lebanon – Oman MoU on Space Sciences (October 2022)**

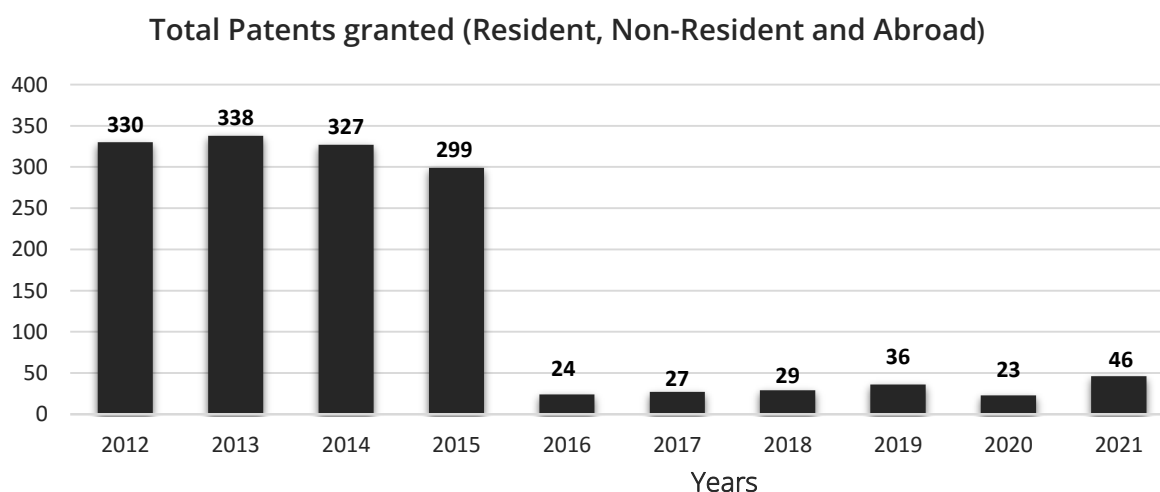
In the field of space sciences and technologies, an MoU was signed between the Ministry of Transport, Communications and Information Technology of Oman, represented by the National Centre for Space, Artificial Intelligence and Advanced Technologies, and the National Space Science Authority of Bahrain.



INNOVATION

H. INNOVATION, ENTREPRENEURSHIP & TECHNOLOGY PARKS

❖ Patent Granted



Source: WIPO: https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=LB

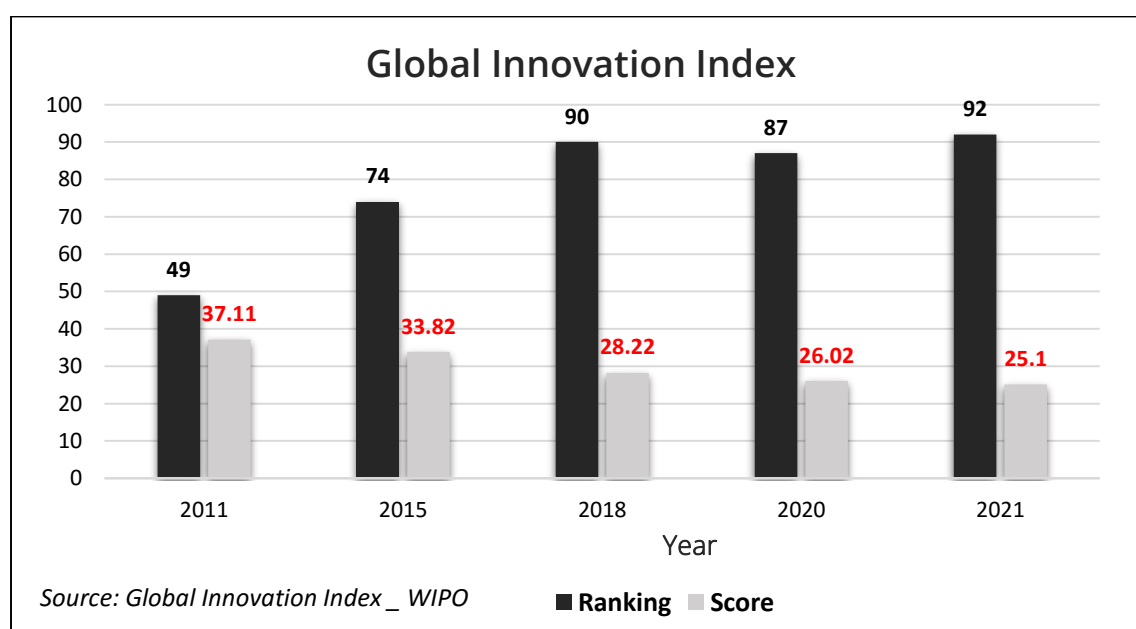
Lebanon's innovative and entrepreneurial activity shows a dramatic decrease starting in 2016, as shown by the above graph. There is a very drastic drop from almost 300 patents in 2015 to 24 in 2016! The decrease continues for the next six years on the record. It is clear from that the detailed data below that decrease has come in patent activity from the resident and non-resident categories suggesting a virtual standstill in innovative and entrepreneurial activity within the country, both by locals or by non-resident corporate research teams.

Total Patents granted (Resident, Non-Resident and Abroad)

Year	Resident	Non-Resident	Abroad	TOTAL
2012	59	258	13	330
2013	75	250	13	338
2014	55	261	11	327
2015	85	194	20	299
2016	-	-	24	24
2017	-	-	27	27
2018	-	-	29	29
2019	-	-	36	36
2020	-	-	23	23
2021	-	-	46	46

Source: https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=LB

❖ Global Innovation Index



Consistent with the patent data discussed above, the Global Innovation Index ranking of Lebanon has also declined significantly from 49th in 2011, to 92nd in 2021 reflecting a worsening of the conditions for innovation and entrepreneurship. The GII score too has declined from 37.11 to 25.1 over the last six years. Both factors appear connected to the political and economic challenges confronting the country.

❖ Initiatives to Support Innovation

- As an initiative to guarantee investment, in 2013 the Central Bank, the Banque du Liban, issued Circular 331 in an effort to kickstart the entrepreneurial ecosystem, curb brain drain and support local employment. Through this circular, the Central Bank guarantees to reimburse banks for up to 75% of their investment in a startup, should the start-up go bankrupt. By May 2017, US\$ 300–320 million had reportedly been raised and half of this sum had been invested.
- The Beirut Digital District, which provides co-working spaces, concentrates many of the country's start-ups. As of 2017, the district reportedly hosted 70 companies employing 1,200 people, and a process of expansion was begun that has likely stalled in 2020. A survey conducted over 2017–2018 of tech start-up founders, co-founders or partners found that navigating the regulatory framework and accessing local talent were the two greatest impediments to entrepreneurship. With regard to the wider innovation system, the main barriers identified were a weak collaborative culture, a lack of funding for researchers at the prototyping stage, an insufficient number of incentives and reward mechanisms and poor intellectual property protection at the national level.

Source: *UNESCO Science Report 2021*

❖ Supportive Ecosystem

- **Incubation and Acceleration:** Today, there are 9 incubators and accelerators that provide training, technical & financial assistance to new and existing businesses across Lebanon. They include Berytech, the South Business Innovation Centre (SouthBIC), the Business Incubation Association in Tripoli (BIAT), Alt City, the UK Lebanon Tech Hub, speed@BDD, Smart-ESA, and Flat6labs. Other programs offer a wealth of mentorship and networking opportunities including Endeavour, LebNet, Lebanon for Entrepreneurs, Lebanese League of Women in Business, and more.
- **Clustering:** Physical and virtual clusters equally seek to capitalize and expand on the vibrant digital community. These include the Beirut Creative Cluster and the Lebanon Softshore Cluster. Together with

industry associations like the Association for Lebanese Software Industries.

- **Business Parks:** New business parks are being developed to host companies in the digital industry, and include large-scale developments like the Beirut Digital District (BDD) which provides state of the art facilities and services at reduced rates
- **Business Support Unit:** New Business Support Unit (BSU) was launched in 2018 by the Investment Development Authority of Lebanon (IDAL), providing startups operating in productive sectors with market information.

❖ Technology Parks and Centres

➤ **Houmal Technology Park – HTP:**

Technology park in Houmal, Lebanon opened in November 2019. It is owned by Fadi Daou, the founder and CEO of Multilane, a semiconductor company. The total built up area of Houmal is 22,000 sq meters. Investment in the park is US\$15 million. HTP comprises



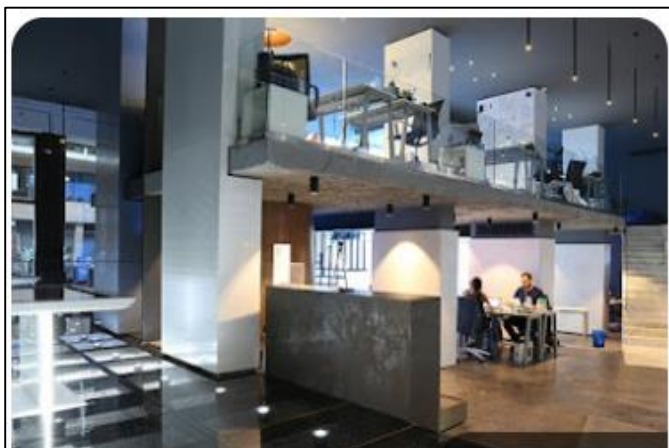
a training academy to train fresh graduates on IC design. It will contain a light production facility, an incubator, and co-working spaces for high Tec companies. It will also include an R&D section, and a prototype centre.

- **Park Innovation:** Park Innovation is a community project and business incubator based in Semkanieh, Chouf. The Park offers unique streams and resources to empower tech entrepreneurs and tech employment. It offers a variety of programs, events and offerings like coworking and office spaces that can help propel young people towards their goals.
- **MANDARA Industrial Park:** In the heart of the Bekaa Valley, Lebanon, only 45 Km from the capital Beirut, and at 870m above sea level, MANDARA is strategically positioned as the centre of the industrial zone in the Bekaa Valley, with more than 100 large,

medium, and small manufacturing plants either operating or being erected in this zone, such as: A-Z Manufacturing, Dalal Steel Industries, Saccal Group, Kassatly Chtoura, and many more. The industrial zone includes lots from Kab Elias (Mandara), Chabrakiyet Tabet, and Taanayel.



- **UK Lebanon Tech Hub :** The UK Lebanon Tech Hub (UKLTH) is a joint initiative by Banque du Liban, Lebanon's Central Bank, and the UK Government through the British Embassy in Beirut. It aims to support the growth of the knowledge economy in Lebanon through a number of initiatives. These include international accelerator and scale up programmes for Lebanese startups and an International Research Centre that focuses on transferring knowledge from academia to industry. The Tech Hub exists to grow local economies and connect low density ecosystems to global markets. It aims to create opportunities of growth, profitability & impact by engaging the three interdependent components of industry, talent and finance through their two main programs; Acceleration and Corporate Finance.





I. COMBATING THE COVID-19 PANDEMIC

❖ **Government Initiatives for combating COVID-19**

➤ **WHO Lebanon fighting COVID-19 through risk communication and community engagement:**

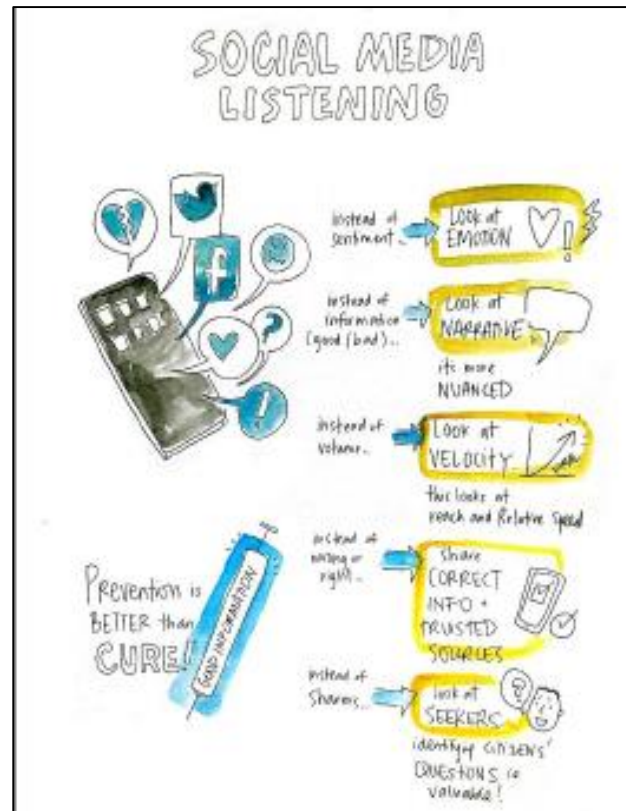
The WHO office in Lebanon worked closely with the Ministry of Public Health to provide much needed health system support to accelerate the response. To provide accurate information disseminated at the right time, a risk communication and community education taskforce was established, which included United Nations agencies, local nongovernmental organizations, Lebanese Red Cross, Ministry of Public Health, Ministry of Information and others. Their main task was to assess the situation on the ground, reach out to communities and engage with key messages that will allow the smooth and fast flow of information on how to avoid being infected with and how to protect from COVID-19.

A set of animated videos targeting all sectors of the population; children, adults, both males and females, was produced and disseminated on local TV stations and social media platforms within record time. Other than videos, WHO along with partners also produced a number of brochures and flyers on handwashing, protection during travel, student protection and many more.

To counter the spread of COVID-19 misinformation in Lebanon a rumour log was created to record locally monitored rumours, verify them and

provide neutral, accurate, trusted information to dispel the rumours. The log was placed on the Ministry of Information website.

The taskforce has also addressed concerns about the spread of the virus in refugee camps in Lebanon sharing messages with camp leaders to share with the inhabitants of the camps. Messages were also shared with refugees through Facebook, the UNHCR website, community health care volunteers and pamphlets included in hygiene and dignity kits.

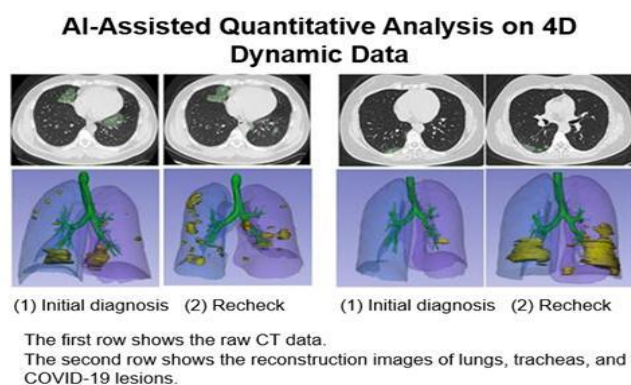


Source: <https://www.emro.who.int/lbn/lebanon-news/the-role-of-who-lebanon-is-fighting-covid-19-through-risk-communication-and-community-engagement-in-lebanon.html>

➤ **AI Solutions from Huawei helps Lebanon to fight COVID-19**

The Lebanese Ministry of Health is utilizing the solutions and technical tools that Huawei has created. These contribute through artificial intelligence, visual communication technologies, information and experience exchange systems between the Ministry and Lebanese hospitals and the possibility of cooperation with Chinese hospitals, thereby strengthening ways to confront the epidemic and limit its spread. These technologies include:

An AI-assisted quantitative medical image analysis service for COVID-19, Huawei Cloud's computer vision and medical image analysis technologies combine clinical information and laboratory results to help doctors more



accurately distinguish between early, advanced, and severe stages of COVID-19, facilitating early screening and prevention/control.

For confirmed cases in hospitals, this AI-assist service can perform registration and quantitative analysis on the 4D dynamic data of multiple rechecks within a short period of time, helping doctors effectively evaluate patients' conditions and drug use effects.

❖ Local Technological Initiatives To Fight Covid-19

➤ Lebanese Industrialists Team Up To Produce Innovative Protection Gears

Lebanese industrialists at Polytextile Group joined hands with other researchers to develop protection gears with improved filtration and barrier reducing aerosolization, and respiratory dead space, thereby reducing the need for the common combination of the N95 face masks, goggles and face shields. The end product, which has been developed in coordination with renowned international experts including the Stanford Covid Team, was provided as an in-kind assistance to the Rafic Hariri University Hospital (RHUH). The completion of this innovative solution relies on a wider collaboration that included a leading paint manufacturer Tinol, as well as volunteers in the printing industry.



Source: https://investinlebanon.gov.lb/Content/uploads/IDALInnovation_During_the_COVID-19_Crisis.pdf

➤ A New Lebanese Online Symptom Checker

In collaboration with the Epidemiological Surveillance and the Ministry of Public Health in Lebanon, and in line with the World Health Organization's guidelines, the Lebanese startup **trakMD** has developed an online symptom checker and self-help guide for people who suspect having symptoms of COVID-19, or need guidance in this regard.



The online symptom checker allows people to determine if testing is needed and provides information on the nearest testing location, and best course of action.

Source: https://investinlebanon.gov.lb/Content/uploads/IDALInnovation_During_the_COVID-19_Crisis.pdf

➤ **Proximie Is Being Deployed Across The Globe To Support The Global Fight Against Covid-19.**

The Lebanese scaleup Proximie is using its technology platform to support more than 50 Hospitals in the UK and US and internationally by remotely connecting self-isolating healthcare professionals to the front line to support their colleagues in trauma, emergency



operating rooms and ICU facilities. By maximizing healthcare resources, scaling expertise, and minimizing exposure, the Tech startup is helping save lives while ensuring every patient has access to the best possible care.

Source: https://investinlebanon.gov.lb/Content/uploads/IDALInnovation_During_the_COVID-19_Crisis.pdf

❖ **AI Assisted Solutions for Combating COVID-19**

➤ **Lebanese University Launches Robot Trolley to Aid in Fight Against COVID-19**

The Lebanese University (LU) launched a robot trolley invented by the university's students to help doctors and nurses in reducing their contact with COVID-19 patients and minimizing their risk of infection with the virus.

The trolley can be controlled through a mobile application and it allows doctors and nurses to send the robot into patients' rooms to deliver food and medicines to infected people.



➤ **Lebanese Experts Make Robots to Facilitate COVID-19 Testing**

A team of Lebanese experts invented two robots to facilitate the testing of COVID-19 without exposing physicians and nurses to the risk of being infected through direct contact with patients. The project was launched at Geitawi Hospital in Ashrafieh, and uses robots, cameras and voice transmission through internet connection.

The two robots include Courier Robot, which assists the nurses in examining the swab test by carrying the tubes containing the tests of the suspects from the emergency room to the lab, and Cleaning Robot, which is designed to carry a tank of 20 liters of sanitizer and sterilize the emergency room.



Source: http://www.xinhuanet.com/english/2020-04/17/c_138983053.htm

➤ **A Disinfection Robot Built by Students Combats COVID-19 In Lebanon**

Two Lebanese engineering graduate students are helping their country's fight against the pandemic by developing a low-cost automaton that has already been deployed in hospitals and homes across the country. The students explained that the project aims to reduce risks to humans through technological solutions. The idea is to sterilize infected areas and surfaces, such as hospitals, endemic neighborhoods and isolation rooms, to prevent doctors, health workers and volunteers from being infected. The device can spray an area of three square meters. The robot is powered by batteries and can be controlled remotely from a distance of up to one kilometer.

Source: <https://www.arabnews.com/node/1705616/middle-east>



COMSTECH Secretariat
33 - Constitution Avenue
G-5/2, Islamabad - 44000
Islamic Republic of Pakistan

Tele: 92-51-9220681-3
Fax: 92-51-9211115, 9205264
www.comstech.org

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