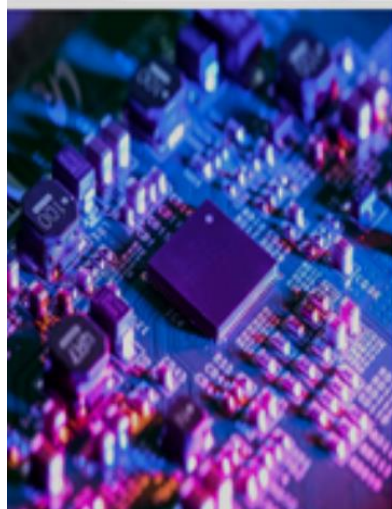
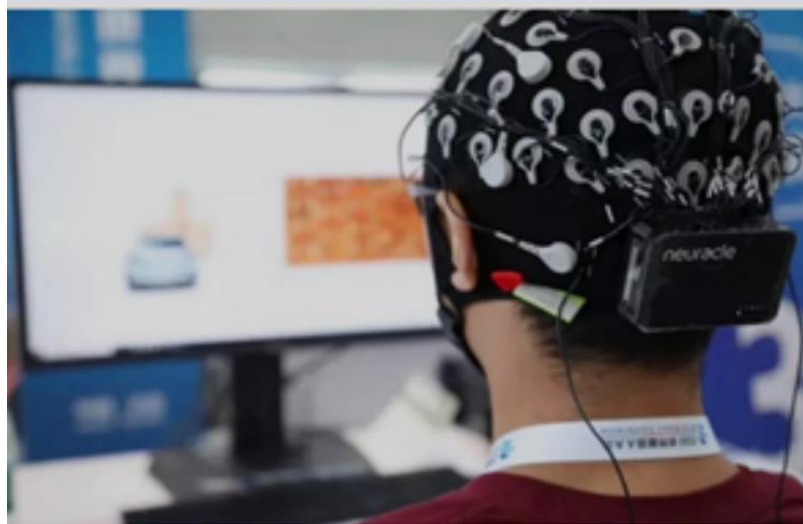




OMAN

STI Profile of the OIC Member State

Science, Technology and Innovation Indicators



COMSTECH

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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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OMAN

officially the Sultanate of Oman, is an Arabian country located in Southwestern Asia. It is situated on the southeastern coast of the Arabian Peninsula, and spans the mouth of the Persian Gulf. Oman shares land borders with Saudi Arabia, the United Arab Emirates, and Yemen, while sharing maritime borders with Iran and Pakistan. The coast is formed by the Arabian Sea on the southeast, and the Gulf of Oman on the northeast. Muscat is the nation's capital and largest city.

Oman has been inhabited since ancient times and recent years surveys have uncovered Palaeolithic and Neolithic sites on its eastern coast. Sumerian tablets referred to Oman as "Magan" and in the Akkadian language "Maka". Mazoon, a Persian name used to refer to Oman's region, which was part of the Sasanian Empire.



From the 17th century, the Omani Sultanate was an empire, vying with the Portuguese and British empires for influence in the Persian Gulf and Indian Ocean. At its peak in the 19th century, Omani influence and control extended across the Strait of Hormuz to Iran and Pakistan, and as far south as Zanzibar. When its power declined in the 20th century, the

sultanate came under the influence of the United Kingdom. For over 300 years, the relations built between the two empires were based on mutual benefit. Historically, Muscat was the principal trading port of the Persian Gulf region.

A vast gravel desert plain covers most of central Oman, with mountain ranges along the north (*Al Hajar Mountains*) and southeast coast (*Qara or Dhofar Mountains*), where the country's main cities are located. Like the rest of the Persian Gulf, Oman generally has one of the hottest climates in the world—with summer temperatures in Muscat and northern Oman averaging 30 to 40 °C (86.0 to 104.0 °F). Oman receives little rainfall, with annual rainfall in Muscat averaging 100 mm.

Oman is an absolute monarchy led by a Sultan, with power passed down through the male line. Formerly a maritime empire, Oman is the oldest continuously independent state in the Arab world. It is a member of the United Nations, the Arab League, the Gulf Cooperation Council, the Non-Aligned Movement and the Organisation of Islamic Cooperation. It has oil reserves ranked 22nd globally. In 2010, the United Nations Development Programme ranked Oman as the most improved nation in the world in terms of development during the preceding 40 years. In 2018, oil and gas represented 71 percent of the government's revenues. The government's reliance on oil and gas as a source of income dropped by 1 percent from 2016 to 2018. Oil and gas sector represented 30.1 percent of the nominal GDP in 2017. A portion of its economy involves tourism and trading fish, dates and other agricultural produce. Oman is categorized as a high-income economy and, as of 2022, ranks as the 64th most peaceful country in the world according to the Global Peace Index.

In 2022 it was estimated to have a population of 3.76 million. Because of the combination of a relatively small local Omani population and a fast-growing oil-driven economy, Oman has attracted many migrants. At the 2014 census the total expatriate population was 1,789,000 or 43.7% of the then population. Oman's population primarily consists of Arab, Baluchi, South Asian (Indian, Pakistani, Sri Lankan, Bangladeshi), and African ethnic groups.

Source: <https://en.wikipedia.org/wiki/Oman#History>



A. ECONOMIC OVERVIEW

Oman's Basic Statute of the State expresses in Article 11 that the "national economy is based on justice and the principles of a free economy." By regional standards, Oman has a relatively diversified economy, but remains dependent on oil exports. In terms of monetary value, mineral fuels accounted for 82.2 percent of total product exports in 2018. Tourism is the fastest-growing industry in Oman. Other sources of income, agriculture and industry, are small in comparison and account for less than 1% of the country's exports, but diversification is seen as a priority by the government. Agriculture, often subsistence in its character, produces dates, limes, grains and vegetables, but with less than 1% of the country under cultivation, Oman is likely to remain a net importer of food.

Oman's socio-economic structure is described as being highly centralized with the largest 10 percent of corporations in Oman as the employers of almost 80 percent of Omani nationals in the private sector. One third of employed Omanis are in the private sector, while the remaining majority are in the public sector.

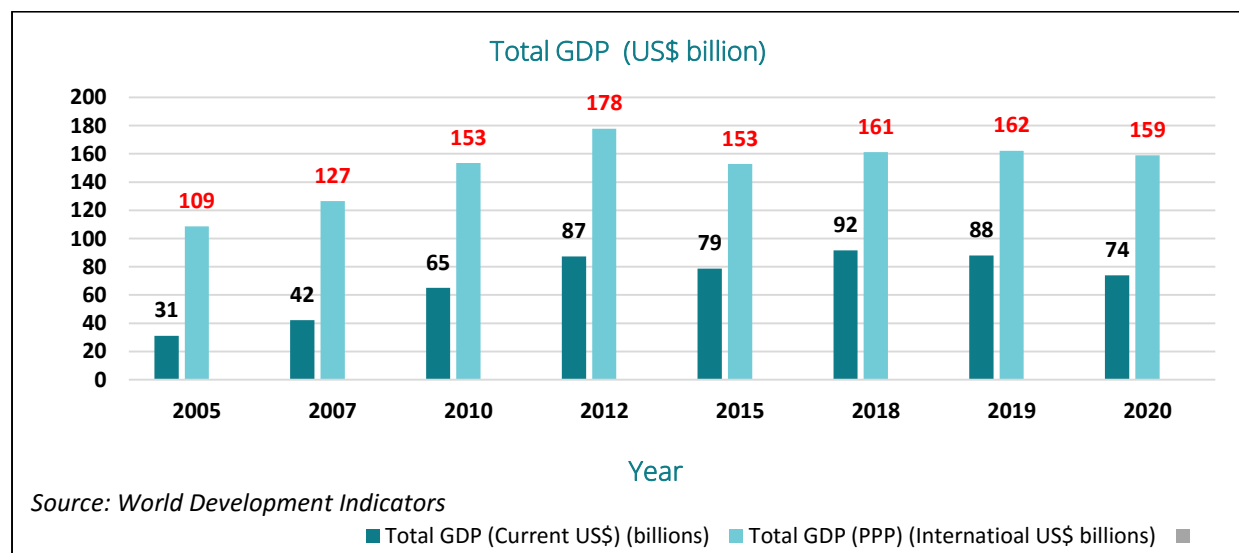
Since a slump in oil prices in 1998, Oman has made active plans to diversify its economy and is placing a greater emphasis on other areas of industry, namely tourism and infrastructure. Oman had a 2020 Vision to diversify the economy established in 1995, which targeted a decrease in oil's share to less than 10 percent of GDP by 2020, but it was rendered obsolete in 2011. Oman then established 2040 Vision.

A free-trade agreement with the United States took effect in 2009, eliminating tariff barriers on all consumer and industrial products, and also providing strong protections for foreign businesses investing in Oman. Tourism, another source of Oman's revenue, is on the rise.

In terms of foreign direct investment (FDI), total investments in 2017 exceeded US\$24billion. The highest share of FDI went to the oil and gas sector, which represented around US\$13billion (54.2 percent), followed by financial intermediation, which represented US\$3.66billion (15.3 percent). FDI is dominated by the United Kingdom with an estimated value of US\$11.56billion (48 percent), followed by the UAE USD 2.6billion (10.8 percent), followed by Kuwait USD 1.1billion (4.6 percent).

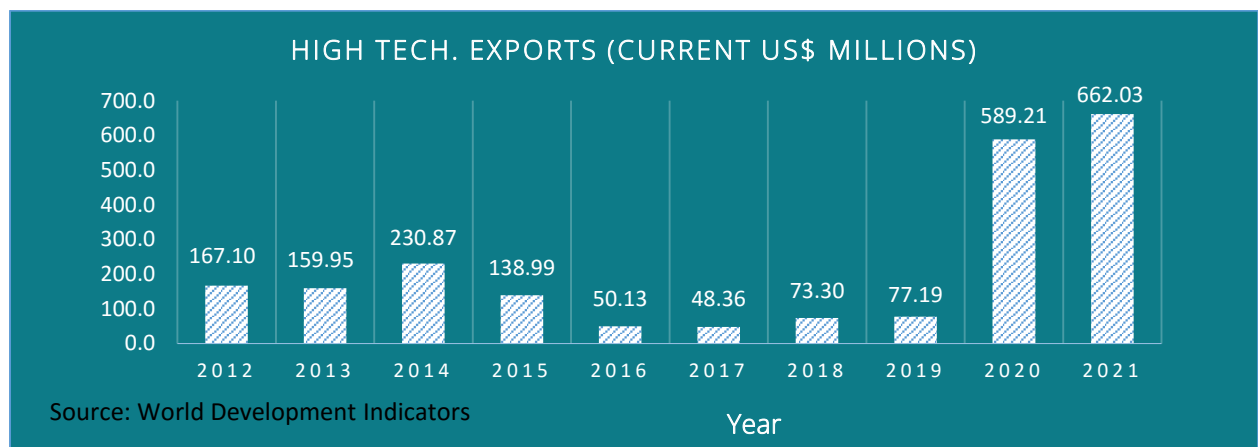
Oman, in 2018 had a budget deficit of 32 percent of total revenue and a government debt to GDP of 47.5 percent. Oman's military spending to GDP between 2016 and 2018 averaged 10 percent, while the world's average during the same period was 2.2 percent. Oman's health spending to GDP between 2015 and 2016 averaged 4.3 percent, while the world's average during the same period was 10 percent. Oman's research and development spending between 2016 and 2017 averaged 0.24 percent, which is significantly lower than the world's average (2.2 percent) during the same period. Oman's government spending on education to GDP in 2016 was 6.11 percent, while the world's average was 4.8 percent (2015).

Source: <https://en.wikipedia.org/wiki/Oman#Economy>



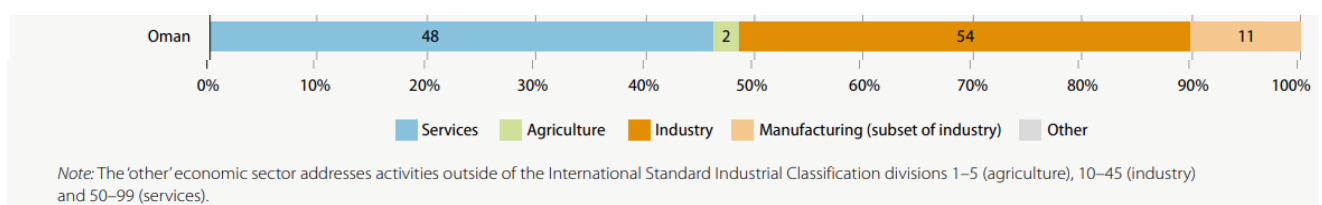
Oman's GDP has shown risen from US\$31 billion in 2005 to 74 billion in 2020, but displaying a significant decline in the Covid year 2020. The GDP in terms of PPP however shows a relatively constant figure (159-162 billion US\$) in the recent past years (2018-2020). The percapita GDP for 2019 was estimated to be US\$27896 in terms of PPP.

❖ High Technology Exports



The trend for the high technology exports of Oman is depicted in the figure and shows a very pronounced surge from 77 to 589 million US\$ between 2019-20. In 2021 these constituted about 6.6% of all exports.

❖ Oman: Economic sector's share in the GDP



Industry, with 54% contribution to the GDP has the dominant share in the economy. However, manufacturing has a small contribution to the overall industrial share. Services account for 48% of the economy.



B. SOCIAL AND HUMAN DEVELOPMENT

The Sultanate of Oman has been ranked among the five best Arab countries in the newly released index in the Human Development Report of the United Nations Development Programme (UNDP). With a Human Development Index (HDI) of 0.816, Oman ranks 54th globally and counts as one of the high developed economies by UN definition. (The average HDI of the high human development group is 0.757, while the average of the European and Central Asian countries is 0.771).

Some of the key HD indicators are shown in the table below. As can be seen most of Oman's human development indicators are quite high and constant over the past few years where data is available. The usage of the internet has increased over the past few years and is now accessible and being used by almost all the population.

Series Name	2016	2017	2018	2019	2020	2021
Life expectancy at birth, total (years)	77.142	77.393	77.633	77.861	..	..
Literacy rate, adult total (% of people ages 15 and above)	94.90	95.58	95.65	..	..	..
Labor force with advanced education (% of total working-age population with advanced education)	..	..	67.85	..	..	..

Labor force with intermediate education (% of total working-age population with intermediate education)	..	..	67.85	..	..	..
Mortality rate, infant, male (per 1,000 live births)	10.6	10.5	10.5	10.5	10.4	..
Individuals using the Internet (% of population)	76.84	80.19	85.5	90.3	95.23	..
Mobile cellular subscriptions (per 100 people)	153.29	148.82	139.97	138.23	133.84	..

Data from database: World Development Indicators

Oman has slightly increased the average life expectancy to about 78 years over the past 6 years with an almost 100% literacy for persons over 15 years of age. The infant mortality rate (number of deaths per thousand births) is about 10 for males.

Source: <https://hdr.undp.org/sites/default/files/Country Profiles/UZB.pdf>



❖ Skill development

Oman's Five-Year Plan and Voluntary National Reviews (2016 and 2019) describe the need to boost the employment rate of nationals as the country's most pressing priority. Launched in August 2018, Oman's National Youth Programme for Skills Development lies at the intersection between this challenge and the government's ambitions for the Fourth Industrial Revolution. By 2020, the government aims to train about 3 000 Omanis aged 15–29 years in related skills, such as programming, coding and critical thinking, including in relation to robotics and artificial intelligence (AI). Successful participants will receive a 'nanodegree', a new qualification recognizing the acquisition of Industry 4.0 skills.

Source: UNESCO Science Report 2021

❖ **Science Talent Development:**

Stemazone Initiative; The *Stemazone* initiative provides services to children across the country and inspires young Omanis to enter STEAM (science, technology, engineering, art, and mathematics) fields and set them on the STEAM pathway from an early age, which studies show is critical to building a skilled workforce. It is national in scope and implemented in partnership with the Oman Children's Museum. Under this partnership, Oman's Children Museum serves as the anchor location in Muscat for the initiative, hosting visitors from the public and schools interested in engaging in STEAM-related activities, including coding, robotics, 3-D printing, and more.





➤ **Ministry of Higher Education, Research and Innovation:**

➤ **The former Research Council** established in 2005, is now part of this Ministry of Higher Education, Research and Innovation. The Research Council is Oman's exclusive research funding body and leader of research development in the country. TRC serves as a focal point and hub dedicated to promoting and supporting research, scientific enquiry, and innovation in the Sultanate of Oman. As a policy-making body and funding agency, TRC encourages the promotion and application of research, innovation and science to create value that serves business, markets and the wider needs of society. The Council convenes the scientific expertise and resources needed to lead on

catalysing, incubating and coordinating impactful international action on issues of major scientific and public importance.

➤ **A new Ministry of Transport, Communications and Information Technology,** responsible besides transport for information technology (IT) and telecommunication was Oman established in 2019. The new ministry assumes the responsibilities of the now-defunct *Information Technology Authority (ITA)*, which was tasked with implementing national IT infrastructure and supervising projects relating to the *Digital Oman Strategy* and other e-Government activities. As a result, all *ITA* powers, prerogatives, allocations, and assets have now been transferred to the new *Ministry of Technology and Communications*. Employees of the *ITA* have also been transferred to the new ministry.

➤ **Directorates and other centers within The Ministry of Transport, Communications and Information Technology:**

- The Directorate General of Policies & Governance
- The Directorate General of Infrastructure and Digital Platforms
- The Directorate General of Sector stimulation and Future skills
- The Directorate General of Digital transformation and Sectors empowerment
- The National Center for Space and Advance Technology
- AI and Oman CERT

➤ **Ministry of Energy and Minerals**

The Ministry of Energy and Minerals (MEM) is the governmental body in the Sultanate of Oman responsible for developing and implementing the government policy for exploiting the oil and gas resources in Oman. Besides oil and gas related directorates, the following two also function under this Ministry:

- The Directorate General of Electricity
- The Directorate General of Renewable Energy and Hydrogen

❖ **STI related policies**

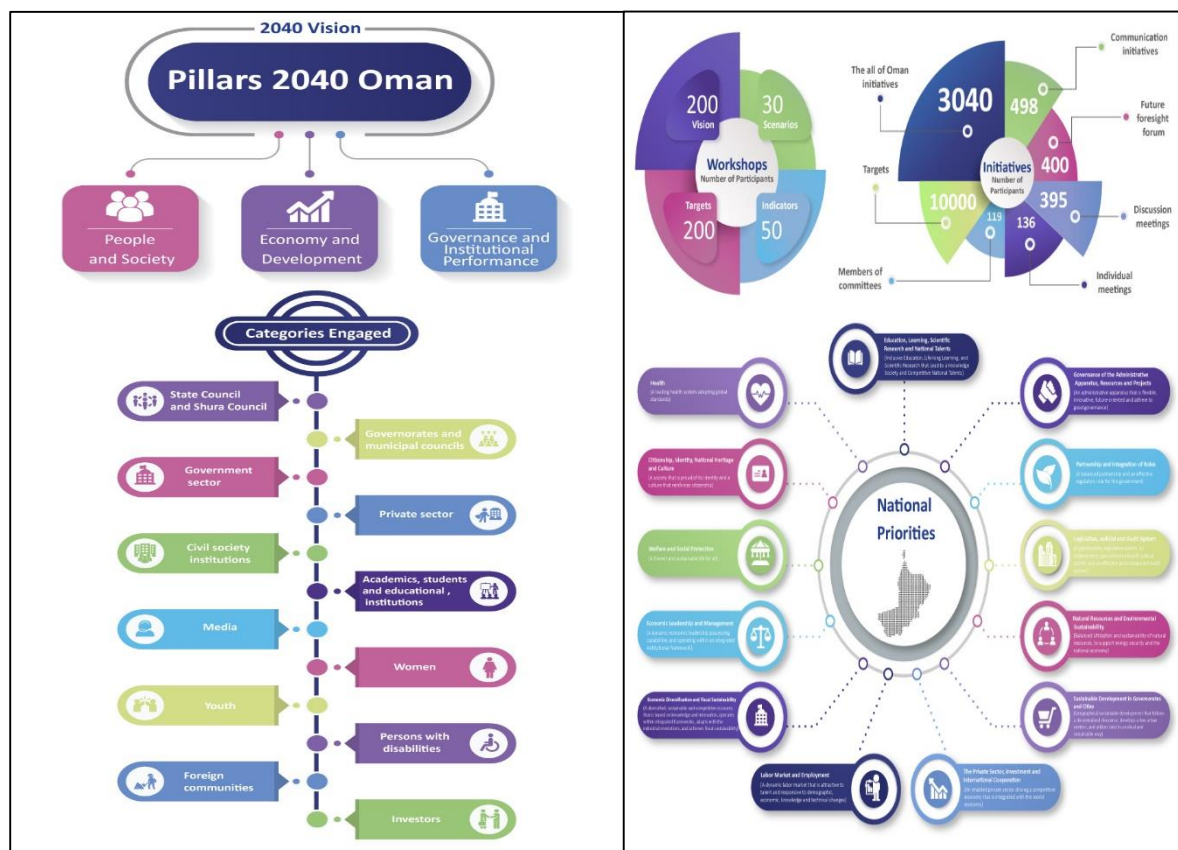
➤ **National Industrial Strategy 2040 (2018):** The Industrial Strategy 2040 aims to diversify the manufacturing activities into technology-

and knowledge-based activities and develop unique and diversified products, in addition to focusing on industries based on natural resources and industries based on capital. The programmes of the Industrial Strategy 2040 include creating new knowledge-based industries, entrepreneurship and industrial innovation, developing and modernising the Omani industry, governance and management of industrial development, and strategy developments to improve in-country value opportunities.

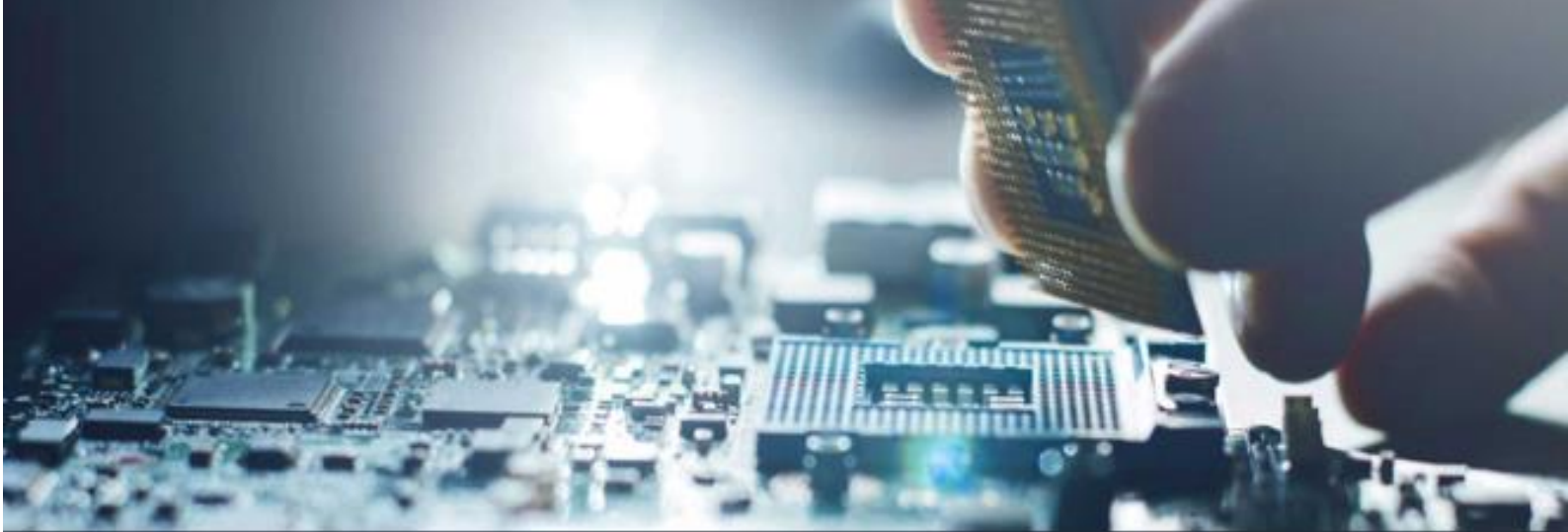
- **National Energy Strategy 2040 (2015):** This goal is to be in line with the aims of the Oman vision 2040, to reduce the dependency on non-renewables and effectively develop resources such as renewable energy, to lower production cost and enhance competitive element in economic sectors. Also, develop the infrastructures and building the human capacity of Omanis to meet the vision 2040.
- **Digital Oman Strategy (2003):** The e-Government vision in Oman was made after the approval of the National Strategy for Digital Society and eGovernance in May 2003. The Digital Transformation Program aims to create a sustainable knowledge-based society, raise the productivity and efficiency of the public sector by building national capacities, strengthening the infrastructure, developing the IT industry and improving the quality and execution of government services. These services should adhere to specific standards and timeframes to achieve the objective of simplifying the service procedures to citizens, businesses, and government entities. Ministry of Transport, communications and Information Technology (MTCIT) is the authority responsible for supervising the development and implementation of the Digital Transformation Program as well as monitoring the performance.

Source: <https://oman.om/wps/portal/index/DigitalOman2030>

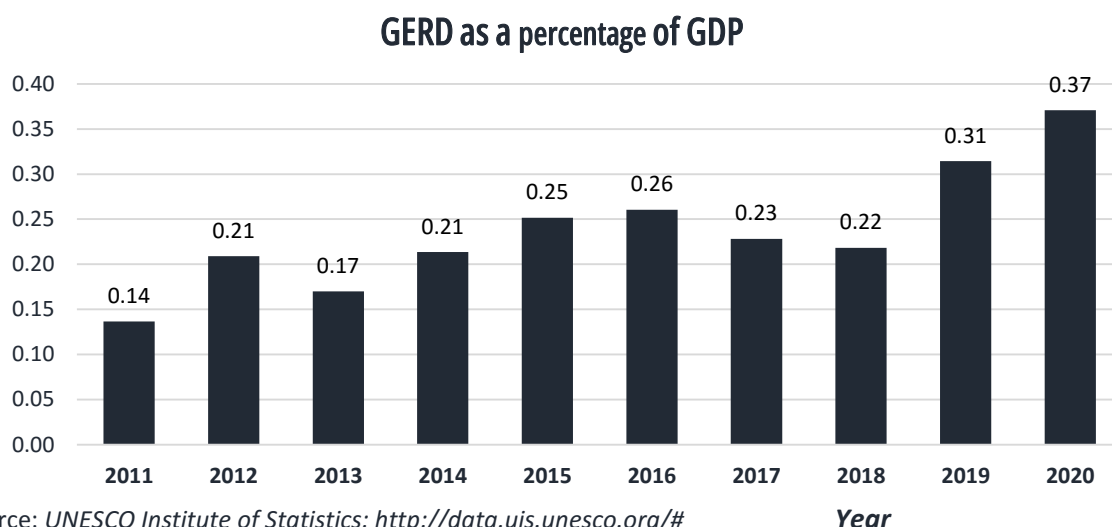
- **Hour of Code:** As a strategy to bridge the digital divide, *Omantel* has conducted in Muscat and Salalah governorates in cooperation with the Engineering Village "*Hour of Code*" which is a global campaign that seeks to reach tens of millions of children in more than 180 countries around the world, where programming lessons are provided in more than 40 different languages. The participants spend an hour learning the basics of programming by the "Together Volunteering team" consisting of *Omantel* employees in addition to the Engineering Village team. The idea behind the initiative is to instill the principles and basics of programming in Youth to keep pace with latest technologies.



Source: <https://omanportal.gov.om/wps/portal/index/strategiesandpolicies>



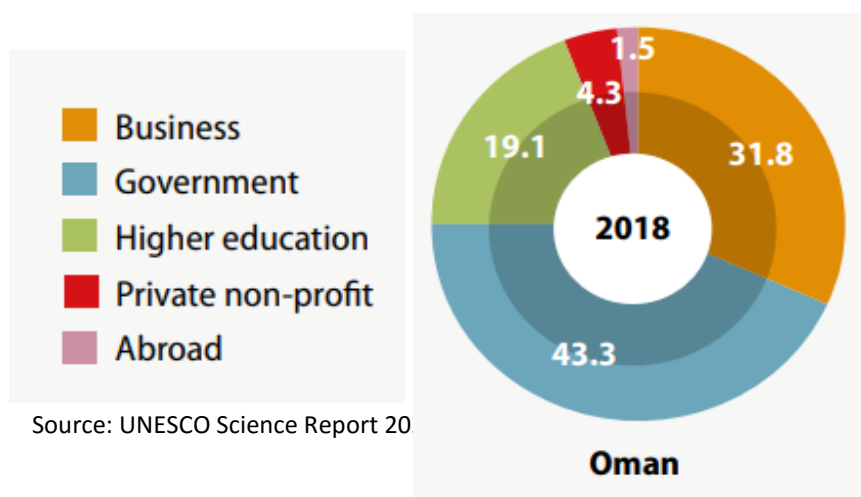
D. RESEARCH AND DEVELOPMENT



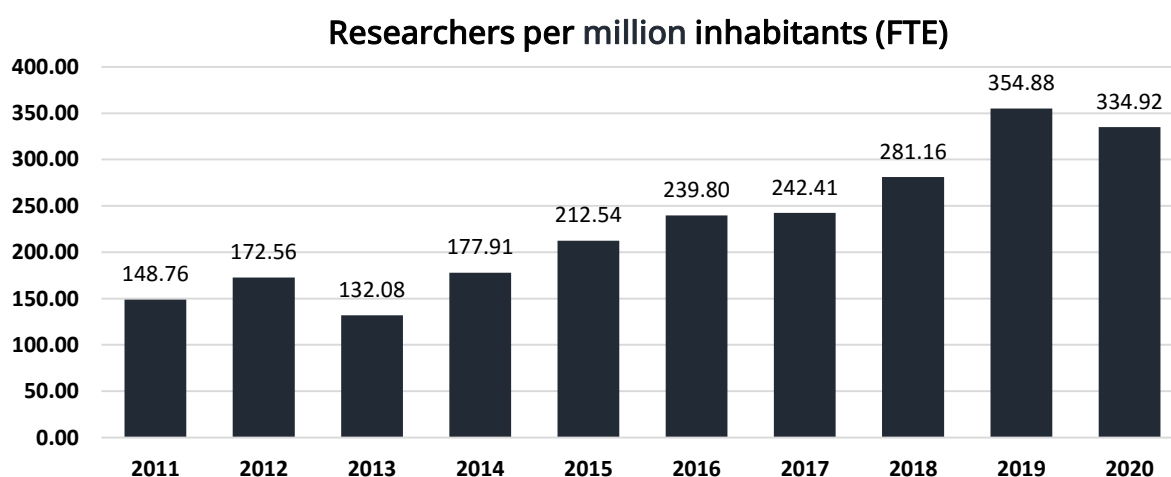
Oman's gross domestic expenditure on research and development (GERD) as a percentage of GDP is shown in above graph for the period 2011 to 2020. It is noticeable that over this period it has increased from a very low of 0.14 to 0.37%. This slow but consistent increase reflects Oman's resolve expressed in its policy documents to convert Oman into knowledge economy and to diversify its economy based on S&T efforts.

It is interesting to note that a very significant share of research funding in Oman, almost 32%, comes from the business sector, while government (43.3%) and higher education (19.1%) are also major contributors.

❖ GERD by source of funds in Oman, 2018 (%)



❖ R&D Human Capital



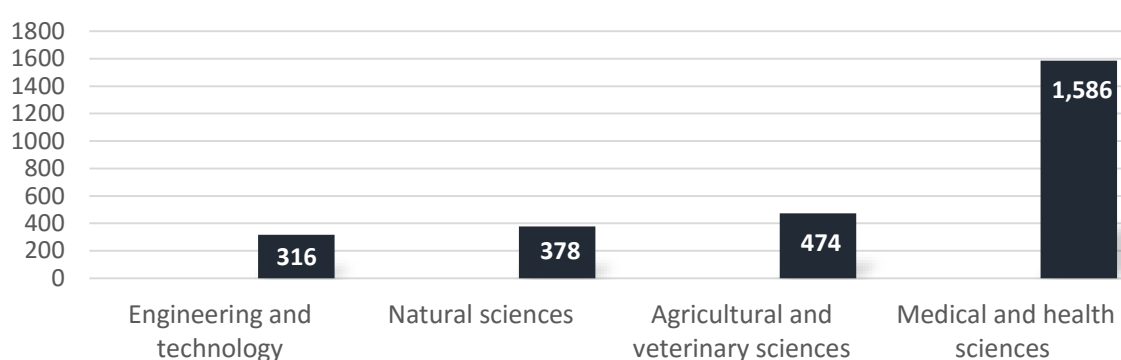
Source: UNESCO Institute of Statistics

Consistent with the increased R&D spending, the number of researchers in Oman has also increased systematically over the past ten years displaying an overall 125% increase over this period. The trend can be seen in the graph above. However, the latest figures of about 335 researchers per million are still well short of the global average of 1368 per million. According to UIS data, the majority of researchers were employed by the government (65%) while the remaining were almost entirely employed by the higher education sector. Business is still a very

limited employer in Oman despite its very significant support to research in other organizations.

❖ Researchers distribution by major fields (HC)

As the following data show, the overwhelming majority of researchers are engaged in the medical and health sciences areas with comparatively small numbers in the fields of agriculture, natural sciences and engineering. The small numbers in engineering and natural sciences may well create problems for Oman in executing its plans for a knowledge economy based on innovation.



Source: UNESCO Institute for Statistics (UIS)

❖ Researchers by sectors of employment and fields (HC) - 2018

#	Fields	BUSINESS ENTERPRISE (2018)	GOVERNMENT (2018)	HIGHER EDUCATION (2018)	TOTAL
1	Natural sciences	N/A	6	372	378
2	Engineering and technology	31	4	281	316
3	Agricultural and veterinary sciences	N/A	397	77	474
4	Medical and health sciences	N/A	1373	213	1,586
	TOTAL	31	1,780	943	2,754

Source: UNESCO Institute for Statistics (UIS)

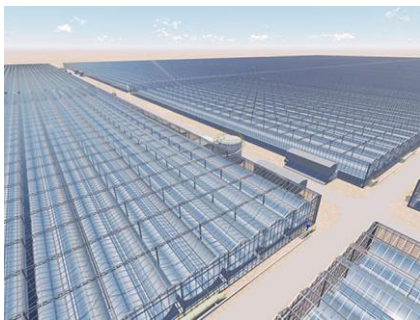
- Female researchers constituted 36.4% of the research workers according to 2018 data.

❖ R&D HIGHLIGHTS

➤ OMAN'S RENEWABLE ENERGY PROJECTS

Oman's National Energy Strategy aims to derive 30% of electricity from renewable sources by 2030. Oman wants to expand its electricity generation capacities through renewable independent power projects (IPPs).

- The state-owned Petroleum Development of Oman (PDO) is an early pioneer in large-scale solar power projects in Oman. In 2015, Petroleum Development Oman (PDO) launched the 7 MW pilot for the U.S. based Glass Point Miraah concentrated solar power project.



- Oman's first waste-to-energy project has received government approval and the RFQ is due to be released by the second quarter of 2020.
- Oman has embarked on many projects in line with its goal to generate 30% of its electricity from renewables. These projects include a wind farm in Dhofar; two solar IPPs in Manah; 11 solar-diesel hybrid facilities; and the 'Sahim' initiative to install small-scale solar panels on residential and commercial buildings, among others.
- In February 2019, a consortium led by Japan's Marubeni signed a power purchase agreement (PPA) with PDO Oman to develop a 100MW PV solar project at Amin.
- In March 2019, a consortium of Saudi and Kuwaiti firms secured financing for the 500 megawatt (MW) solar photovoltaic (PV) independent power project (IPP) at Ibri in Oman.

- Oman is planning to build a hydrogen-centric economy by 2040, with an annual production of green and blue hydrogen of approximately 30GW by 2040. The government has announced several gigawatt-scale green hydrogen projects, including a 14GW facility powered by 25GW of wind and solar energy. Oman plans over \$45 billion worth of green hydrogen and green ammonia projects, according to research agency MEED. Oman established a Directorate General for Clean Energy and Hydrogen at the Ministry of Energy and Minerals, and an EDO subsidiary called Hydrogen Development Oman to manage hydrogen projects.

➤ **Health and Medicine**

Researchers at *Sultan Qaboos University* have adopted artificial intelligence technologies in a number of medical projects, such as the use of artificial neural networks to diagnose obstructive sleep apnea, congestive heart failure and preeclampsia, an investigation of heart rate on variability of patients in non-surgical ways, and a mobile healthcare system to monitor and diagnose remote patient with sleep disorders through a wireless body area sensor network that provides all the necessary biomedical signals.

The Sultanate has employed Artificial Intelligence (AI) in the early diagnosis of breast cancer in a project adopted by the Ministry of Health and the Information Technology Authority. With an accuracy rate of 96%, this technology has been implemented in 5 hospitals around the Sultanate, to facilitate the early detection of breast cancer, provide the necessary early healthcare to the diagnosed women, and measure the efficiency of the system and the possibility of circulating it around the Sultanate hospitals through the integration with Al Shifa system and the Digital Screening system. Breast cancer is one of the most common diseases in Oman, representing 24.4% of the total diagnosed cancer cases.



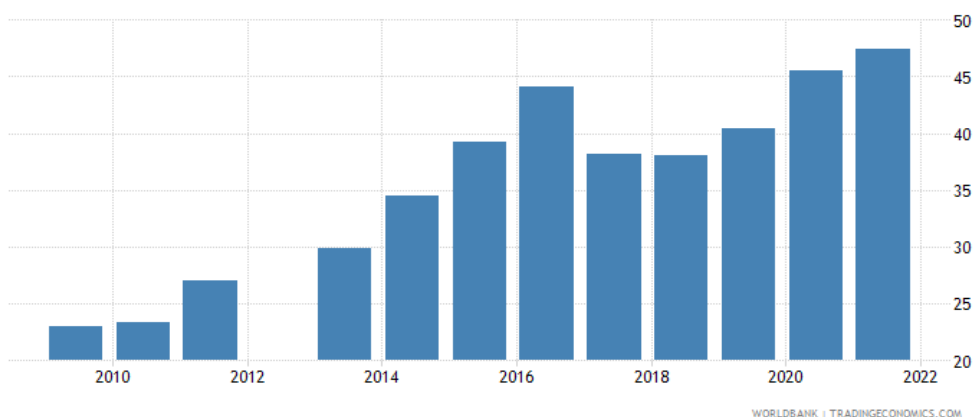
E. HIGHER EDUCATION

Since its establishment under the Royal Decree No. (2/1994), the Ministry of Higher Education has been working to promote higher education in the Sultanate in both government and private sectors. Higher education has expanded in the second half of the 1990s with the announcement of the Royal Decree No. (18/96). As a result, private universities and colleges are now distributed geographically among the regions and governorates of the Sultanate providing variety of programs in all levels: diploma, bachelors and masters covering a wide range of specializations in professional, technical and administrative fields.

The Omani higher education system started officially with the establishment of Sultan Qaboos University (SQU) in 1986. Indeed, SQU is the only public university till now and regarded as the premier university carrying His Majesty's name. In the year 2003, Oman's Ministry of Higher Education approved the merger of five private run colleges in order to form the Muscat University. In 2016 Oman spent 1.28% of its GDP on higher education.

❖ Tertiary Enrollment in Oman:

Tertiary gross enrollment in Oman has steadily increased since 2010 and has reached 47% in 2022. (Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown).



❖ Leading Omani Universities

University Name	National Ranking	Global Ranking
Sultan Qaboos University	1	1091
University of Nizwa	2	3294
Dhofar University	3	3449
Higher College of Technology	4	3928
Sohar University	5	3976
National University of Science and Technology	6	5084
Middle East College	7	5191
Al Buraimi University College	8	5368
German University of Technology in Oman	9	5398
Modern College of Business & Science	10	6118
Gulf College	11	6736
University of Buraimi	12	6749

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

- Other higher education institutions include ASharqiyah University, Muscat University, Arab Open University and several colleges namely Oman Tourism College, College of Banking and Financial Studies, Global College of Engineering & Technology, Al Musanna College of Technology, Colleges of Applied Sciences, Fire Safety Engineering College, Gulf College of Oman, Majan College (University College), Mazoon College, Muscat University College, Nizwa College of Technology, Oman College of Management and Technology, Royal Guard of Oman Technical College, Scientific College of Design, Sur University College, Waljat College of

Applied Sciences, International Maritime College, Shinas College of Technology and Salalah College of Technology.



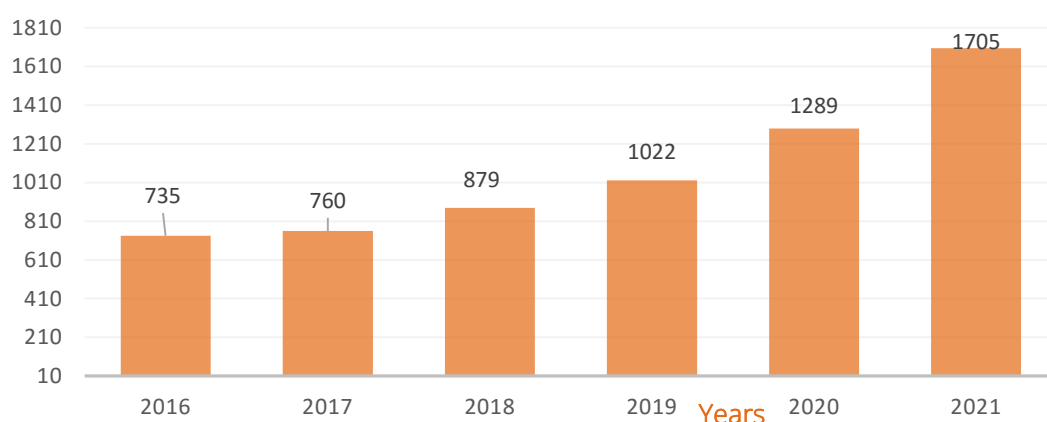
- There are 6 colleges of applied science, 7 colleges of technology, and 1 higher college of technology in Muscat.
- Oman's system of higher education currently includes 27 private universities and colleges with an enrollment of some 35,000 students.
- A memorandum of understanding has been signed between *Omantel* and University City (Oman University, Science and Technology City) to develop the city and turn it into a smart academic city equipped with the latest ICT services and 4th Industrial Revolution technologies to promote scientific research, find a smart scientific environment, and build a digital community able to keep up with the technological advancements.
- The Internet of Things (IoT) Laboratory was recently opened at Sultan Qaboos University as a platform for developing various IoT applications in smart cities and finding smart solutions based on ICT and latest digital technologies. The lab aims to transform the campus into a smart one, as well as enhance the application of IoT technology in Oman to improve the quality of life in different Omani cities.





F. RESEARCH PUBLICATIONS

Research Publications (Science and Technology)



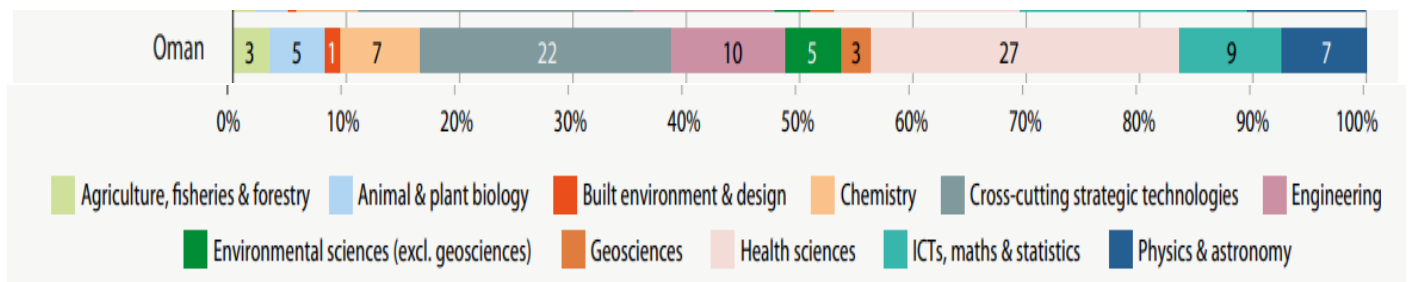
Source: Web of Science Core Collection | Document type: Articles

The number of Oman's research publications has grown steadily in the past five years as may be seen from the above graph. The latest number, though still small at 1705, has actually almost doubled since 2018 reflecting Oman's serious commitment to developing an R&D base. Within the OIC member countries Oman ranks 22nd in terms of the total number of publications.

❖ Scientific publications in Oman by broad field of science, 2017-2019 (%)

Health sciences constitutes the field of most frequent publication for Oman with 27% of publications belonging to it. Cross cutting or multidisciplinary technologies constitutes the next most frequented

discipline (22%). Engineering (10%) and ICT, Math, Stats are the next most popular disciplines with about 9-10% share each.



Source: UNESCO Science Report 2021

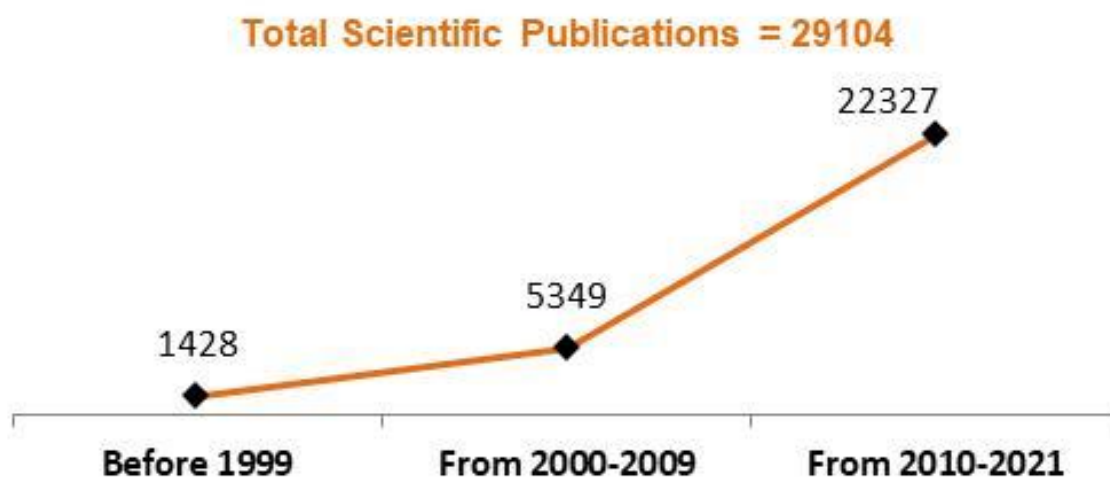
❖ Detailed Analysis

In this section we will present the total research scholarly output of Oman in three eras. Precisely we will focus on the last ten years (from 2012 to 2021) and will present;

1. The per year publications.
2. The quality of publications can be described by the per year citations, citations per publications and field weighted citation impact.
3. The source or journal ranking can be used as an indicator for the quality of publications.
4. The number of papers in different subject areas will be provided.
5. Based on the number of publications, the top ten most productive universities will be highlighted.
6. The percent (%) international collaboration and the top ten collaborating countries with Oman will be presented.

The data was retrieved from Scopus (one of the largest database in the world).

In total Oman has published 29104 research papers. The highest documents (n=22327 or 76.71%) are published from 2010 to 2021. The data for three eras is presented in the figure.



1. The per year number of publications or scholarly output (SO), citations, and citations per publications (CPP) of 20140 documents (as shown in the table) from 2012-2021 is also presented in the table.
2. The highest documents are published in 2021 (n=3593), followed by 2020 (n=2761) and 2019 (n=2384).
3. The quality of publications can be presented by citations or the CPP. The total citations were 297331 or CPP was 14.8.
4. Article Field Weighted Citation Impact (FWCI) is another indicator which can be used to present the quality of papers. It "indicates how the number of citations received by an article compares to the average or expected number of citations received by other similar publications". The total FWCI was found to be 1.47 which indicates that the articles received 47 % higher citations as compared with global average.

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Scholarly Output	20140	1197	1341	1468	1647	1851	1817	2081	2384	2761	3593
2	Citations	297331	20901	23538	27812	40856	32604	38203	27658	27226	37404	21129

3	Citations per Publication	14.8	17.5	17.6	18.9	24.8	17.6	21	13.3	11.4	13.5	5.9
4	Field Weighted Citation Impact	1.47	1.09	1.23	1.29	1.97	1.68	1.7	1.28	1.2	1.6	1.48

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.

❖ Research Quality Indicators

The research quality can be indirectly presented by the quality of journals. For the purpose, Scopus has categorized all journals in seven quartile (Q) groups (from Q1 to Q7). For example, Q1 is occupied by the top 1%, and Q7 is occupied by journals in the 75 to 100% group. The per year publications details in different quartile groups are presented in the table.

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Pub in top 1% Sources (Q1)	236	9	13	20	16	22	23	27	18	39	49
2	Pub in top 5% Sources(Q2)	1305	67	77	81	97	96	122	121	136	219	289
3	Pub in top 10% Sources(Q3)	2814	128	164	179	198	206	261	287	319	432	640
4	Pub in top 25% Sources(Q4)	6542	270	329	401	485	570	671	654	761	973	1428
5	Pub in top 50% Sources(Q5)	11203	508	571	696	820	919	1031	1153	1315	1723	2467
6	Pub in top 75% Sources(Q6)	14624	719	888	1030	1190	1209	1283	1443	1674	2182	3006
7	Pub in top 100% Sources(Q7)	16364	875	1007	1140	1337	1420	1471	1597	1893	2363	3261

In figure we presented the overall distribution of papers in different quartiles. For example, the highest documents are published in Q5, followed by Q4 and Q6.



We also described the number of publications in different or twenty-seven (n=27) major subject areas. For example, the highest documents were published in;

1. Medicine (n=449),
2. Engineering (n=4175) and
3. Computer Science (n=3011)

While the highest citations were noted for;

1. Medicine (n=97703)
2. Engineering (n=46429) and
3. Environmental Science (n=32732)

The number of authors, citations per paper (CPP) and field weighted citation impact (FWCI) for all 27 areas are described in the table.

S#	Subject Area	SO	Citations	Authors	CPP	FWCI
1	Medicine	4499	97703	4493	21.7	1.93
2	Engineering	4175	46429	2803	11.1	1.16
3	Computer Science	3011	23641	2043	7.9	1.1
4	Social Sciences	2062	17281	1720	8.4	1.29
5	Agricultural and Biological Sciences	1838	31180	1432	17	1.25
6	Environmental Science	1803	32732	1420	18.2	1.32
7	Physics and Astronomy	1648	24174	1021	14.7	1.25
8	Biochemistry, Genetics and Molecular Biology	1614	30170	1446	18.7	1.15
9	Mathematics	1577	11028	1007	7	1.14
10	Energy	1568	24475	2013	15.6	1.25
11	Materials Science	1507	23531	1039	15.6	1.21

12	Chemistry	1504	28923	1031	19.2	1.14
13	Earth and Planetary Sciences	1416	14319	1917	10.1	1.04
14	Business, Management and Accounting	1314	12796	1005	9.7	1.05
15	Chemical Engineering	1188	23672	966	19.9	1.18
16	Economics, Econometrics and Finance	757	7466	490	9.9	1.61
17	Pharmacology, Toxicology and Pharmaceutics	744	11010	622	14.8	1.05
18	Decision Sciences	654	5014	709	7.7	1.19
19	Arts and Humanities	569	3216	487	5.7	1.02
20	Immunology and Microbiology	497	12010	598	24.2	1.32
21	Multidisciplinary	399	8671	563	21.7	0.91
22	Nursing	377	6180	446	16.4	2.25
23	Psychology	211	3422	269	16.2	1.55
24	Neuroscience	207	4506	270	21.8	1.5
25	Veterinary	138	1501	210	10.9	1.09
26	Health Professions	137	1645	173	12	1.1
27	Dentistry	22	113	16	5.1	0.54

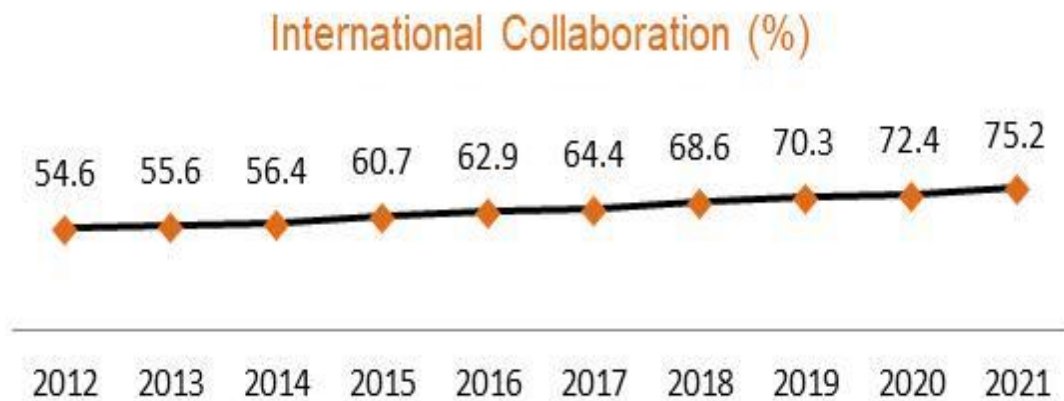
The list of top ten universities is provided in the table. The highest documents are published by

1. Sultan Qaboos University (n=10076)
2. University of Nizwa (n=1464) and
3. Dhofar University (n=1043)

While, for each university the total citations, number of contributing authors, CPP and FWCI are provided in the table.

S#	Institution	SO	Citations	Authors	CPP	FWCI
1	Sultan Qaboos University	10076	151554	4241	15	1.19
2	University of Nizwa	1464	25361	539	17.3	1.26
3	Dhofar University	1043	9836	299	9.4	1.11
4	Ministry of Health, Oman	905	50912	805	56.3	4.99
5	Royal Hospital Oman	787	11255	638	14.3	1.19
6	Sohar University	682	9496	242	13.9	1.17
7	National University of Science & Technology (by Merger of Caledonian College of Engineering and Oman Medical College)	639	7739	454	12.1	0.87
8	Petroleum Development Oman	567	3872	1094	6.8	1.02
9	Middle East College	357	2447	247	6.9	1.2
10	German University of Technology	327	3035	101	9.3	1.04

Oman has published 66.4% documents in strong international collaboration. The rate of per year collaboration (from 2012 to 2021) is presented in the figure, which shows an overall increasing trend.



The highest documents were published in strong collaboration with

1. Indian (n=3191),
2. UK (n=2751) and
3. USA (n=2626).

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





G. International Cooperation and Support Initiatives (selected)

- ❖ **Agreement between the UNITED STATES OF AMERICA and OMAN Signed at Davos, Switzerland January 22, 2016:** Under this Agreement the two Parties intend to strengthen scientific and technological capabilities, broaden and expand relations between the extensive scientific and technological communities of both countries, promote scientific and technological cooperation in areas of mutual benefit for peaceful purposes, and provide opportunities to exchange ideas, information, skills, and techniques.
- ❖ **UK Science and Innovation Network (SIN) in Oman:**

In Oman SIN objectives include increasing trade and investment cooperation in education, healthcare, infrastructure, water, clean energy, cyber security, Science and Innovation – working on higher education, collaborating with the British Council and the Gulf Science and Innovation, Knowledge and Economy programme.

SIN activities in Oman are focused on the following priority thematic areas:

 - Antimicrobial Resistance (AMR)
 - Food Security
 - Cyber and ICT

- Clean and Renewable Energy

❖ **In September 2022 the United Arab Emirates and the Sultanate of Oman signed** a number of Memoranda of Cooperation (MoC) on the sidelines of the visit of the UAE President to Oman. In the field of higher education, scientific research, innovation and vocational training, a memorandum of understanding was signed between the Ministry of Higher Education and Scientific Research in Oman and the Ministry of Education in the UAE. The two countries also signed a memorandum of understanding in the field of energy between the Ministry of Energy and Minerals in Oman and the Ministry of Energy and Infrastructure in the UAE.

❖ **In October 2022 Oman and Bahrain signed a number of MoUs of cooperation in various areas:**

- An MoU covering cooperation in the field of information technology was signed by Oman's Ministry of Transport, Communications and Information Technology and Bahrain's Information and e-Government Authority.
- An MoU was also signed between Oman's Ministry of Higher Education, Scientific Research and Innovation and Bahrain's Higher Education Council in the field of higher education, scientific research and innovation.
- 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

❖ Policy initiatives towards promoting innovation

- **Vision 2040**, Oman's long-term development plan, calls for the enhancement of national technical capabilities, the construction of vital ICT infrastructure, and the improvement of e-government services. The government has prioritized the development of ICT and the sector is well positioned for growth in the years ahead. Several U.S. firms are at the forefront of ICT development in Oman.
- The Ministry of Transport, Communications, and Information Technology (MTCIT) oversees national IT infrastructure projects and e-government initiatives. The Telecommunications Regulatory Authority provides considerable oversight and policy guidance, most notably in the deployment of Oman's 5G networks. The Oman Technology Fund has invested in local companies that developed online auction, marketplace, and teaching platforms, among others.
- Oman is building the ICT infrastructure to reduce the digital divide through its National Broadband Strategy, which envisions providing broadband service to more than 90 percent of urban areas by 2030, with overall penetration reaching 75 percent.

- **Oman Technology Fund** provides investments and guidance to technology startups and entrepreneurs through three investment programs: "Techween Incubator", "Wadi Accelerator" and "Jasoor Ventures". Wadi Accelerator, which is a seed stage fund and accelerator program, has invested \$ 1.2 million in 12 tech startups in Oman and MENA region. These companies provide services in the field of technology, biotechnology, Industrial Internet of Things, artificial intelligence, smart cities, digital media, e-commerce and advertising, such as: Almanjam, Crowd Media, Iris Technology, MerMaid, Mrayti, Social Champ, Smartchoice, PG Studios and WattNow.



- **The Government Innovation Initiative** is established to support innovation and creativity in government entities providing effective proposals that contribute in finding innovative solutions to enhance the governmental performance and increase its efficiency in various fields. The initiative aims to reduce time and effort required to provide a service while maintaining the highest standards of quality and effectiveness. This is fulfilled by using unconventional patterns and emerging technologies such as Artificial Intelligence, Blockchain, IoT, Cloud Computing, Virtual Reality Applications and other procedures that are considered a paradigm shift in supporting advanced governmental performance.

❖ **Promoting Digitization of economy**

- The *Digital Oman Strategy (2003)* has prioritized e-governance and business support. As of 2020, the process of digitizing government services is still ongoing. Since 2019, more than 50 government departments have been participating in an initiative to digitalize their services by 2022. According to the Ministry of Technology and Communications, about 160 public e-services were launched in 2019. Many of these are delivered through the Altakamul app, a single access point for government services.
- Other key initiatives include the Oman Technology Fund (est. 2016), which had invested in 53 innovative enterprises in the information technology sector with strong growth potential by 2018. Its three

sub funds target start-ups, mid-stream businesses and global venture capital companies.

- To help drive the digital economy and ensure cybersecurity, the Oman ICT Group was founded in early 2019 through the country's largest sovereign wealth fund, the State General Reserve Fund. The role of the ICT Group is to fund and oversee projects while supporting SMEs specializing in robotics, blockchain, the Internet of Things and related areas.

❖ **Other Digital Facilities and Networks facilitating Innovation**

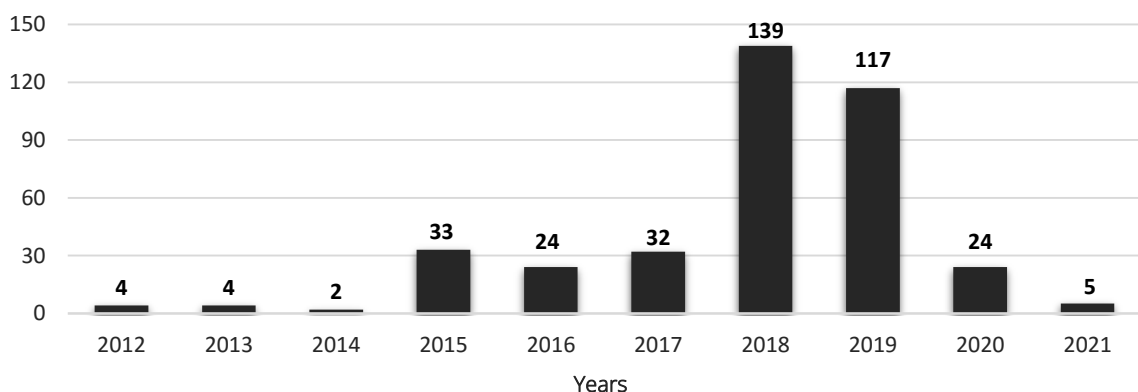
- **Oman Research and Education Network (OMREN)** is a central part of a sustainable infrastructure that contributes to the emergence of an effective national innovation ecosystem. It provides the research and education community in the Sultanate of Oman with a common network and collaboration infrastructure adapted to their needs.
- **Masader** is the brand name of the Oman Virtual Science Library, which provides seamless and affordable access to a wealth of global research material. Membership of the Oman Research and Education Network (OMREN) makes Masader available to universities, technical colleges, and other Oman-based institutions engaged in education and scientific research.
- **Shuaa an OMREN Digital Repository:** The digital repository contributes significantly to scientific research in the Sultanate and offers a great opportunity to provide value-added services to the research community by providing free of charge sources online. The digital repository includes collection of research outcomes and Omani academic research innovations, electronically available for the research and academic community. It organizes the management of the outcomes of Omani academic research innovations indexed, categorized and saved in standardized digital repositories.



- The Research Council has also approved a study to establish *the Institute of Advanced Technology Integration (IATI)*, hoping to establish a culture of innovation and entrepreneurship in the fields of research and science and to function as intermediary between the industry and business sector and the academic sector in Oman. The objective behind establishing this institution is to develop scientific researches into innovative technologies and marketable products as well as to create a stimulating environment to conduct researches that will help the Sultanate meet market demands and tackle current challenges in water, renewable energy and oil and gas sectors.

❖ Award of Patents

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



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

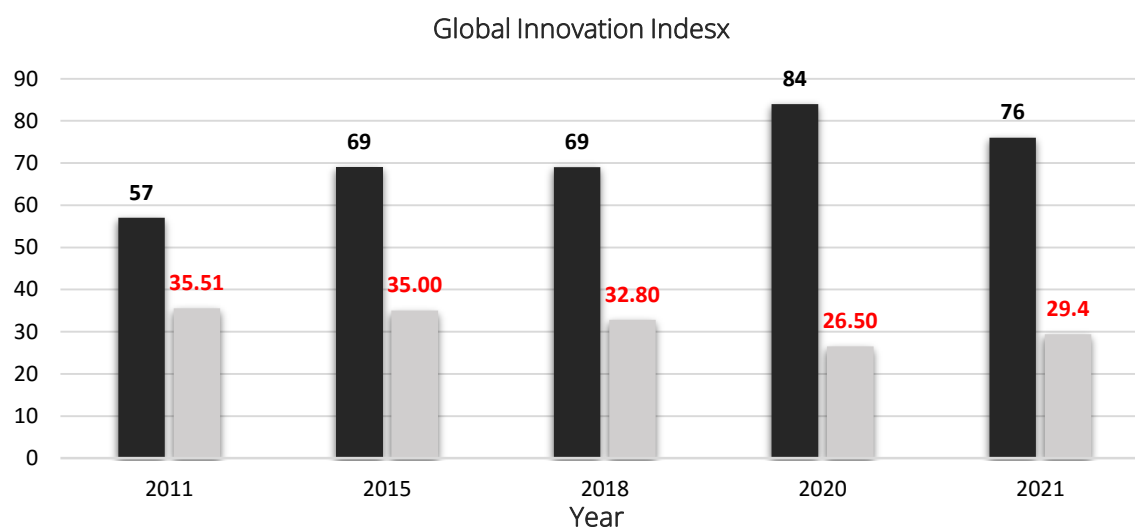
The above data on patents granted to Omanis, including resident, non-resident and abroad is small except for two in between years, 2018 and 2019, where non-resident patents have shown a very strong surge.

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

Year	Resident	Non-Resident	Abroad	TOTAL
2012			4	4
2013			4	4
2014			2	2
2015		29	4	33
2016	1	17	6	24
2017	1	17	14	32
2018		136	3	139
2019	1	91	25	117
2020			24	24
2021			5	5

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

❖ GLOBAL INNOVATION INDEX



Source: Global Innovation Index _ WIPO

■ Ranking ■ Score

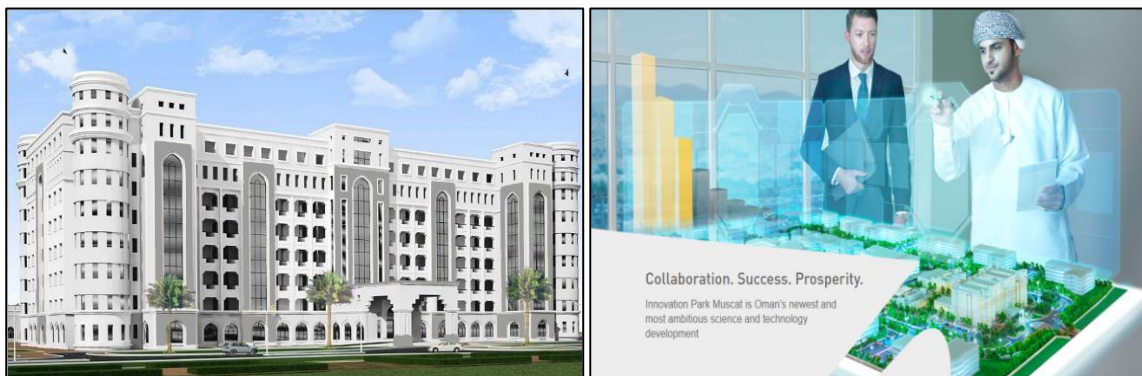
The Global Innovation Index as an indicator of a country's innovation ecosystem is depicted in the above graph. The GII ranking of Oman has shown some decline over the recent years declining from 57th position in 2011 to 76 in 2021. Its GII score has also shown some decrease going from 35.51 to 29.4 over the same period. Within the OIC countries Oman has a GII ranking of 16.

The decline in the GII indicators suggests that Oman is not keeping up with its international competitors in enabling a very positive innovation ecosystem.

❖ **TECHNOPARKS and INCUBATION CENTRES**

➤ **INNOVATION PARK MUSCAT (IPM)**

- Innovation Park Muscat is Oman's newest and most ambitious science and technology development. IPM seeks to provide and enable a healthy milieu for researchers, innovators and entrepreneurs by providing them with the services that help them to develop their soft skills and focus on scientific research. It also strives to build on their ability to utilize knowledge, develop products based on scientific research, and turn ideas into commercial products. IPM is located in Al Khoudh near Sultan Qaboos University. It stretches over 540,000 square meters and is to be implemented in three stages over 10 years.



- The first stage of the project, which was initiated in March 2013, includes three buildings namely the main building the innovation center, the social center and the fabrication workshop. The second stage will include institutes focused on Energy & Health sectors, a hotel and a mosque. The third stage includes other institutes for Food & Biotechnology and Water & Environment sectors and an international school. IPM provides spaces for setting up R&D centers by local and foreign investors.

➤ **OMANTEL INNOVATION LABS and OASIS**

Omantel, the leading and first telecommunications company in Oman and a key role-player in MENA, officially launched its path-breaking Innovation Labs. Along with the Labs, the Company also inaugurated its 5G experience center, the Omantel Innovation Oasis, and E-Dukkan, Middle East's first unmanned convenience store. The Omantel Innovation Labs have been launched to leverage Omantel's expertise, partnerships, reach and access to technology to contribute to Oman's Vision 2040 and promote innovation and entrepreneurship in new and emerging technologies namely 5G, Internet of Things, Cybersecurity, Customer Experience technology and Big Data.

Participating start-ups benefit from a 1,100 sqm space with nine well-equipped meeting rooms, a community square, a hardware lab, co-working space and individual offices. *The Omantel Innovation Oasis* is a showcase of uses of 5G technology and other frontier technologies. It complements the Omantel Innovation Labs as a place where incubated tech start-ups can potentially showcase their innovations in the future.



➤ **Support to Startups**

Oman is achieving a continuous increase in the number of startups, especially those specialized in digital technology and applications, whether through the Smart City Platform, or through the Program of Transforming Graduation Projects into Start-ups 'Upgrade'.

- Other examples of startups that are on the rise are those within the Agriculture and Fisheries Sector, such as the start-up specialized in the production of Omani rose water, and the start-ups using drones to pollinate palm trees in the 'One Million Date Palm Trees' project.

- Another prime example of the growing number of start-ups are the knowledge-based and innovation-based start-ups, such as 'Antotech' and the Innovation Factory.
- A number of initiatives have also been launched to link the industry to academia, including the Industrial Innovation Center and EJAAD, which is the membership-based virtual collaborative platform launched by TRC, the Ministry of Oil and Gas and Petroleum Development Oman (PDO), where industry, academia and government can interact and engage in energy-related research and innovation activities. EJAAD has successfully so far linked 45 institutions including private companies, as well as government and private higher education institutions, in order to reach effective scientific and research solutions for addressing the challenges faced by the private sector.
- Support funds that finance start-ups, including Oman Technology Fund (OTF) and Innovation Development Oman Holding (IDO), have contributed towards raising Oman's ranking on the Early Stage Venture Deals indicator, with the Sultanate reaching the fourth position in the region of the Middle East and North Africa (MENA).





I. COMBATING THE COVID-19 PANDEMIC

❖ **Oman Technology Fund and UNICEF Oman announce COVID-19 Youth Technology Challenge**

In 2020 the Oman Technology Fund (OTF) and UNICEF Oman partnered to launch the OTF-UNICEF COVID-19 Youth Technology Challenge to support entrepreneurs in the region to develop innovative, tech-enabled platforms that will help young people access remote education, training and employment opportunities. At the start of the outbreak, OTF announced the allocation of 1 million OMR (2.6 million USD) for investment in projects that will help buttress the community against the impacts of the COVID-19 pandemic. About 400,000 OMR is earmarked for investment in innovative projects to help children and young people continue learning remotely, build skills, and access employment.

❖ **Oman to use drones in fight against COVID-19**

The Oman health ministry has been using drone technology to combat the spread of COVID-19, it was reported. A joint team of researchers and academics has developed a drone system that can measure and register human temperature remotely. The ministry aims to use the technology to detect unreported cases of coronavirus, the report said. In addition, the Muscat Municipality has been using drones both to sterilise neighbourhoods and to conduct remote heat temperature examinations on those suspected of having the virus.

Source: <https://www.arabnews.com/node/1660386/middle-east>

❖ **Oman relies on technological innovations to fight COVID-19 pandemic**

Oman has witnessed a spurt in technological innovations and start-up activity as researchers, entrepreneurs as well as the government pushes to fight the COVID-19 crisis. At the onset of the pandemic, Oman Technology Fund (OTF), announced the allocation OR1mn for investment in technology startups in Oman that provide immediate solutions for the community to overcome the challenges caused by the spread of COVID-19. The fund till now has supported seven tech-startups, ranging from providing medical services to providing fruit, vegetables, fish among others. The aim of the initiative is to provide technical solutions to help citizens and residents to abide by social distancing, which is the mainstay of Oman's efforts to check the spread of COVID-19.



❖ **The Research Council launches a COVID-19 research programme:**

The program focuses on financially supporting projects conducting short-term applied research in various clinical and non-clinical fields associated with the pandemic.

These include diagnostics, the role of telemedicine, the application of artificial intelligence, and the impacts on business and the economy, according to a report by Oxford Business Group (OBG).

A case in point is Sonnaa Oman, which is based at the Research Council's Muscat Innovation Complex. It has developed a digital artificial

respiration device that simulates the ventilation system already approved for use in the country's hospitals. The prototype, which was developed in coordination with specialist doctors and engineers, has been subjected to several quality control tests in recent weeks, prior to large-scale production of the device, it was reported. Start-up Wareed came first with its new digital platform designed to quickly connect suspected Covid-19 patients with their doctors.



In collaboration with the Oman Technology Fund (OTF) and the institutions concerned with the development of SMEs and start-ups, a number of applications and innovations have been launched to combat this crisis as follows;

- The 'dakhterclinic', which is an application launched by Omani doctors for providing specialized online medical consultations by specialist doctors for emergencies.
- The 'Wareedco' platform, which has been designed to offer medicine home delivery to the elderly people in a bid to avoid infection with COVID-19.
- The smart platforms 'behar_market' and 'Athmar'. These platforms have been launched with the Ministry of Agriculture and Fisheries, and Muscat Municipality to convert auctions in the Central Fish Market to online ones.
- The smart platform 'Fastmovers' that has been tailored for ordering refrigerated trucks for transporting fish and vegetables from central markets.

- The distance-learning platform 'easy', which offers distance-learning services.
- The 'Igtimaati' application that provides the video conferencing service.
- The use of unmanned aircrafts (drones) to sterilize Omani neighborhoods, cities and villages by Muscat Municipality.
- The use of unmanned aircrafts (drones) for comprehensive investigation and remote examination of heat temperatures for individuals suspected of COVID-19 infection.

Source: <https://www.muscatdaily.com/2020/05/02/oman-relies-on-technological-innovations-to-fight-covid-19-pandemic/>

- Through the use of the 3D modelling technology, the Makers Oman team also managed to produce locally engineered items, including a uniquely designed hands-free door opening and a face shield that is designed to strengthen the capabilities of Oman's frontline healthcare workers when dealing with the COVID-19 pandemic. The IPM's prototyping center has also developed a digital artificial ventilator to fight the virus by simulating the ventilation systems approved in the Sultanate's government hospitals.





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