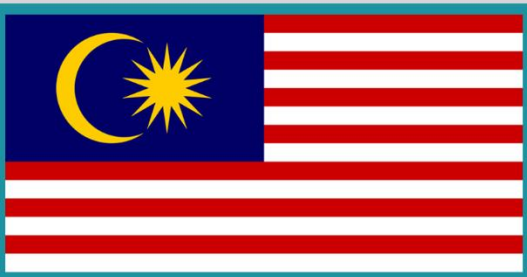


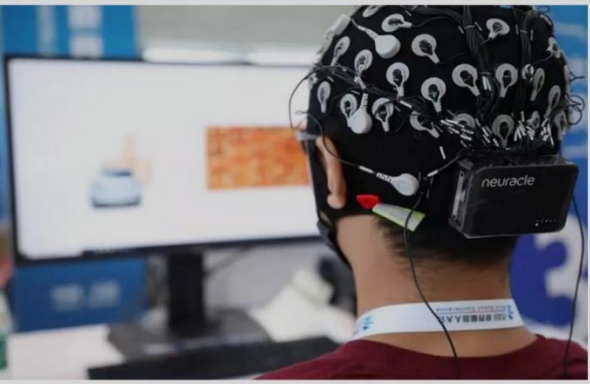


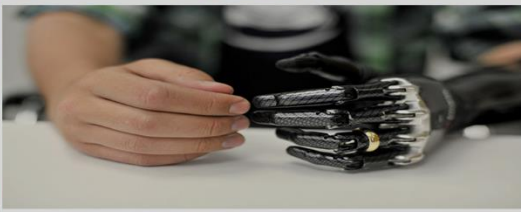
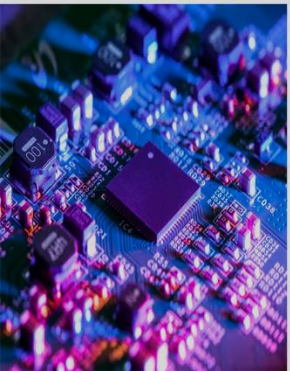




MALAYSIA

STI Profile of the OIC Member State

Science, Technology and Innovation Indicators



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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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CONTENTS

Following is the list of topics covered in the STI profiles of OIC Member States. All sub-sections/topics may not appear for every country due to unavailability of some data.

CONTENTS

MALAYSIA is a Federation comprising 13 states. Peninsular Malaysia consists of 11 states and is bordered by Thailand to the north and across the Straits of Johore by Singapore in the south. To the west lies the narrow Straits of Malacca and to the east the South China Sea. Sabah and Sarawak are separated from Peninsular Malaysia by about 750 km of the South of China Sea.

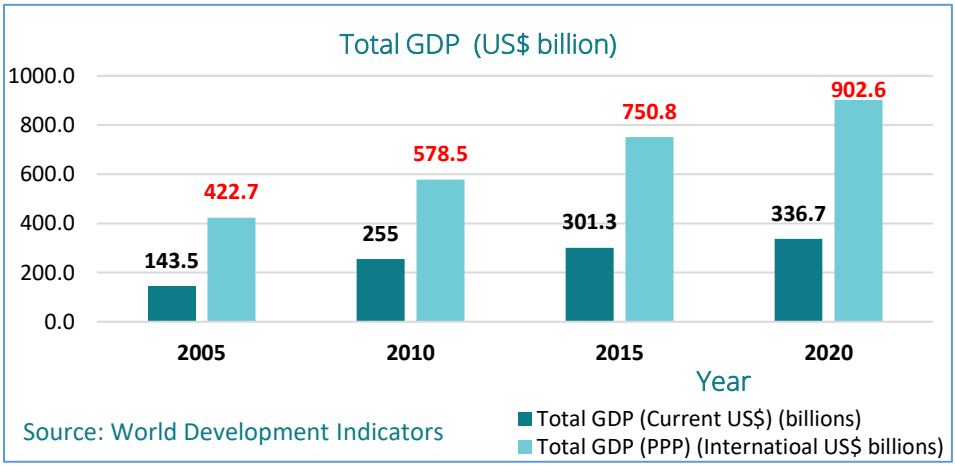
The total area of Malaysia is approximately 328.55 thousand sq km, with Peninsular Malaysia covering an area of 131,577sq km, Sarawak 124,449 sq km and Sabah 74,398 sq km. Malaysia's coastline extends nearly 4830 km. from the Indian Ocean to the South China Sea. The coastline of Sarawak and Sabah is 2100 km long. About 70% of Malaysia is covered with forest, the rest of the land is broad coastal plains and a mountain range that runs along the length of peninsular Malaysia, Sabah and Sarawak.

Malaysia gained independence in 1957 from the British who had colonized it since 1874. The Malaysian Federation was formed in 1963 with the addition of Sabah, Sarawak and Singapore. However, Singapore withdrew from the federation in 1965. Malaysia is a multi-racial country with a population of 24.8 million.

The population comprise of three ethnic groups; Malay, Chinese, and Indians. The predominant religion is Islam with minority religions; Buddhist, Daoist, Hindu, Christian, Sikh.

The country is rich in mineral resources; tin, petroleum, bauxite and iron ore. Malaysia has successfully transferred its economic base from agriculture and mineral resources to an economy where the electronics and electrical goods form a major percentage of exports. Manufacturing sector plays a major role in industrial expansion and economy is highly diversified. Malaysia's large reserves of oil and gas have enabled it not only meet its own energy needs but constitutes a significant percentage to exports.

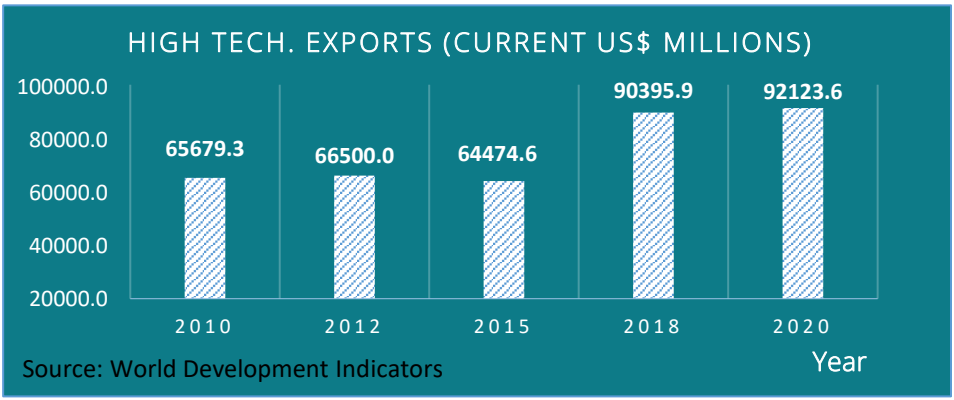
A. ECONOMIC OVERVIEW



In 2019 Malaysia was the number 35 economy in the world in terms of GDP (current US$), the number 21 in total exports, the number 25 in total imports, the number 66 economy in terms of GDP per capita (current US$) and the number 26 most complex economy according to the Economic Complexity Index (ECI). The per capita GDP grew by 3.88% between 2011 and 2015.

The top exports of Malaysia are Integrated Circuits ($63B), Refined Petroleum ($17.8B), Petroleum Gas ($11.5B), Semiconductor Devices ($9.65B), and Palm Oil ($8.91B).

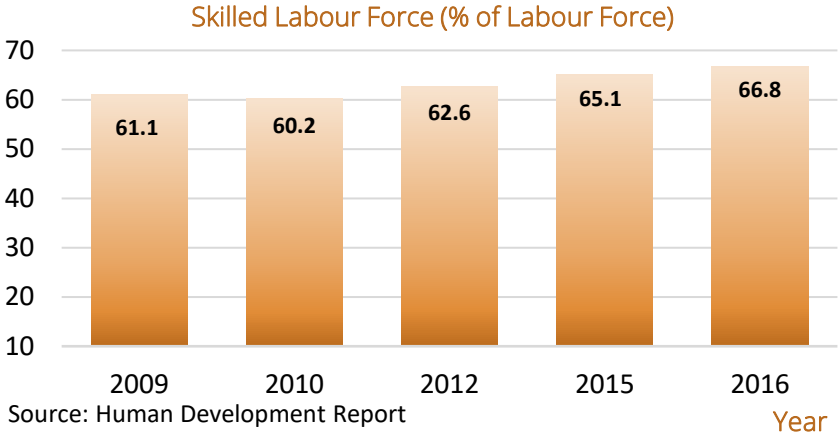
In 2019, Malaysia was the world's biggest exporter of Rubber Apparel ($4.37B), Other Vegetable Oils ($1B), Copper Powder($873M), Asphalt Mixtures ($417M), and Platinum Clad Metals($127M).



The rapid expansion of exports in electronics from the 1970s onwards has turned Malaysia into a major hub for the production of high-tech goods. Today, Malaysia is highly integrated in global trade, with manufacturing contributing over 70% of its exports. Though Malaysia's high-technology exports fluctuated substantially in recent years, it tended to increase through 2011 - 2020 period ending at US$92.123 billion in 2020, constituting 51.8% of all manufactured exports.

Since the launch of export-oriented industrialization in 1971, multinational corporations have relocated to Malaysia, fueling a rapid expansion in manufactured exports that has helped turn the country into one of the world's leading exporters of electrical and electronic goods. In 2013 alone, Malaysia accounted for 6.6% of world exports of integrated circuits and other electronic components (WTO, 2014). The export of electronic integrated circuits and micro assemblies from Malaysia totalled $ 49 billion in 2020, amounting to 21% of total exports.

B. SOCIAL AND HUMAN DEVELOPMENT



Source: Human Development Report

Malaysia's human development indicators show an impressive improvement with time. Classified as an upper middle income country, the incidence of poverty is forecast at 1.5% for 2021 (on the basis of WBG's poverty line of US$5.50), down from 2.9% in 2015.

The average life expectancy has increased from 73.55 to 76.15 years between 2005 and 2019. The basic amenities of life such as access to electricity are amenable to 100% of the population while 95% have access to piped water. The skilled labour force as a percentage of the total labour force constitutes an impressive 66.8% in 2016, up from 61.1% in 2009.

C. KEY GOVERNMENT ORGANIZATIONS RELATED TO SCIENCE, TECHNOLOGY AND HIGHER EDUCATION

The key actors in Malaysia's STI system are predominantly government or government-linked organisations.

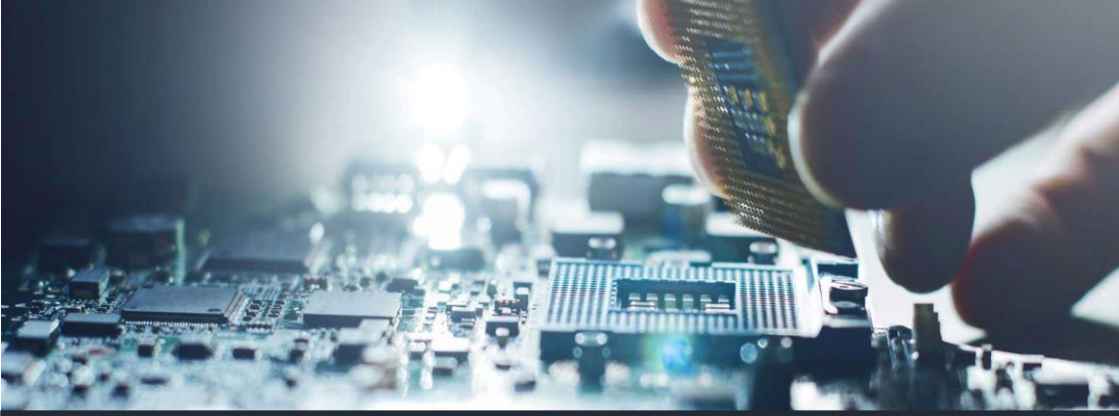
1. **Ministry of Science, Technology and Innovation (MOSTI):**
   MOSTI spearheads the development of STI in the country. It oversees more than 20 departments, agencies and companies, clustered into five focus areas: biotechnology, ICT policy, industry, sea to space, and science and technology core.

2. **Ministry of Education (MOE):**
   MOE has oversight of the National Education System at school level from pre-school to secondary and post-secondary education (excluding higher education).

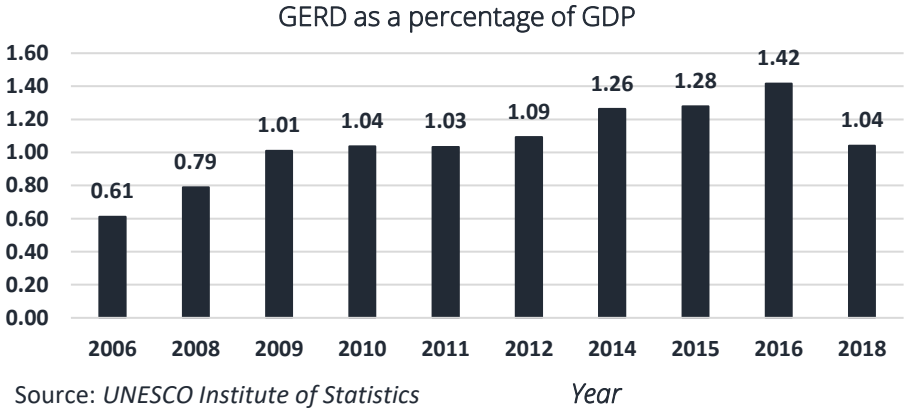
3. **Ministry of Higher Education (MOHE):**
   MOHE aims to turn Malaysia into a hub of excellence for higher education. Its targets include developing at least 20 Centres of Excellence that are internationally recognised in terms of research output, copyrights, publications and research collaborations.

Several other departments contribute to other aspects of the STI system, including:

- Ministry of Natural Resources and Environment (MNRE)
- Ministry of Energy, Green Technology and Water (MEGTW)
- Ministry of Agriculture and Agro-based Industry (MOA)
- Ministry of International Trade and Industry (MITI)
- Ministry of Plantation Industries and Commodities (MPIC)
- Ministry of Health (MOH)
- The Academy of Sciences Malaysia.



D. RESEARCH AND DEVELOPMENT

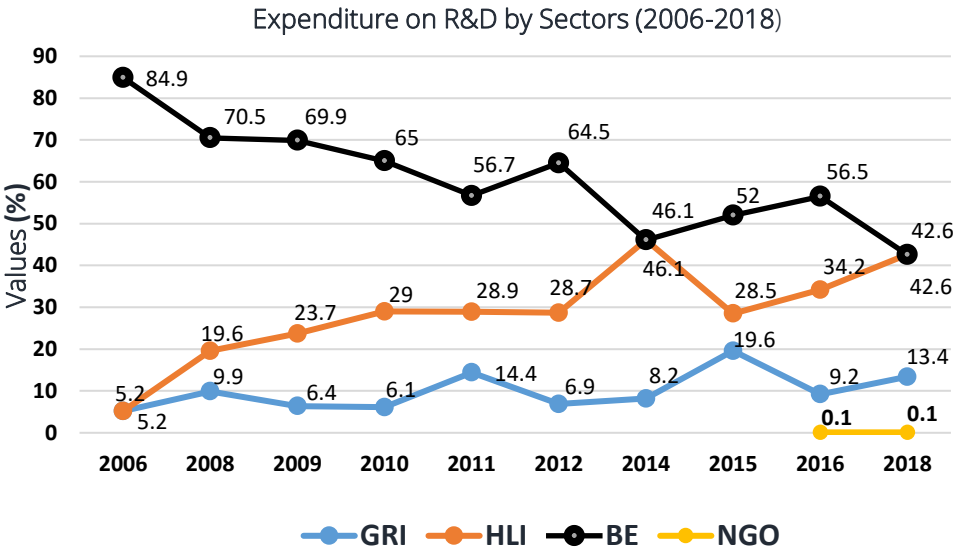


Source: *UNESCO Institute of Statistics*

The recent trend in Gross expenditure on Research and Development, the GERD, is shown in the figure. It is apparent that while the GERD increased very significantly over the 2006–2016 period, from 0.61 to 1.42% of the GDP, it has dropped to 1.04% in 2018. The government has trimmed or eliminated several funding schemes, including the Long Term Research Grant Scheme, the Transcendental Research Grant Scheme and the Fundamental Research Grant Scheme for universities.

- **Expenditure on R&D by Sectors:**

As displayed in the accompanying graph, governnment support for research and development (GRI) was consistently surpassed by business support for research (BE). However it does appear that the trend over the past deacde has been of decreasing research support by business. Institutions of higher learning (HLI) have generally contributed the next highest to R&D. In 2018, business (BE) and HLI funding for research are at par with 42.6% share for each.

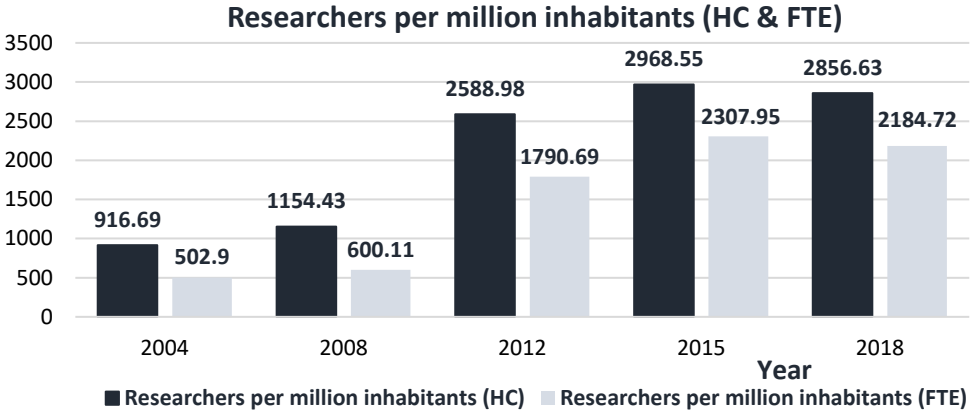


Source: MASTIC: https://mastic.mosti.gov.my/statistic/expenditure-rd-sectors-2000-2018

- **Researchers Intensity:**

The number of researchers per million (head count, HC) more than doubled between 2008 and 2012 while in the same period the number of full-time equivalent (FTE) researchers tripled from 16,345 to 52, 052, resulting in a researcher intensity (FTE) of 1,780 per million population in 2012. In 2018 Malaysia had about 2184 (FTE) researchers per million inhabitants with 48.2% of these being female. These researchers were employed mostly in higher education (71.4%) while 22% were employed by business and 6.6% by the government. Malaysia's higher

education sector funds and performs a major share of R&D and most researchers also work in this sector.

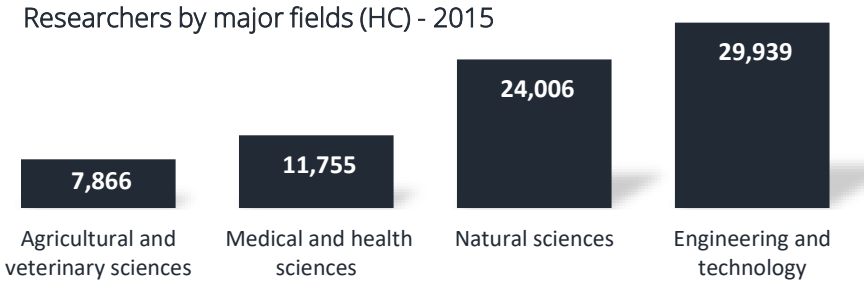


Source: UNESCO Institute of Statistics

- **Researchers distribution by major fields:**

➢ The distribution of Malaysia's research workers in different major fields in 2015 is shown in the accompanying figure. It is clear that the largest number are in the fields of Engineering and Technology, followed by those in the Natural Sciences. There is then a significantly smaller number who are active in Medical and Health Sciences and in Agricultural and Veterinary Sciences respectively. We also find that Higher Education employees the overwhelm number of researchers, 57,606 out of a total of 73,566. Government research institutions employee 6,116 while Business Enterprises support 9,844 researchers. Business Enterprises support engineering and technology researchers (4,701) in almost equal numbers to those in Natural Sciences (4,310). Higher Education institutions have a significant domination of Engineering and Technology researchers (23,966) as compared to Natural Sciences (17,883). The heightened focussed on Engineering and Technology related research is

consistent with Malaysia's successful attempts towards industrialization and knowledge economy.



Source: UNESCO Institute for Statistics (UIS)

- **Research and Development in Private Sector**

  As discussed earlier the business sector contributes very significantly to Malaysia's R&D. R&D is conducted predominantly in large-scale enterprises in the electronics, automotive and chemical industries, where it mainly involves process and product improvements. SMEs make little contribution to R&D, even though they make up 97% of all private firms.

Some examples of private sector R&D activity:

- **Malaysian Industry-Government Group for High Technology (MIGHT)**:

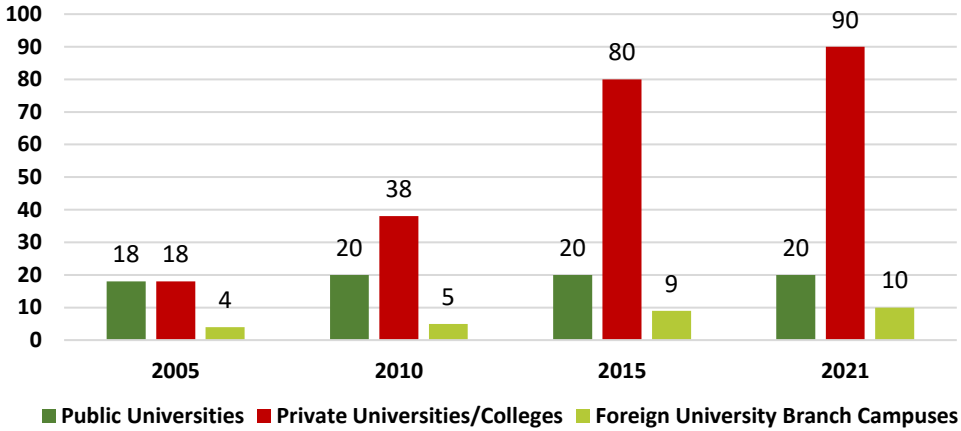
  Its key role is building and driving partnerships in technology through a consensus building platform between the private and public sectors. Some examples of their initiatives are:

- In the rail industry, MIGHT was instrumental to establish the Malaysian Rail Industry Consortium (MARIC), a consortium of local rail companies to enhance the local rail industry capability and capacity.
- MIGHT led the formation of Aerospace Manufacturing Innovation Centre (AMIC). The centre is jointly funded from the Government and industry which includes Airbus, Rolls Royce and CTRM.

- The palm oil industry contributes to R&D through a cess fund managed by the Malaysian Palm Oil Board. In addition, the Malaysian Palm Oil Board receives budget allocations from the government to fund development projects and for research projects approved by the Long-term Research Grants scheme.
- An example of private business R&D, Top Glove Corporation Berhad, the world's largest rubber glove manufacturer, allocates about 12% of its annual profits in R&D. The company plans to increase it further.

E. HIGHER EDUCATION

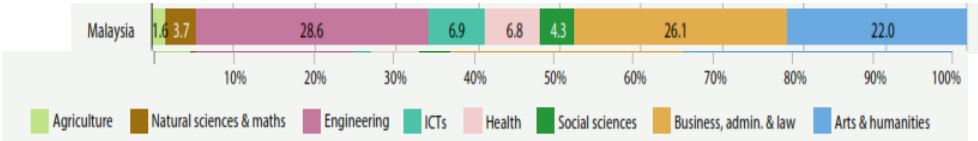
Number of Public and Private Universities



** In all there are 370 including Universities, College/Instiutions and Polytechnic institutions campuses of higher education institutions.*

Source: *Higher Education Department, Ministry of Higher Education Malaysia*

Distribution of tertiary graduates in Malaysia by programme, 2019 or closest year (%)



Source: UNESCO Science Report - 2021

University Name	National Ranking	Global Ranking
University of Malaya	1	397
University of Science, Malaysia	2	778
Putra University, Malaysia	3	805
National University of Malaysia (UKM)	4	884
University of Technology, Malaysia	5	991
International Islamic University Malaysia	6	1527
MARA University of Technology	7	1566
PETRONAS University of Technology	8	1824

Source: https://cwur.org/2021-22/country/malaysia.php

AREAS OF CONCENTRATION

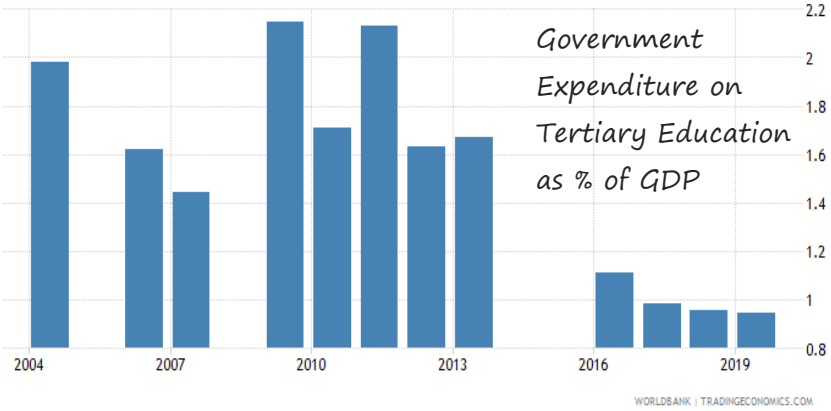
In terms of graduating programs, Malaysia's recent tertiary graduates are distributed over a range of fields with a strong concentration in engineering (28.6%); business, administration and law (26.1%); and arts and humanities (22%). Smaller concentrations are found in the disciplines of ICT (6.9%), health (6.8%), natural sciences and maths (3.7%) and agriculture (1.6%). There is a strong participation of females in higher education with 53% of the tertiary level graduates being females.

(Source: UNESCO Science Report 2021)

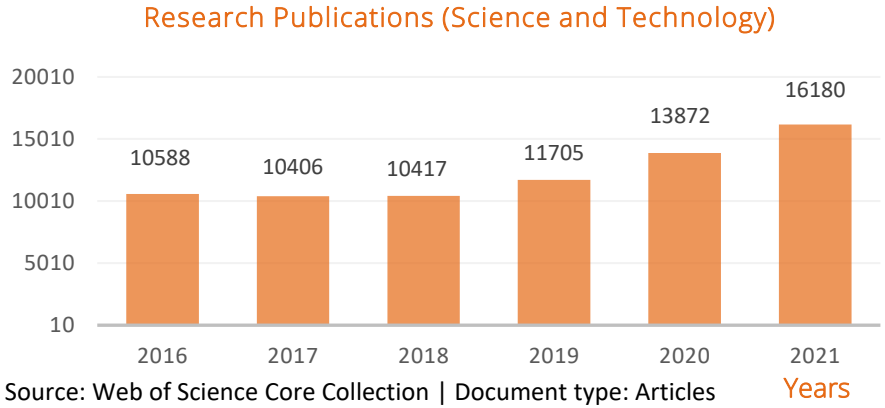
Public Expenditure on Higher Education:

In 2006, the government introduced a *Higher* E*ducation Strategic Plan Beyond 2020* which established five research universities over the next three years and raised government funding for higher education**.** For more than a decade, public expenditure on higher education has accounted for about one-third of the education budget. But the level of commitment had slipped somewhat between 2003 and 2007 from 2.6% to 1.4% of GDP. The government restored higher education and in 2011 it accounted for 2.2% of GDP. However, government expenditure on tertiary education as % of GDP was reported at 0.9466 % in 2019, according to the World Bank collection of development indicators, compiled from officially recognized sources.

To develop endogenous research capabilities, The Higher Education Strategic Plan Beyond 2020 fixed the target of producing 100 000 PhD-holders by 2020, as well as increasing the participation rate in tertiary education from the current 40% to 50%. As part of this effort, the government allocated MYR 500 million (circa US$ 160 million) to financing graduate students, a measure which helped to double enrolment in PhD programmes between 2007 and 2010.



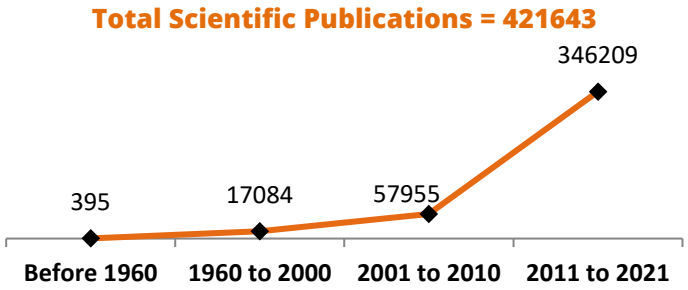
F. RESEARCH PUBLICATIONS



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

❖ Share of scientific publications in Malaysia by broad field of science, 2017–2019 (%)

There has been a strong rise in scientific publications since 2009 where the number of scientific publications was 4326. This is understood to have been a positive outcome of the government's decision to promote excellence at the five research universities, namely: Universiti Malaya, Universiti Sains Malaysia, Universiti Kebangsaan Malaysia, Universiti Putra Malaysia and Universiti Teknologi Malaysia. Major increase in research funding to these institutions followed. In 2019, with over 11700 published articles in impact factor journals, Malaysia ranks 6th amongst the OIC countries in terms of number of scientific publications. In 2021, the number of scientific research publications increased to 16180.



- Before 1960, Malaysia has published only 395 research documents. After that a significant increase (in publications) can be observed in the figure. In fact in the last decade (from 2012 to 2021), 346209 (or 82.10%) documents are published in twenty-seven (n=27) different areas of research. The per era data is presented in the figure. For the last ten years (2012-2021), we presented the scholarly output (SO), citations, citations per publications (CPP), and field-weighted citations impact (FWCI) of all (n=325450) documents in the table. Article field weighted citation impact (FWCI) "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 highest documents are published in 2021 (n=42805), followed by 2020 (n=39100). All publications received 3469355 citations or 10.7 citations per publications. The total citations increased till 2016, which later decreased. At the same time, the FWCI crossed the standard 1.0 mark. For example, 1.02 means the articles received 2% higher citations as compared with global average.

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	SO	325450	23089	25617	28998	28297	30802	33622	34958	38162	39100	42805
2	Citations	3469355	350209	392573	434863	440607	431659	411692	363767	299418	231086	113481
3	FWCI	1.02	0.86	0.93	0.95	0.93	0.97	1.03	1.05	1.03	1.06	1.2
4	CPP	10.7	15.2	15.3	15	15.6	14	12.2	10.4	7.8	5.9	2.7

S#	Subject Area	SO	Citations	Authors	CPP	FWCI
1	Engineering	105140	922515	88916	8.8	1
2	Computer Science	59251	439072	54549	7.4	0.88
3	Materials Science	44044	531377	43049	12.1	1.09
4	Physics and Astronomy	43184	429847	42182	10	1.15
5	Medicine	39553	531847	48484	13.4	1.26
6	Social Sciences	32984	189586	38356	5.7	0.9
7	Environmental Science	32280	454979	41764	14.1	1.14
8	Agricultural and Biological Sciences	25983	296877	32877	11.4	0.89
9	Chemistry	25665	452307	26703	17.6	1.06
10	Biochemistry, Genetics and Molecular Biology	24165	367738	33212	15.2	0.91
11	Mathematics	23314	151014	27200	6.5	0.92
12	Chemical Engineering	22848	382311	28557	16.7	1.05
13	Energy	21914	427404	28580	19.5	1.21
14	Business, Management and Accounting	21430	189205	24781	8.8	0.92
15	Economics, Econometrics and Finance	12861	85091	14711	6.6	0.92
16	Earth and Planetary Sciences	11893	111340	17307	9.4	1.17
17	Pharmacology, Toxicology and Pharmaceutics	10983	139629	15380	12.7	0.93
18	Multidisciplinary	10196	113661	20683	11.1	0.5
19	Arts and Humanities	10192	42728	13539	4.2	0.94
20	Decision Sciences	6954	49443	10728	7.1	0.92
21	Immunology and Microbiology	6584	99188	11181	15.1	0.92
22	Nursing	2959	32245	5877	10.9	0.97
23	Psychology	2481	32106	3780	12.9	1.27
24	Neuroscience	2294	30881	4088	13.5	1
25	Health Professions	1997	18972	3871	9.5	1.16
26	Dentistry	1785	11392	2418	6.4	0.75
27	Veterinary	1463	12387	2613	8.5	1.1

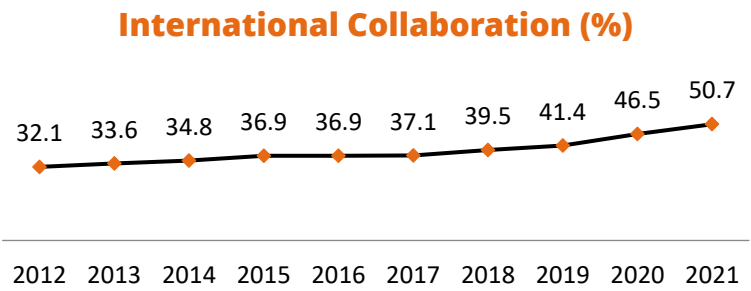
- We also retrieved details about the research publication in twenty-seven (n=27) subject areas. In fact, the number of scholarly output (SO), citations, number of authors, citations per paper (CPP) and field weighted citation impact (FWCI) are provided. The highest documents are published in Engineering (n=105140), followed by Computer Science (n=59251) and Material Science (n=44044). The journals quality of metrics can be employed to present the quality of publications. Scopus categorized all journals in quartile sets. For example, Q1 is occupied by the top 1%, and Q7 is occupied by journals in the 75 to 100% group. The ten years data is presented in the table.

S#	Title	Overall	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Pub in top 1% Sources (Q1)	2558	119	154	199	237	318	291	220	237	313	470
2	Pub in top 1% (Percent)	1	0.8	0.9	1	1	1.3	1.1	0.8	0.7	0.9	1.2
3	Pub in top 5% Sources(Q2	17361	1103	1131	1613	1536	1608	1821	1745	1727	2062	3015
4	Pub in top 5% (Percent)	6.8	7.5	6.4	8.2	6.8	6.5	6.8	6.4	5.4	6.1	7.9
5	Pub in top 10% Sources(Q3)	35749	1903	2345	2685	3309	3485	3695	3509	3746	4730	6342
6	Pub in top 10% (Percent)	13.9	13	13.2	13.6	14.6	14.1	13.7	12.9	11.7	14.1	16.7
7	Pub in top 25% Sources(Q4)	78201	4447	5212	6042	6897	7043	7352	7432	8486	10647	14643
8	Pub in top 25% (Percent)	30.4	30.4	29.3	30.7	30.5	28.4	27.3	27.4	26.5	31.7	38.5
9	Pub in top 50% Sources(Q5)	135958	8060	9743	11040	11750	12314	12961	13767	15192	17770	23361
10	Pub in top 50% (Percent)	52.9	55	54.8	56.1	52	49.7	48.1	50.7	47.5	52.9	61.4
11	Pub in top 75% Sources(Q6)	195364	12091	13911	15698	16779	17916	18842	20545	24368	24751	30463
12	Pub in top 75% (Percent)	76	82.5	78.3	79.8	74.2	72.3	70	75.6	76.2	73.7	80
13	Pub in top 100% Sources(Q7)	257164	14652	17766	19681	22602	24773	26921	27162	31975	33568	38064
14	Pub in top 100% (Percent)	100	100	100	100	100	100	100	100	100	100	100

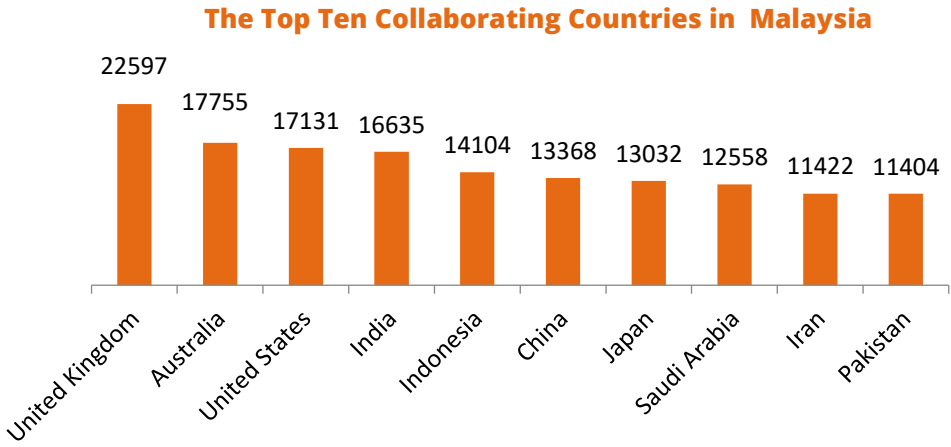
- We will specifically state that 79.08 (or 257164) publications are published in Q1 to Q7 journals. Or in other words 20.98% publications sources do have not Citescore data. 47.13% documents (n=121206) are published in Q6 & Q7 sources, and 22.45 % are published in Q5 sources.

S#	Institution	SO	Citations	Authors	CPP	FWCI
1	University of Malaya	43387	818363	17592	18.9	1.37
2	Universiti Teknologi Malaysia	39417	457176	18615	11.6	1.03
3	Universiti Kebangsaan Malaysia	36753	424077	18806	11.5	1.05
4	Universiti Putra Malaysia	36053	443684	19455	12.3	0.96
5	Universiti Sains Malaysia	35398	416470	17560	11.8	1.07
6	Universiti Teknologi MARA	25600	163090	17641	6.4	0.78
7	Universiti Teknologi Petronas	13528	127548	5727	9.4	1.13
8	International Islamic University Malaysia	13126	99023	7438	7.5	0.79
9	Universiti Tun Hussein Onn Malaysia	12761	67659	6979	5.3	0.97
10	Universiti Malaysia Perlis	12425	83520	6214	6.7	1.01

- Based on the number of publications, the highest documents are published by University of Malaya (n=43387), followed by Universiti Teknologi Malaysia (n=39417) and Universiti Kebangsaan Malaysia (n=36753). For each university we also provided total citations, CPP and FWCI data.



- The degree of collaboration for the last ten year is depicted in the figure. In 2012, it was 32.1 which increased to 50.7 in 2021. The average degree of collaboration was 39.9%.



- Based on Scopus record, Malaysia also showed strong collaboration with more than 160 countries. In fact, Malaysia published atleast 500 research publications with 81 countries. In the last ten years, the highest collaboration was noted with UK (n=22597), Australia (n=17755) and USA (n=17131).

G. International Cooperation and Support Initiatives (selected)

- **International Science, Technology and Innovation Centre for South-South Cooperation under the auspices of UNESCO (ISTIC),** Kuala Lumpur, Malaysia. Its goal is to implement a programme for South-South cooperation in science and technology with the objective of facilitating the integration of a developmental approach into national science and technology and innovation policies; capacity building in science and technology through providing policy advice and exchange of experience and best practices; and creating a problem-solving network of centres of excellence in developing countries as well as supporting the exchange of students, researchers, scientists and technologists among developing countries.
  https://www.istic-unesco.org/v1/programme-2021/

- **Malaysian Technical Cooperation Programme (MTCP)**

  Malaysia through MTCP, shares its development experiences and expertise with other developing countries through technical cooperation programmes. MTCP emphasises the development of human capital through trainings in various areas including agriculture, education, environment, industrial technical training, and science,

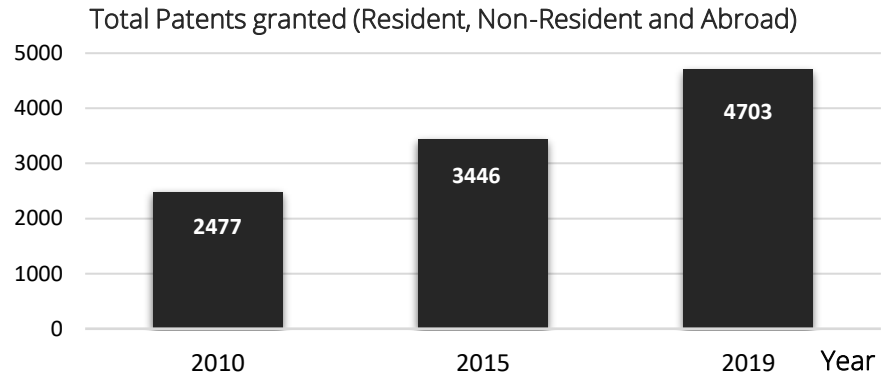
and science, technology and ICT. To-date Malaysia has extended trainings to 143 recipient countries and has trained more than 32,000 participants.

Malaysian Technical Cooperation Programme (MTCP) Scholarships: https://biasiswa.mohe.gov.my/INTER/nyroModalDoc/mtcp.php

- **The Malaysia-UNESCO Funds-in-Trust** places special emphasis on Small Island Developing States and Least Developed Countries in Asia and the Pacific, and in Africa. It draws on the expertise of Malaysian institutions, including the International Centre for South-South Cooperation for science, Technology and Innovation (ISTIC) and on the Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific (HTC).

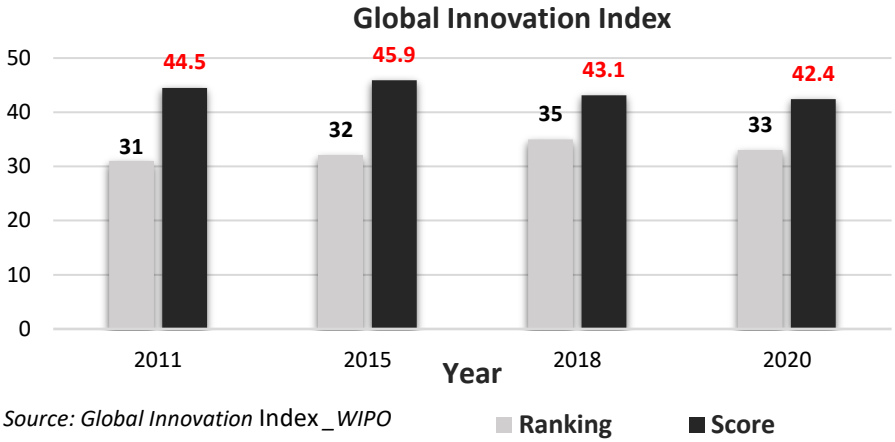
  https://www.moe.gov.my/en/menumedia/electronic-media/news-and-activities/mucp-mfit

H. INNOVATION, ENTREPRENEURSHIP & TECHNOLOGY PARKS



*Source: WIPO: https://*www.wipo.int/ipstats/en/statistics/country_profile/

Malaysia scored a perfect 10 score in terms of performance and market reach in the Global Startup Ecosystem Report 2020 (GSER 2020). Kuala Lumpur was ranked 11th in the Top 100 Emerging Ecosystem category, and scored 9 for talent and 8 for funding. Furthermore, the Global Innovation Index 2020 ranked Malaysia second after China for most innovative country in the upper middle-income group category.



Source: Global Innovation Index_*WIPO*

In February 2021, the Ministry of Science, Technology and Innovation launched the Malaysia Grand Challenge to encourage disruptive innovation and reduce reliance on foreign technologies. This body will allocate funds to start-ups and SMEs through the following five new mechanisms to help them commercialize their products and services: the Strategic Research Fund, Technology Development Funds 1 and 2 (TeD 1 and TeD 2), a Bridging Fund and an Applied Innovation Fund.

The government has sought to strengthen Malaysia's industrial zones and science parks by developing the surrounding ecosystems in Malaysia's five economic corridors. A total of RYM 1.1 billion (ca US$ 270 million) was allocated in the 2020 budget to the five corridors to support projects such as the Chuping Valley Industrial Area and Kuantan Port.

TECHNOPARKS

The Malaysian government has been supporting local technological development by establishing science and technology parks, technology incubators and the Multimedia Super Corridor. These physical development initiatives involve offering affordable office spaces and access to modern facilities e.g. telecommunications, linkages to researchers, networking and venture capital funding. The science park strategy has been adopted by the government to stimulate innovation among small and-medium sized enterprises (SMEs) and to enhance university–industry collaboration. The following are listed as the technology parks of Malaysia:

- Technology Park Malaysia (TPM), Kuala Lumpur
- Multimedia Super Corridor (MSC) / Cyberjaya, Selangor
- Selangor Science Park, Selangor
- Selangor Science Park 2, Selangor
- Subang Hi-Tech Industrial Park, Selangor
- FRIM-MTDC Technology Centre, Selangor
- UPM-MTDC Technology Centre, Selangor
- UKM-MTDC Technology Centre. Selangor
- UITM-MTDC Technology Centre. Selangor
- Penang (Known as "Silicon Valley of the East")
- Penang Science Park, Penang
- Penang Cybercity, Penang
- MSC Cyberport, Johor
- Johor Technology Park, Johor
- Nusajaya Tech Park, Johor
- Kulim Hi-Tech Park (KHTP), Kedah

More than 3,000 technology driven companies have benefited from the Technology Park Malaysia (TPM) – both local and multi-national within various clusters of industry. The ICT cluster has recorded the highest tenancy within TPM, followed by Engineering and Biotech, Telecommunication and Content, and Support Services.

I. COMBATING THE COVID-19 PANDEMIC

- **Vaccine Development for Covid-19:** The Covid-19 vaccine in development in Malaysia is expected to be ready in 2024, and it is also being designed as a booster shot, say Malaysian Government reports. The current status of the country's first Covid-19 vaccine development is at the laboratory or proof of concept (POC) stage. The research conducted for the vaccine development covered virus inactivated technology such as Sinovac and genetic sequencing or mRNA for the Pfizer vaccine. Development of the vaccine was being spearheaded by local experts from the Institute of Medical Research (IMR) with the cooperation of experts from Universiti Putra Malaysia and Veterinary Research Institute.

- **Vaccine Administration of the population:** Malaysia secured doses for 40 per cent and 110 per cent of its population by December 2020 and February 2021 respectively. At its peak, about 1 per cent to 2 per cent of the population were vaccinated daily. As of 31 October, 2121, 74.9% of Malaysia's total population (95.5% of the adult population and 66.4% of the adolescent population) have received their second dose of the COVID-19 vaccine.

- **Development of Detection Technologies:** Science, Technology and Innovation (MOSTI) Ministry is working in collaboration with the Ministry of International Trade and Industry (MITI) and the Higher Education Ministry to provide funding and

support for university research and development of new technologies to detect Covid-19. This includes developing Covid-19 testing using DNA and fiber-optic sensor to detect the virus from saliva samples.

- **Digital Solutions for Fighting the Pandemic:**

  Malaysia's Ministry of Health has been provided digital solutions to support the country's efforts to fight the Covid-19 pandemic. These include Huawei Telemedicine Video Conference, Hospital Wireless Network Communication Solution, AI Cloud Auto Detection Solution and Nova 7i smartphones. (Huawei Cloud AI-assisted Diagnosis solution empowers local medical personnel with AI capabilities by providing an AI solution for CT image analysis of possible COVID-19 patients).

- **Indigenous production to meet pandemic needs:**

  a. **I3S Cubicle for COVID-19 Screening:** The I3S Cubicle which is based on Isolate, Examination, and Sampling concept can reduce the risk of infection as it does not require any face-to-face contact between health workers and those getting screened. The space inside of the cubicle is only for the health worker to avoid the transmissions of air contamination from the patient.

  b. **MCK19 Delivery Robot.** MCK19 or "Makcik Kiah" is the first Malaysian-made delivery robot designed to assist the delivery of healthcare to COVID-19 patients. The use of MCK19 to deliver foods and medications to patients' rooms on its own can reduce the exposure of health workers from isolated patients who may be highly contagious. It can be instructed via its touchscreen interface, laptops, phones, or tablets. An LCD screen enables health checks to be done remotely through teleconferencing.

c. Aerosol Box or Intubation Box for Intubation Procedure:

An intubation procedure for a COVID-19 patient is performed in Aerosol Box with video laryngoscopy to prevent virus infections toward the health workers from the possible occurrence of aerosol generated by the patient's airway. It is used to ensure the safety of medical frontliners.

Over 1,000 units of these Aerosol Boxes were successfully distributed to hospitals and medical centres in Johor, Pahang, Negeri Sembilan, Melaka and Selangor to be used by the health workers.

d. Ventilator and Splitter Kit:

University of Technology, Malaysia (UTM) in collaboration with the Ministry of Health (MOH) Malaysia has developed a ventilator prototype using 3D printing technology to give patients infected with coronavirus chances to survive. A splitter kit prototype that enables a standard ventilator unit to be shared by two patients from the same settings while receiving breathing assistance was also developed in collaboration with a private company.

e. 3D Printed Face Shields & Hand sanitizer

- **Covid-19 and Digital Transformation of Malaysia**

Covid-19 has fast-tracked digital transformation of Malaysia. This includes:

a. Education technology (EdTech) being used extensively for remote learning.

b. Remote workforce being employed extensively.

c. Rapid growth of digital entertainment and gaming.

e. E-commerce expansion. (Between March 1 and October 31, 2020, a total of 373,213 entities registered their businesses with the Companies Commission of Malaysia under the online category).

f. Digital speed: A new national digital infrastructure project, known as Jendela, will spearhead Malaysia's transition to 5G, a game-changer for many industries. The concerned company is expected to roll out 5G technology by the end of 2022 or early 2023.

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