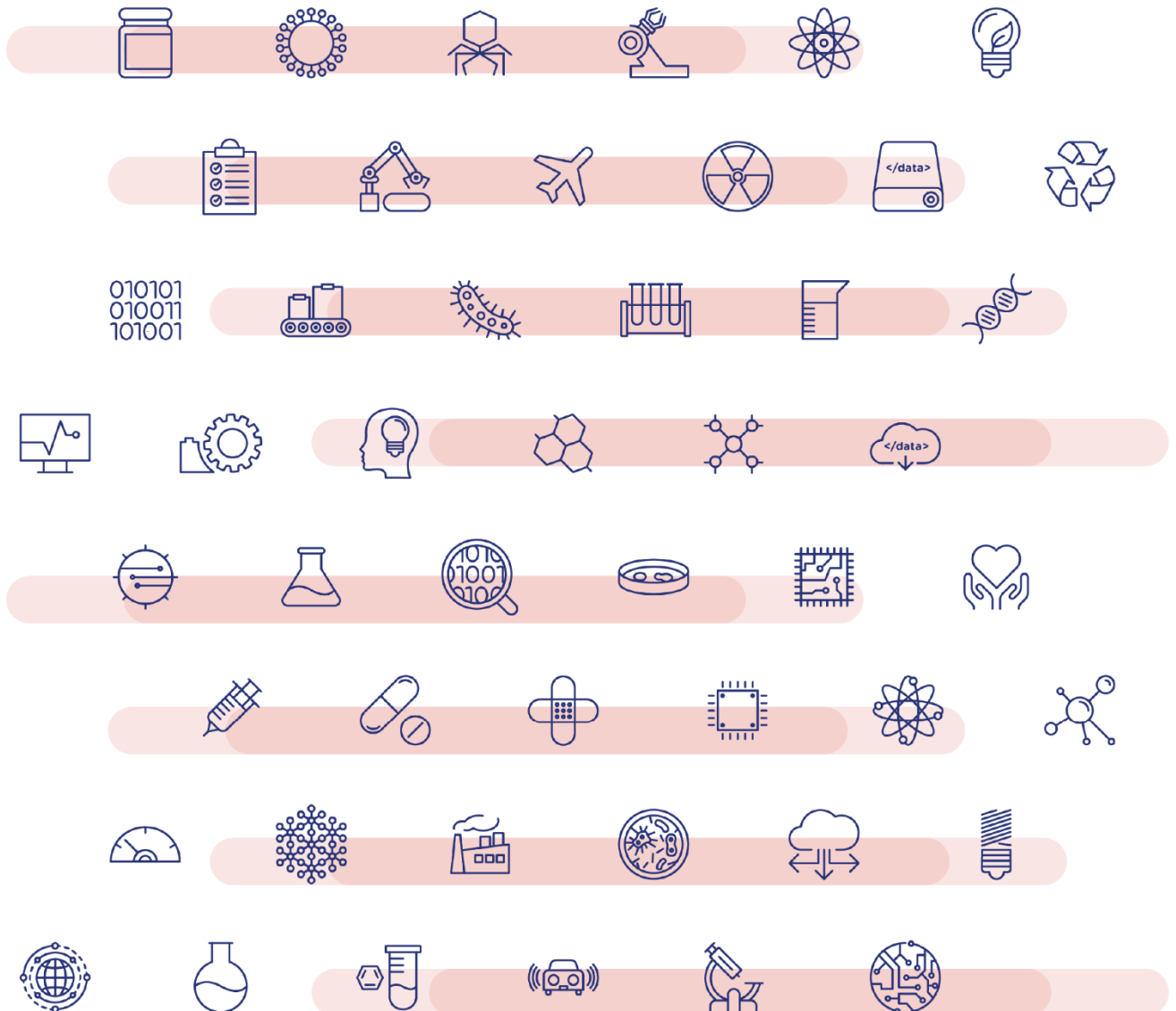


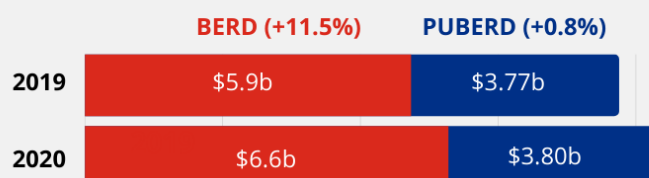
National Survey of Research, Innovation and Enterprise in Singapore 2020



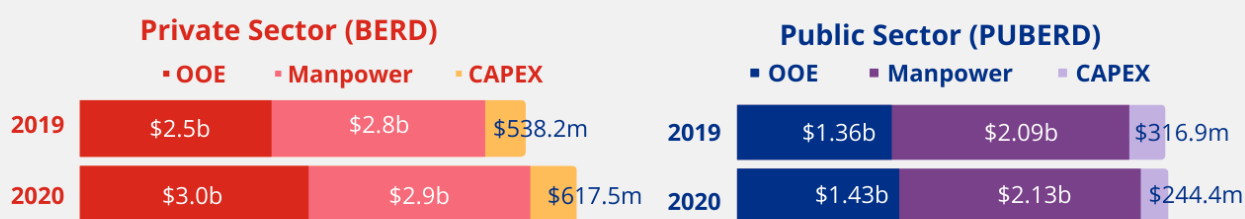
NATIONAL SURVEY OF RESEARCH, INNOVATION AND ENTERPRISE 2020

Expenditure on R&D rose in 2020...

BERD/PUBERD ratio up from 1.57 in 2019 to 1.73 in 2020.



All types of expenditure increased for private and public sector in 2020, except for CAPEX among public sector.



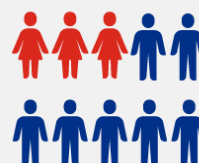
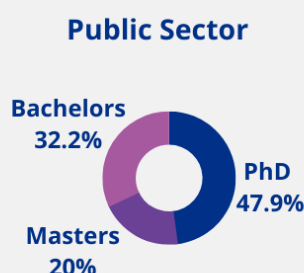
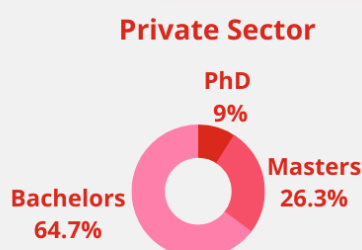
R&D Employment in Private Sector up in 2020...

53,520 jobs* associated with R&D in 2020

	Private Sector			Public Sector		
	2019	2020	% Change	2019	2020	% Change
Researchers ¹	23,477	24,183	+3.0%	22,853	21,878	-4.3%
- Research Scientists and Engineers (RSE) ²	21,466	22,166	+3.3%	17,616	16,609	-5.7%

Bulk of RSEs in Private Sector were bachelor's degree holders while there was higher proportion of PhD RSEs in the Public Sector in 2020

30.6% of all RSEs were females in 2020



* Includes researchers, technicians and other supporting staff.

¹Comprises Research Scientists and Engineers, non-degree researchers and full-time postgraduate students.

²Refers to those who hold formal qualifications at university degree level, and excludes full-time postgraduate students.

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Introduction

Singapore has built up a rich and diverse research and innovation ecosystem through the years. In recent times, a stronger emphasis has been placed on initiatives to strengthen innovation capabilities in companies and public agencies, together with the institutes of higher learning and the research institutes. These efforts help to position Singapore as a global innovation hub, as well as to better equip Singapore in tackling challenges for the future.

This is the second year in which the renamed National Survey of Research, Innovation and Enterprise (RIE), has been administered to collect data on the scale and direction of Singapore's innovation activities in addition to R&D activities. The expansion in scope is in recognition of the importance of both R&D and innovation activities in contributing to Singapore's RIE journey.

In 2020, Singapore's Gross Expenditure on R&D (GERD) increased by 7.3% to reach \$10.4 billion from \$9.7 billion in 2019, registering growth of 64.8% (or CAGR of 5.1%) between 2010 to 2020. Singapore's GERD as a percentage of GDP was 2.2% in 2020. The increase in GERD was largely due to the increase in Business Expenditure on R&D (BERD), which rose 11.5% in 2020 from 2019, supplemented by the 0.8% increase in Public Expenditure on R&D (PUBERD). As a result, the BERD/PUBERD ratio in 2020 increased to 1.73, from 1.57 in 2019.

R&D investments enable job creation. In 2020, a total of 53,520 jobs were associated with R&D activities. RSEs (Research Scientists and Engineers) accounted for the majority at 72%, or 38,775 jobs. The bulk of RSEs were Bachelor's degree holders (51%), followed by PhD (26%) and Master's degree holders (24%)¹. The number of RSEs in the private sector increased by 3.3% in 2020, while the public sector saw a decline by 5.7%, reversing the 4.3% increase seen in 2019. As such, the total number of RSEs dropped slightly by 0.8% in 2020.

The RIE survey data provides insights about the R&D ecosystem, from the expenditure of organisations to the impact on manpower. This survey would not be possible without the support of participating organisations in both the public and private sectors. We thank you for your important contributions and look forward to continuing our work together to advance Singapore's Research, Innovation and Enterprise ecosystem, which will be a crucial differentiator in driving our research strategy and securing Singapore's future.

***National Research Foundation,
Agency for Science, Technology and Research***

¹ Percentages may not add up to 100% due to rounding.

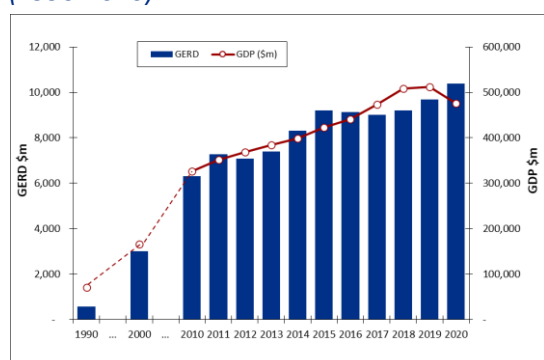
1. OVERVIEW OF R&D IN SINGAPORE

1.1. Gross Expenditure on R&D (GERD)

GERD in Singapore increased by 7.3% from \$9.7 billion in 2019 to \$10.4 billion in 2020. Conversely, Singapore's GDP (at current market prices) decreased by 7.0% from \$512.2 billion to \$476.4 billion, attributable to the COVID-19 pandemic.

In 2010, GERD was \$6.3 billion and GDP was \$327.0 billion. The Compound Annual Growth Rate (CAGR) of GERD over the past decade (from 2010 to 2020) was 5.1%.

Fig.1.1 Gross Expenditure on R&D and GDP (1990-2020)

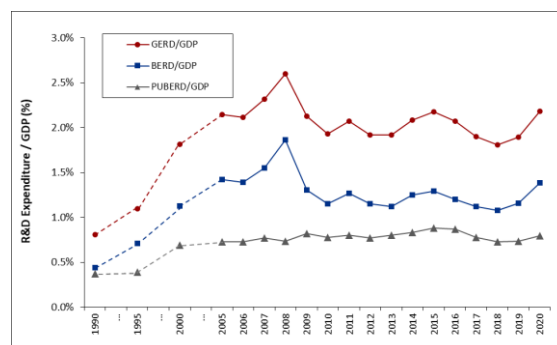


1.2. Ratio of Public Expenditure on R&D (PUBERD) to Business Expenditure on R&D (BERD)

GERD as a percentage of GDP increased from 1.9% in 2019 to 2.2% in 2020. Of this, Business Expenditure on R&D (BERD) as a percentage of GDP increased from 1.2% in 2019 to 1.4% in 2020, while Public Expenditure on R&D (PUBERD) as a percentage of GDP increased slightly from 0.7% in 2019 to 0.8% in 2020.

For every \$1 spent on research in the public sector, \$1.73 was spent by businesses in 2020.

Fig.1.2 Gross Expenditure, Business Expenditure and Public Expenditure on R&D as a percentage of GDP (1990-2020)

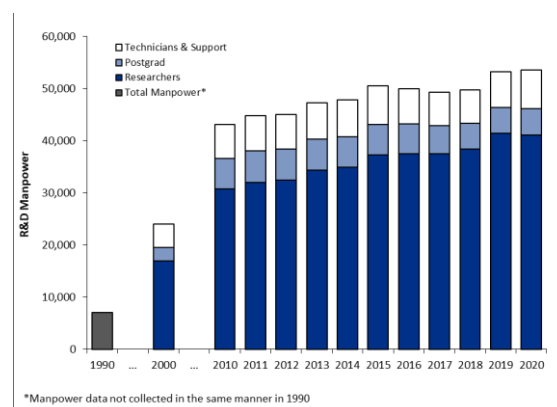


1.3. Manpower

Total R&D Manpower (including researchers, postgraduate students, technicians and support staff) increased by 0.6% from 53,210 persons in 2019 to 53,520 persons in 2020. This represents a CAGR of 2.2% from a base of 43,159 persons in 2010.

The number of researchers (excluding postgraduate students) decreased slightly by 0.7% from 41,399 in 2019 to 41,111 in 2020. The CAGR from 2010, with 30,796 researchers, to 2020 was 2.9%. Including postgraduate students, the total number of researchers was 46,061 in 2020.

Fig.1.3 R&D Manpower (1990-2020)



2. BUSINESS EXPENDITURE ON R&D (BERD)

2.1 Overview

In 2020, 972 private sector companies indicated that they performed R&D in Singapore. The total BERD of these companies amounted to \$6.6 billion, corresponding to 1.4% of Singapore's GDP in 2020. This represents an increase of 11.5% compared to the BERD in 2019 at \$5.9 billion. The CAGR from 2010-2020 was 5.8%, from a base of \$3.8 billion in 2010.

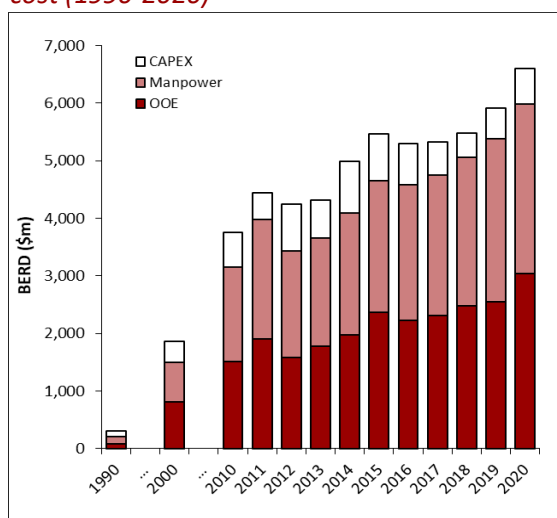
2.2 Type of Expenditure

Capital expenditure (CAPEX) increased by 14.7% from \$538.2 million in 2019 to \$617.5 million in 2020 and was relatively unchanged from \$614.7 million in 2010.

Manpower expenditure increased by 3.8% to \$2.9 billion in 2020 from \$2.8 billion in 2019. From a base of \$1.6 billion in 2010, the CAGR for 2010-2020 was 6.0%.

Other operating expenditure (OOE) rose by 19.4% to \$3.0 billion in 2020 from \$2.5 billion in 2019. From a base of \$1.5 billion in 2010, the CAGR for 2010-2020 for OOE was 7.3%.

Fig.2.1 Business Expenditure on R&D by type of cost (1990-2020)



2.3 Type of R&D

The types of R&D conducted in private sector companies are classified into 3 categories.

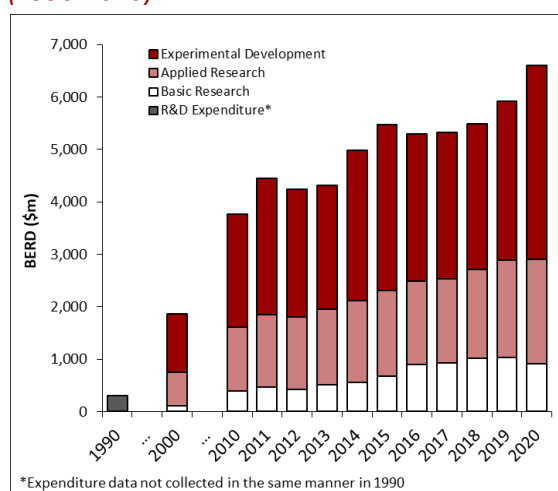
- a) **Basic research** (both experimental or theoretical work undertaken without any particular application or use in view);
- b) **Applied research** (original investigation directed primarily towards a specific practical aim or objective); and
- c) **Experimental development** (systematic work directed to producing or improving substantially materials, products and devices; or installing new processes, systems and services).

Basic research expenditure in the private sector decreased by 11.8% from \$1.03 billion in 2019 to \$906.4 million in 2020. From a base of \$385.8 million in 2010, the CAGR for 2010-2020 was 8.9%.

Applied research by private sector companies increased by 7.0% from \$1.9 billion in 2019 to \$2.0 billion in 2020. This represents a CAGR of 5.0% from 2010 when it was \$1.2 billion.

In 2020, business expenditure on experimental development rose by 22.1% from \$3.0 billion in 2019 to \$3.7 billion in 2020. CAGR for the period 2010 to 2020 was 5.6% as business expenditure on experimental development by private sector companies in 2010 was \$2.1 billion.

Fig.2.2 Type of Business Expenditure on R&D (1990-2020)



2.4 Fields of Science & Technology

The types of R&D conducted are classified by Fields of Science and Technology as follows:

- Electronics;** Comprising: Electrical & Electronics Engineering, and Computer Engineering.
- Info-communication & Media Technology;** Comprising: Info-communication & Media Technology, and Computer & Related Sciences.
- Chemicals;** Comprising: Material Sciences & Chemical Engineering, and Chemical Sciences.
- Biomedical Sciences;** Comprising: Biomedical & Related Sciences, and Biomedical Engineering.
- Precision & Transport Engineering;** Comprising: Aeronautical Engineering, Civil & Architecture Engineering, Marine Engineering, Mechanical Engineering, and Metallurgy & Metal Engineering.
- Others;** Comprising: Agricultural Sciences, Food Sciences, Earth & Related Environmental Sciences, Environmental Engineering, Physical Sciences & Mathematics, Energy, and Other Areas.

In the private sector, research expenditure in Electronics grew by 12.9% from \$3.0 billion in 2019 to \$3.4 billion in 2020. This was a CAGR of 6.6% from 2010 when it was \$1.8 billion.

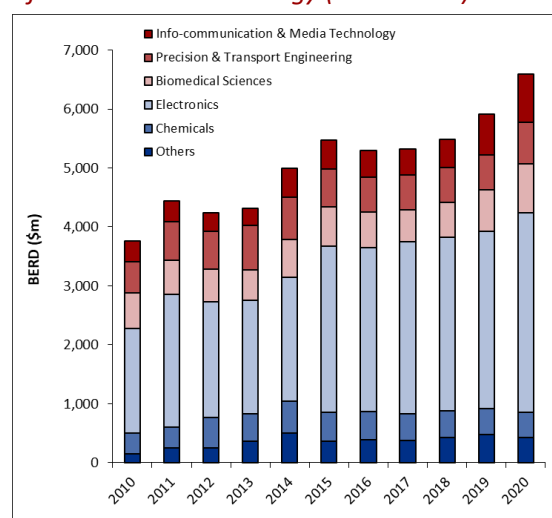
Research expenditure in Info-communication & Media Technology grew by 18.4% from \$690.7 million in 2019 to \$817.7 million in 2020. This was a CAGR of 8.8% from 2010 when it was \$350.4 million.

Research expenditure on Biomedical Sciences increased by 17.2% from \$706.7 million in 2019 to \$828.1 million in 2020. This was a CAGR of 3.3% from 2010 when it was \$598.6 million.

Spending in Chemicals research decreased by 5.2% from \$448.6 million in 2019 to \$425.3 million in 2020. Nevertheless, from a base of \$351.3 million in 2010, the CAGR was still positive at 1.9%.

Expenditure in Precision and Transport Engineering research increased by 18.4% from \$599.4 million in 2019 to \$709.9 million in 2020. Between 2010 and 2020, the CAGR was 2.9%, from a base of \$533.4 million in 2010.

Fig.2.3 Business Expenditure on R&D by fields of science and technology (2010-2020)



3. PUBLIC EXPENDITURE ON R&D (PUBERD)

3.1 Overview

In 2020, 80 public institutions, including A*STAR research institutes, institutes of higher learning, academic medical centres, hospitals and other publicly-funded research organisations, indicated that they performed R&D in Singapore.

These organisations reported a total R&D expenditure of \$3.80 billion in 2020, making up 0.8% of Singapore's GDP. This was a slight increase of 0.8% from \$3.77 billion in 2019. From a base of \$2.55 billion in 2010, the CAGR for 2010-2020 was 4.1%.

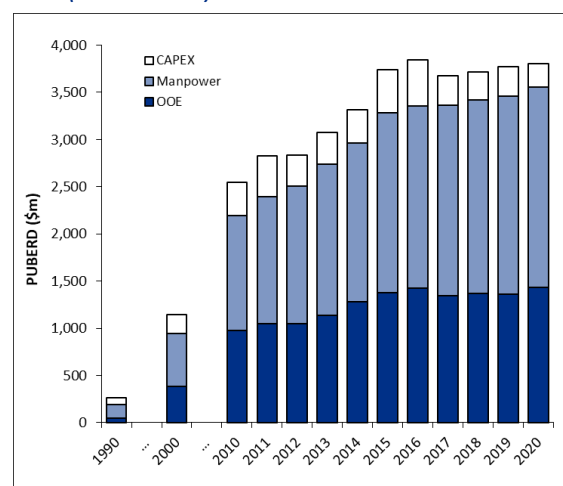
3.2 Type of Expenditure

Amongst public institutions, CAPEX decreased by 22.9% from \$316.9 million in 2019 to \$244.4 million in 2020. From a CAPEX of \$349.1 million in 2010, the CAGR for 2010-2020 for CAPEX decreased by 3.5%.

Manpower expenditure increased by 1.7% from \$2.09 billion in 2019 to \$2.13 billion in 2020. From a base of \$1.22 billion in 2010, the CAGR for 2010-2020 for manpower expenditure was 5.7%.

OOE increased by 4.8% from \$1.36 billion in 2019 to \$1.43 billion in 2020. From a base of \$976.1 million in 2010, the CAGR for 2010-2020 for OOE was 3.9%.

Fig.3.1 Public Expenditure on R&D by type of cost (1990-2020)



3.3 Type of R&D

The types of R&D conducted in public sector research organisations are as follows:

- Pure basic research** (primarily focused on the advancement of knowledge, rather than to solve a specific problem or to seek long-term economic or social benefits);
- Strategic basic research** (carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to current or future problems or possibilities);
- Applied research** (original investigation directed primarily towards a specific practical aim or objective); and
- Experimental development** (systematic work directed to producing or improving substantially materials, products and devices; or installing new processes, systems and services).

Pure basic research expenditure in public institutions decreased by 20.3% from \$287.3 million in 2019 to \$229.1 million in 2020. From a base of \$384.6 million in 2010, the CAGR for 2010-2020 showed a decrease at 5.0%.

This section shows a breakdown by Fields of Science and Technology as follows:

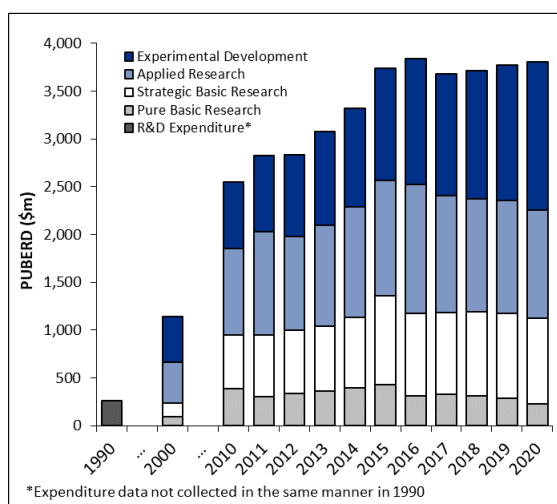
- a) Electronics;
- b) Info-communication & Media Technology;
- c) Chemicals;
- d) Biomedical Sciences;
- e) Precision & Transport Engineering; and
- f) Others.

Strategic basic research expenditure in public institutions increased by 0.6% from \$889.1 million in 2019 to \$894.5 million in 2020. This represents a CAGR of 4.8% from 2010 when it was \$561.9 million.

Applied research expenditure in public institutions declined by 4.3% from \$1.2 billion in 2019 to \$1.1 billion in 2020. Nevertheless, there was still a CAGR of 2.2% from 2010 when it was \$906.9 million.

Experimental development expenditure in public institutions increased by 9.3% from \$1.4 billion in 2019 to \$1.5 billion in 2020. This represents a CAGR of 8.4% from 2010 when it was \$693.5 million.

Fig.3.2 Type of Public Expenditure on R&D (1990-2020)



3.4 Fields of Science & Technology

In public institutions, expenditure on R&D in Electronics increased by 3.6% from \$635.3 million in 2019 to \$658.5 million in 2020. This was a CAGR of 5.9% from 2010 when it was \$372.1 million.

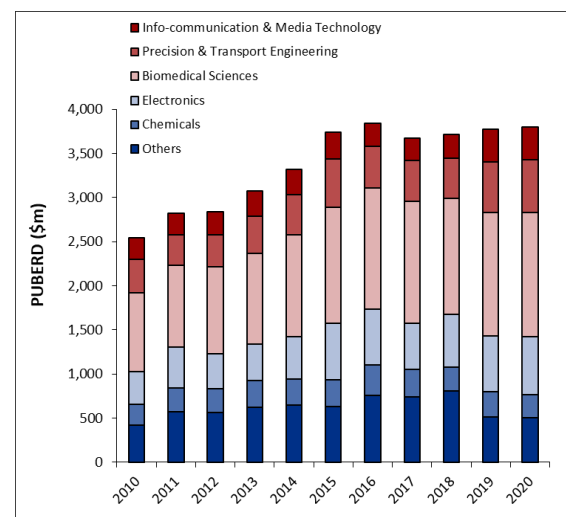
R&D expenditure on Info-communication & Media Technology increased by 0.7% from \$370.3 million in 2019 to \$372.9 million in 2020. This was a CAGR of 4.0% from 2010 when it was \$251.1 million.

Expenditure on R&D in Chemicals decreased by 8.0% from \$286.1 million in 2019 to \$263.3 million in 2020. Between 2010 and 2020, the CAGR was 1.4%, from a base of \$229.4 million in 2010.

Expenditure on R&D in Biomedical Sciences increased by 1.0% from \$1.39 billion in 2019 to \$1.41 billion in 2020. This represents a CAGR of 4.6% from 2010 when it was \$897.4 million.

The expenditure for Precision and Transport Engineering also increased by 4.0% from \$577.3 million in 2019 to \$600.2 million in 2020. Between 2010 and 2020, the CAGR was 4.8%, from a base of \$374.8 million in 2010.

Fig.3.3 Public Expenditure on R&D by fields of science and technology (2010-2020)



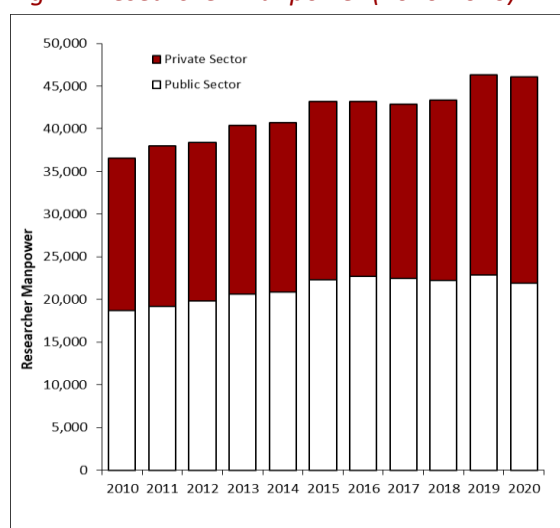
4. R&D TALENT

4.1 Total Researchers²

The total number of researchers (comprising Research Scientists and Engineers (RSEs), non-degree researchers and full-time postgraduate research students) decreased slightly by 0.6% from 46,330 in 2019 to 46,061 in 2020. Nevertheless, there was still a CAGR of 2.3% from a base of 36,556 in 2010.

Researchers in the private sector grew by 3.0% from 23,477 in 2019 to 24,183 in 2020, while researchers in the public sector declined by 4.3% from 22,853 in 2019 to 21,878 in 2020. Between 2010 and 2020, this represented a CAGR of 3.1% and 1.6% among researchers in the private and public sector respectively.

Fig.4.1 Researcher Manpower (2010-2020)



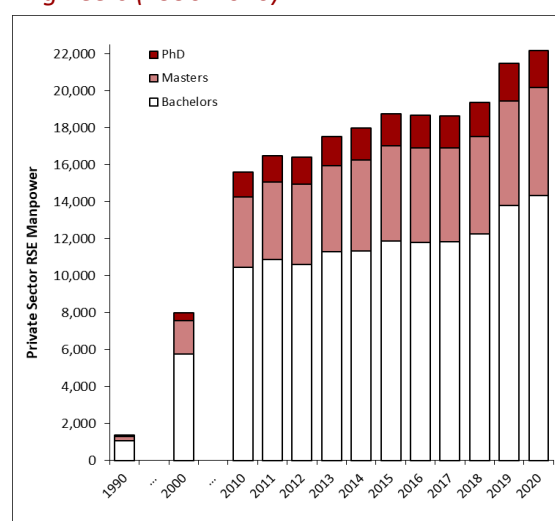
4.2 Total Research Scientists & Engineers

RSEs comprise researchers who hold formal qualifications at the university degree level. RSEs exclude full-time postgraduate research students.

In 2020, the number of RSEs fell by 0.8% from 39,082 in 2019 to 38,775 in 2020. Nevertheless, there was still a positive CAGR of 3.2% from a base of 28,296 in 2010.

In the private sector, the number of PhD RSEs declined by 0.8% from 2010 in 2019 to 1,993 in 2020. This was a CAGR of 4.0% from 1,347 PhD RSEs in 2010. RSEs with a Master's degree increased by 3.1% from 5,657 in 2019 to 5,831 in 2020. This was a CAGR of 4.3% from 3,817 RSEs with Master's degrees in 2010. The number of RSEs with a Bachelor's degree also increased by 3.9% from 13,799 in 2019 to 14,342 in 2020. This was a CAGR of 3.2% from 10,445 RSEs with Bachelor's degrees in 2010.

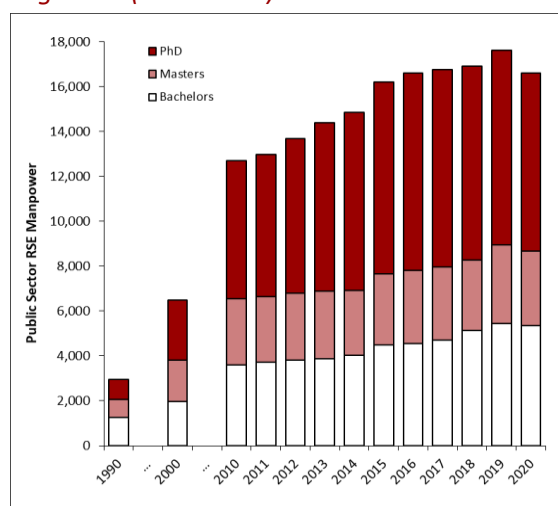
Fig.4.2 Private Sector Research Scientists & Engineers (1990-2020)



In the public sector, the number of PhD RSEs also declined and by a larger magnitude of 8.4% from 8,682 in 2019 to 7,949 in 2020. Nevertheless, between 2010 and 2020, the CAGR was 2.6%, from a base of 6,130 in 2010. RSEs with a Master's degree decreased by 4.8% from 3,488 in 2019 to 3,320 in 2020. There was an overall CAGR growth of 1.2% from a base of 2,949 in 2010. RSEs with a Bachelor's degree decreased by 1.9% from 5,446 in 2019 to 5,340 in 2020. The CAGR was 4.0% from a base of 3,608 in 2010.

² Data on all R&D manpower (including non-researchers) can be found from Page 21 onwards.

Fig.4.3 Public Sector Research Scientists & Engineers (1990-2020)

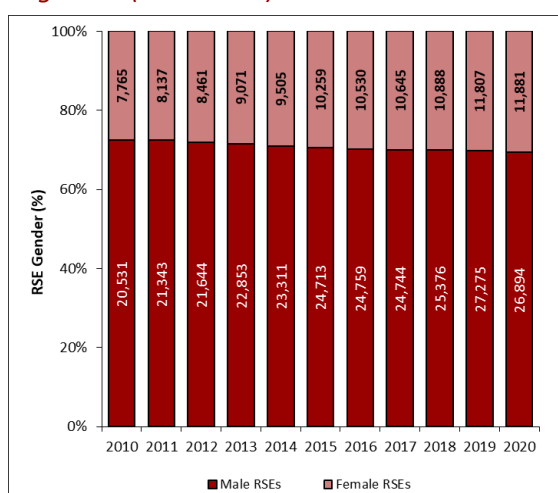


4.3 Profile of Research Scientists & Engineers

Gender

In 2020, females, at 11,881 made up 30.6% of all RSEs, similar to the 30.2% in 2019 but higher than the 27.4% in 2010. This was a CAGR of 4.3% from 7,765 female RSEs in 2010.

Fig.4.4 Gender of Research Scientists & Engineers (2010-2020)

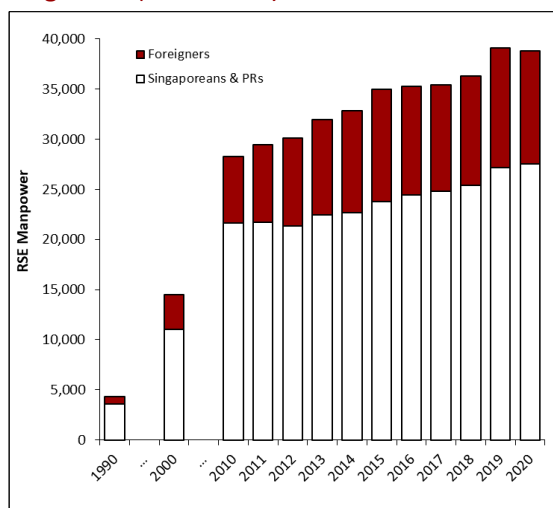


Citizenship

The number of Singaporean and Permanent Resident (PR) RSEs increased by 1.4% from 27,133 in 2019 to 27,518 in 2020. This represents a CAGR of 2.4% from a base of 21,655 RSEs in 2010.

The number of non-resident foreign RSEs decreased by 5.8% from 11,949 in 2019 to 11,257 in 2020, likely due to the COVID-19 travel restrictions in 2020. Nevertheless, there was a CAGR of 5.4% from a base of 6,641 foreign RSEs in 2010.

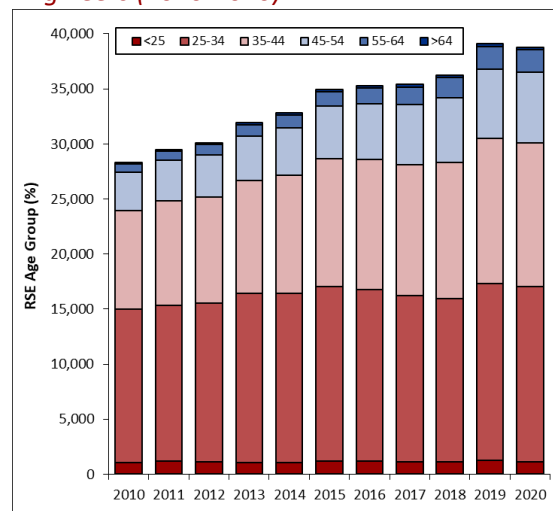
Fig.4.5 Citizenship of Research Scientists & Engineers (1990-2020)



Age-Bands

In 2020, 43.9% of all RSEs were under the age of 35 and 77.6% of all RSEs were under the age of 45. Compared to 2010, these proportions had fallen from 52.9% and 84.7% respectively, as there were now more RSEs in the higher age-bands.

Fig.4.6 Age-Bands of Research Scientists & Engineers (2010-2020)



5. PATENTS

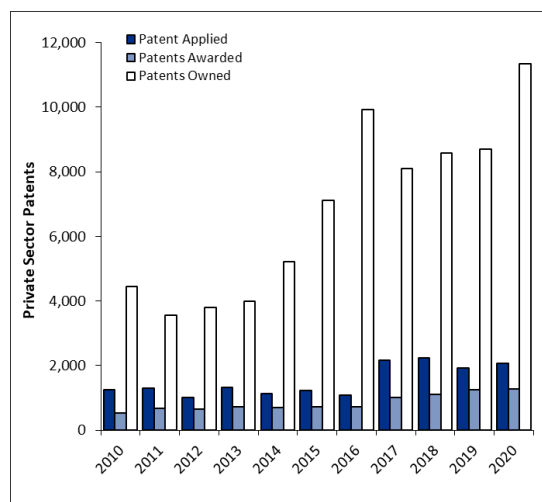
5.1 Patents Applied

In 2020, the total number of primary patent applications (first filings) as a result of R&D conducted in Singapore, stood at 2,966. This was an increase of 14.3% from the 2,594 patents filed in 2019, and a CAGR of 5.3% from the 1,762 patents filed in 2010.

In the private sector, 2,062 patents were filed in 2020, showing a 7.1% increase from the 1,925 patents filed in 2019, and a CAGR of 5.0% from the 1,263 patents filed in 2010.

In the public sector, the number of patent applications increased from 669 in 2019 to 904 in 2020. This represents an increase of 35.1%, and a CAGR of 6.1% from the 499 patents filed in 2010.

Fig.5.1 Patents Applied, Awarded and Owned in the Private Sector (2010-2020)

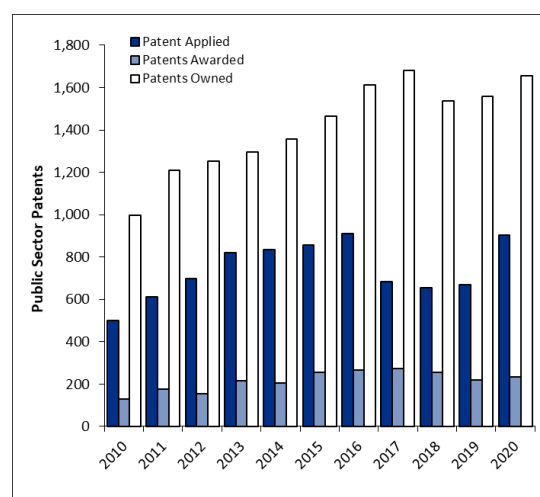


5.2 Patents Awarded

In 2020, the total number of patents awarded (first grants) as a result of R&D conducted in Singapore was 1,510. This represents an increase of 2.2% from 1,478 patents awarded in 2019 and a CAGR of 8.7% from the 653 patents awarded in 2010.

The number of patents awarded to private sector companies increased by 1.5% from 1,257 patents awarded in 2019 to 1,276 in 2020 and a CAGR of 9.3% from the 522 patents awarded in 2010. In the public sector, the number of patents awarded increased by 5.9% from 221 in 2019 to 234 in 2020, and a CAGR of 6.0% from the 131 patents awarded in 2010.

Fig.5.2 Patents Applied, Awarded and Owned in the Public Sector (2010-2020)



6. INTERNATIONAL COMPARISON OF R&D

6.1 Research Intensity in Selected Countries/Regions

According to OECD Main Science and Technology Indicators 2022/03, the United States of America remained the top R&D spender, with US\$721 billion spent on research. China claimed second position in 2020, having spent US\$583 billion, while Japan in third position spent US\$174 billion. Normalised as a percentage of GDP, GERD/GDP was 3.5% in the United States, 2.4% in China and 3.3% in Japan.

Singapore's GERD/GDP was 1.9% in 2019 and 2.2% in 2020. The top 3 most research-intensive countries/regions in the world were Israel (5.4%), Republic of Korea (4.8%), and Taiwan (3.6%). Sweden, Belgium and United States had the next highest GERD/GDP ratio at 3.5%.

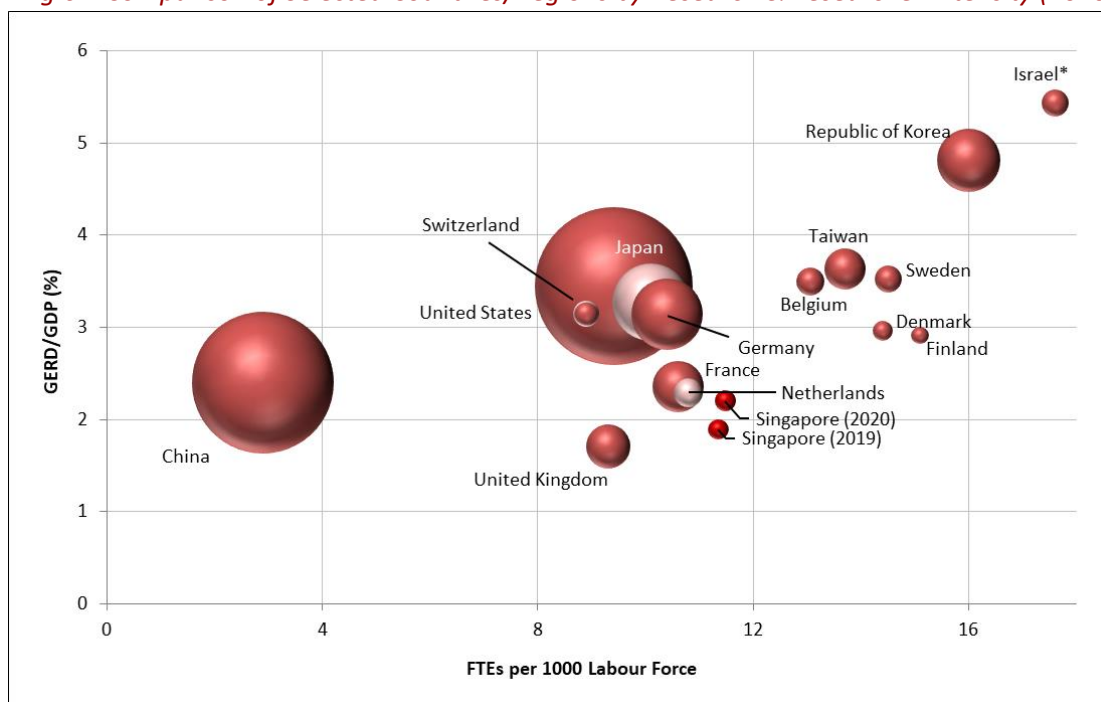
6.2 Researcher Intensity in Selected Countries/Regions

Researcher intensity is measured by Full-time Equivalence (FTEs) as a percentage of the labour force. Singapore's labour force decreased slightly by 0.8% from 3.74 million in 2019 to 3.71 million in 2020. Researcher FTEs however rose slightly by 0.2% from 42,485 in 2019 to 42,579 in 2020.

Singapore's researcher intensity (FTEs/1,000 Labour Force) was 11.4 in 2019 and 11.5 in 2020. This places Singapore within the ranks of countries such as Netherlands (10.8), France (10.6), Germany (10.4) and Japan (10.1).

The top 3 countries in terms of researcher intensity in 2020 are Republic of Korea (16.0) and Finland (15.1) and Sweden (14.5).

Fig.6.1 Comparison of Selected Countries/Regions by Research & Researcher Intensity (2020)



Bubble size indicates GERD.

*Researcher intensity for Israel is of 2012.

Source: OECD, Main Science and Technology Indicators 2022/03

7. EXPLANATORY NOTES AND DEFINITIONS

7.1 DEFINITION OF R&D

7.1.1 Research and development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications. R&D covers three activities: basic research, applied research and experimental development, which are defined and described below. The scope of the definition of R&D for this Survey extends to R&D in science and technology only and excludes the social sciences and humanities.

7.1.2 R&D is related to a number of other activities with a scientific and technological basis, which are often very closely linked to R&D through flows of information or in terms of operations, institutions and personnel. The basic criterion for distinguishing R&D from related activities is the presence of an appreciable element of novelty and the resolution of scientific or technological uncertainty, i.e. when the solution to a problem is not readily apparent to someone familiar with the basic stock of common knowledge and techniques for the area concerned. In particular, there is difficulty locating the cutoff point between experimental development and the related activities required to realise an innovation.

7.2 R&D MANPOWER

7.2.1 R&D manpower comprises all persons directly employed on R&D and those providing direct services. It includes persons who are mainly or partially engaged in R&D. It comprises the three occupation groups defined and described below: researchers; technicians; and other supporting staff.

7.2.2 Researchers are professionals engaged in the conception or creation of

new knowledge, products, processes, methods and systems, or in the management of the projects concerned. Managers and administrators engaged in the planning and management of the scientific and technical aspects of a researcher's work are categorised as researchers. Full-time postgraduate research students, at both the master degree and PhD level, are categorised as researchers.

7.2.3 Researchers are further sub-classified as follows:

(a) **Research scientists and engineers (RSEs)** comprise the researchers, excluding the full-time postgraduate research students, who hold formal qualifications at the university degree level. RSEs are classified into three subcategories according to the highest level of the formal qualifications: PhD; master degree; and bachelor degree.

(b) **Non-degree researchers** comprise the researchers, excluding the full-time postgraduate research students, who hold formal qualifications below the university degree level.

(c) **Full-time postgraduate research students (FPGRSs).**

We define also TRSEs ("total" RSEs) to be the category comprising the RSEs and FPGRSs.

7.2.4 **Technicians** are persons whose main tasks require technical knowledge and experience in one or more fields of science and technology. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. The tasks of technicians include: preparing computer programmes; carrying out experiments, tests and analyses; preparing materials and equipment for experiments, tests and analyses; and recording measurements,

making calculations and preparing charts and graphs.

7.2.5 **Other supporting staff** comprise other persons who participate in or are directly associated with R&D projects. Managers and administrators dealing mainly with financial and personnel matters and general administration, skilled and unskilled craftsmen, and secretarial and clerical staff, are included in this heading, insofar as their activities are a direct service to R&D. Persons providing an indirect service should be excluded (but their wages and salaries should be included as an overhead costs when measuring expenditure on R&D).

7.2.6 The Survey's reporting convention for the headcount of those engaged in R&D is the number of persons as at the last day of the one year reporting period.

7.2.7 One full-time equivalence (FTE) unit may be thought of as one person-year. A person who spends 30% of his time on R&D and the rest on other activities during the one-year reporting period should be considered as 0.3 FTE. If a full-time R&D worker is employed for only six months during the one-year reporting period, this results in a 0.5 FTE.

7.2.8 R&D manpower is also classified by the following:

(a) **Nationality**, categorised by "Singapore citizens and Singapore permanent residents" as well as "non-PR foreign citizens".

(b) **Age group**, categorised by the following:
(i) under 25 years; (ii) 25-34 years; (iii) 35-44 years; (iv) 45-54 years; (v) 55-64 years; and (vi) above 64 years.

(c) **Gender**.

7.3. R&D EXPENDITURE

7.3.1 The (intramural) R&D expenditures for an organisation comprise all expenditures on R&D performed *within the organisation* during the reporting period. They include non-R&D expenditures made outside the organisation but in support of the R&D performed within the organisation. It excludes extramural R&D expenditures, which are the sums an organisation paid or committed to pay to another organisation for the performance of R&D (e.g., acquisition of R&D performed by others and grants given to others for performing R&D).

7.3.2 Intramural R&D expenditures comprise current and capital expenditures.

(a) **Current expenditures** comprise manpower and other operating expenditures:

(i) **Manpower expenditures** comprise annual wages and salaries and all associated expenditures for R&D manpower. The manpower expenditures on persons who provide an indirect service to R&D and are not categorized as R&D manpower are included as other operating expenditures on R&D and not as manpower expenditures on R&D.

(ii) **Other operating expenditures (OOE)** include non-capital purchases of materials, supplies and equipment to support R&D performed by the organisation. Administrative and other overhead expenditures are included and prorated if necessary. Expenditures on indirect services are included. Rents and fees associated with R&D are included.

(b) **Capital expenditures (CAPEX)** are the annual gross expenditures on fixed assets used in the R&D programmes of the organisation, i.e. on (i) land, buildings and other structures, and on (ii) vehicles, plant,

machinery and equipment. They are reported in full for the reporting period when they took place rather than registered as an element of depreciation.

7.3.3 Sources of R&D funds are reported by the performers of research. The surveyed organisation reports the sums which it received or will receive from various sources for the performance of (intramural) R&D during the one-year reporting period. Funds received for R&D performed during earlier periods or for R&D not yet started are excluded. The categories of sources of R&D funds are:

- (a) Within Singapore:
 - (i) Private sector;
 - (ii) Government sector;
 - (iii) Institutes of Higher Learning.
- (b) Abroad:
 - (i) Foreign-based companies;
 - (ii) Foreign governments and international organisations.

7.3.4 All monetary amounts in this report are in Singapore dollars. Monetary amounts that are reported by survey respondents in foreign currency units are converted to Singapore dollars based on the average exchange rates for the relevant year, as published by the Monetary Authority of Singapore.

7.4. INSTITUTIONAL CLASSIFICATION

7.4.1 Sectors. The Survey classifies organisations into four sectors:

- (a) **Private sector.** This comprises all business enterprises, excluding institutions of higher learning.
- (b) **Government sector.** This comprises all government organisations, but excludes the public institutions of higher learning and the A*STAR research institutes, which are classified under separate sectors. It includes

all government ministries and statutory boards.

(c) **Institutes of Higher Learning.** This comprises institutions of higher learning, including the universities and polytechnics.

(d) **Public research institutes.** This comprises the A*STAR research institutes.

7.4.2 Industrial classification. The enterprises in the private sector are further sub-classified into industry groups and subgroups according to their classification by the Singapore Standard Industrial Classification (SSIC) 2020.

7.4.3 The enterprises in the private sector are also sub-classified by ownership and size:

- (a) A company with at least 30% local equity is classified as a local company, and with less than 30% local equity a foreign company.
- (b) A local company is classified as a small/medium-sized enterprise (SME) if it satisfies the following criteria (following Enterprise Singapore), and a large enterprise (LE) otherwise:
 - (i) Annual sales turnover of not more than \$100 million; or
 - (ii) Employment size of not more than 200 workers.

7.5. FUNCTIONAL DISTRIBUTION

7.5.1 Type of R&D. Three types of R&D are distinguished:

- (a) **Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

The performer of the research may not know about actual applications when doing the research, and therefore does not have them in view: such research is basic according to the definition. Research that is undertaken with the goal of a broad range of applications in the future, but which does not have a particular use in view, is basic according to the definition.

Thus, two types of basic research are distinguished:

(i) **Pure basic research** is carried out primarily for the advancement of knowledge, rather than to solve a specific problem or to seek long-term economic or social benefits or to transfer the results to sectors responsible for their application.

(ii) **Strategic (or oriented) basic research** is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognised or expected, current or future problems or possibilities.

(b) **Applied research** is also original investigation undertaken in order to acquire new knowledge. However, it is directed primarily towards a specific practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems. The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas.

(c) **Experimental development** is systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials,

products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

7.5.2 Fields of science and technology (S&T). The areas of R&D are classified by the following S&T fields:

Natural sciences (excluding biological sciences)

- Computer and related sciences [computer programming, computer studies, electronic data processing, information sciences, system analysis, and areas related to software development]
- Physical sciences and mathematics [astronomy and space sciences, physics and related sciences]
- Chemical sciences [chemistry and related sciences]
- Earth and related environmental sciences [geology, geophysics, mineralogy, meteorology, physical geography and other geosciences, other atmospheric sciences including climate research, oceanography, vulcanology, palaeoecology and related sciences]

Engineering and technology

- Civil and architecture engineering [architecture engineering, building sciences and engineering, construction engineering, municipal and structural engineering]
- Mechanical engineering
- Metallurgy and metal engineering
- Aeronautical engineering
- Marine engineering
- Electrical and electronics engineering [electrical engineering, electronics, communication engineering and systems]
- Computer engineering [hardware only]
- Info-communication and media technology

- Materials science and chemical engineering
- Environmental engineering
- Biomedical engineering

Biomedical and related sciences

- Basic medicine [anatomy, cytology, physiology, pharmacy, pharmacology, toxicology, immunology and immunohaematology, pathology, neuroscience]
- Clinical medicine [anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology, oncology, geriatrics, cardiovascular, dermatology, urology, infectious diseases]
- Health sciences [public health services, social medicine, hygiene, nursing, epidemiology]
- Pharmaceutical sciences and manufacturing
- Biological sciences [biochemistry, biology, biophysics, genetics, microbiology, molecular biology, bioengineering, bioinformatics]
- Other related biomedical sciences

Agricultural sciences, food sciences
[Agronomy, agrotechnology, animal husbandry, fisheries, forestry, horticulture, bacteriology related to animals, veterinary medicine, botany, zoology, food and other related sciences]

Energy

[Clean energy systems; solar energy; wind energy]

Other areas

7.6. OTHER DATA

7.6.1 The following R&D-related data are also collected by the Survey:

(a) **Patenting activities** arising from R&D performed in Singapore:

- (i) Number of primary patent applications during the reporting period. Only first filings of patent applications are counted, and patent applications for the same invention in more than one country are entered as one.
- (ii) Number of patent awards during the reporting period. Patent awards for the same invention in more than one country are entered as one.
- (iii) Number of patents owned as at the last day of the calendar year.

(b) **Revenue data:**

- (i) Licensing revenue from patents and new technologies developed in Singapore;
- (ii) Sales revenue from commercialized products/processes attributed to R&D performed in Singapore.

7.6.2 For enterprises in the private sector, (a) The following classification data are also collected in the Survey:

- (i) Total number of employees;
- (ii) Total fixed assets;
- (iii) Total sales revenue over the one-year reporting period;
- (iv) Information on local and foreign equity in the company.

(b) The industrial classification of private sector enterprises by the SSIC 2020 is obtained from the Department of Statistics.

7.6.3 The convention for reporting data such as sales revenue may differ across organisations.

7.7 LIST OF ABBREVIATIONS:

BERD	Business Expenditure on R&D
CAPEX	Capital Expenditure
CAGR	Compound Annual Growth Rate
EDB	Economic Development Board
FPGRS	Full-time Postgraduate Research Student
FTE	Full-time Equivalence
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D
IPOS	Intellectual Property Office of Singapore
LE	Large Enterprise
OOE	Other Operating Expenditure
PG	Post Graduate
PUBERD	Public Expenditure on R&D
RIE	Research, Innovation and Enterprise
R&D	Research & Development
RSE	Research Scientists and Engineers
SME	Small & Medium Enterprise
SSIC	Singapore Standard Industrial Classification
S&T	Science and Technology
UEN	Unique Entity Number

8. METHODOLOGY

8.1. METHODOLOGY

8.1.1 The National Survey of Research, Innovation and Enterprise (RIE) in Singapore is conducted under the Statistics Act (Chapter 317), which makes the submission of returns mandatory. Individual returns received are kept in confidence with the Statistics Act. The Act is available on the Singapore Department of Statistics' website (www.singstat.gov.sg).

8.1.2 The approach is to survey all organisations that are known to perform R&D. A register of R&D performing organisations is maintained. The Survey form is sent to the organisations on the register. The register comprises all organisations that had reported previously to the Survey that they performed R&D, after excluding those that subsequently reported that they did not perform R&D or ceased operations. The register is updated annually through a Preliminary Survey of organisations that are potentially performing R&D but are not on the register. The list of organisations surveyed in the Preliminary Survey is compiled annually from various sources, and includes all companies that are in receipt of government R&D grants.

8.1.3 From 2019, the register has expanded to include organisations that perform innovation activities (other than R&D). This is in line with the expansion of the survey to include returns on innovation activities performed by organisations in Singapore.

8.2. RESPONSES

8.2.1 The organisations that reported to the Survey that they performed innovation and/or R&D in 2020 comprised private sector enterprises, government organisations, institutions of higher learning and the public research institutes. A total of

972 private sector enterprises reported that they performed R&D in 2020.

8.2.2 Approximately 15,200 survey forms were sent out in the Preliminary Survey. Subsequently, 2,636 survey forms were sent out to private sector enterprises in the 2020 register of innovation and/or R&D-performing organisations. From these, 1,369 private sector enterprises (51.9%) reported that they performed innovation activities (including R&D) from 2018 to 2020, 303 (11.5%) reported that they did not perform innovation and/or R&D in 2020 or had ceased business operations, and 964 (36.6%) did not respond or provided incomplete/late submissions.

8.2.3 In 2020, the top 150 private sector enterprises (by R&D expenditure in 2019) accounted for 79% (\$5.2 billion) of private sector R&D expenditure. 147 (98%) reported that they performed R&D in 2020 and their returns were either reported under their own name or under a parent or subsidiary and 3 (2%) either reported that they did not perform R&D in 2020 or had ceased business operations or did not respond to us.

8.2.4 97% of all the government organisations, institutions of higher learning and public research institutes that were surveyed in 2020 responded.

8.2.5 The 2020 National RIE Survey publication continues to report the aggregated findings of organisations that perform in-house R&D. Findings of innovation activities performed by organisations in Singapore may be included in future editions of the publication.

8.3. CONVENTIONS

8.3.1 The reporting period of the Survey is one year in length. The actual period may vary across Survey respondents but it would usually be the calendar or fiscal year.

8.4. HISTORICAL NOTES

8.4.1 The National Survey of R&D in Singapore was conducted by the Singapore Science Council on a triennial basis from 1978 to 1987. Since 1990, it has been conducted and published annually by the Agency for Science, Technology and Research (formerly the National Science and Technology Board). In 2019, the National Survey of R&D has been renamed the National Survey of Research, Innovation and Enterprise (RIE), which includes innovation as well.

8.4.2 Postgraduate research students (at the master degree and PhD levels) have been reported as R&D manpower only since the 2000 Survey. In the 2000 Survey, both full-time and part-time postgraduate research students were counted. Since the 2001 Survey, only full-time postgraduate research students (FPGRSs) have been included.

8.4.3 In 2000 and 2001, the Survey published data on patents applied and awarded that combined data from the Survey with data from the public databases of the Intellectual Property of Singapore (IPOS). Specifically, the published data combined the patenting data of the Survey respondents with the patenting data in the IPOS databases of locally-based companies (and individuals) that were not among the Survey's respondents. (The IPOS data contributed an additional 128 patents applied and 46 patents awarded in 2000, and an additional 193 patents applied and 51 patents awarded in 2001.) Since 2002, the Survey publishes only the patenting data of Survey respondents.

8.4.4 Since the 2002 Survey, (a) the industrial classification of enterprises in the private sector by industry groups was revised to ensure overall consistency of the classifications with SSIC 2000 and to align the definitions of the industry groups in the manufacturing industries with EDB's new

definitions; (b) basic research in the private sector was not sub-classified into the subtypes of pure and strategic basic research; (c) "licensing revenue from acquired patents and new technologies" and "sales revenue from commercialised products and processes attributed to R&D performed in Singapore within the last 2 years" ceased to be published; (d) the Survey asked additionally for the age group and gender of R&D manpower to be reported; (e) the Survey included "computer engineering", "info-communication & media technology", "biological sciences", "basic medicine", "clinical medicine", "health sciences", "pharmaceutical sciences & manufacturing" and "other biomedical related sciences" as disaggregated options under the fields of science & technology category for both researchers and R&D expenditure; and (f) the Survey asked for the disaggregation of reported R&D expenditure in each field of science & technology by the type of R&D.

8.4.5 Prior to 2005, the classification of survey respondents from the private sector was based on the SSIC 2000. In 2005, it was updated to SSIC 2005, in 2010, to SSIC 2010, in 2015, to SSIC 2015, in 2017, to SSIC 2015 (version 2018), and in 2020, to SSIC 2020. In 2017, the aggregation of manufacturing activities into the EDB-defined manufacturing subsectors was also updated with EDB's revised classification. These revisions have some but limited impact on the comparability of the published R&D statistics in the 2017 survey report relative to those in the preceding survey reports.

8.4.6 Hitherto, organisations which were known to have performed R&D in the survey period, but which did not submit a survey return or submitted an incomplete survey return, have been excluded from the published survey results. With effect from the 2006 survey report, such organisations would be captured in the published survey results through a mechanism of imputation,

where this is feasible. The imputed data would be based on the previous year's survey returns and/or the current year's incomplete returns. The impact on the published statistics was marginal considering the survey already had a high response rate. Imputation was used for 5 (0.2%) of the 2,748 entities surveyed in 2020.

8.4.7 With effect from the 2007 Survey, an exercise would be undertaken on a yearly basis to update any changes made by the Department of Statistics to an organisation's Unique Entity Number (UEN) which could in turn impact its SSIC code. This is to capture any changes in the organisation's core activity so as to ensure that the organisation is placed in the correct industry classification.

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Table 1.1A R&D Manpower

Type of R&D Manpower	Private Sector	Government Sector	Institutes of Higher Learning	Public Research Institutes	Total
Researchers	24,183	3,878	14,151	3,849	46,061
RSEs [#]	22,166	3,692	9,151	3,766	38,775
PhD	1,993	668	5,158	2,123	9,942
Master	5,831	1,146	1,613	561	9,151
Bachelor	14,342	1,878	2,380	1,082	19,682
Postgrad students*	-	-	4,921	29	4,950
Non-Degree	2,017	186	79	54	2,336
Technicians	1,517	382	251	264	2,414
Other Supporting Staff	2,404	1,662	579	400	5,045
Total	28,104	5,922	14,981	4,513	53,520

* Similar to past years, postgraduate students at the Public Research Institutes are reported under Institutes of Higher Learning (IHL). Postgraduate students matriculated with overseas IHLs are reported under Public Research Institutes.

[#] RSE is a definition used within Singapore context. It includes researchers with at least a degree. For more detailed definition regarding RSE, please see page 11 of explanatory notes.

Table 1.1B R&D Manpower (FTE)

Type of R&D Manpower	Private Sector	Government Sector	Institutes of Higher Learning	Public Research Institutes	Total
Researchers	23,058.5	2,672.7	13,098.9	3,749.1	42,579.2
RSEs [#]	21,209.8	2,518.1	8,103.6	3,666.1	35,497.6
PhD	1,906.3	543.2	4,359.8	2,053.6	8,862.9
Master	5,588.0	718.2	1,459.5	551.5	8,317.2
Bachelor	13,715.5	1,256.7	2,284.2	1,061.1	18,317.5
Postgrad students*	-	-	4,921.0	29.0	4,950.0
Non-Degree	1,848.7	154.6	74.3	54.0	2,131.6
Technicians	1,334.7	347.9	228.9	256.8	2,168.2
Other Supporting Staff	2,077.1	1,544.3	570.5	394.5	4,586.4
Total	26,470.2	4,564.9	13,898.3	4,400.4	49,333.8

Table 1.2 R&D Manpower by Nationality

Type of R&D Manpower	Private Sector		Government Sector		Institutes of Higher Learning		Public Research Institutes		Total	
	Singapore Citizens & Permanent Residents	Foreign Citizens	Singapore Citizens & Permanent Residents	Foreign Citizens	Singapore Citizens & Permanent Residents	Foreign Citizens	Singapore Citizens & Permanent Residents	Foreign Citizens	Singapore Citizens & Permanent Residents	Foreign Citizens
Researchers	17,665	6,518	3,686	192	6,664	7,487	3,084	765	31,099	14,962
RSEs [#]	15,934	6,232	3,507	185	5,049	4,102	3,028	738	27,518	11,257
PhD	1,424	569	591	77	2,394	2,764	1,541	582	5,950	3,992
Master	3,770	2,061	1,100	46	881	732	459	102	6,210	2,941
Bachelor	10,740	3,602	1,816	62	1,774	606	1,028	54	15,358	4,324
Postgrad students*	-	-	-	-	1,553	3,368	4	25	1,557	3,393
Master Level	-	-	-	-	174	195	0	4	174	199
PhD Level	-	-	-	-	1,379	3,173	4	21	1,383	3,194
Non-Degree	1,731	286	179	7	62	17	52	2	2,024	312
Technicians	1,056	461	342	40	236	15	249	15	1,883	531
Other Supporting Staff	1,797	607	1,612	50	560	19	393	7	4,362	683
Total	20,518	7,586	5,640	282	7,460	7,521	3,726	787	37,344	16,176

* Similar to past years, postgraduate students at the Public Research Institutes are reported under Institutes of Higher Learning (IHL). Postgraduate students matriculated with overseas IHLs are reported under Public Research Institutes.

[#] RSE is a definition used within Singapore context. It includes researchers with at least a degree. For more detailed definition regarding RSE, please see page 11 of explanatory notes.

Table 1.3 R&D Manpower by Age Group

Type of R&D Manpower	Private Sector						Government Sector						Institutes of Higher Learning						Public Research Institutes						Total					
	<25	25-34	35-44	45-54	55-64	>64	<25	25-34	35-44	45-54	55-64	>64	<25	25-34	35-44	45-54	55-64	>64	<25	25-34	35-44	45-54	55-64	>64	<25	25-34	35-44	45-54	55-64	>64
Researchers	686	8,785	8,869	4,540	1,213	90	89	1,386	1,240	814	302	47	1,059	8,817	2,463	1,090	599	123	126	1,529	1,295	634	248	17	1,960	20,517	13,867	7,078	2,362	277
RSEs [#]	514	8,325	8,352	3,995	920	60	78	1,352	1,209	734	274	45	434	4,718	2,230	1,058	589	122	101	1,495	1,282	625	246	17	1,127	15,890	13,073	6,412	2,029	244
PhD	3	526	928	381	142	13	0	124	283	165	82	14	1	2,305	1,595	716	448	93	6	665	870	418	151	13	10	3,620	3,676	1,680	823	133
Master	63	1,777	2,309	1,359	307	16	6	377	387	274	91	11	60	842	375	217	99	20	11	192	160	128	68	2	140	3,188	3,231	1,978	565	49
Bachelor	448	6,022	5,115	2,255	471	31	72	851	539	295	101	20	373	1,571	260	125	42	9	84	638	252	79	27	2	977	9,082	6,166	2,754	641	62
Postgrad students*	-	-	-	-	-	-	-	-	-	-	-	-	607	4,068	218	22	5	1	13	16	0	0	0	0	620	4,084	218	22	5	1
Non-Degree	172	460	517	545	293	30	11	34	31	80	28	2	18	31	15	10	5	0	12	18	13	9	2	0	213	543	576	644	328	32
Technicians	141	645	399	236	83	13	31	160	98	40	45	8	15	60	40	52	78	6	12	96	50	51	51	4	199	961	587	379	257	31
Other Supporting Staff	159	652	751	543	258	41	99	653	496	274	110	30	8	153	180	118	110	10	7	96	116	111	60	10	273	1,554	1,543	1,046	538	91
Total	986	10,082	10,019	5,319	1,554	144	219	2,199	1,834	1,128	457	85	1,082	9,030	2,683	1,260	787	139	145	1,721	1,461	796	359	31	2,432	23,032	15,997	8,503	3,157	399

* Similar to past years, postgraduate students at the Public Research Institutes are reported under Institutes of Higher Learning (IHL). Postgraduate students matriculated with overseas IHLs are reported under Public Research Institutes.

[#] RSE is a definition used within Singapore context. It includes researchers with at least a degree. For more detailed definition regarding RSE, please see page 11 of explanatory notes.

Table 1.4 R&D Manpower by Gender

Type of R&D Manpower	Private Sector		Government Sector		Institutes of Higher Learning		Public Research Institutes		Total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Researchers	17,721	6,462	2,438	1,440	9,274	4,877	2,304	1,545	31,737	14,324
RSEs [#]	16,260	5,906	2,331	1,361	6,049	3,102	2,254	1,512	26,894	11,881
PhD	1,433	560	429	239	3,726	1,432	1,448	675	7,036	2,906
Master	4,464	1,367	730	416	983	630	340	221	6,517	2,634
Bachelor	10,363	3,979	1,172	706	1,340	1,040	466	616	13,341	6,341
Postgrad students*	-	-	-	-	3,174	1,747	20	9	3,194	1,756
Non-Degree	1,461	556	107	79	51	28	30	24	1,649	687
Technicians	946	571	172	210	147	104	154	110	1,419	995
Other Supporting Staff	1,178	1,226	410	1,252	239	340	123	277	1,950	3,095
Total	19,845	8,259	3,020	2,902	9,660	5,321	2,581	1,932	35,106	18,414

* Similar to past years, postgraduate students at the Public Research Institutes are reported under Institutes of Higher Learning (IHL). Postgraduate students matriculated with overseas IHLs are reported under Public Research Institutes.

[#] RSE is a definition used within Singapore context. It includes researchers with at least a degree. For more detailed definition regarding RSE, please see page 11 of explanatory notes.

Table 1.5 R&D Expenditure by Type of Costs

Type of Costs	Private Sector		Government Sector		Institutes of Higher Learning		Public Research Institutes		Total	
Capital Costs	617.48		41.60		110.16		92.64		861.88	
Land, Buildings & Other Structures	52.26		18.73		1.92		2.77		75.68	
Vehicles, Plant, Machinery & Equipment	565.22		22.87		108.24		89.87		786.20	
Manpower Costs	2,940.36		623.30		941.25		563.79		5,068.69	
Researchers	2,620.62		483.31		855.83		499.96		4,459.71	
RSEs	2,435.19		461.77		742.32		494.86		4,134.14	
Postgrad students	0		0		109.82		0.74		110.56	
Non-Degree	185.42		21.54		3.69		4.36		215.02	
Technicians	102.97		27.09		8.89		23.85		162.81	
Other Supporting Staff	216.77		112.89		76.53		39.98		446.17	
Other Operating Costs	3,037.50		616.07		410.20		403.26		4,467.02	
Total	6,595.33		1,280.97		1,461.61		1,059.69		10,397.59	

Table 1.6 R&D Expenditure by Source of Funding

	\$ million				
Source of Funding	Private Sector	Government Sector	Institutes of Higher Learning	Public Research Institutes	Total
Own Funds	5,734.54	152.32	222.01	54.72	6,163.59
Private Sector	148.24	37.13	95.44	46.07	326.89
Government Sector	294.59	1,060.75	1,114.10	943.69	3,413.14
Institutes of Higher Learning	7.09	16.29	7.01	2.51	32.90
Foreign-Based Companies	406.97	14.16	14.16	11.01	446.30
Foreign Governments & International Organisations	3.88	0.31	8.89	1.68	14.77
Total	6,595.33	1,280.97	1,461.61	1,059.69	10,397.59

Table 1.7 Patenting Indicators

Patenting Indicators	Private Sector	Government Sector	Institutes of Higher Learning	Public Research Institutes	Total
Patents Applied	2,062	105	661	138	2,966
Patents Awarded	1,276	29	149	56	1,510
Patents Owned (Cumulatively as at 31 Dec 2020)	11,328	253	848	556	12,985

Table 1.8 Revenue Indicators

	\$ million				
Revenue Indicators	Private Sector	Government Sector	Institutes of Higher Learning	Public Research Institutes	Total
Licensing Revenue from Patents and New Technologies Developed in Singapore	263.03	0.63	8.51	2.79	274.95
Sales Revenue from Commercialised Products/Processes Attributed to R&D Performed in Singapore	30,817.13	0.17	12.41	10.95	30,840.66

Table 2.1A Researchers by Field of Science & Technology

Field of Science & Technology	Private Sector				Government Sector				Institutes of Higher Learning					Public Research Institutes					Total				
	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree
Agricultural & Food Sciences	155	182	602	134	38	27	54	5	140	26	61	83	9	10	1	3	0	0	343	236	720	83	148
Biomedical & Related Sciences	324	271	763	65	353	436	809	83	1,277	321	767	939	10	899	162	544	17	9	2,853	1,190	2,883	956	167
Engineering & Technology	1,171	4,315	10,186	1,549	179	521	841	94	1,960	701	735	2,143	39	894	302	452	8	45	4,204	5,839	12,214	2,151	1,727
Natural Sciences (excluding Biological Sciences)	288	887	2,516	201	79	137	146	3	1,213	313	409	1,328	19	307	96	78	4	0	1,887	1,433	3,149	1,332	223
Energy & Other Areas	55	176	275	68	19	25	28	1	568	252	408	428	2	13	0	5	0	0	655	453	716	428	71
Total	1,993	5,831	14,342	2,017	668	1,146	1,878	186	5,158	1,613	2,380	4,921	79	2,123	561	1,082	29	54	9,942	9,151	19,682	4,950	2,336

Table 2.1B Researchers (FTE) by Field of Science & Technology

Field of Science & Technology	Private Sector				Government Sector				Institutes of Higher Learning					Public Research Institutes					Total				
	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree	PhD	Master	Bachelor	Postgrad Students	Non-Degree
Agricultural & Food Sciences	148.3	173.2	571.2	130.4	35.6	21.1	32.0	1.0	123.9	18.6	56.8	83.0	9.9	10.0	1.0	3.5	0.0	0.0	317.8	213.8	663.5	83.0	141.3
Biomedical & Related Sciences	316.4	263.8	736.2	63.4	291.0	197.1	486.5	77.0	999.4	286.0	727.3	939.0	9.8	871.9	159.4	533.8	17.0	9.0	2,478.8	906.2	2,483.8	956.0	159.2
Engineering & Technology	1,115.0	4,131.9	9,742.0	1,399.0	148.7	386.8	622.7	74.5	1,706.5	630.7	703.3	2,143.0	34.4	851.8	295.0	442.8	8.0	45.0	3,822.1	5,444.4	11,510.7	2,151.0	1,552.8
Natural Sciences (excluding Biological Sciences)	273.4	849.5	2,410.0	189.4	66.0	110.7	112.7	2.1	1,010.7	295.3	402.4	1,328.0	18.6	306.9	96.2	76.0	4.0	0.0	1,656.9	1,351.7	3,001.1	1,332.0	210.0
Energy & Other Areas	53.2	169.7	256.1	66.5	1.9	2.5	2.8	0.1	519.2	229.0	394.5	428.0	1.7	13.0	0.0	5.0	0.0	0.0	587.4	401.1	658.4	428.0	68.3
Total	1,906.3	5,588.0	13,715.5	1,848.7	543.2	718.2	1,256.7	154.6	4,359.8	1,459.5	2,284.2	4,921.0	74.3	2,053.6	551.5	1,061.1	29.0	54.0	8,862.9	8,317.2	18,317.5	4,950.0	2,131.6

Table 2.2 Private Sector Researchers by Enterprise Ownership/Size and Field of Science & Technology

Field of Science & Technology	Local Companies				Foreign Companies				Total			
	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Non-Degree	PhD	Master	Bachelor	Non-Degree
Agricultural & Food Sciences	67	28	135	48	88	154	467	86	155	182	602	134
Biomedical & Related Sciences	161	97	192	19	163	174	571	46	324	271	763	65
Engineering & Technology	293	1,280	3,866	615	878	3,035	6,320	934	1,171	4,315	10,186	1,549
Natural Sciences (excluding Biological Sciences)	66	433	1,172	86	222	454	1,344	115	288	887	2,516	201
Energy & Other Areas	27	88	122	48	28	88	153	20	55	176	275	68
Total	614	1,926	5,487	816	1,379	3,905	8,855	1,201	1,993	5,831	14,342	2,017

Table 2.3 R&D Expenditure by Type of R&D and Field of Science & Technology

Field of Science & Technology	Private Sector			Government Sector				Institutes of Higher Learning				Public Research Institutes				Total		
	Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Pure Basic Research	Strategic Basic Research	Applied Research	Experimental Development	Basic Research	Applied Research	Experimental Development
Agricultural & Food Sciences	22.26	105.61	152.22	0.00	16.67	5.11	0.00	4.21	7.54	14.53	12.32	0.52	3.29	3.13	2.02	54.49	128.39	166.56
Biomedical & Related Sciences	124.04	175.97	439.30	15.31	20.83	180.67	175.70	44.25	280.85	134.51	49.75	11.09	105.09	173.99	124.05	601.46	665.14	788.79
Engineering & Technology	531.25	1,403.17	2,859.45	0.00	3.21	87.99	684.85	70.11	138.60	166.78	75.20	4.76	114.65	166.01	253.26	862.57	1,823.94	3,872.77
Natural Sciences (excluding Biological Sciences)	218.50	277.33	189.98	0.00	0.00	38.29	51.01	47.65	110.43	90.05	39.73	1.01	26.31	21.57	45.57	403.90	427.24	326.30
Energy & Other Areas	10.37	35.33	50.56	0.00	0.00	0.00	1.34	30.20	65.56	45.55	33.77	0.00	1.51	0.86	1.01	107.64	81.75	86.68
Total	906.41	1,997.41	3,691.51	15.31	40.71	312.05	912.90	196.43	602.98	451.42	210.78	17.38	250.84	365.56	425.90	2,030.06	3,126.44	5,241.09

Table 2.4 Private Sector R&D Expenditure by Enterprise Ownership/Size, Type of R&D and Field of Science & Technology

\$ million

Field of Science & Technology	Local Companies			Foreign Companies			Total		
	Basic Research	Applied Research	Experimental Development	Basic Research	Applied Research	Experimental Development	Basic Research	Applied Research	Experimental Development
Agricultural & Food Sciences	13.90	13.02	13.00	8.36	92.59	139.22	22.26	105.61	152.22
Biomedical & Related Sciences	48.35	35.18	208.60	75.69	140.79	230.70	124.04	175.97	439.30
Engineering & Technology	53.73	319.23	595.60	477.51	1,083.94	2,263.85	531.25	1,403.17	2,859.45
Natural Sciences (excluding Biological Sciences)	104.80	36.81	79.80	113.69	240.52	110.18	218.50	277.33	189.98
Energy & Other Areas	5.75	10.35	27.24	4.61	24.98	23.32	10.37	35.33	50.56
Total	226.54	414.59	924.23	679.88	1,582.82	2,767.28	906.41	1,997.41	3,691.51

Table 3.1 Private Sector R&D Expenditure as Percentage of Total Sales Revenue by Enterprise Ownership/Size and Industrial Classification

Industrial Classification	Local Companies			Foreign Companies			Total		
	R&D Expenditure	Total Sales Revenue	R&D Expenditure as % of Total Sales Revenue	R&D Expenditure	Total Sales Revenue	R&D Expenditure as % of Total Sales Revenue	R&D Expenditure	Total Sales Revenue	R&D Expenditure as % of Total Sales Revenue
Primary Industries & Construction	37.05	944.14	3.92%	9.96	25.14	39.63%	47.01	969.28	4.85%
Manufacturing	486.28	33,373.76	1.46%	2,879.29	154,435.63	1.86%	3,365.57	187,809.39	1.79%
Biomedical Manufacturing	54.89	1,002.47	5.48%	174.08	12,125.76	1.44%	228.97	13,128.23	1.74%
Chemicals	19.30	2,794.60	0.69%	276.87	21,762.43	1.27%	296.17	24,557.04	1.21%
Electronics	89.15	20,043.41	0.44%	1,830.61	93,563.97	1.96%	1,919.76	113,607.38	1.69%
Precision Engineering	208.86	5,764.72	3.62%	388.46	14,481.19	2.68%	597.31	20,245.91	2.95%
Transport Engineering	98.49	2,305.33	4.27%	108.37	5,549.08	1.95%	206.86	7,854.41	2.63%
General Manufacturing	15.60	1,463.22	1.07%	100.90	6,953.20	1.45%	116.50	8,416.42	1.38%
Services	1,042.03	43,836.09	2.38%	2,140.72	215,076.18	1.00%	3,182.75	258,912.28	1.23%
R&D	354.71	168.87	210.04%	781.89	1,019.23	76.71%	1,136.60	1,188.10	95.67%
Financial Intermediation & Other Business Activities	374.75	33,093.70	1.13%	159.61	11,428.48	1.40%	534.36	44,522.18	1.20%
Information & Communications	153.32	2,984.83	5.14%	445.68	45,249.13	0.98%	598.99	48,233.96	1.24%
Wholesale & Retail Trade	134.03	6,605.61	2.03%	720.44	156,883.22	0.46%	854.47	163,488.83	0.52%
All Other Services ¹	25.23	983.08	2.57%	33.10	496.12	6.67%	58.33	1,479.20	3.94%
Total	1,565.35	78,153.99	2.00%	5,029.97	369,536.96	1.36%	6,595.33	447,690.95	1.47%

¹ Refers to industries in Education, Health & Social Services, Logistics & Other Services.

Table 3.2 Private Sector Patenting Indicators by Enterprise Ownership/Size and Industrial Classification

Industrial Classification	Local Companies			Foreign Companies			Total		
	Patents Applied	Patents Awarded	Patents Owned	Patents Applied	Patents Awarded	Patents Owned	Patents Applied	Patents Awarded	Patents Owned
Primary Industries & Construction	3	1	13	0	0	0	3	1	13
Manufacturing	76	83	1,698	302	107	4,151	378	190	5,849
Biomedical Manufacturing	16	3	391	86	9	41	102	12	432
Chemicals	1	0	1	29	0	14	30	0	15
Electronics	21	34	659	117	48	2,151	138	82	2,810
Precision Engineering	33	23	523	48	41	1,708	81	64	2,231
Transport Engineering	3	23	119	12	7	191	15	30	310
General Manufacturing	2	0	5	10	2	46	12	2	51
Services	386	226	1,130	1,295	859	4,336	1,681	1,085	5,466
R&D	227	173	663	127	86	391	354	259	1,054
Financial Intermediation & Other Business Activities	71	32	192	42	31	117	113	63	309
Information & Communications	32	6	41	50	12	83	82	18	124
Wholesale & Retail Trade	21	13	231	1,075	729	3,743	1,096	742	3,974
All Other Services ¹	35	2	3	1	1	2	36	3	5
Total	465	310	2,841	1,597	966	8,487	2,062	1,276	11,328

¹ Refers to industries in Education, Health & Social Services, Logistics & Other Services.

Table 3.3 Private Sector Licensing Revenue from Patents and New Technologies Developed in Singapore and Sales Revenue from Commercialised Products/Processes Attributed to R&D Performed in Singapore by Enterprise Ownership/Size and Industrial Classification

Industrial Classification	\$ million					
	Local Companies		Foreign Companies		Total	
	Licensing Revenue	Sales Revenue	Licensing Revenue	Sales Revenue	Licensing Revenue	Sales Revenue
Primary Industries & Construction	0.00	22.69	0.00	0.00	0.00	22.69
Manufacturing	225.76	2,350.62	2.10	20,201.01	227.85	22,551.63
Biomedical Manufacturing	0.00	6.87	1.19	64.53	1.19	71.40
Chemicals	0.00	1,256.12	0.00	195.51	0.00	1,451.63
Electronics	0.50	179.71	0.64	18,711.74	1.14	18,891.45
Precision Engineering	17.99	133.39	0.27	934.03	18.25	1,067.42
Transport Engineering	0.24	658.88	0.00	203.09	0.24	861.97
General Manufacturing	207.03	115.65	0.00	92.11	207.03	207.76
Services	18.10	5,570.94	17.07	2,671.87	35.18	8,242.81
R&D	0.16	4.26	0.12	249.28	0.28	253.55
Financial Intermediation & Other Business Activities	0.44	4,579.44	0.02	6.75	0.45	4,586.19
Information & Communications	13.35	421.48	15.85	47.95	29.20	469.44
Wholesale & Retail Trade	0.85	562.57	1.08	2,367.75	1.94	2,930.32
All Other Services ¹	3.32	3.17	0.00	0.14	3.32	3.31
Total	243.86	7,944.25	19.17	22,872.88	263.03	30,817.13

¹ Refers to industries in Education, Health & Social Services, Logistics & Other Services.

Table 4.1 Private Sector Survey Respondents by Enterprise Ownership/Size and Industrial Classification

Industrial Classification	Local Companies	Foreign Companies					Total
		USA	Europe	East Asia ¹	Asean (excl. S'pore)	Others	
Primary Industries & Construction	19	0	1	2	0	0	22
Manufacturing	172	34	50	44	3	16	319
Biomedical Manufacturing	18	4	10	2	0	1	35
Chemicals	22	5	9	11	0	3	50
Electronics	27	10	11	9	1	6	64
Precision Engineering	59	11	11	15	1	2	99
Transport Engineering	12	2	4	3	0	2	23
General Manufacturing	34	2	5	4	1	2	48
Services	403	34	92	65	4	33	631
R&D	106	12	12	20	0	8	158
Financial Intermediation & Other Business Activities	75	7	17	9	1	5	114
Information & Communications	152	8	16	8	1	13	198
Wholesale & Retail Trade	49	6	41	27	2	7	132
All Other Services ²	21	1	6	1	0	0	29
Total	594	68	143	111	7	49	972

¹ East Asia comprises of Japan, Republic of Korea, China (incl. HK) & Taiwan.

² Refers to industries in Education, Health & Social Services, Logistics & Other Services.

Table 4.2 Private Sector Survey Respondents by Bands of R&D Expenditure and Industrial Classification

Industrial Classification	\$200,000 & below	\$200,001 - \$500,000	\$500,001 - \$1,000,000	\$1,000,001 - \$2,000,000	\$2,000,001 - \$5,000,000	\$5,000,001 - \$10,000,000	\$10,000,001 - \$15,000,000	\$15,000,001 - \$20,000,000	\$20,000,001 - \$30,000,000	\$30,000,001 & Above	Total
Primary Industries & Construction	8	4	4	0	3	2	0	0	1	0	22
Manufacturing	70	49	47	33	39	20	19	10	11	21	319
Biomedical Manufacturing	4	4	7	3	6	3	3	0	3	2	35
Chemicals	13	11	9	4	4	2	3	2	1	1	50
Electronics	9	7	3	7	11	7	3	4	1	12	64
Precision Engineering	24	15	18	10	11	5	8	2	1	5	99
Transport Engineering	4	2	0	5	3	3	1	2	2	1	23
General Manufacturing	16	10	10	4	4	0	1	0	3	0	48
Services	185	110	81	76	79	41	13	8	13	25	631
R&D	43	32	17	18	16	12	1	2	6	11	158
Financial Intermediation & Other Business Activities	27	23	14	14	16	8	4	1	3	4	114
Information & Communications	75	36	31	26	17	5	3	2	0	3	198
Wholesale & Retail Trade	30	14	16	15	25	15	4	2	4	7	132
All Other Services ¹	10	5	3	3	5	1	1	1	0	0	29
Total	263	163	132	109	121	63	32	18	25	46	972

¹ Refers to industries in Education, Health & Social Services, Logistics & Other Services.

Table 4.3 Private Sector Survey Respondents by Bands of R&D Expenditure and R&D Manpower

No. of R&D Manpower	\$200,000 & below	\$200,001 - \$500,000	\$500,001 - \$1,000,000	\$1,000,001 - \$2,000,000	\$2,000,001 - \$5,000,000	\$5,000,001 - \$10,000,000	\$10,000,001 - \$15,000,000	\$15,000,001 - \$20,000,000	\$20,000,001 - \$30,000,000	\$30,000,001 & Above	Total
5 and Below	231	105	38	16	7	1	1	0	1	0	400
6 - 10	28	48	63	31	16	4	0	0	0	1	191
11 - 20	1	5	23	47	32	8	3	0	0	0	119
21 - 40	3	4	7	14	50	24	7	3	2	3	117
41 - 60	0	1	0	1	10	16	5	4	3	3	43
61 - 80	0	0	0	0	4	5	5	2	2	2	20
81 - 100	0	0	1	0	0	2	5	5	8	4	25
101 and Above	0	0	0	0	2	3	6	4	9	33	57
Total	263	163	132	109	121	63	32	18	25	46	972

Table 5.1 Time Series of Some Key Indicators

Year	RSEs	Private Sector RSEs	PhD RSEs	PG Students	RSEs per 10k Labour Force	RSEs + PG Students per 10k Labour Force	Total R&D Expenditure (\$m)	Private Sector R&D Expenditure (\$m)	Private Sector R&D Expenditure as % of Total R&D Expenditure	Total R&D Expenditure as % of GDP	Private Sector R&D Expenditure as % of GDP
1990	4,329	1,363	970	-	27.7	-	571.70	309.50	54.14%	0.81%	0.44%
1991	5,218	2,315	1,184	-	31.2	-	756.80	442.00	58.40%	0.96%	0.56%
1992	6,454	3,187	1,424	-	37.2	-	949.54	577.62	60.83%	1.12%	0.68%
1993	6,629	3,248	1,630	-	37.6	-	997.93	618.58	61.99%	1.02%	0.63%
1994	7,086	3,561	1,724	-	38.5	-	1,174.98	736.23	62.66%	1.04%	0.65%
1995	8,340	4,163	1,887	-	47.7	-	1,366.56	881.37	64.50%	1.10%	0.71%
1996	10,153	5,085	2,237	-	50.1	-	1,792.14	1,133.42	63.24%	1.32%	0.83%
1997	11,302	5,792	2,485	-	53.4	-	2,104.56	1,314.52	62.46%	1.42%	0.88%
1998	12,655	6,573	2,733	-	57.8	-	2,492.26	1,536.10	61.63%	1.74%	1.07%
1999	13,817	7,502	3,054	-	62.6	-	2,656.30	1,670.86	62.90%	1.82%	1.14%
2000	14,483	7,997	3,111	2,570	66.1	77.8	3,009.52	1,866.05	62.00%	1.82%	1.13%
2001	15,366	8,389	3,347	3,211	65.9	79.7	3,232.68	2,045.02	63.26%	2.02%	1.28%
2002	15,654	8,598	3,639	3,723	67.5	83.5	3,368.34	2,055.01	61.01%	2.03%	1.24%
2003	17,074	9,827	3,791	4,065	73.8	91.4	3,396.90	2,053.62	60.46%	2.00%	1.21%
2004	18,935	11,596	4,063	3,705	80.9	96.7	4,041.47	2,569.56	63.58%	2.08%	1.32%
2005	21,338	13,217	4,575	3,718	90.1	105.8	4,569.41	3,018.54	66.06%	2.15%	1.42%
2006	22,675	13,893	5,005	3,761	87.4	101.9	4,998.45	3,281.74	65.66%	2.12%	1.39%
2007	24,506	14,921	5,637	4,094	90.4	105.5	6,326.20	4,222.10	66.74%	2.32%	1.55%
2008	25,744	15,348	6,147	4,605	87.6	103.2	7,113.54	5,105.45	71.77%	2.60%	1.86%
2009	26,608	15,060	6,751	5,295	87.8	105.3	6,009.08	3,689.06	61.39%	2.13%	1.31%
2010	28,296	15,609	7,477	5,760	90.2	108.6	6,308.04	3,761.11	59.62%	1.93%	1.15%
2011	29,480	16,496	7,752	5,990	91.1	109.6	7,271.73	4,446.29	61.14%	2.07%	1.27%
2012	30,105	16,422	8,365	5,924	89.6	107.2	7,074.25	4,238.01	59.91%	1.92%	1.15%
2013	31,924	17,526	9,109	6,012	92.7	110.2	7,393.51	4,315.42	58.37%	1.92%	1.12%
2014	32,816	17,967	9,648	5,800	92.9	109.4	8,307.22	4,989.14	60.06%	2.08%	1.25%
2015	34,972	18,761	10,299	5,862	96.9	113.1	9,207.58	5,469.39	59.40%	2.17%	1.29%
2016	35,289	18,686	10,603	5,734	96.1	111.7	9,136.46	5,295.59	57.96%	2.07%	1.20%
2017	35,389	18,625	10,540	5,367	96.8	111.4	9,002.13	5,325.15	59.15%	1.90%	1.12%
2018	36,264	19,368	10,474	4,955	98.7	112.1	9,198.76	5,484.22	59.62%	1.81%	1.08%
2019	39,082	21,466	10,692	4,931	104.4	117.6	9,690.45	5,916.67	61.06%	1.89%	1.16%
2020	38,775	22,166	9,942	4,950	104.4	117.7	10,397.59	6,595.33	63.43%	2.18%	1.38%

Table 5.1 - Time Series of Some Key Indicators (Continued)

Year	Patents Applied	Patents Awarded	Patents Owned	Licensing Revenue from Patents and New Technologies Developed in Singapore (\$m)	Sales Revenue from Commercialised Products/Processes Attributed to R&D Performed in Singapore (\$m)	Private Sector Survey Respondents	Labour Force ¹ ('000)	GDP ² (\$m)
1990	-	-	-	-	-	266	1562.8	70,492.3
1991	-	-	-	-	-	311	1673.7	78,542.8
1992	-	20	96	38.45	-	331	1733.6	84,920.2
1993	142	52	200	41.22	-	410	1,762.7	97,923.1
1994	263	58	204	52.80	-	427	1,842.2	112,555.4
1995	242	51	256	111.41	-	440	1,749.3	124,463.3
1996	316	91	614	27.34	6,381.02	496	2,024.9	135,777.2
1997	490	132	831	26.61	9,647.26	508	2,116.0	148,664.4
1998	579	136	847	50.97	13,369.92	571	2,187.9	143,474.9
1999	673	161	1,077	671.89	10,663.94	593	2,208.7	146,252.5
2000	774	239	1,268	74.63	15,577.77	539	2,192.3	165,632.4
2001	913	410	1,456	55.17	16,659.52	513	2,330.5	160,885.6
2002	936	451	1,739	87.50	11,445.60	519	2,320.6	165,698.1
2003	1,001	460	2,314	132.37	10,360.46	617	2,312.3	170,117.9
2004	1,257	599	2,570	82.70	12,068.56	765	2,341.9	194,433.0
2005	1,594	877	3,475	93.66	13,508.99	900	2,367.3	212,723.0
2006	2,036	933	4,717	139.15	25,678.32	897	2,594.1	236,158.8
2007	1,727	953	5,786	127.88	16,385.51	992	2,710.3	272,697.6
2008	1,581	730	5,455	42.43	21,548.76	887	2,939.9	273,941.6
2009	1,562	747	6,061	31.80	12,299.85	851	3,030.0	282,394.5
2010	1,762	653	5,450	34.69	10,908.47	797	3,135.9	326,980.1
2011	1,913	855	4,763	95.63	13,478.21	802	3,237.1	351,367.9
2012	1,722	817	5,048	1,358.06	21,297.28	695	3,361.8	368,770.5
2013	2,144	934	5,275	1,458.02	22,308.06	809	3,443.7	384,870.3
2014	1,965	911	6,579	475.60	25,237.34	880	3,530.8	398,947.9
2015	2,090	988	8,575	322.55	23,227.05	806	3,610.6	423,444.1
2016	1,997	988	11,534	298.45	29,318.35	772	3,672.8	440,467.0
2017	2,852	1,290	9,784	295.94	26,314.41	849	3,657.0	473,915.7
2018	2,896	1,356	10,114	280.76	31,807.62	855	3,675.6	508,495.1
2019	2,594	1,478	10,253	270.99	29,301.87	1,058	3,742.5	512,219.9
2020	2,966	1,510	12,985	274.95	30,840.66	972	3,713.9	476,404.8

¹Source - Ministry of Manpower and Singapore Department of Statistics

²Source - Singapore Department of Statistics