

# Industrial research and development, 2022 (actual), 2023 (preliminary) and 2024 (intentions)

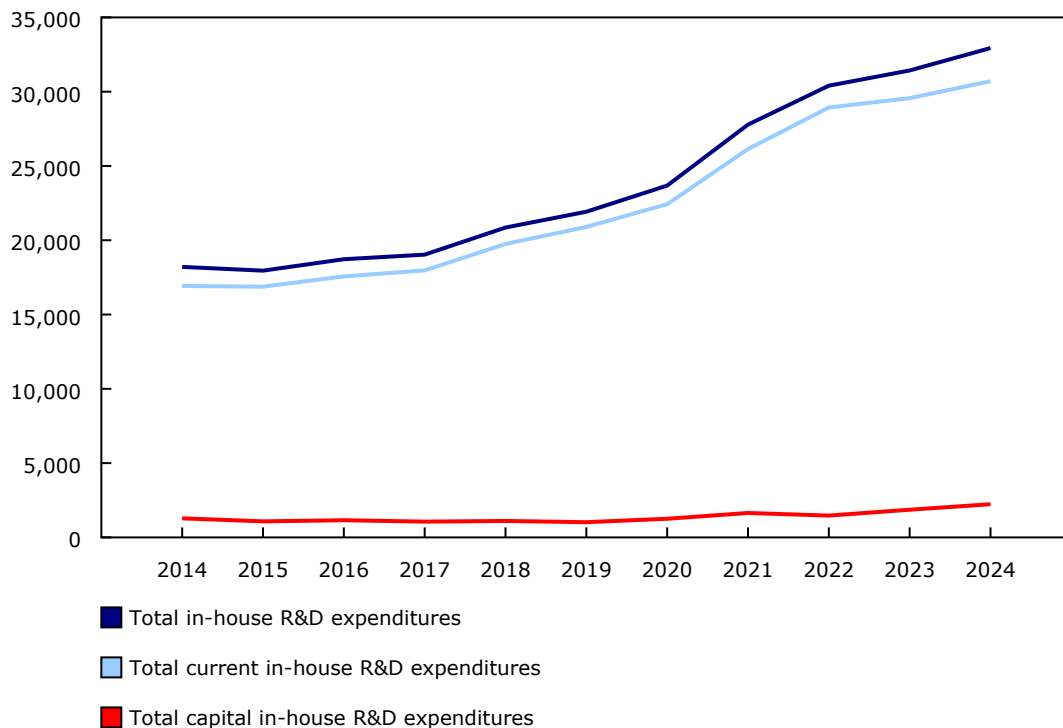
Released at 8:30 a.m. Eastern time in *The Daily*, Thursday, September 5, 2024

Businesses in Canada continued their upward trend in research and development (R&D) spending in 2022, reaching new heights and building on the steady increase that began in 2016. All told, Canadian businesses spent a record \$30.4 billion on in-house R&D in 2022, an increase of 9.4% from 2021.

Preliminary data for 2023 indicate that in-house R&D spending will continue to rise, albeit at a slower pace with spending increasing by 3.4% (+\$1.0 billion) to a projected \$31.4 billion, two years after record year-over-year growth from 2020 to 2021 (+17.3%).

**Chart 1**  
Total in-house research and development (R&D) expenditures, 2014 to 2024

millions of dollars



**Note(s):** Current in-house R&D expenditures include wages, salaries, benefits, materials, supplies, services (such as R&D consultants), R&D materials (water, fuel, gas, electricity), and overhead costs. Capital in-house R&D expenditures refer to the annual gross payment for fixed assets used for R&D for over a year. Capital in-house R&D expenditures include costs for software, land, buildings and structures, equipment, machinery and other capital costs. Total in-house R&D expenditures equal the sum of capital and current R&D expenses.

**Source(s):** Table 27-10-0333-01.

Despite the slowdown expected in 2023, businesses are optimistic for 2024 with indications that R&D spending intentions will increase by \$1.5 billion (+4.8%) to reach \$32.9 billion.

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R&D is vital to supporting innovation and technological progress, boosting economic growth and keeping Canada competitive on the world stage. R&D plays a crucial role in using discoveries to develop new and improved products and processes to bring to the market, especially in fields like healthcare and information technology. The Canadian business sector has contributed to these successes, historically conducting over half of all R&D activities in the country, rising to nearly 60% in recent years. Despite recent spending increases, Canadian business enterprise R&D expenditure remained around 1% of gross domestic product, and half the Organisation for Economic Co-operation and Development average for businesses from reporting member countries, according to its most recent data for 2022.

## **Business sector allocated \$20.7 billion for research and development personnel wages and salaries**

Of the \$30.4 billion spent on total in-house R&D in 2022, the vast majority (95.2%) was allocated to current in-house expenditures (\$28.9 billion) with the balance going to capital investments (\$1.5 billion). Current in-house expenditures include wages and salaries, services to support R&D, R&D materials, and other related costs. Wages and salaries make up the largest part of these expenditures, accounting for \$20.7 billion in 2022. While wages have always been the largest single expense for performers of R&D, their share of the total cost has been increasing over the past decade. In 2014, for instance, wages accounted for 61.8% of current in-house expenditures (57.4% of total in-house expenditures) but have since increased to 71.5% (68.1% of total in-house expenditures) in 2022.

The significant allocation of resources towards R&D personnel is expected, as R&D activities are predominantly knowledge-based. They require highly educated and qualified experts to conduct experiments, manage projects, provide technical and scientific advice, and support operations. The importance of R&D personnel is also underscored by the increase in their numbers from 2014 to 2022. During this time, the number of R&D personnel in the business sector rose from around 154,000 full-time equivalents (FTEs) to around 212,000 FTEs, a compound annual growth rate of 4.0%.

## **Outsourced research and development holding steady after rebounding in 2021**

Following a rebound in 2021, outsourced R&D expenditures remained steady in 2022 at \$5.8 billion. This spending is in stark contrast to the declines noted in 2019 (-\$423 million) and 2020 (-\$55 million) and is the result of increased outsourcing to both Canadian (+\$754 million) and foreign (+\$474 million) R&D performers in 2021 which remained relatively constant in 2022 (-\$47 million to Canadian performers; +\$11 million to foreign performers).

Preliminary data for 2023 and company intentions for 2024 suggest that the current level of expenditure is expected to be maintained, which highlights the importance of external collaborations in advancing R&D activities.

Despite the overall total numbers remaining steady, there is an expected shift in the location where outsourced R&D is performed. Whereas in 2022 expenditures to Canadian recipients accounted for 68.1% of all outsourced expenditures, indications suggest that this rate will drop to 61.5% in 2024.

## **A closer look at emerging technologies**

Biotechnology and nanotechnology are two dynamic and rapidly advancing fields of R&D that deal with very small things. Biotechnology uses living organisms, like plants and animals, to make products that are useful to humans, while nanotechnology works with materials and devices at the scale of atoms and molecules. Although they both currently only make up a small fraction of industrial R&D in Canada, the potential impact of these technologies looms large.

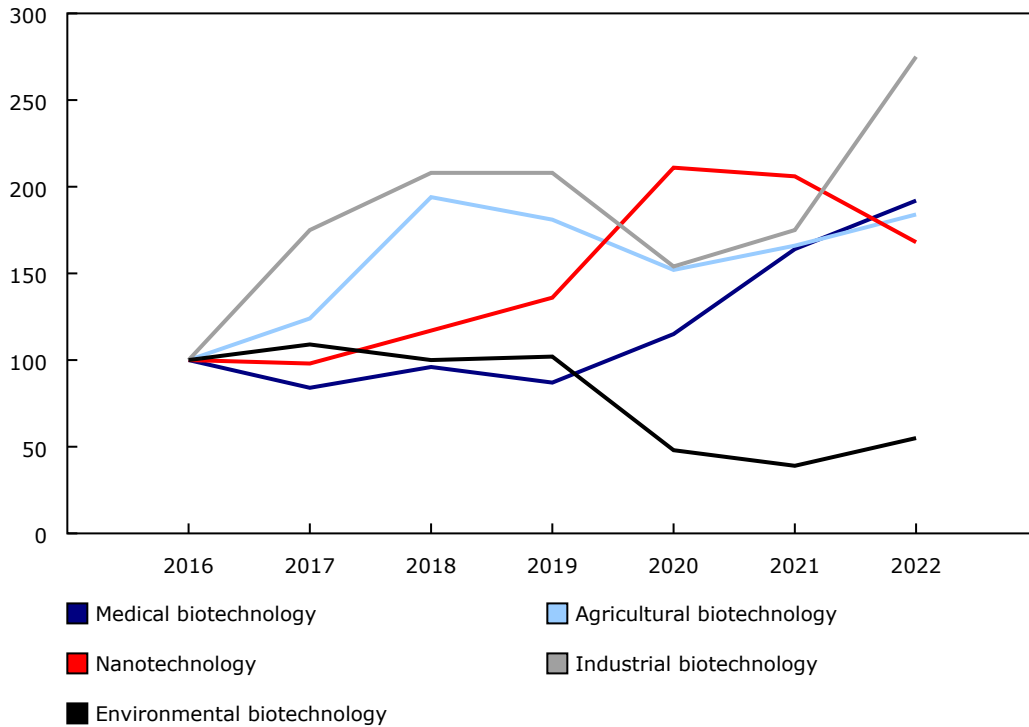
Medical biotechnology, the largest emerging field of R&D in terms of expenditures made by businesses in Canada, involves the use of living cells or materials from cells to improve human health. This technology can lead to the creation of personalized medicines tailored to the patient's genes, as well as new vaccines and diagnostic tools. R&D expenditures have increased from \$561 million in 2019 to \$1.2 billion in 2022, pushed up in part due to the COVID-19 pandemic.

Agricultural biotechnology focuses on improving plants and animals for farming. It helps to create crops that grow faster, are more resistant to pests and can survive in harsher climates. It also helps in the development of animals to be healthier and produce more meat, milk, or eggs. Second only to medical biotechnology as the largest emerging biotechnology, it has maintained a relatively stable state since 2018 when R&D expenditures reached \$130 million. In 2022, they decreased to \$123 million.

Despite being small, nanotechnology experienced fast growth in 2020, jumping from \$64 million in 2019 to \$99 million in 2020. Nanotechnology involves manipulating materials at the nanoscale to create materials that are stronger and lighter. These properties enable advancements in industries such as medicine, electronics, and energy. Unlike medical biotechnology, expenditures decreased from 2021 to \$79 million in 2022, though they remain above 2019 levels.

**Chart 2**  
**Research and development trends in emerging technologies, 2016 to 2022**

index (2016=100)



Source(s): Table 27-10-0343-01.

Industrial biotechnology uses living cells and enzymes to create useful consumer products and processes. This technology helps make items such as biofuels, biodegradable plastics, and various other chemicals commonly found in everyday products. Expenditures tied to industrial biotechnology have varied in recent years, with both 2018 and 2019 coming in around \$50 million, and decreasing in the next two years before reaching \$66 million in 2022.

**Table 1**  
**Research and development expenditures in emerging technologies, 2016 to 2022**

	2016	2017	2018	2019	2020	2021	2022
	millions of dollars						
Medical biotechnology	646	543	619	561	742	1,062	1,242
Agricultural biotechnology	67	83	130	121	102	111	123
Nanotechnology	47	46	55	64	99	97	79
Industrial biotechnology	24	42	50	50	37	42	66
Environmental biotechnology	44	48	44	45	21	17	24

Source(s): Table 27-10-0343-01.

The smallest of the emerging technologies in terms of expenditures is environmental biotechnology, which applies biotechnological methods to address environmental issues. This technology helps in tasks such as cleaning up pollution, managing waste, and creating other environmentally friendly processes. Expenditures ranged from \$44 million to \$48 million from 2016 to 2019, declining to a low of \$17 million in 2021, before rising to \$24 million in 2022, well below the historic high in 2017.

### Sustainable development goals

On January 1, 2016, the world officially began implementing the [2030 Agenda for Sustainable Development](#)—the United Nations' transformative plan of action that addresses urgent global challenges over the following 15 years. The plan is based on 17 specific sustainable development goals.

Data on the characteristics of research and development in Canadian industry are an example of how Statistics Canada supports the reporting on the global sustainable development goals. This release will be used to help measure the following goal:



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### Note to readers

The data in this release are subject to revision.

**Research and experimental development** comprises creative and systematic work carried out to increase the stock of knowledge—including knowledge of humankind, culture and society—and to devise new applications from the available knowledge.

**In-house research and development (R&D) expenditures** refer to expenditures within Canada for R&D performed within the company by employees (permanent, temporary or casual) and self-employed individuals working on site on the company's R&D projects.

**Current in-house R&D expenditures** include wages, salaries, benefits, materials, supplies, services (such as R&D consultants), R&D materials (water, fuel, gas, electricity), and overhead costs.

**Capital in-house R&D expenditures** refer to the annual gross payment for fixed assets used for R&D for over a year. Capital in-house R&D expenditures include costs for software, land, buildings and structures, equipment, machinery and other capital costs.

**Total in-house R&D expenditures** equal the sum of capital and current R&D expenses.

**Onsite R&D contractors** are onsite personnel hired to perform specialized project-based R&D work under the supervision and direction of the contracting organizations. They are considered separate from industrial R&D employees.

#### **Random tabular adjustment**

The random tabular adjustment (RTA) technique, which aims to increase the amount of data made available to users, while protecting the confidentiality of respondents, was applied to the estimates from the Annual Survey of Research and Development in Canadian Industry.

Statistics Canada typically uses suppression techniques to protect sensitive statistical information. These techniques involve suppressing data points that can directly or indirectly reveal information about a respondent. This can often lead to the suppression of a large number of data points and significantly reduce the amount of available data.

Using RTA, Statistics Canada can identify sensitive estimates and randomly adjust their value rather than suppress them. The size of the adjustment is calculated to protect respondent confidentiality. After adjusting the value, the agency assigns a quality measure (A, B, C, D or E) to the estimate to indicate the degree of confidence that users can have in its accuracy. Quality measures account for uncertainty related to sampling, non-response and RTA, when applied.

For more information on RTA, please refer to the blog article "[Random Tabular Adjustment is here!](#)," now available as part of the StatCan Blog.

**Available tables:** [27-10-0001-01](#), [27-10-0049-01](#), [27-10-0333-01](#) to [27-10-0346-01](#) , [27-10-0350-01](#) to [27-10-0355-01](#) , [27-10-0357-01](#) and [27-10-0358-01](#).

**Definitions, data sources and methods:** survey number [4201](#).

The interactive dashboard "[Characteristics of research and development in Canadian industry](#)" ([71-607-X](#)) is available.

For more information, or to enquire about the concepts, methods or data quality of this release, contact us (toll-free 1-800-263-1136; 514-283-8300; [infostats@statcan.gc.ca](mailto:infostats@statcan.gc.ca)) or Media Relations ([statcan.mediahotline-ligneinfomedias.statcan@statcan.gc.ca](mailto:statcan.mediahotline-ligneinfomedias.statcan@statcan.gc.ca)).