information BULLETIN
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RESEARCH AND DEVELOPMENT

Research and Development in Canada's Mining and Mineral Processing Industries

Innovation is recognized as being key in building and maintaining an industry's competitive advantage. Although the innovation process involves a number of elements, research and development (R&D) plays a vital role in bringing forward new products and processes. As such, R&D statistics, although only providing part of the picture, act as an indicator of the state of innovation. Canada continues to pursue new and advanced technologies in order to build upon its competitive advantage in the mining and natural resource sectors.

Unlike most other industries, R&D in the mining sector is primarily process-driven, which means that the processes used by the mining industry are continuously improved upon rather than the product itself. In 2004, 52% of R&D expenditures by the mining industry were allocated to the development and improvement of processes, compared to 16% of total R&D spending for all industries. The development and improvement of processes can enable the reduction of production costs, strive for more efficient use of resources, and help limit environmental impacts.

Although there are various ways to analyze R&D expenditures, this bulletin focuses its analysis on Business Enterprise Expenditures on R&D (BERD). These data are gathered and published by Statistics Canada at the national level and by the Organization for Economic Co-operation and Development (OECD) at the international level. For more information, including definitions and methodologies used in gathering R&D-related statistics, consult these two organizations.[1]

[1] Statistics Canada (www.statcan.ca); Organization for Economic Co-operation and Development (www.oecd.org).

MINING AND MINERAL-PROCESSING INDUSTRIES BERD

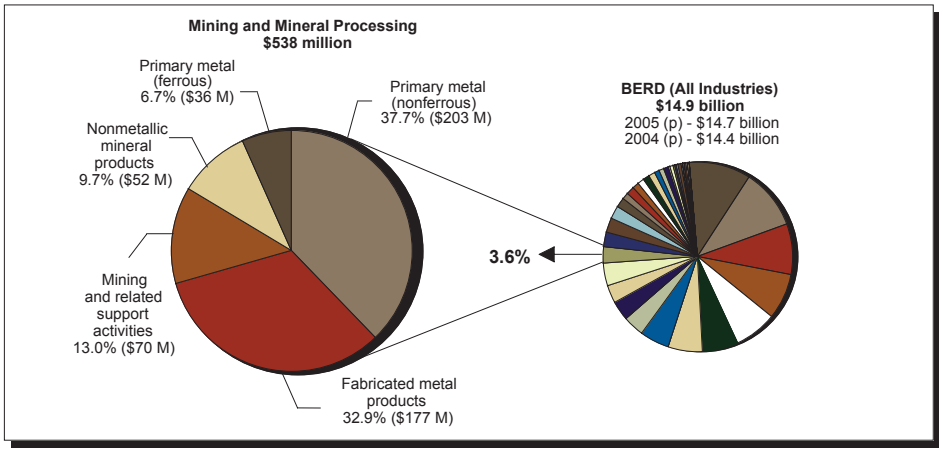
R&D expenditures in Canada's mining and mineral-processing industries, which include the mining and related support activities, primary metal manufacturing, and nonmetallic mineral and metal products industries, are expected to reach $538 million in 2006. This represents 3.6% of all BERD and places the industry in ninth place out of over 40 industries, ahead of such industries as motor vehicles and parts, machinery, and paper.

R&D expenditures for the **mining and related support activities industries** are expected to increase by over 4% in 2006 to $70 million. This would mark the fourth increase in as many years, showing a similar trend to metal price increases and implying that mining companies are investing some of their newfound wealth into R&D. As with previous years, the mining industry is expected to deliver the bulk of the investment in 2006, representing some 80% of the expenditures, or $56 million, while its related support activities contribute the remaining 20%.

The **primary metal manufacturing industries**, which include ferrous and nonferrous materials, have experienced a decrease in R&D expenditures for the past two years. Spending reached a 10-year high in 2003 at $262 million and has subsequently decreased to $240 million in 2005. Intentions for 2006 are expected to be similar at $239 million. These decreases in expenditures are mostly attributable to R&D expenditures related to nonferrous materials.

The **nonmetallic mineral products industries** are expected to remain steady in 2006 with expenditures reaching $52 million. As well, in 2006, the **fabricated metal products industries** are expected to invest $177 million in R&D, an increase of nearly 3% since 2005. This industry has seen a steady and notable increase in expenditures since 1997, more than tripling from $57 million to $175 million in 2004, before investments declined slightly in 2005 to $172 million.

Mining and Mineral Processing, Business Enterprise Expenditures on R&D (BERD), 2006 (i)



Source: Statistics Canada. (i) Intentions; (p) Preliminary.

NATURAL RESOURCE SECTORS BERD

A comparison of Canada's minerals, forest and energy sectors shows that the energy sector leads in R&D expenditures for 2005. Indeed, oil and gas extraction and its related support activities were the largest investors in R&D with expenditures reaching $178 million in 2005, or $139 million excluding support activities. These recent energy expenditures actually represent a 14% decline in investments compared to 2004 figures, although 2006 intentions predict a partial rebound to $191 million. As for forestry and logging and its related support activities, 2005 investments reached $18 million, slightly under both 2004 and 2006 expected investments of $19 million. The largest proportion of R&D investments in the forest sector originated from its related support activities, representing almost 80% or $15 million of total expenditures. Finally, mining and its related support activities remain an important natural resource R&D contributor with 2005 investment of $67 million; this follows an upward trend with 2004 expenditures of $66 million and expected investments of $70 million in 2006. The mining industry contributed some $56 million while the remaining $11 million in R&D expenditures came from support activities such as contract drilling.

When comparing the intensity of R&D investment as a ratio of R&D expenditures and industry Gross Domestic Product (GDP), a new perspective is highlighted. The mining industry boasts an impressive R&D-to-GDP ratio of 0.44%, compared to 0.24% for oil and gas extraction and 0.07% for forestry and logging.

FEDERAL GOVERNMENT EXPENDITURES ON R&D

Federal government R&D expenditures for mining and mineral processing are primarily carried out or funded by the Mining and Mineral Sciences Laboratories (MMSL) and the Natural Sciences and Engineering Research Council of Canada (NSERC). In fiscal year 2004/05, MMSL's and NSERC's combined expenditures on mining-related R&D reached close to $17 million, representing approximately 0.14% of the industry's GDP. This is well below the previously stated mining BERD/GDP ratio of 0.44%. Comparatively, the forest sector is reported to have received approximately $120 million for the same period, representing 2.06% of that industry's GDP, which is again very different from the previously stated BERD/GDP ratio of 0.07%.

HIGHER EDUCATION EXPENDITURES ON R&D

Mining-related R&D is carried out in universities throughout Canada. Universities not only play a role in educating future geologists, mine engineers and other specialists, but also carry out important value-added industry research. In fact, universities will assist in addressing the upcoming labour shortage resulting from mine re-openings, new mine developments, and positions vacated by retirees. An estimated 81 000 workers will be required in the next decade to address these issues. To respond to these needs, universities are working to educate new graduates destined for the mining industry and are promoting the development of new R&D technologies.

INTERNATIONAL EXPENDITURES ON R&D

International R&D expenditures are provided as a measure of Canada's Mining and Quarrying[2] (includes extraction of crude petroleum and natural gas) R&D spending intensity in relation to other nations. Unfortunately, detailed statistics are scarce and limited to data from the OECD and its members.

With a Mining and Quarrying[2] BERD-to-GDP ratio of 0.47% in 2003, Canada ranked above average when compared to all other OECD member countries and on par with countries such as Germany, the United Kingdom and Italy. The highest ratios were reported by Belgium, Finland and Australia with levels of 3.05%, 1.56% and 1.25%, respectively.[3]

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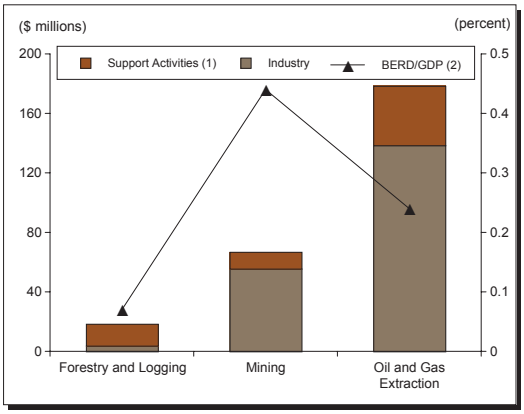
[2] Mining and Quarrying is a classification from the International Standard Industrial Classification (ISIC), Revision 3. Its sub-categories are: mining of coal and lignite, extraction of peat, extraction of crude petroleum and natural gas, service activities incidental to oil and gas extraction excluding surveying, mining of uranium and thorium ores, mining of metal ores, and other mining and quarrying.

[3] Most recent data were used in instances where 2003 data were not available.

Note: This information bulletin was prepared by the Minerals and Metals Sector of Natural Resources Canada with contributions from the Office of the Chief Scientist.

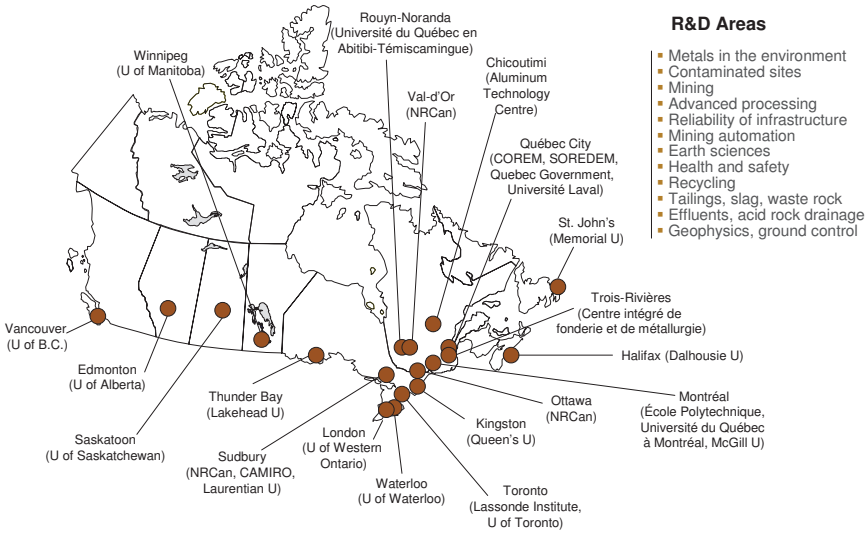
For more information on the mining industry in Canada, please visit www.nrcan.gc.ca/mms or send an e-mail to info-mms@nrcan.gc.ca.

Natural Resource Industries Business Enterprise Expenditures on R&D (BERD) and as a Percentage of GDP, 2005 (Preliminary)



Source: Statistics Canada.
(1) Includes the North American Industry Classification System (NAICS): Mining, 213117 and 213119; Forestry and Logging, 115310; Oil and Gas Extraction, 213111 and 213118. (2) BERD industry/GDP ratios excludes support activities since GDP values for these industries are not available. As current dollar GDP by industry is not available for 2005, estimates have been derived from the product of 1997 constant dollar GDP multiplied by the corresponding raw materials price index.

Higher Education and Government Mining-Related R&D Centres Can Be Found Across Canada



U = University; NRCan = Natural Resources Canada