The economic footprint of the Global 7500 program in Quebec and Canada

Report prepared by PwC

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About the program

The Global 7500 program was launched in 2010 with the intention of creating an industry-leading business jet with the fastest speeds and longest range, with four living areas, a 7,700 nautical mile range, and with a top speed of Mach 0.925. Originally named the Global 7000, the Global 7500 is Bombardier's latest addition to the *Global* family, positioned at the forefront of the Global product line, in complement to the Global 5500 and the Global 6500. Its design includes state-of-the-art fly-by-wire technology and a lightweight wing design, while the interior specifications include four true living spaces, accommodating up to 14 passengers.

The Global 7500 also marks the world's first environment program declaration (EPD)-certified aircraft in the business jet segment, aligning with Bombardier's environmental, social, and governance (ESG) plan for sustainable aviation and a reduced environmental footprint. After the entry-into-service of the Global 7500 in December 2018, Bombardier marked its 50th aircraft delivery in March 2021.

Program timeline

2010 — On October 13, 2010, Bombardier introduces the Global 7000.

2011 — In October 2011, Bombardier partners with GE Aviation to equip the Global 7000 with brand new GE Passport engines.

2014 — In May 2014, Bombardier begins the production and assembly of major structures for the first Global 7000 flight test vehicle.

2014 — Bombardier presents its full-scale cabin mock-up of the Global 7000 at the European Business Aviation Conference and Exhibition in Geneva, Switzerland.

2015 — In 2015, a new program schedule is announced allowing design enhancements for a no-compromise performance wing.

2016 — On November 4, 2016, Bombardier celebrates the first flight of its first Global 7500 flight test vehicle.

2017 — On July 7, 2017, Bombardier announces the completion of 500 hours of testing of the Global 7000 through its three flight test vehicles.

2018 — On May 28, 2018, Bombardier changes the name of the Global 7000 aircraft to the Global 7500 to highlight the range increase of 7,400 to 7,700 nautical miles (nm).

2018 — On September 28, 2018, the Global 7500 aircraft receives type certification from Transport Canada, after Bombardier conducted more than 2,700 flight test hours using five flight test vehicles.

2018 — The Global 7500 is given Federal Aviation Administration (FAA) certification in the United States.

2018 — On December 20, 2018, the Global 7500 aircraft is officially delivered to its first customer.

2019 — In February 2019, the Global 7500 receives certification from the European Aviation Safety Agency.

2020 — In June 2020, the Global 7500 receives the first-ever environmental product declaration (EPD) in business aviation history, as verified by the International EPD System, an environmental declaration program based in Sweden.

2021 — Bombardier marks the delivery of its 50th aircraft.

2021 — In November 2021, Bombardier announces the construction of a brand new facility in Mississauga to perform the final assembly of Global green aircraft family, including the Global 7500. The facility reduces energy consumption by close to 60%, cuts greenhouse gas emissions by more than half, and is set to become operational in 2023.

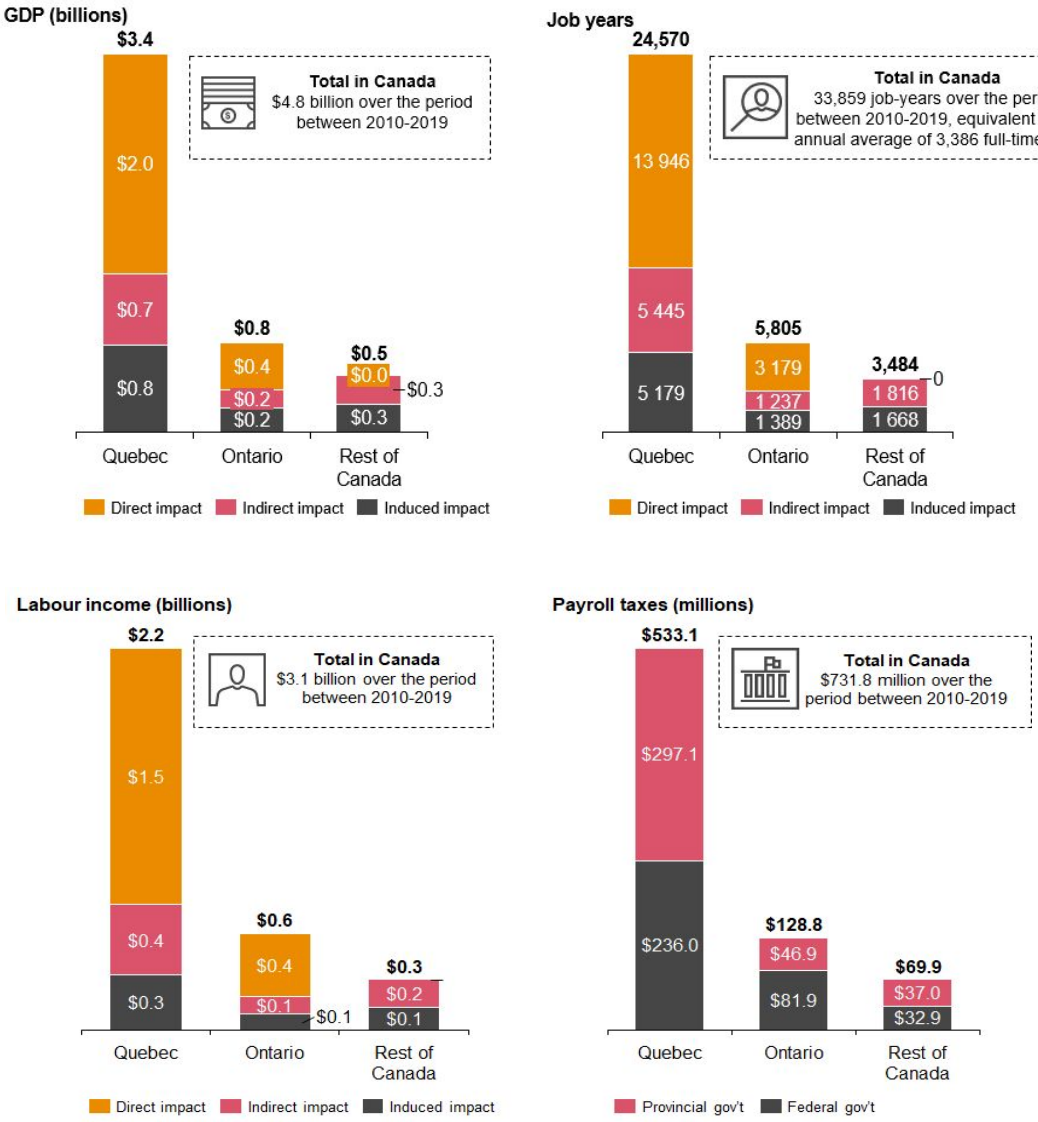
Economic footprint of program development

Program development supports the design and engineering of a new product. Spending on program development for the Global 7500 occurred over the period 2010–2019, with costs on labor for engineering and program development, aerostructures, and ground and flight testing making up a substantial portion of total spending.

Approximately 52.9% of the direct spending occurred in Quebec, while around 12.4% of spending occurred in Ontario, with the rest occurring in international jurisdictions. We estimate that the development of the Global 7500 program[2] created a total economic footprint in Canada, throughout its supply chain, of $4.8 billion[3] in GDP, 33,860 job-years[4] (i.e. equivalent to an annual average of 3,386 full-time jobs lasting 10 years, of which, 1,713 were direct jobs), and $3.0 billion in labour income. Total payroll taxes from labour income collected in Quebec and Ontario in relation to the program totalled $732 million, of which $380 million went to provincial governments and $351 million went to the federal government.[5]

Economic footprint over program development[6]

In 2021 $CAD*, cumulative between 2010 and 2019, full-time equivalent jobs



*Due to rounding, the totals may not always add up to the sum of the items.

The development of the Global 7500 program has significantly contributed to R&D investments in the aerospace sector in the country. These investments have impacts that go beyond economic contribution, since they support the development of knowledge and talent in aerospace in Quebec, fostering an ecosystem of innovation within the industry.

Economic footprint of ongoing operations

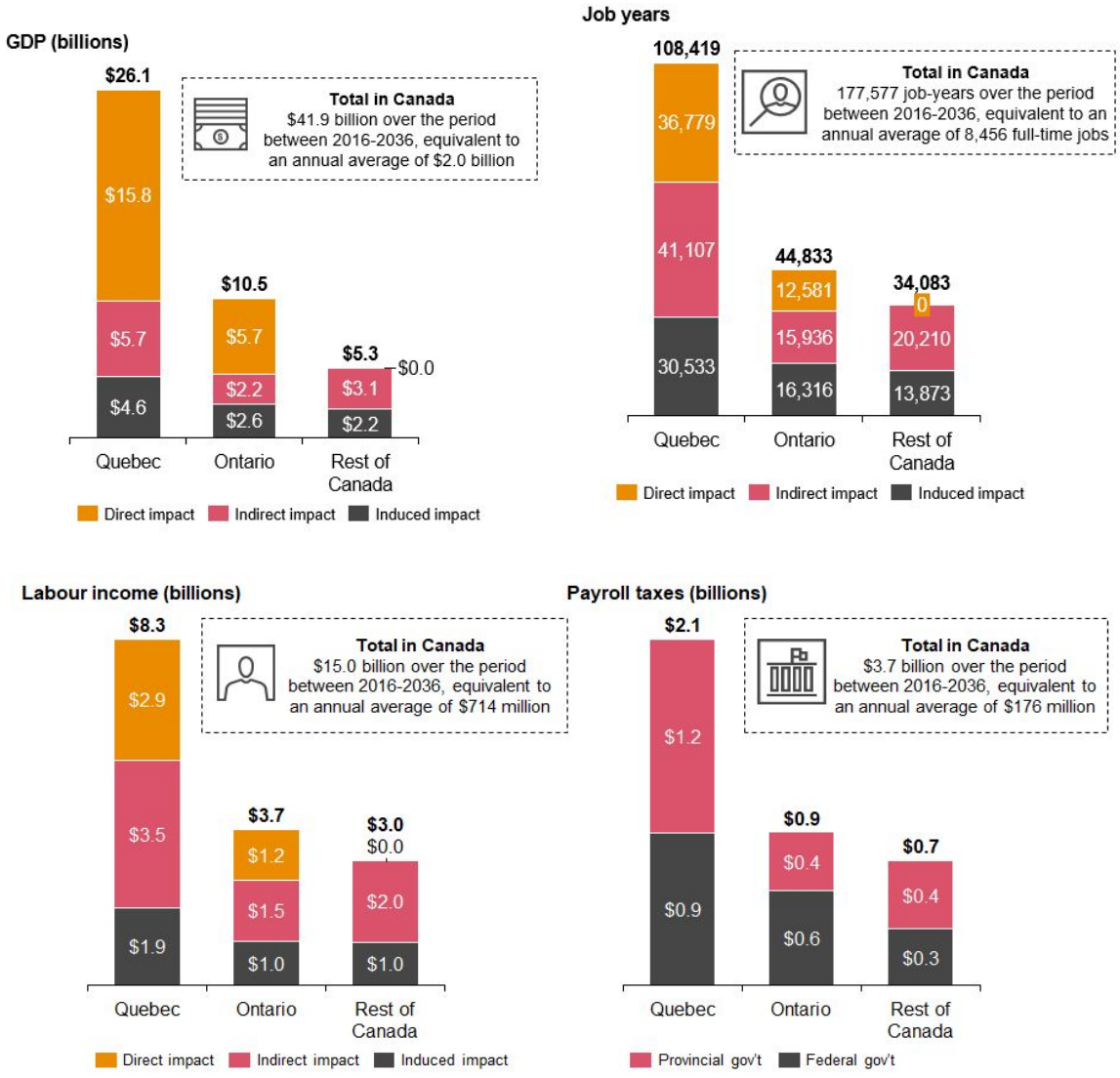
Ongoing operation expenditures are annual recurring costs within the program, whereas development costs do not recur. The majority of the assembly operations of Global 7500 aircraft is currently being done in Toronto's Downsview facility. Bombardier is set to switch its final assembly operations of the Global series to a new facility near Toronto's Pearson International Airport by 2023, with assembled aircraft subsequently transported to the Laurent Beaudoin Completion Centre in Montréal for interior completion. Other operations include the production of Global 7500's wings, which takes place in the Red Oak facility in the US, and the production of the rear aircraft fuselage and harnesses at Bombardier's Querétaro site in Mexico.

The total economic contribution (direct, indirect, and induced impacts) of projected Global 7500 aircraft manufacturing in Canada over the first 20 years of the program (i.e. between 2016-2036) is estimated at $41.9 billion in GDP (or an annual average of $2.0 billion), 177,577 job-years[7] (or an annual average of 8,456 full-time jobs including an annual average of 2,468 direct jobs). In 2021, Bombardier employed 2,291 people full-time in its Global 7500 operations. Total payroll taxes to be collected in relation to the ongoing operations between 2016 and 2036 would total $3.7 billion, of which $1.9 billion will be collected by provincial governments, and $1.8 billion by the federal government.

In addition, the Global 7500 program's operating activities in the US have the potential to create an annual average of 479 direct jobs, and another 511 direct jobs at Bombardier's Mexico facility.

Economic footprint over operating expenditures[8]

In billions of dollars (2021 $) *, expenditure incurred and planned for the first 20 years of the program (period 2016-2036) full-time equivalent jobs



*Due to rounding, the totals may not always add up to the sum of the items.

The Global 7500 program establishes Bombardier as one of the global leaders in technology and talent development…

Through the Global 7500 program, Bombardier has demonstrated its importance in the private jet industry on many fronts, spanning from technological innovation, through talent development, to environmental leadership and international collaboration. The success of the program has supported the overall aerospace R&D environment in Canada and Quebec, and Bombardier's position as a leader in the aerospace sector on the global stage.

The Global 7500 program adheres to the technological and innovation vision of Bombardier as it capitalizes on some insights acquired as part of the Bombardier CSeries program (now known as the Airbus A220), while also deploying new technologies. In addition, the Global 7500's environmental program declaration (EPD) certification elevates Bombardier's ESG profile, as it is the first in the business jet segment to do so. Moreover, these activities, which occur across Canada, the US, and Mexico, support the Canadian government's desire to maintain and develop commercial partnerships in North America as described in the Canada–United States–Mexico Agreement (CUSMA).

Technological leadership

With 22.7% of total manufacturing R&D[9] in Québec in 2019, the aerospace product and parts sector is the top R&D contributor in the province.[10] Over the last three decades, Bombardier has launched 35 aircraft programs. R&D investments for the Global 7500 have supported the development of one of the most advanced aircraft of the private jet industry:

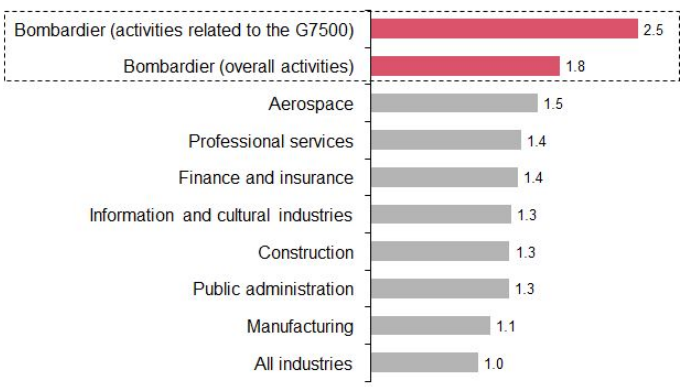
- The wing of the Global 7500, allowing the fast maximum cruising speed (Mach 0.925), low landing speeds for greater safety, and increased access to smaller airports
- The airframe, using aluminium-lithium alloys,[11] which lowers the weight of the aircraft structures by 7–10%
- The fly-by-wire control system, which is an evolution from the CSeries
- The ground testing strategy, including several innovative systems and structures which made it possible to complete the certification tests in a short time and ensured a high level of reliability from the start of service

Talent development and the creation of value-added jobs

Product development in the aerospace industry takes place over several years and requires design and proof-of-concept partnerships with universities and research organizations. The research behind the engineering of the Global 7500 has been supported by various collaborations between Bombardier and universities such as McGill University, Concordia University, Polytechnique Montréal at the University of Montréal, the Institute for Aerospace Studies at the University of Toronto, and Ryerson University.

Many of the students and researchers at partner institutions are provided full-time opportunities at Bombardier, creating a pipeline of expertise and innovation opportunities. Bombardier has been creating many high-value-added jobs. The average wage (including benefits) paid by Bombardier is 1.8 times higher than the average wage for all industries. Within the Global 7500 program, this ratio reaches 2.5 times the average salary, due to the relatively high concentration of high-skilled professionals assigned to this program.

Comparison of annual wages (including benefits) by industry (index = all industries)[12]



...and strengthens Bombardier's commitment to ESG[13] initiatives and international collaboration.

Environmental certification

Awarded in June 2020 by the International EPD system, the Global 7500 also boasts the world's first environment program declaration (EPD)-certified aircraft in the business jet segment.[14] An EPD is a public document which details a product's environmental impact within each stage of its production cycle and lifecycle.[15, 16] This certification aligns with Bombardier's commitment to transparent reporting of ESG standards in every segment of the industry.

To evaluate the overall environmental impacts in order to grant the EPD certification, a lifecycle analysis was undertaken. This included outlining the amount of non-renewable material consumption at each stage and the amount of renewable energy used at each stage.

The Global 7500 aircraft was further evaluated at the end-of-life stage to determine the rate of material and energy recyclability and recoverability, as well as the amount of waste produced (including whether the waste was hazardous). It was determined that 80% of the aircraft could be materially recycled, and that 5% could be energy-recoverable. This leaves 15% of the aircraft as waste, 99.96% of which is non-hazardous.

Activities part of a highly integrated North American platform

Through the Canada–United States—Mexico Agreement (CUSMA), Bombardier can benefit from and help strengthen relations between these countries. This agreement facilitates the distribution of value-added activities within the aircraft supply chain and fosters a collaborative environment in North America.

Manufacturing activities at Bombardier's sites in the United States and Mexico (Red Oak and Querétaro) totaled $ 126 million in direct expenses (salaries, materials, and equipment expenditure) in 2021 and the creation of 990 direct full-time jobs. Beyond on-site activities, Bombardier's supply chain includes several suppliers throughout North America. The purchase of goods and services from suppliers in the United States and Mexico for the Global7500 totals several hundred million of dollars. Thus, the interconnection of Bombardier's production activities helps maintain good commercial relations in these countries.

***Pictured below**: The new Bombardier site near Toronto Pearson Airport where final assembly operations of Global series green aircraft are set to commence in 2023. The site features enhanced environmental benefits such as lower energy consumption and GHG emissions. On the left: the actual construction site. On the right: final rendering.*

Appendix A: Data sources and approach

Data sources

Data on program development spending was provided by Bombardier. PwC allocated the spending to industry categories based on descriptions provided by Bombardier.

Data on operational spending at the Bombardier facilities for 2021, and development expenditures from 2010-2019 was provided by Bombardier.

Data on compensation and client orders of the Global 7500 aircraft to conduct additional analysis was provided by Bombardier.

Input output analysis

To estimate the economic footprint of the Global 7500 program, we have applied Statistics Canada's input-output multipliers to data provided by Bombardier.

The fundamental philosophy behind economic impact analysis is that spending on goods and services has attendant impacts throughout the economy. For instance, production of Global 7500 will generate demand for the inputs to this process (such as tools and labour) that in turn generates additional demand that extends beyond the initial spending. Our analysis permits the estimation of this cascading effect by using the input-output model of the Canadian economy.

The input-output model used for the purpose of this report estimates the relationship between economic activity for a given good or service and the resulting impacts throughout the economy (including demand for other goods and services and tax revenues). For the purpose of this report, economic impacts were estimated for the following measures of economic activity:

- **GDP (also known as value added)** – the value added to the economy, or the output valued at basic prices less intermediate consumption[17] valued at purchasers' prices. GDP includes only final goods to avoid the double counting of products sold during a certain accounting period.
- **Employment** – the number of jobs created or supported.
- **Labour income** – the amount earned by the employment expected to be generated (including social benefits such as employer contributions towards pensions and employment insurance).
- **Payroll tax revenue** – the amount of revenue collected by provincial and federal governments for personal income taxes.

Economic impacts are typically estimated at the direct, indirect, and induced levels:

- Direct impacts are those that result directly from the company's expenditures on labour and capital as well as gross operating profits.
- Indirect impacts arise from the activities of the firms providing inputs to the company's suppliers (in other words, the suppliers of its suppliers).
- Induced impacts are the result of consumer spending by employees of the businesses stimulated by direct and indirect expenditures.
- For the purposes of confidentiality, direct and indirect impacts were aggregated.

In applying the input-output analysis, we made the following key assumptions:

- Spending breakdown associated with the Global 7500 program is similar to that in the industry as a whole (aerospace product and parts manufacturing).
- The selling price of a Global 7500 was based on the 2021 list price of the aircraft; the actual price is typically lower based on confidential negotiations with clients.

Appendix B: Limitations

Limitations

Data limitations and verification: PwC has relied on the information provided by Bombardier regarding the allocations of operating and capital expenses of Global 7500 operations in Canada, the US, and Mexico. PwC has relied upon the completeness, accuracy, and fair presentation of all information and data obtained from Bombardier and the various sources set out in our report, which were not audited or otherwise verified. The findings in this report are conditional upon such completeness, accuracy, and fair presentation, which have not been verified independently by PwC. Accordingly, we provide no opinion, attestation, or other form of assurance with respect to the results of this study.

Where the information or data provided is not sufficient to conduct the analysis that has been requested, we have made assumptions, as noted throughout the report.

In addition, PwC has relied on Bombardier for information about its environmental commitments, technological development, and technical abilities. PwC has not verified this information.

Technology assessment: We are not technical experts and are not in a position to assess the technical aspects of the Global 7500. Thus, any statement in this report regarding the technical aspects of the Global 7500 reflects our understanding based on discussions with Bombardier.

Receipt of new data or facts: PwC reserves the right at its discretion to withdraw or revise this report, should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of December 2021, and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Input-output analysis: Input-output analysis does not address whether the inputs have been used in the most productive manner or whether the use of these inputs in this industry promotes economic growth more than their use in another industry or economic activity. Nor does input-output analysis evaluate whether these inputs might be employed elsewhere in the economy if they were not employed in this industry at the time of the analysis. Input-output analysis calculates the direct, indirect, and induced economic impacts that can reasonably be expected to affect the economy based on historical relationships within the economy. This analysis does not take into account fundamental shifts in the relationships within the economy that may have taken place since the last estimation of multipliers by Statistics Canada in 2018, nor shifts that may take place in the future.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with, Bombardier. We understand that Bombardier may share our report with third parties. This report can be released to third parties and/or the public only in its entirety. Any commentary or interpretation in relation to this report either requires PwC's written consent or has to be clearly identified as the interpretation of Bombardier or third parties. Alternatively, these parties are required to add a link to the full deliverable. PwC accepts no duty of care, obligation, or liability, if any, suffered by Bombardier or any third party as a result of an interpretation made by those parties of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event, shall PwC have any liability for damages, costs, or losses suffered by reason of any reliance upon the contents of this report by any person other than Bombardier.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.

We note that significant deviations from the above-listed major assumptions may result in a significant change to our analysis.

Endnotes

[1] Transport Canada reviews aeronautical products which operate or are designed in Canada to ensure industry standards are met. Type certification is subsequently given to authenticate the airworthiness of aeronautical products.

[2] We estimated the economic footprint of program development for the period from 2010 to 2019.

[3] All dollar values in this report are in 2021 CAD unless otherwise noted.

[4] One "job-year" is defined as a year of full-time employment for one worker.

[5] Corporate taxes and taxes on production and products were not examined in this study.

[6] Direct impacts result from business expenditure on suppliers and employees. Indirect (Canadian suppliers) impacts arise from the activities of businesses providing inputs to the Global 7500's suppliers (in other words, its suppliers' suppliers). Induced (consumer spending by employees) impacts result from consumer spending by employees of the businesses stimulated by the direct and indirect expenditures. Total economic impacts are equal to the sum of direct, indirect, and induced economic impacts.

[7] One "job-year" is defined as a year of full-time employment for one worker.

[8] Reported in 2021 CAD. Expenditure for the period 2016–2021 is based on data provided by Bombardier. Over the period 2021–2036, we considered a typical year as defined by the level of expenditure of 2021, assuming an annual rate of inflation of 2% between 2022 and 2036.

[9] Based on Statistics Canada data for *Business enterprise in-house research and development characteristics, by industry group based on the North American Industry Classification System (NAICS)*.

[10] PwC analysis of business enterprise in-house research and development characteristics using data for Canada and by province, analyzing 3-digit and 4-digit NAICS industries. Data for 2019 is the last available data.

[11] Aviation International News, *Global 7000 Prepping for 2018 EIS*.

[12] Based on an analysis of Statistics Canada's data for *Average weekly earnings by industry (annual)* compared to Bombardier's compensation data.

[13] ESG stands for environmental, social, and corporate governance.

[14] *Bombardier Global 7500 Jet Receives Business Aviation's First-ever Environmental Product Declaration*.

[15] ISO 14025 is an international standard that establishes the principles and specifies the procedures for developing Type III environmental declaration programs and Type III environmental declarations.

[16] ISO 14040 is an international standard describing the principles and framework for the lifecycle assessment of a product.

[17] Defined as the value of goods and services used or transformed as inputs by a process of production.