



## Reporting Guide

*Version française  
est disponible,  
veuillez téléphoner  
1-866-297-3138*

This guide is designed to provide additional information as you work through your questionnaire. If further assistance is required, please call us. A Statistics Canada employee will be happy to assist you.

Help Line: 1-866-297-3138

### **WHY IS THIS SURVEY IMPORTANT?**

The Survey of Advanced Technology is conducted occasionally. The last time such a survey was conducted by Statistics Canada was in 1998. This survey is being conducted in order to collect important information about the extent to which advanced technology is being used by Canadian manufacturing and logging businesses. In addition, information is being collected on skill requirements as a result of advanced technology adoption; sources of information or assistance for advanced technology adoption; results and outcomes of adoption; obstacles to adoption; and advanced business practices. Information is also being collected on use of emerging technologies including geomatics/geospatial technologies, biotechnologies, and nanotechnologies. Some general information about the business unit such as success factors, research and development activities and innovation are also being collected. Data from this survey are important as it will provide the basis for informed decisions on policies, programs and strategies for technology adoption in the manufacturing and logging industries.

### **WHY WERE YOU CHOSEN TO RECEIVE THE SURVEY OF ADVANCED TECHNOLOGY?**

The majority of Statistics Canada business surveys are sample surveys. For the Survey of Advanced Technology, only certain businesses in particular industries, within each province and territory, were selected to receive the survey questionnaire. Together, the sampled businesses represent the entire industry being studied. The businesses in the sample were randomly selected to represent other businesses of a similar size as defined by the number of employees.



## **IS IT A LEGAL REQUIREMENT TO COMPLETE THIS SURVEY?**

Yes. The Survey of Advanced Technology is collected under the authority of the *Statistics Act, Revised Statutes of Canada, 1985, Chapter S19*. This Act stipulates that the completion of questionnaires issued under the Act is mandatory. You can consult a copy of the *Statistics Act* on our Web site ([www.statcan.ca](http://www.statcan.ca)) by following the links "About us", then "Privacy".

## **IS THE INFORMATION PROVIDED KEPT CONFIDENTIAL?**

Yes. Under the provisions of the *Statistics Act*, Statistics Canada is prohibited by law from publishing or releasing outside Statistics Canada, in any manner, any statistics which would divulge information obtained from this survey relating to any identifiable business without the previous written consent of that business (there are some exceptions under the data-sharing agreements described in the next paragraph).

The data reported on this questionnaire will be treated in strict confidence, used for statistical purposes only, and published in aggregate form only.

**The confidentiality provisions of the *Statistics Act* are not affected by either the *Access to Information Act* or any other legislation.**

## **DATA-SHARING AGREEMENTS**

To avoid duplicating surveys, Statistics Canada sometimes enters into joint collection and sharing agreements with federal or provincial government departments, and with other organizations. This reduces the overall paperwork imposed on businesses.

### **Agreements with provincial statistical agencies**

Section 11 of the *Statistics Act* allows Statistics Canada to enter into agreements with provincial and territorial statistical agencies that are governed by a statistics act that provides for the same level of confidentiality protection as the federal *Statistics Act*. These provincial and territorial agencies cannot disclose identifiable information to anyone outside their agency, including other provincial departments.

Under Section 11 agreements, respondents do not have the option to refuse to share their information. This is because the statistical agencies entering into Section 11 agreements have the legal authority to collect the information on their own and to compel response.

**Your co-operation and assistance in completing the enclosed survey is vital to the process of this survey. If you have any questions, please contact us at 1-866-297-3138.**

# Guidelines

## **General Remarks**

This guide is designed to assist you in completing the Survey of Advanced Technology. In addition to providing some basic definitions it provides further clarification for **each question, by section**, to enable complete and accurate responses. The four sections comprise:

**Section A - ADVANCED TECHNOLOGIES**

**Section B - ADVANCED PRACTICES**

**Section C - EMERGING TECHNOLOGIES**

**Section D - GENERAL QUESTIONS**

## **Basic Definitions**

**Business unit** refers to the smallest operating unit in your business that can report the following items:

- the value of sales;
- the cost of materials and supplies purchased;
- the cost of energy and water utility purchased;
- the opening and closing inventories;
- the number of employees and their salaries and wages.

Generally, a **business unit** refers to your establishment or your local operations. It is the same as a business unit, mill or factory however it may be comprised of more than one business unit or location if your accounting records do not permit separate reports of the items listed above. A business unit may also include ancillary or support units, such as sales offices or warehouses. If your business is comprised of more than one business unit, please complete the questionnaire only for the business unit described on the front of the questionnaire in the address label area.

If you are unsure of how to report or if you are not sure what is meant by "business unit" please call for assistance at **1-866-297-3138**. To assist us in responding to your question, please quote the reference number, beginning with the letter "Q" on the front page of the questionnaire.

**Firm** refers to the legal entity that owns a business unit, plant or establishment. It is comprised of all business units and operations in Canada or other countries that comprise a company.

## Section A - ADVANCED TECHNOLOGIES

**Technology** is broadly defined to include the technical means and know-how required to produce a product or service. It takes the form of equipment, materials, processes, blue prints and knowledge.

**Advanced technology** refers to a new technology that performs a new function or improves some function significantly better than commonly used technologies. For the purposes of this survey the technologies considered to be advanced can be found in Question 1.

### Questions 1 and 2: Advanced Technology Adoption

**Advanced technologies** are technologies that are advanced in the sense that they are significant improvements over traditional or more commonly used technologies. The technologies listed in this section are those that are considered to be advanced for the purposes of this survey. Technologies are defined to include equipment, materials and processes. They may be owned or leased/licensed. In some cases (e.g. testing, design work) the technology may be located off-site but is used by or with others, at the business unit's request and for the benefit of business unit operations.

### Question 1: Advanced Technology

This question explores advanced technology adoption. It will provide important information on technological capabilities.

If you are using (in use) any of the listed technologies, you are asked to indicate the geographical location of your supplier(s) of this technology.

**Asia Pacific** includes China, India, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand, the Philippines, and Vietnam.

### Design, Engineering and Virtual Manufacturing Technologies

a) **Computer Aided Design (CAD)** is the use of computer-based software to carry out design. CAD allows engineers, architects, or designers to produce complete designs on the computer screen and to visualize the implications of design changes on other aspects of the design.

CAD may be used with **Computer Aided Engineering (CAE)** software so that the designer can carry out specific engineering calculations on the part or product design such as a heat flow, strength, formability, or electronic performance.

**Modelling or simulation technologies** are used to provide a computer-based visualization of the performance of a computer aided design. Examples include the simulation of the flow of molten plastic into an injection mould, the tool path for the cutter of a numerically controlled machine tool, and the trajectories of robots, machine tools and materials handling equipment in a flexible manufacturing system.

- b) CAD may also be used with **Computer Aided Manufacturing (CAM)** software such that the output from the computer aided design is used to control the machines manufacturing the parts or products.
- c) **Virtual product development** refers to the use of simulation software or services to develop products.
- d) **Virtual manufacturing** is a virtual reality based engineering application that provides a modelling and simulation environment to model and simulates actual manufacturing systems using computers. It includes a graphical user interface to select and input all necessary variables, parameters and process control information; process models are used to simulate changes in materials as they are shaped into products with graphical multimedia procedures used for indicating the results.
- e) **Software technologies for systems engineering:** Systems engineering is a discipline of engineering that has as its objective, to create, sort and exchange the needs, functions and resources of a system with the view of obtaining a product based on the life cycle following the needs of interested parties.
- f) **Electronic exchange and management of CAD files** is the transfer and organization of CAD files.
- g) **Rapid prototyping** is the name of a number of computer based technologies that make it possible to quickly build a 3D model of a part or physical objects directly from a Computer Aided Design (CAD) file.

## Processing, Fabrication and Assembly

- h) **Flexible Manufacturing Cells or Flexible Manufacturing Systems (FMC/FMS):** Single or multiple machines with fully integrated materials handling capabilities controlled by computers or programmable controllers, capable of single or multiple path acceptance of raw material and single or multiple path delivery of finished product.
- i) **Reconfigurable systems:** Includes single piece fabrication, soft tooling and tool-less assembly.
- j) **Lasers used in materials processing:** Refers to the use of lasers to scribe, mark, cut, weld, cure or otherwise alter the properties of a material. These lasers may also be used in surface modification to selectively alter the surface metallurgy or properties of the material, deposit other materials or coating, or assist in other surface modification.
- k) **E-beam processes** make use of electron beams for purposes such as plastic product enhancement, wire and cable jacket curing, sterilization and bioreduction, food irradiation, semiconductor enhancement, polymer chain scissoring and composite curing.
- l) **Plasma sputtering** is a process often used for laying down nano-surface treatments/coatings. This process involves the use of a device that sprays or overlays plasma onto a surface within a defined outline. An example of use is thin-film deposition.
- m) **Robots with sensing capabilities** are programmed to alter their function based on input from sensors, e.g. to identify and pick up specific parts, to follow a track, to avoid obstacles.  
**Robots** are re-programmable, multifunctional manipulators designed to move materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks.
- n) **Robots without sensing capabilities** are programmed to undertake simple tasks such as **pick and place**. Pick and place robots are typically two or three degrees of freedom robots performing simple repetitive tasks of moving an item from place to place in point-to-point moves.  
**Robots** are re-programmable, multifunctional manipulators designed to move materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks.

- o) **High speed machining** systems are metal cutting machines operating at speeds of 10,000 rpm or higher, with feed rates up to 10 m/minute and power to speed rates of 1 kW per 1000 rpm.
- p) **Near net shape technologies** produce finished plastic, metal, ceramic, or composite parts in a single production stage with a minimum of final machining; the processes used include precision die casting, squeeze casting, injection moulding, isostatic pressing, and metal spraying.
- q) **Micro manufacturing (micro machining or micro moulding):** small scale manufacturing includes micro-nanomanufacturing. Also the purpose of it is a time energy and resource saving technology that will address economic sustainability requirements.
- r) **Micro Electro Mechanical Systems (MEMS):** micro machines, typically made using micro-electronic technology including micro-nanosystems. Some examples are air bag sensors, image processing devices for projectors and microfluidic devices.

### Inspection

- s) **Automated vision-based systems, used for inspection/testing of inputs and/or final products**, incorporate a video camera, interface electronics and a computer or controller. The systems are programmed to identify specific manufacturing parameters such as product colour, part orientation, missing parts, defects or blemishes, etc. The results of the inspection/testing may be used for monitoring or controlling the production process. Includes embedded sensors.
- t) **Other automated sensor-based systems used for inspection/testing of inputs and/or final products including e-beam inspection:** Automated sensor-based equipment used for inspecting and/or testing incoming or in-process materials or final products. Such electronically controlled sensors are capable of measuring chemical composition, moisture, weight, etc. and are linked to an information and/or control system.

## Communications

u) **Local Area Network (LAN) to machines on the business unit (plant) floor:** Communications network within a plant or building to enable the transfer and sharing of computer software and data between production units and engineering and administration, typically for the production management, production and process control, and materials management.

v) **Company-wide computer networks (including LAN, Intranet and WAN):** Communications networks within an enterprise extending beyond a single building or site. Wide area networks provide connectivity extending beyond a region or city and generally require access to public carrier long distance services.

**LAN:** A Local Area Network is a communications network within a business unit or building that interconnects computers, terminals, printers, workstations and other peripheral devices to enable the transfer and sharing of computer software and data between production units, engineering and/or administration, typically for the production management, production and process control, materials management, and/or computer aided design and engineering.

**Intranet:** A computer network internal to a business unit that uses the same software standards as the Internet. It is a network that runs on open TCP/IP networks that are accessible to selected servers and browsers or users within an organization. Intranet activities usually take place behind secure “firewalls” so that only authorized users have access.

**WAN:** Wide Area Network is similar to a Local area Network but is not confined to a specific area or space within a building. It may include wireless devices or hard-wires to other buildings in other regions.

w) **Inter-company computer networks (including Extranet and EDI):** are wide area networks that connect establishments with their sub-contractors, suppliers and customers.

**Extranets** are intranets that have been opened by business units to selected business partners. Suppliers, sub-contractors, customers, distributors and other authorized users can connect to the business unit's network over the Net or through virtual private networks. Through this access they can share information, track shipments, process orders and make payments.

- x) **Wireless communications for production** is the use of wireless devices for the assembly or production of products or processes.
- y) **Wireless communications for office operations and/or marketing/sales activities** is the use of any type of wireless device or product for interaction with the establishment in a administrative or management capacity.

### **Automated Material Handling**

- z) **Part identification for manufacturing automation (e.g. bar coding)** is a method of identifying components so that they can be scanned electronically to identify them. Bar coding is a method of encoding data for fast and accurate readability. Bar codes are a series of alternating bars and spaces or various widths printed or stamped on products, labels or other media, representing encoded information which can be read by electronic readers called bar code scanners. Also included is lot numbering (e.g. batch numbering) for similar components or items that are made in groups at the same time.
- aa) **Part identification for tracking materials and components (e.g. Radio Frequency Identification, RFID)** is a method relying on storing and remotely retrieving data using devices called RFID tags, transporters or other identification tags. The purpose could be applied to supply change management, loss prevention or just-in-time inventory controls.
- bb) **Post production tracking (e.g. radio Frequency Identification, RFID) of products** is the use of devices to track the movement or condition of products after production when they are shipped to their next destination for sale or consumption. Also included is tracking of sale frequency and or buying patterns of consumers.
- cc) **Automated Storage and Retrieval System (AS/RS)** is an automated, mechanized system for moving merchandise into storage locations and retrieving it when needed.

## Integration and Control

- dd) **Multi axis capability** enables precision components to be completed without the need for re-fixturing ensuring maximum accuracy.
- ee) **Computer(s) used for control on the business unit (plant) floor:** This includes computers on the factory floor that may be dedicated to control, but which are capable of being reprogrammed for other functions. It excludes computers embedded within machines or computers used solely for data acquisition or monitoring.
- ff) **Adaptive machine control:** includes haptic feedback and forced feedback and is ability, in real-time, to monitor a process in situ and automatically adjust the process to eliminate variations. For example, machine tool spindle speed and force can be measured, as well as cutter location, and lately real-time data on the actual amount of material being removed at the cutter tip is being measured. This measurement tells whether the desired product dimensions are being generated and allows immediate control feedback to prevent variations before they occur. This data could be collected with sensors, transducers, and softeners. Using sensors coupled with three-dimensional data sets, products could be inspected in real-time against dimensional properties.
- gg) **Human Machine Interface (HMI) with coordinated motion control:** refers to the equipment or instruments where people and technology meet. It is also where information is delivered from the machine to people to allow for control monitoring or recording data. Examples are keyboard, control pads or switchboards.
- hh) **Computer Integrated Manufacturing (CIM)** refers to totally automated production, in which all manufacturing processes are integrated and controlled by a central computer.
- ii) **Supervisory Control and Data Acquisition (SCADA)** refers to the online, computer-based monitoring and control of processes and plant variables at a central site.
- jj) **Process control software** is a tool used to collect, analyze and distribute data. The software replaces the traditional log book that can be used by manufacturing technicians to record data from various controls during a process. For example, a technician may monitor temperature levels to ensure they are within certain parameters and will check a temperature gauge recording the value in a log book. Process data is usually collected at regular intervals such as once every 30 minutes. The software programs stores collected data either in an internal database or writes data to an external file that can then be used with other programs for analysis. Statistical process control software can be used to calculate such values as mean and average values. Chart tools are common.

- kk) **Digital, remote controlled process plant control (e.g. Fieldbus or Total Process Control (TPC)):** A local area network that interconnects measurement and control equipment such as sensors, actuators and controllers with the built-in capability to distribute the control application across the network.
- ll) **Predictive process control software and/or smart machines:** Software systems that employ artificial intelligence or rules based on process knowledge to control manufacturing processes or run business systems within the establishment.
- mm) **Use of inspection data in manufacturing control:** is used to discriminate between good and defective parts, aligning parts for processing or assembly, adjusting process settings, monitoring production throughput during the production process as opposed to at the end of the production line.

### **Question 2: Advanced Technology Investment**

This question explores the intensity of investment in advanced technologies. You are asked to provide your **business unit's** percentage of capital investment in machinery and equipment which was spent on advanced technologies, as listed in question 1, for reference years **2005 to 2007**.

### **Question 3: Skill Requirements**

The purpose of this question is to provide a general picture of the skills required as a result of advanced technology adoption and the effect of new technology on training needs.

**Training** may be either formal (on-the-job or off-the-job instruction in a place removed from the production process) or informal (less-structured on-the-job instruction).

By **management skills** include problem identification such as trouble shooting.

By **business skills** includes administrative or clerical work such as Marketing, Human Resources or Accounting.

#### **Question 4: Development and Implementation of Advanced Technologies**

This question seeks information on the process of technological change, specifically, how advanced technologies are integrated into your business unit.

#### **Question 5: Sources of Information or Assistance**

This question seeks information on the process of technological change including the source of information or assistance for the adoption of advanced technologies.

#### **INTERNAL to your firm**

- e) **Related business units** refer to other business units within your business unit.
- f) **Technology watch program** is a team given the responsibility for identifying new technologies (products and processes) that could be acquired or adapted by the business unit or firm.

#### **Question 6: Results/Outcome of Adoption**

This question seeks information on the results of technology adoption. You are asked to rate the impact of the effects that your business unit has experienced from the advanced technologies that you have adopted.

#### **Product improvement**

**Product improvement** refers to those existing products whose technical characteristics have been enhanced or upgraded. This can take two basic forms. A simple product may be improved (in terms of improved performance or lower cost) through the use of higher performance components or materials, or a complex product, which consists of a number of integrated technical subsystems, may be improved by changes to one of the subsystems. Product reliability and product durability are sometimes also considered as additional elements of product quality.

#### **Business unit efficiencies**

- m) **Reduced energy consumption** means that less energy was required as a result of the adoption of advanced technology to produce the same amount of output as before the adoption.

n) **Reduced energy costs** means that the amount of money expended on energy required to produce the same amount of output has been reduced either through use of a different energy source or through reduction of energy consumption for the existing energy source or both.

### **Question 7: Obstacles to Adoption**

This question explores the obstacles of conditions in input markets (labour, material, capital, and technology), and other external and internal obstacles which have prevented or slowed the adoption of new technologies, i.e. have hindered their procurement, adaptation, and/or development. You are asked to rate the importance of financial, human resource, organizational, external support services and other obstacles that you had to overcome or that prevented the adoption of advanced technologies in your business unit.

## SECTION B - ADVANCED PRACTICES

This section contains questions on organizational and business practices.

### **Question 8: Business Practices**

Information is requested on business practices or techniques being used in your business unit. These practices or techniques can be closely associated with the need for new technologies and/or the development and adoption of advanced technologies.

#### **Product development**

- a) **Concurrent engineering** refers to the conduct of engineering work simultaneously rather than sequentially with design work and other developmental activities.
- b) **Cross-functional design teams** are groups responsible for product/process design. They are comprised of people from all relevant functional areas such as manufacturing, maintenance and finance and including users, each with authority to speak for his/her respective area. By simultaneously considering all aspects of development, production and use, such teams can increase quality, reduce the time from design to production and minimize costs.

#### **Manufacturing and control management**

- c) **Electronic work order management** refers to the use of computers to process and analyse work orders. Work orders describe the work to be done and indicate the location, priority, department to be charged, originator, approvals and so on.
- d) **Distribution Resource Planning (DRP)** which is also referred to as *Distribution Requirements Planning* applies to manufacturing and logging business units that have distribution warehouses. It is a procedure for determining where, when and how much should be shipped. Demands on central shipping and/or the manufacturing plant are mathematically estimated for every item using national demand forecasts and data on safety stock, transit time and economical shipping quantities.

e) **Lean Manufacturing** is an approach aimed at eliminating waste in all areas of production including customer relations, product design, supplier networks and factory management. The goal is to incorporate a reduction of human effort, inventory, product development time and space in order to be highly responsive to customer demand while still producing top quality products as efficiently and economically as possible.

f) **Manufacturing Resource Planning (MRP II)/Enterprise Resource Planning (ERP)**: A type of computer software that helps manage the manufacturing process. Its purpose is to reduce in-process inventory.

**ERP** management information systems integrate and automate many of the business practices associated with the operations or production activities of a business unit including manufacturing, logistics, distribution, inventory, shipping, invoicing and accounting. ERP software can be used to manage business activities such as sales, delivery, billing, production inventory management and human resource management systems.

g) **Just-in-time control** is a low inventory system in which suppliers agree to deliver what is needed, immediately before it is needed. This results in faster response to market changes and lower costs but requires close co-ordination with suppliers. (This principle can also be applied to operations within the business unit).

### Quality management (including Lean)

h) **Continuous improvement (including TQM)** refers to the persistent search for quality improvement using small steps continuously, as applied to product and process development. It includes Total Quality Management (TQM).

i) **Business unit certification (e.g. ISO 9000, ISO 14000)** refers to any program that includes quality certification by a third party. ISO 9000 is an internationally recognized series of quality system standards and guidelines used to certify the consistency of the way an establishment produces and delivers its products and services. While these standards enumerate the basic rules governing quality systems, the manner in which the systems are implemented must be adapted to the actual production for which registration is sought.

- j) **Statistical Process Control (SPC)** applies the laws of probability and statistical techniques to the observed characteristics of a product or process.
- k) **Quality Management System (QMS)** is a system that outlines the policies and procedures necessary to improve and control the various processes that will ultimately lead to improve and control the various processes that will ultimately lead to improved business performance.
- l) **Quality Function Deployment (QFD)** refers to designing and building quality into all aspects of both the product and the processes associated with it.
- m) **Six sigma** is a quality management program designed to achieve “six sigma” levels of quality. Pioneered by Motorola in the mid-1980’s six sigma aims to have the total number of failures in quality, or customer satisfaction, to be beyond the sixth sigma of likelihood in a normal distribution of customers. Sigma stands for one standard deviation. Designing processes with tolerances of at least six standard deviations will, under reasonable assumptions, yield less than 3.4 defects per one million.

### Supply chain/logistics management

- n) **Certification of suppliers** refers to inputs that are purchased only from suppliers whose production processes meet the buyer’s standards, which could be those of a standards setting organization. The evaluation of the supplier’s performance may be by the buyer or by a third party. For example, the buyer could require that all its suppliers be certified as meeting ISO 9000 standards.
- o) **E-sourcing(online sourcing)/E-procurement(online procurement)** consists primarily of the distribution, buying, selling, marketing and servicing of products or services through electronic systems such as the Internet and other computer networks. This involves the use of electronic techniques to carry out business transactions, including electronic mail or messaging, World Wide Web technology, electronic bulletin boards, purchase cards, electronic funds transfers and electronic data interchange.

- p) **E-Based (online) design/engineering** consists primarily of a service derived from an e-sourcing based solution. Items can include electronic forms and custom programs.
- q) **On-line trading (bartering)** consists of the exchange of goods or services on-line with no monetary exchange.
- r) **Warehouse Management System (WMS)** is a software program designed to direct the flow of materials both into and out of specific storage locations.
- s) **Customer Relationship Management (CRM)** encompasses the capabilities, methodologies, and technologies that support an enterprise in managing customer relations.
- t) **Use of forecasting/demand planning software** is the use of software that deals with planning and managing supplies and resources for future production.
- u) **Advanced Planning and Scheduling (APS)** refers to the management and outlay of goods and services needed for production.
- v) **A transportation management system** is a software program designed to deal with the management and logistics involved in the transportation and shipment of raw materials and goods to their destination. Also included in the transport of finished goods to resellers or consumers.

### Others

- w) **Competitive technological intelligence (CTI) and Benchmarking** refers to the process by which you measure your business unit against industry leaders. It includes qualitative aspects but effective benchmarking requires some level of output and financial performance measurement with respect to products, services and practices. Benchmarking is process oriented as opposed to simple performance measurement, which is results-oriented.
- x) **Sustainable development strategy/Environmental stewardship plan** refers to a strategy or plan to produce goods, function and grow while working within the means of their environment and resources and not deplete them to a point where they will sustain negative growth.
- y) **Product Data Management/Life Cycle Management (PDM/PLM)** refers to the management of the life cycle of a product and the stages that the product will go from conception to obsolescence.

- z) **Outsourcing/Offshoring** is the assignment of activities to be carried out in other business units, firms or organizations that would otherwise have been performed in the business unit. These activities can be performed in another business unit (plant) within the same firm or may be performed by a non-affiliated business unit, firm or organization. **Outsourcing** is the assignment of the activities to another business unit, firm or organization within the same country. **Offshoring** occurs when outsourcing is to a business unit, firm or organization in a different country.
- aa) **Collaboration(s)/strategic alliance(s)** involves the active participation in joint projects between your business unit and other business units or firms on projects. Pure contracting out work, where there is no active participation, is not regarded as collaboration or a strategic alliance.

### **Question 9: Design Activities**

**DESIGN ACTIVITIES** include creative problem solving in developing, engineering, testing and communicating designs for products, structures, and systems. This also includes industrial, product, process and service design and specifications for production or delivery.

### **Question 10: Design Practices Expenditures**

This question explores the percentage of the total expenditure of your business unit's related to the design activities during reference year 2007.

## **SECTION C - EMERGING TECHNOLOGIES**

This section explores the use or adoption in three emerging technologies: geomatics/geospatial technologies, biotechnology, and nanotechnology. It will provide information on use and planned use of these technologies as well as information on development of nanotechnologies.

### **Questions 11 and 12: Geomatics/Geospatial Technologies**

**Geomatics** is the science and technology of gathering, analyzing, interpreting, distributing and using geographic information. Geomatics encompasses a broad range of disciplines that can be brought together to create a detailed but understandable picture of the physical world and our place in it. The disciplines included: surveying, mapping, remote sensing, geographic information systems, and global positioning systems.

**Geospatial technologies** refer to hardware and software systems that relate and display data of geographic, spatial or location nature. The technology helps to increase the speed of data interpretation and analysis for geomatic research.

- a) **Geographic information systems (GIS):** GIS uses computer technology to integrate, manipulate and display a wide range of information to create a visualization of an area's geography, environment, and socio-economic characteristics. Uses include: basic mapping to support resource exploration and development; environmental management; planning, administration of transportation, telecommunication systems, utility infrastructures, urban development and land use. GIS technology provides users with a powerful tool with which to archive, manipulate, integrate, analyze and visualize both the spatial and statistical characteristics of the volumes of data that are routinely collected. 3-D GIS is a technology that is increasingly being used for display and analysis of data containing horizontal and vertical spatial coordinates. 3-D GIS geoscientific applications include oil exploration; mining; meteorology; environmental monitoring; landscape architecture and geological modelling.
- b) **Global positioning system (GPS):** GPS is a constellation of satellites providing geospatial information. GPS satellites beam signals to Earth, where they are picked up by receiving devices that range from hand-held units to more sophisticated vehicle-mounted and stationary equipment. The signals are used to determine the receiver's position on the ground at any time. GPS can be used for locating and tracking vehicles and other objects, managing infrastructures, time-tamping information and images, environmental applications, and navigating between points on the globe. Location based technology applications are expected to continue to grow rapidly as more companies develop new products and services.
- c) **Remote sensing (RS):** In the broadest sense, remote sensing is the measurement or acquisition of information of an object or phenomenon, by a recording device that is not in physical or intimate contact with the object. In practice, remote sensing is the utilization at a distance (as from aircraft, spacecraft, satellite, or ship) of any device for gathering information about the environment.

### **Question 13: Biotechnology**

**Biotechnology** is defined as the application of science and engineering in the direct or indirect use of living organisms in their natural or modified forms in an innovative manner in the production of goods and services or to improve existing processes. For the purpose of this survey, do not include fermentation for beer, bread, cheese or yogurt.

Biotechnologies can be grouped in the following types of biotechnology:

- **DNA (the coding):**  
e.g. Genomics/pharmaco-genetics; Gene probes;  
DNA sequencing synthesis amplification; Genetic engineering;
- **Proteins and molecules (the functional blocks):**  
e.g. Protein/peptide sequencing/synthesis;  
Lipid/protein engineering; Proteomics; Hormones,  
growth factors, pheromones; Cell receptors signalling;
- **Cell and tissue culture and engineering**  
e.g. Cell/tissue culture; Embryo manipulation; Tissue engineering;  
Hybridization; Cellular fusion; Vaccine/immune stimulants;
- **Process biotechnologies:**  
e.g. Bioreactors; Fermentation (excluding beer, bread, cheese and  
yogurt); Bioprocessing; Bioleaching; Bio-pulping; Biobleaching;  
Biodesulphurization; Bioremediation; Biofiltration;
- **Sub-cellular organisms:**  
e.g. Gene therapy; Viral vectors;
- **Other** (bioinformatics, nanobiotechnologies, environmental  
biotechnology and other).

### **Questions 14 and 15: Nanotechnologies**

**Nanotechnology** is a broadly-based enabling and transformative group of technologies that may hold widespread implications for a number of sectors across industry and society. It is a field where science and related technologies are advancing rapidly, and are poised to enter the industrial sectors of the Canadian economy. Statistics Canada and partners are developing information on this important emerging technology.

Nanotechnology is the manufacturing of devices and products from molecular or nano-scale components with extraordinary properties. One nanometre (1 nm) is one billionth of a metre (.000000001 m), 3 to 4 atoms wide. Examples of nanotechnology include: nanoparticles, nanomaterials, nanocoatings, nanostructures, nanosystems, nanophotonics, nanoelectronics, nanomedicine, nanobiotechnology.

## SECTION D - GENERAL QUESTIONS

This section collects information on the topics of business success factors, innovation, and research and development activities as well as some more general information on the location of the head office of the controlling business unit and the markets in which the business unit sells.

### Question 16: Success Factors

- r) **Securing funding from venture capitalists:** individuals or firms that specialize in investing in start ups or companies in the development stage.
- s) **Securing funding from angel investors/family:** are investors who do not typically manage pooled money of others in a professionally-managed fund. They generally provide capital for a business start-up and in most cases for exchange in ownership equity. Also of note angel investors are not usually involved in the daily activities or business management of their investments.

### Questions 17 to 20: Innovation

Innovation is vital for economic growth and development. Responses to these questions will allow an exploration of the relationship between advanced technology use and innovation.

A **PRODUCT INNOVATION** is the market introduction of a **new** good or service or a **significantly improved** good or service. The innovation (new or improved) must be new to your business unit. Exclude the simple resale of new goods purchased from other business units and changes of a solely aesthetic nature (i.e. colour change, model change, label change etc.).

A **PROCESS INNOVATION** is the implementation of a **new** or **significantly improved** production process, distribution method, or support activity for your goods or services. The innovation (new or improved) must be new to your business unit.

### **Question 21: Organizational Innovation**

An **ORGANIZATIONAL INNOVATION** is the implementation of new or significant changes in your firm or your business unit's structure or management methods that are intended to improve your business unit's use of knowledge, the quality of your goods or services, or the efficiency of work flows.

A **MARKETING INNOVATION** is the implementation of new or significantly improved designs or sales methods to increase the appeal of your goods or services or to enter new markets.

### **Questions 22 and 23: Research and Development (R&D)**

These questions will provide data on the type of involvement in R&D and intensity of R&D being carried out in the business unit.

Research and Development (R&D) refers to the creative work undertaken on a systematic basis in order to increase the stock of knowledge. Development is the application of research findings to devise new applications. R&D may or may not result in a new product (good or service) and/or process innovation and/or organizational and/or marketing innovation (please see definitions of each type of innovation found in this guide).

R&D does not include:

- Minor variations in product specifications or packaging
- Quality control and routine analysis and testing of materials, devices or products
- Routine data collection (unless integral to R&D work)
- Market research and sales promotion
- Operations research except when required during the development phase of a product or process
- Research in the social sciences
- The commercial production of a new or improved material, device or product or the commercial use of a new or improved process after development is completed.

Within the business unit, R&D will refer to the investigations carried out in the natural sciences and engineering, by means of experimentation and analysis to achieve a scientific or commercial advance.

## **Questions 24 and 25: General Information**

These questions will provide information on the control and markets of the business unit.

**Asia Pacific** includes China, India, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand, the Philippines and Vietnam.

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### **How can I obtain data from Statistics Canada?**

#### **Inquiry service**

Ask about our most recent data by:

- Telephone: 1-800-263-1136
- Telecommunications device for the hearing impaired: 1-800-363-7629
- Fax: 1-877-287-4369
- E-mail: [infostats@statcan.ca](mailto:infostats@statcan.ca)
- Website: [www.statcan.ca](http://www.statcan.ca)

### **Statistics Canada Reference Centres**

Halifax	(902) 426-5331
Montreal	(514) 283-5725
Ottawa	(613) 951-8116
Toronto	(416) 973-6586
Winnipeg	(204) 983-4020
Regina	(306) 780-5405
Edmonton	(780) 495-3027
Vancouver	(604) 666-3691

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## **INFORMATION ON GOVERNMENT SUPPORT PROGRAMS**

For more information on government programs designed to promote advanced technology adoption visit the following Industry Canada websites.

[Http://strategis.ic.gc.ca/epic/internet/inmib-dgjf.nsf/vwapj/completeen.pdf/\\$file/completeen.pdf](http://strategis.ic.gc.ca/epic/internet/inmib-dgjf.nsf/vwapj/completeen.pdf/$file/completeen.pdf)  
(PDF version)

<http://strategis.ic.gc.ca/epic/internet/inmib-dgjf.nsf/en/hu00022e.html>  
(HTML version)

The documents within the two links will give an overview of nearly 100 programs and activities to assist in advancing innovation or technology adoption.

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## **FOR FURTHER INFORMATION AND ASSISTANCE**

Remember, if you are experiencing difficulty in completing the survey or if you are not sure about how to respond to a specific question, please call us at **1-866-297-3138** and someone will be happy to assist you.

Please keep a copy of this questionnaire accessible, in case you receive an enquiry from our staff.

**Thank you for your cooperation.  
Remember, all data provided are kept confidential.**