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Innovation in the Forest Sector

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Innovation in the Forest Sector

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Preface

The Information System for Science and Technology Project was created to develop useful indicators of science and technology activity in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed for five key entities:

- **Actors**: persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities**: the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages**: the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, and the source of ideas for innovation in industry.
- **Outcomes**: the medium-term consequences of activities. Outcomes of an innovation in a firm may be improved productivity, improved product quality and/or more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts**: the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to information and data on the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a narrow picture of science and technology in Canada. More measures were needed to improve the picture.

It is in this context that the Survey of Innovation, 1999 was developed. It is hypothesized that innovation makes firms competitive. Thus one of the goals of this survey was to determine if there were significant differences between innovative and non-innovative firms in the manufacturing and selected natural resources sectors. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

This working paper is part of a series that examines the results from the Survey of Innovation 1999. Previous working papers include an examination of national estimates of innovation in manufacturing and a second working paper, which included statistical tables of provincial estimates of innovation in manufacturing.

The framework briefly described above that guides the future elaboration of indicators was published in December, 1998 (**Science and Technology Activities and Impacts: A Framework for a Statistical Information System,** Cat. No. 88-522). The framework has given rise to **A Five-Year Strategic Plan for the Development of an Information System for Science and Technology** (Cat. No. 88-523).

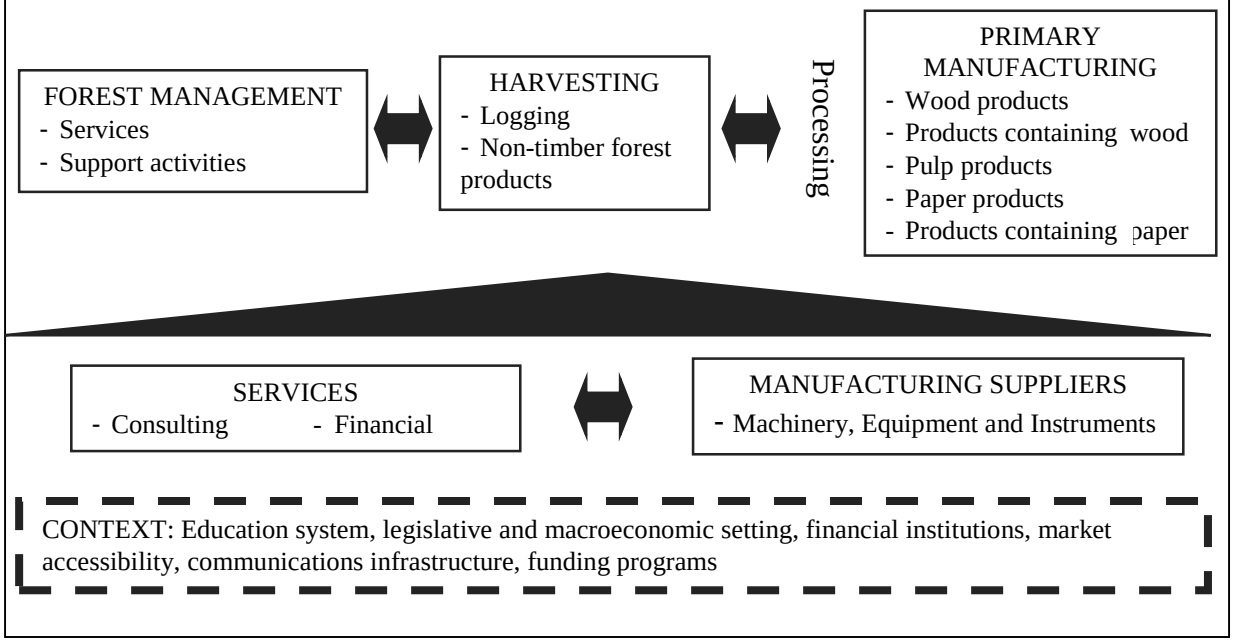
Working papers and research papers are available at no cost on the Statistics Canada Internet site at **http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193**

Introduction

Innovation is vital to economic growth and development. Through innovation, new products are introduced to the market, new production processes are developed and introduced, and organizational changes are made.

Statistics Canada, in collaboration with Natural Resources Canada, has developed a systems approach to understanding innovation in the Forest Sector. This is outlined in Figure 1. This system brings together the various elements of the sector as follows: industries that are involved in the production of forest products in the resource and manufacturing sectors; private firms who provide services, machinery, equipment and instrument suppliers; and public sector firms who provide infrastructure support for the production process. The understanding of the flows of information, products and services among these performers is key to the systems approach.

Figure 1. The Forest Sector system.



The Forest Sector System includes six main groups of performers:

Harvesting

- Forest products (raw materials) are harvested by industries such as logging.

Primary Manufacturers

- Transform raw materials into products composed of wood, pulp or paper, or products containing wood or paper.
- Products are output for use by consumers or are input into other industries for further processing.

Forest Management

- Includes a variety surveying and mapping services, environmental services, engineering, support services and consulting industries.

Services

- Purchased services provided to a variety of industries or developed as a specialization in one sector including: private research and development labs, banks and investment counseling.

Manufacturing Suppliers

- Produce machinery, equipment and instruments used by those involved in resource management, harvesting and primary manufacturing.

Context

- Includes public education system and public R&D facilities, communications infrastructure specialists (roads and other transportation networks, etc.), funding programs and government regulators.

The Survey of Innovation 1999

The Survey of Innovation 1999 surveyed all firms in the manufacturing sector and in selected natural resource industries[1]. In the analysis that follows, data will be presented for three groups of performers within the Forest Sector System as follows: one harvesting industry, namely Logging (NAICS 1133)[2]; five primary manufacturing industries, namely Sawmills and Wood Preservation (NAICS 3211), Veneer, Plywood and Engineered Wood Products (NAICS 3212), Other Wood Products (NAICS 3219), Paper Manufacturing (NAICS 322); and some manufacturing suppliers of products to forestry and logging.

What types of innovations are produced by forest sector firms?

Forest harvesting and primary manufacturing industries in the forest sector distinguish themselves by the types of innovation, either product or process, they produce (Figure 2).

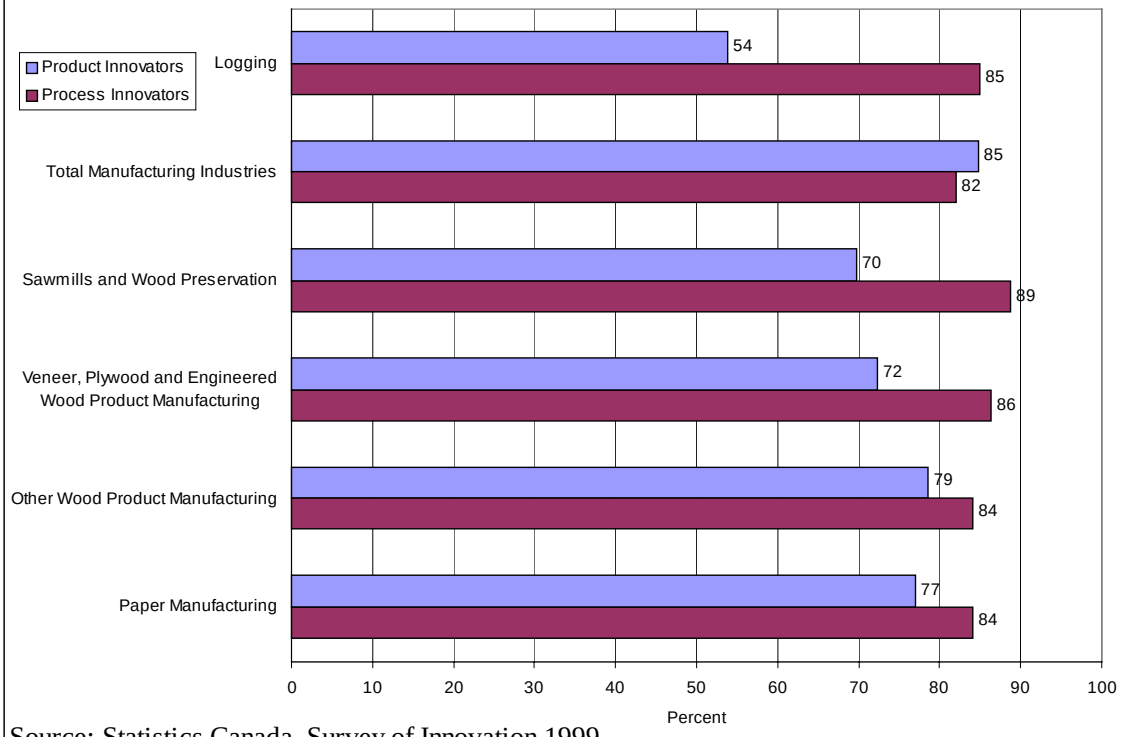
Overall, innovative firms in these forest sector industries introduced more process than product innovations in the period 1997-1999. Eighty-two percent (82%) of innovative

[1] For an overview of the survey methodology, see Susan Schaan and Frances Anderson, Innovation in Canadian Manufacturing; National Estimates, Statistics Canada Cat. No. 88F0006XIE, No. 10. A copy of this paper and other documents related to the Survey of Innovation 1999 are available on the Statistics Canada web site. Go to *www.statcan.ca*. Then go to *Our products and services*. Under the heading *Electronic publications* choose *Research papers (free)* and then choose *Science and technology*. A copy of the questionnaire is reproduced in the working paper.

[2] Industries are classified by the North American Industry Classification System (NAICS) codes. Details on each industry can be found in Statistics Canada, *North American Industrial Classification System 1997*, (Catalogue No. 12-501-XPE). In the Survey of Innovation 1999, all manufacturing firms were asked if their products were used by logging and forestry industries. Firms that answer yes to this question have been classified as suppliers to forest industries.

firms in manufacturing introduced process innovation. When forest industry firms do innovate, they introduced a higher percentage of process innovations. However, in contrast to the manufacturing industries as a whole where 85% of innovative firms introduced innovative products, a lower percentage of innovative firms in each of the forest sector industries introduced product innovation ranging from 54% of innovative Logging firms to 79% of innovative Other Wood Product firms.

Figure 2. Percentage of product and process innovators for selected Forest Sector industries and Manufacturing as a whole.



Source: Statistics Canada, Survey of Innovation 1999

Why do forest sector firms innovate?

Improving product quality was the objective of innovation chosen by the largest percentage of innovative firms in Logging and in three out of the four primary manufacturing industries (Table 2).[3] Improving the quality of the product is particularly important for Logging (91% of innovative firms) and Paper (87%).

Data from the Survey of Innovation 1999 shows that a higher percentage of innovative firms in forest sector industries undertake innovation to respond to environmental issues than do manufacturing industries as a whole, with the exception of Other Wood Products. Undertaking innovation to deal with or to respond to new government regulations is particularly important to Logging (50% of innovative firms) and Sawmills and Wood

[3] Veneer, Plywood and Engineered Wood Products Manufacturing firms had improving product quality as their second most frequently chosen objective. Increasing production capacity was the most frequently chosen objective.

Preservation (26%). Innovation to improve production flexibility is an objective of two-thirds of innovative manufacturing firms and of innovative primary manufacturing firms as well; however it is an objective of only one half of innovative logging firms.

Table 1: Selected objectives of innovation for innovative firms in selected Forest Sector industries and in Manufacturing as a whole.

Objective	Percentage of innovative firms choosing listed objective					
	Logging	Manufacturing	Sawmills and Wood Preservation	Veneer, Plywood and Engineered Wood Products	Other Wood Product	Paper
To improve product quality	91	83	82	79	79	87
To reduce environmental damage	57	25	35	37	18	30
To deal with or to respond to new government regulations	50	18	26	10	13	19
To improve production flexibility	47	67	67	61	66	68

Source: Statistics Canada, Survey of Innovation 1999

What role does innovation play in a firm's strategy?

Satisfying existing clients is considered to be the most important firm success factor for innovative firms in forest sector industries and for manufacturing industries as a whole (Table 2). Developing new products (goods and services) and processes is not

Table 2: Selected firm success factors of innovative firms in selected Forest Sector industries and in Manufacturing as a whole.

Firm Success Factor	Percentage of innovative firms indicating factor is important[4]					
	Logging	Manufacturing	Sawmills and Wood Preservation	Veneer, Plywood and Engineered Wood Products	Other Wood Product	Paper
Satisfying existing clients	93	97	95	96	96	98
Developing new products (goods or services) and processes	38	72	64	59	51	61
Promoting firm or product (good or service) reputation	61	84	79	88	80	79
Developing export markets	28	62	68	66	70	59
Seeking new markets	50	77	79	81	83	75

Source: Statistics Canada, Survey of innovation 1999

considered by innovative firms in forest sector industries to be as important for firm success as it is for manufacturing as a whole. Concerning three other success factors -

[4] Firms were asked to indicate the importance of a series of success factors on a scale of 1-5 where 5 is low importance and 5 is high importance. It is considered that firms indicating 4 or 5 for a given success factor find this factor important.

promoting firm or product reputation, developing export markets and seeking new markets - primary manufacturing industries in the forest sector see these factors to be generally as important as do manufacturing firms as a whole. In contrast, fewer innovative firms in logging consider these factors to be important.

How is knowledge generated?

The Survey of Innovation 1999 posed several questions to innovative firms on their involvement in R&D (Table 3).

Table 3. R&D activities of innovative firms in selected Forest Sector industries and in Manufacturing as a whole.

	Percentage of innovative firms undertaking given activity					
	Logging	Manufacturing	Sawmills and Wood Preservation	Veneer, Plywood and Engineered Wood Products	Other Wood Products	Paper
Undertake R&D[5]	26	68	53	64	55	69
For those firms that undertake R&D, % for whom R&D is:						
Carried out by a separate and distinct R&D department	38	45	31	41	25	53
Contracted out to other firms	60	29	45	46	27	37

Source: Statistics Canada, Survey of Innovation 1999

There are considerable differences among the industries belonging to the various groups of performers in the forest sector concerning their involvement in research and development and - when they are involved in R&D - the nature of their involvement. Approximately a quarter of innovative Logging firms undertake R&D, in sharp contrast to approximately one half of innovative firms in Sawmills and Wood Preservation and Other Wood Products and more than two-thirds of innovative firms in Paper. Of those firms that do carry out R&D, one half of innovative firms in Paper (53%) carry it out in separate and distinct R&D departments, followed by Veneer, Plywood and Engineered Products (41%). Sixty percent (60%) of innovative Logging firms that carry out R&D contract out their R&D as do almost one half of both the innovative firms in Sawmills and Wood Preservation (45%) and Veneer, Plywood and Engineered Wood Products (46%).

Manufacturing Suppliers to the Forest Sector

Approximately one in five (17%) manufacturing firms produce products that are used by logging and forestry industries. Acquisition of technologies and new products is an important mechanism for the transmission of S&T knowledge and facilitating technological change.

Five very innovative manufacturing industries, as shown on Table 4, supply products to logging and forestry industries. The percentage of innovative firms in these industries are

[5] Data on R&D performance and how this R&D is carried out comes from Question 24 of the Survey of Innovation 1999 where respondents were asked if their firm undertook R&D activities.

Table 4: Selected Manufacturing industries with products used by forestry and logging.

	% of all firms with products used by logging and forestry	% innovative firms in this industry	relative innovation rank	% of all firms that undertook R&D
Electrical Equipment, Appliance and Component Manufacturing	33	90	5	74
Agricultural, Construction and Mining + Industrial Machinery Manufacturing	39	88	6	80
Machinery [Commercial and Service Industry Machinery Manufacturing + Ventilation, Heating, Air-Conditioning and Commercial Refrigeration Equipment Manufacturing + Metalworking Machinery Manufacturing + Engine, Turbine and Power Transmission Equipment Manufacturing + Other General Purpose machinery Manufacturing]	27	87	8	76
Navigational, Measuring, Medical ad Control Instruments Manufacturing + Manufacturing and Reproducing Magnetic and Optical Equipment	15	91	4	77
Chemical Manufacturing (excluding Pharmaceuticals)	24	88	7	75

Source: Statistics Canada, Survey of Innovation 1999

all higher that of the manufacturing industry as a whole in which 80% of firms are innovative. Of the 31 industries that were surveyed, these five industries are ranked in the top eight industries among innovative industries. They are also among the industries that have a higher percentage of firms that carry out R&D. In these industries, three-quarters of the firms undertook R&D activities, compared to 59% of firms in the manufacturing sector as a whole. These data show that products from highly innovative manufacturing sectors are flowing into harvesting industries in the forest sector system, logging and forestry industries.

Conclusions

The forest sector can be described as a system of innovation including harvesting, resource management, primary manufacturing, and service industries as well as manufacturers of machinery, equipment and instruments, and the conditions or context under which each firm operates. To have a more complete picture of innovation within a system, components must include all performers that are participating in the innovation process.

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