

Factors Affecting the Evolution of Manufacturing in Canada: An Historical Perspective

Jaydeep Balakrishnan

Janice B. Eliasson

Operations Management Area

Haskayne School of Business

University of Calgary

Calgary Alberta T2N 1N4 CANADA

Ph: (403) 220 7844 Fax: (403) 210 3327

Internet: Jaydeep.Balakrishnan@haskayne.ucalgary.ca

Janice.Eliasson@haskayne.ucalgary.ca

Timothy R.C. Sweet

Revolve Business Consulting Ltd.

30 Citadel Crest Link NW

Calgary, Alberta T3G 4W4 CANADA

www.revolveconsulting.com

Published in the *Journal of Operations Management*, 25, 2, 2007, pp 260-283

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Abstract

This paper examines the factors that influenced developments in industry and manufacturing in Canada from the seventeenth to the twentieth century. Although Canada's abundance of natural resources led to the development of primary industries in the seventeenth and eighteenth centuries, the manufacturing industry was not significant until the early nineteenth century. Of these, four representative manufacturing industries are discussed to illustrate the overall trend in the chronological evolution of Canadian manufacturing in the nineteenth and twentieth centuries. The role and impact of factors such as transportation, electricity, foreign investment, particularly by U.S. entrepreneurs, and government support for industry is reviewed to understand their impact on manufacturing as it has evolved to the present. It appears that these were indeed influential and thus are factors that other countries in a less developed stage of their manufacturing evolution may look to for directions.

Our analysis also shows that Canadian manufacturing which began by producing simple items in small volumes due to geographical diversity and the absence of a large market, moved into the mass manufacturing age only in the twentieth century. But in the twenty first century due to competition from low labour cost countries Canada has moved back to customized manufacturing though in sophisticated goods such as aircraft manufacturing and biotech. While there are bright spots in Canadian manufacturing, recent studies also show that work needs to be done to produce more value added products and ensure Canadian manufacturing competitiveness in the global market place.

Factors Affecting the Evolution of Manufacturing in Canada: An Historical Perspective¹

Introduction

Canada is the second largest country in the world, with over nine million square kilometres; however, historically it has had a significantly lower population than many other countries with far less area. Canada's population is unevenly distributed, with major concentrations in the southern part of the central Canadian provinces of Quebec and Ontario, and to a lesser extent British Columbia (B.C.) on the west coast. This unequal dispersion of people has created small, distinct markets, while different regional climates and cultural concentrations have led to variation in utilitarian needs and personal tastes, and thus pressures for small-scale customized manufacturing. It was often necessary for a company serving the entire country to tailor its product for each demographic sub-group. Thus the size of the country, distribution of population and divergence of geographical features created unique issues in manufacturing, transportation and distribution.

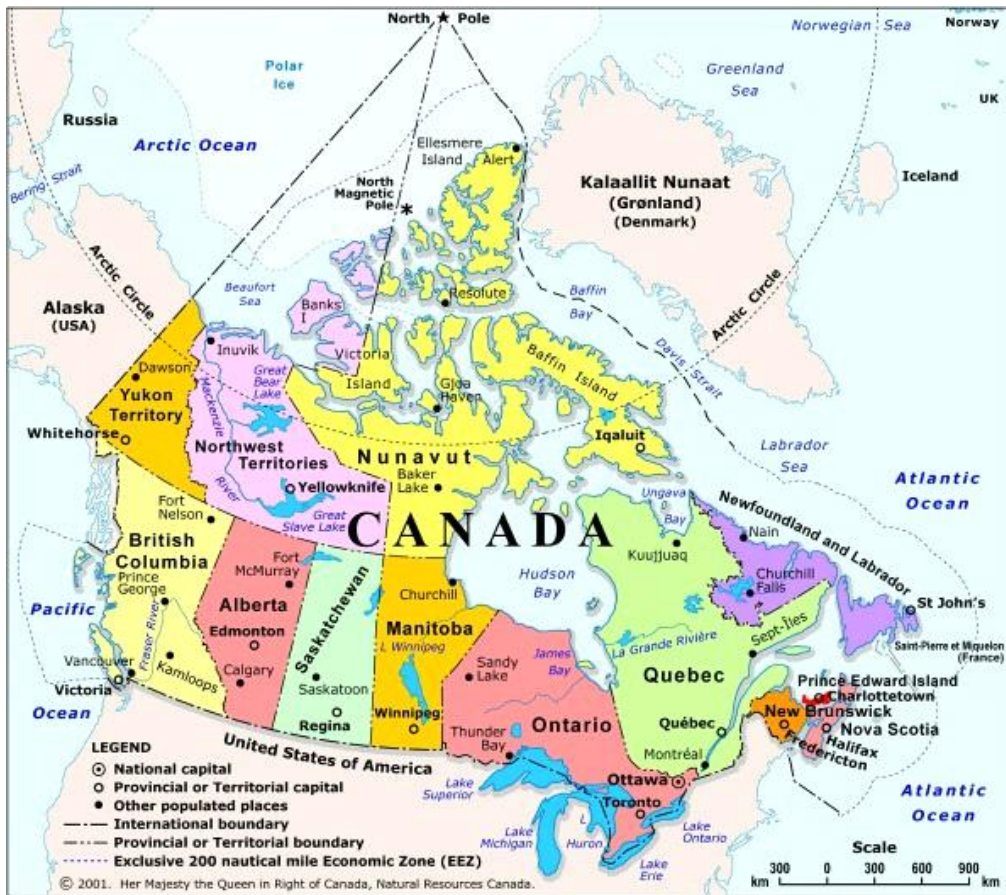
At the same time, according to McNally (1991, p.xiv), "The various manufacturing sectors of the Canadian economy have been badly served by historians". He states further, "There is not one book on the history of Canadian manufacturing and even the names of the early industrialists have been forgotten. [Thus] there is a great need for more information on the history of the productive base in Canada" (McNally, 1991, p. 117). Michael Bliss (1987) echoes these sentiments. Manufacturing in Canada also developed in a different pattern from its major trading partner, the United States (U.S.), and its former colonizer, the United Kingdom (U.K.), though clearly both these countries were influential in Canada's development. Thus this paper addresses some of these gaps in the history of manufacturing in Canada. The paper first discusses the chronological growth of manufacturing,

¹ The authors are thankful to the reviewer, Dr. Robert Klassen of the Ivey Business School, University of Western Ontario, for his thorough and insightful comments during the double blind review process which helped evolve the paper to its present form.

starting from the first European settlement along the Atlantic coast in the sixteenth century and ending with evolvments in the twentieth century. Particular emphasis is placed on the development of industry and the influence of the U.K. and the U.S. Developments in major industries such as iron and steel, furniture, textiles and shoes, and automobiles are examined. Examining these industries allows us to illustrate the dynamics of Canadian manufacturing in general from a product-process matrix (Hayes and Wheelwright, 1984), as well as from a value chain perspective.

Subsequently, we discuss some of the main factors that affected the evolution of Canadian manufacturing including railway transportation, energy, skilled labour, and the role of foreign (particularly U.S.) investment. All had a great impact on the development of Canadian manufacturing beginning in the nineteenth century. The paper will then summarize Porter's 1991 analysis of Canadian competitiveness and his follow-up analysis with Martin in 2001, which serves as a guide to Canadian manufacturers as the twenty first century begins. Finally, we will attempt to describe the lessons learned from the evolution of Canadian manufacturing that other countries which are in earlier stages of their manufacturing evolution may use for guidance.

The name "Canada" is used to refer to all areas that are part of Canada today (see Figure 1), even in reference to pre-Confederation years. Confederation occurred in 1867, with four eastern and central provinces joining to form the new country. The other six provinces and three territories joined later, with the last joining in 1949. As European settlement first began on the east coast and then moved slowly across the country, manufacturing development follows the same pattern with the western provinces becoming manufacturing centres much later than the eastern ones.



Source: Government of Canada (<http://atlas.nrcan.gc.ca>)

Figure 1: Current Political Map of Canada

The Chronological Development of Manufacturing in Canada

Early Economic Development in Canada

Unlike its neighbour, the U.S. which began as a country whose economy was based upon agriculture, Canada began as a commodity-based colony (Pomfret, 1981, p. 7). Fish, fur and timber were harvested and shipped back to France or the U.K. As early as the sixteenth century, European countries had fisheries in Newfoundland on the east coast (See Figure 1), and trade had begun between the French fur traders and the natives along the St. Lawrence River (shown in Figure 1, but not labelled, flowing through Montreal, Quebec). By the mid-seventeenth century, the French fur

traders were using the Hudson's Bay (Figure 1) as an alternate trade route when the water was navigable. In 1670, fur traders formed the Hudson's Bay Company (still in existence as a major department store chain) and received a royal charter from the British government (Pomfret, 1981, p. 10). The fur trade had a significant effect upon economic characteristics as its challenges were different from those of the fisheries. Its requisite organization for collecting goods and transporting them over long distances both increased overhead and promoted economies of scale. In addition, the trade was unpredictable and unstable due to vagaries in supply and demand. Demand was subject to abrupt shifts due to the whims of fashion such as the desire for beaver hats, which, in turn, caused major fluctuations in prices. Though the variation in the supply and the price paid for furs is not clearly understood (Rich, 1960, p. 23; Rotstein, 1977; Ray and Freeman, 1978), it is thought that fluctuation was at least in part due to political and environmental issues in addition to the demand issues.

By the first half of the nineteenth century, timber replaced fur as Canada's leading export (Pomfret, 1981, p. 24). Wars in Europe had resulted in a disruption of the timber supply there. Thus, the U.K. gave its colonies, including Canada, favourable trade status in timber to encourage its export. Consequently, Quebec City (north east of Montreal, shown as Quebec in Figure 1) and Saint John, New Brunswick (see Figure 2) not only became centres for the timber trade but also benefited from related industries such as shipbuilding.

As added incentive, the timber trade and human settlement were complementary while fur trading and settlement were not. The fur traders needed forests for certain fur bearing animals and settlement meant the destruction of forests. However, land cleared of timber could be used for agriculture if fertile. As well, ships carrying timber to Europe could, instead of returning empty to Canada, offer cheap fares to people who wished to escape poverty, especially in the U.K. and Ireland. Thus, the population growth of British North America (as Canada was known before it ceased being a colony and achieved Dominion status at Confederation in 1867) between 1820 and the middle of the

century was facilitated by timber exports (Urquhart and Buckley, 1965, p. 14; Easterbrook and Aitken, 1956, p. 239, p. 274). However, by 1860 the U.K. had completely eliminated timber tariffs, thus reducing the advantage Canada had as a colony. The advent of the iron and steel age and their increased use in building and manufacturing also had a detrimental effect on the timber trade. However, the decrease in the cross-Atlantic trade due to these factors was more than offset by the increase in trade with the U.S. where the rapidly growing American population was driving demand for construction timber. The American railways were able to provide cheap transportation and trade agreements with the U.S. offered preference to Canada (Pomfret, 1981, p. 26).

The Beginnings of Industrialization in Canada

Prior to the nineteenth century, mass manufacturing as we know it today did not exist. Products were usually custom made by skilled artisans who had spent many years in apprenticeship. Each product was unique, with no two exactly the same. Trades or guilds established standard apprenticeship programs. In turn, the range of products provided by these artisans was very broad. For instance, blacksmiths would act as farriers or locksmiths and forge nails, pins, and hinges while carpenters would build wagons, cribs, beds and coffins. These early businessmen located themselves close to the raw resources needed and/or within easy reach of their market. Additionally, each farming community had its own mills to grind grain into flour and to turn timber into planks (Bliss, 1987, p. 231).

In Canada, limited market size and generalist offerings, though considered a disadvantage by today's standards, allowed artisans to manage relatively simple supply chains. Given the nature of the business, feedback from customers was quick and direct. These simple supply chains did not require constant management, thus the artisans themselves could handle relationships with customers; offerings were tailored directly to the needs of the individual, a situation not available with imported

goods. The imports, typically consumer goods, were often also more expensive than locally made products due to slow and expensive transport (Bliss, 1987, p. 226). This cottage industry approach to manufacturing, however, began to change at the beginning of the nineteenth century.

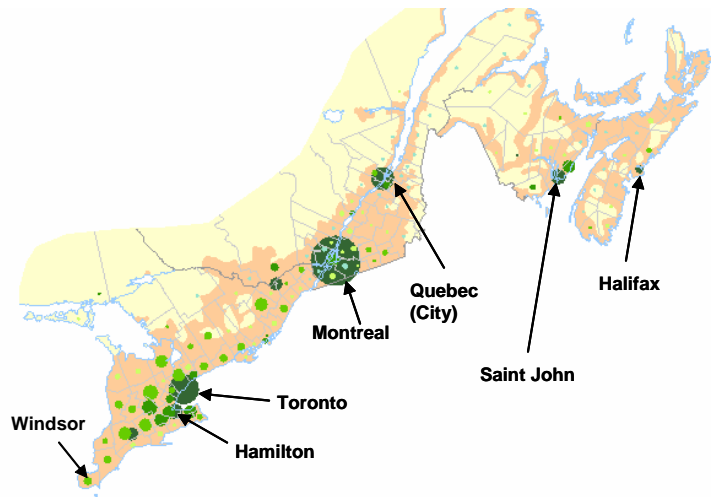
The Early Manufacturing Industry in Canada

According to Wurtelle (1886), the earliest attempt at iron production in Canada occurred in the latter half of the seventeenth century at the St. Maurice Forges Company near Trois Rivières, Quebec (situated midway between Montreal and Quebec City in Figure 1, but not labelled) on the St. Lawrence River. However, the lack of skilled workers, suitable waterpower, a sufficient market, and capital delayed the development of this company (Donald, 1915, p. 42). It was not until the middle of the eighteenth century that the forging industry seemed to have assumed ‘considerable proportions’ (Bartlett, 1895, p. 511). By 1809, iron manufacturing had become the most important industry in Canada (Donald, 1915, p. 44), presumably because iron was the raw material for the production of many household goods and transportation equipment. There were also some local Canadian companies that produced finished goods such as kettles using pig iron and steel. The skilled employees were primarily English and Scottish immigrants, while the unskilled workers were generally Canadian-born (Bartlett, 1895, p. 516). In the first half of the nineteenth century, Canadian steel manufacturers faced three major problems: poor quality ore, use of charcoal rather than better quality coal for power generation, and very poor transportation systems (roads that took their toll on wagons). They therefore found it difficult to compete with British producers, whose larger scale operations used coal and more advanced machinery (Royal Commission, 1890).

By 1820, industrialization on a large scale could be seen in the Eastern Townships close to Montreal (Southam, 2001). Settlers from New England, joined by others from the U.K., brought technical and organizational skills that helped establish industry. Entrepreneurs from Boston and Montreal provided financial backing that stimulated subsequent growth in manufacturing through technological innovation, capital accumulation, and access to resources and growing markets

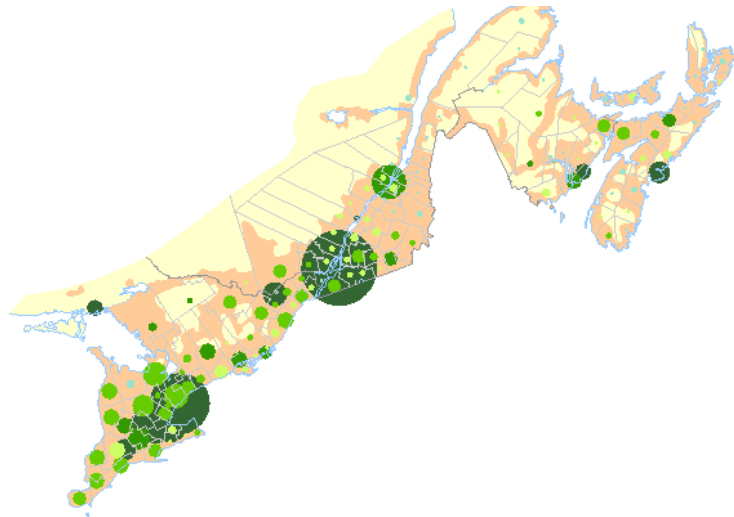
(Kesteman, 1985; Southam, 2001). Canada's first integrated woollen factory was set up in 1826, and a papermaking factory was operating by 1849 (McCullough, 1992).

The industrial development of the Eastern Townships during this time was aided by abundant natural resources, good geographical location, and a well-developed financial sector. The region had productive agricultural land, as well as abundant minerals, timber, and water, which supported the waterwheel technology of that age. The potential of its location improved with the arrival of the railways, as Montreal and the Eastern Townships were located geographically at the crossroads of the New England - Central Canada and the Central Canada - Atlantic Canada routes. Although some foreign banks had operated in Canada starting in the late eighteenth century, the first Canadian bank, The Montreal Bank, was not opened until 1817. By the 1850s, Montreal was the largest city in Canada and the leading manufacturing as well as commercial centre of Canada (Bliss, 1987). However, by the early twentieth century with the shift westward of the demographic centre of Canada, increased freight costs made Ontario a more favoured manufacturing location (Southam, 2001). This can be seen in Figures 2 and 3 that show the 1871 and 1891 industrial distribution maps of south central and south eastern Canada respectively, where the larger manufacturing centres are indicated by larger circles. It is seen that by 1891 south western Ontario was rivalling Montreal as a manufacturing centre.



Source: Historical Atlas of Canada (<http://mercator.geog.utoronto.ca>)

Figure 2: Industrial map of Canada in 1871



Source: Historical Atlas of Canada (<http://mercator.geog.utoronto.ca>)

Figure 3: Industrial map of Canada in 1891

To foster the export of manufactured goods, Canada entered into preferential trade agreements with the U.K. and the U.S in the nineteenth century. Agreements with the U.K. that lasted till the 1840s were effective for both countries, as Canada did not have many industries to protect. Besides, the U.K. was the most efficient producer of nearly all manufactured goods and had nothing to fear from Canada (Pomfret, 1981, p. 75). At the same time such agreements gave preferential access for Canadian raw material exports such as timber. However, in 1846 the U.K. had repealed the protective tariffs on products from countries in the British Empire and it no longer accorded advantageous customs duties to Canadian agricultural products. With a small domestic market, Canada looked to the U.S., with which it tried to sign a reciprocity treaty (though the U.S. was initially reluctant) as Canada believed that it would improve economic trade between the two countries (Historica, 2006).

The Reciprocity Treaty with the U.S. was finally ratified in February, 1855 in exchange for granting American fishermen access to Canada's coastal waters (Historica, 2006; Officer and Smith, 1968). It included a comprehensive list of natural resource products including iron ore, but the agreement excluded manufactured goods (Pomfret, 1981, p. 75). Economists are still divided as to how fruitful this agreement was due to its limited scope. Although trade between the U.S. and Canada boomed during this period, many economists do not (fully) credit the treaty with causing this boom. They note that at the same time as the agreement was in force, the rapid population increase in the U.S. Midwest resulted in demand for construction materials, railway products, and food (Masters, 1963; Officer and Smith, 1968; Ankli, 1971). This accelerated demand would have helped the growth in trade, even without the treaty. The Civil War in the U.S. and cheaper railway transportation increased demand even further. However, fledgling Canadian industries, such as brewing and cheese manufacturing, failed to fully develop because of U.S. competition and did not do so until the Reciprocity Treaty ended in 1866 partly due to pressure from protectionist groups in the U.S. The

ending of the treaty was in a way responsible for Confederation as the separate colonies sought to create a more viable economic entity (Historica, 2006). Although the Canadian tariff protection that was in place for the remainder of the century helped some Canadian industries to develop, U.S. tariffs on imports also contributed to the underdevelopment of the manufacturing sector due to the small markets (Pomfret, 1981, p. 77).

In 1850, the major Canadian manufacturing industries of flour milling, logging, shipbuilding, and boots and shoes manufacturing, in that order, accounted for a total of 60% of the total manufacturing output. Manufacturing represented about 18% of Canada's GNP by 1850. The move from small-scale to large-scale industry in Canada substantially changed in the 1860s (Firestone, 1960). By 1871, the top six industries in Canada still included flour milling and boots and shoes manufacturing, but now included leather tanning (to make boots and shoes), machine manufacturing, wool spinning, and carriage production – most for domestic consumption (McDiarmid, 1946). By 1900, the major industries continued to be logging and flour milling but now also included meat packaging and butter and cheese production with manufacturing now constituting about 21% of GNP (Firestone, 1960). It appears that by 1900 Canada was relying less on resource-based industries such as timber and moving towards production of consumer goods such as dairy products, bread, and sugar. The thirty largest plants produced 12% of Canada's manufacturing output, a substantial amount. At the same time, there was more diversification of manufacturing with the four leading industries producing only 29% of the country's total output as compared to the 60% in 1850 (Pomfret, 1981, p. 124).

Prior to the mid-nineteenth century, most of the production was still for domestic use. By that time, Canada had companies making agricultural implements (Massey and Harris - later to merge and become Massey-Ferguson), distilleries and breweries (Hiram Walker and Sons, Seagrams, Labatt, and Molson), sugar refining factories, ship building, marine engine construction, foundries, and iron making. Although some exporting was done on a small scale starting in the 1800s, for most

companies it was not yet a major part of their business. There were some exceptions: Molson's began exporting liquor to the U.K in the 1820s and exports became an important component of their business (Bliss, 1987, p. 228).

Along with the development of industrialization in the latter half of the nineteenth century came labour organization, and many unions were founded at that time. The development of labour relations in Canada was different from that of the U.S. for a variety of reasons including more decentralization in government, Canada's French heritage and its continued connections with the U.K. (Gunderson et al., 2001). Even today, Canada remains more unionized than the U.S.

Transportation networks were necessary for the movement of raw materials to the manufacturers and finished goods to the consumers. Locomotives moved goods across these expanding rail lines, linking communities and increasing the range of merchants and craftsmen alike. Nevertheless, this method of delivery introduced challenges. Methods of scheduling became increasingly demanding, as customers became dependent on the timely delivery of finished goods and raw materials. It was Sir Sandford Fleming, a Canadian engineer originally from Scotland, and who was responsible for the initial survey for the Canadian Pacific Railway (CPR), who first developed the idea of time zones. The railways adopted time zones in 1883 to standardize railway schedules and make operations easier.

The expense of installing rail made the decision regarding where a line was to be placed increasingly important. As well, because farmers needed to get their grain to market by horse and buggy, grain elevators had to be strategically placed so farmers could travel to market and home in one day. The high costs of locomotives made it important to predict demand and allocate resources accordingly, and logistics became increasingly complicated. As a result, skilled managers were needed to provide viable solutions to the challenges faced by railways since inefficiencies could negatively affect the operation of all businesses dependent on the rail service. As such, the efficiency of Canadian commerce was reliant on the health of the railways. Thus, as in other industrialized

countries, the nineteenth century was an important one for Canada in terms of manufacturing development.

Canadian Manufacturing Experience into the Twentieth Century

The twentieth century proved to be a dynamic era in shaping demographics and manufacturing in Canada. This period saw the gradual introduction of manufacturing to the West which was primarily related to agricultural activities. For example, the centre of Canada's cattle production moved to Southern Alberta from Quebec in the 1880s, with the first large abattoir in the west opening in Calgary, Alberta (Figure 1) in 1899. However, up until the last decades of the nineteenth century, settlement of the Canadian prairies (Manitoba, Saskatchewan, and Alberta) was very slow as the poor climatic conditions and unfavourable Canadian land policy encouraged emigration to the U.S. frontier (Pomfret, 1981, p. 147). Most of western Canada was not even open for homesteading until 1872. The government offered a section of land for free with the only requirements being a ten dollar filing fee and proof that the land had been farmed within a few years. By 1900, the U.S. frontier was practically closed and the population of the Canadian Prairies began to increase dramatically with a large influx of homesteaders. The creation of the CPR facilitated migration and expanded the population base, increasing demand for goods and services. However, with manufacturing primarily located in central Canada and with the Prairies relying almost solely on a wheat-based economy, economic diversification problems inevitably arose in the Prairies.

Meanwhile, British Columbia was abundantly endowed with forests and, by the early twentieth century forestry had become a major export industry. The origin of forestry products' giant MacMillan Bloedel can be traced to the Powell River Trading Company in 1909 (Industry Canada, 2004). The opening of the Panama Canal in 1914 made it economically viable to ship wood, prairie grain, and other products from the west to Europe. Vancouver (Figure 1) thus became a major port and "a city of sawmills" (Bliss, 1987, p. 401). The phenomenon seen in Eastern Canada of Canadian manufacturers slowly moving from raw material production to value added goods production was

also seen in British Columbia, but this trend began a half century or more later. The process continues even today with the British Columbia lumber industry having an association designed to promote its value added products overseas. Further British Columbia is now a centre for many innovative industries including fuel cells.

In the first decade of the twentieth century, mining coal and other minerals, pulp, paper, hydroelectricity and grain production industries began to soar and foreign investment, primarily British and American, poured into the entire country (Zaslow, 1971; Nelles, 1974). By the end of the 1920s, Canada was the world's largest papermaker, and papermaking was Canada's leading industry (Bliss, 1987, p. 401).

Wars played a large part in the formation of Canadian businesses and the legislation that affected them. In the First World War, Canada was organized to equip Canadian and British soldiers. Factories produced rifles, munitions, boots, clothing, shovels, packs and other necessities of combat. Following the war, material and food exports had guaranteed markets in Europe since countries needed rebuilding and citizens needed to be clothed and fed. Soldiers found jobs quickly, and some women who had found temporary work during the war stayed on (Bliss, 1987, p. 383).

A decade of depression followed the crash of 1929. This radically affected the economy and manufacturing. Canada's economy was deeply hurt when other nations stopped buying Canada's primary commodities such as grain and timber on which it was so dependent (Bliss, 1987, p. 411). The situation was particularly difficult for the Prairies by the late 1930s. Since farmers relied primarily on one crop, wheat, that caused major economic problems. In response, provincial and federal governments encouraged diversification. For example, in southern Alberta, livestock farming supplanted wheat on most of the acreage. However, until well into the twentieth century, manufacturing did not play a major role in the Prairie economy.

Canada's steel mills produced at less than twenty percent of their capacity in 1932 because of the depression (Bliss, 1987, p. 421). Better access to the British Empire countries negotiated at the

Ottawa Imperial Economic Conference in 1932 and government support programs helped many Canadian manufacturers in the depression.

During the interwar period between the first and second world wars, locations other than central Canada became important manufacturing locations. For example, Winnipeg had bus coach building industries and clothing manufacturing. Subsequently, it also became an important centre for Canada's aerospace industry.

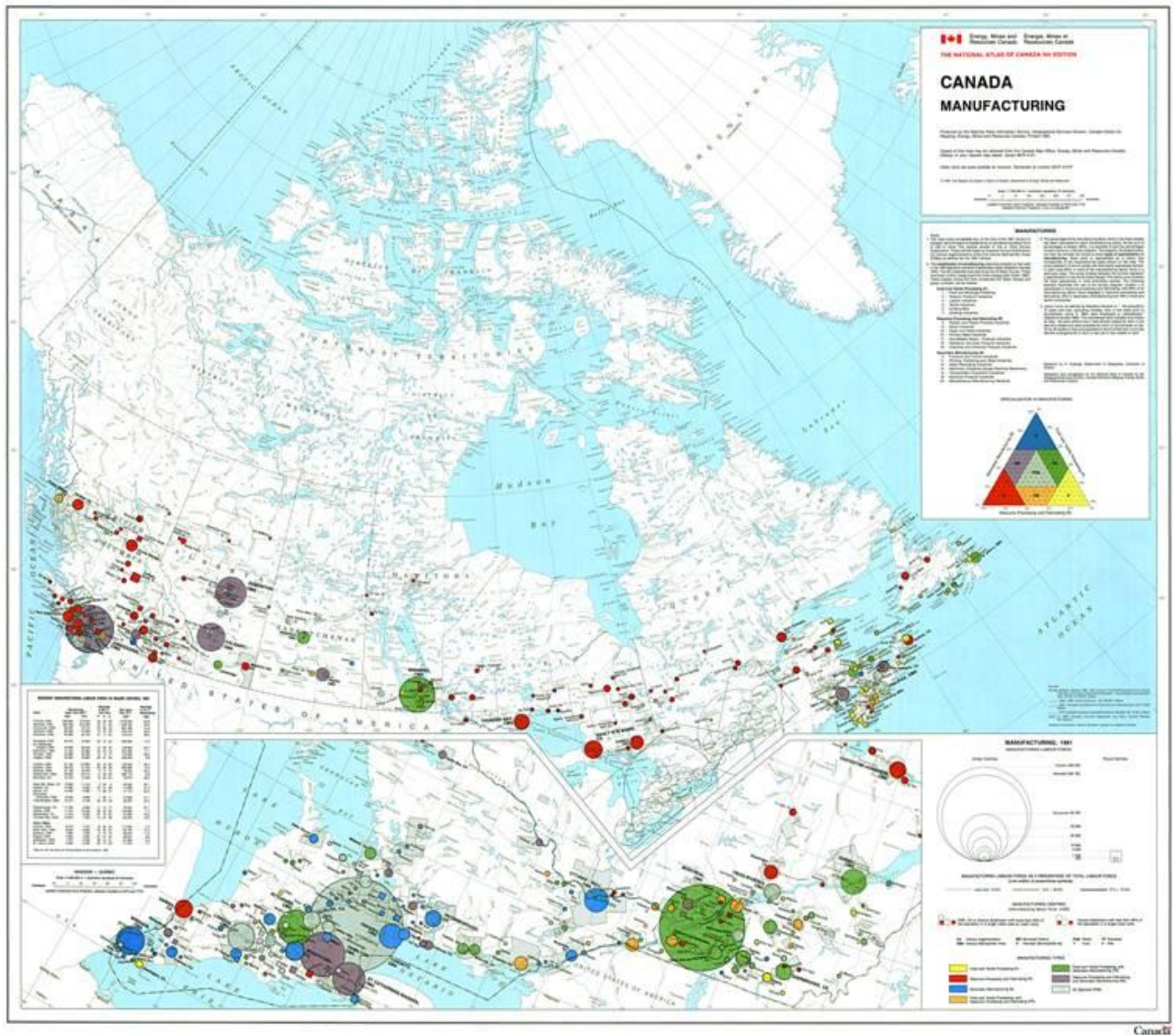
By 1940, the bulk of Canadian industrial markets had developed. These industries included steel mills, power stations, aluminium and chemical plants, textile mills, foundries, and automobile and farm implement factories (Bliss, 1987, p. 447). These facilities enabled Canada to contribute to the material requirements of the Second World War, and helped pull Canada from depression. In fact, the wartime economy resulted in massive increases in the Canadian GDP. Canadian manufacturing for the war was part of an allied effort. For example, chassis were built for planes and automobiles, but the engines were imported from the U.K. or U.S. During the war, Canada was a raw material manufacturer (particularly of food) as well as a manufacturer of small ships, ammunition, and small arms (Bliss, 1987, p. 449). Canada's manufacturing skills were developing at great speed. For example, aircraft production increased from 40 planes in 1939 to 4000 planes by 1944 (Bliss, 1987, p. 448). Major strides in engineering and technological sophistication also occurred, due to the pace of wartime technological changes as well as government support.

After the end of the war, Canada and the U.S. prospered as they were among the few industrialized countries whose infrastructure had not been destroyed by the conflict. While this gave Canadian industry an advantage in the post-war economy, it also led to complacency and future economic difficulties. Protectionism kept Canadian operations from having to deal with the full realities of modern business. Not only did these factors allow manufacturers to become complacent, but they also reinforced and normalized inefficient business practices (Bliss, 1987, pp. 452-458).

Even though Central Canada continued to be the primary manufacturing hub, the West continued to grow economically. Palliser, currently Canada's largest furniture maker, began operations in Winnipeg in 1944. At about the same time, The ATCO Group - well known today in a number of industries including the manufacture of temporary industrial housing, started operations in Alberta. In Calgary, Alberta, the business centre of Canada's oil and gas industry, manufacturing employed almost 52,000 employees in 2001 - more than the number employed in oil and gas - and generated revenues of almost \$4 billion (www.calgarypromote.com, 2002).

The continuation of the shift in manufacturing centres seen in Figures 2 and 3 can also be seen in Figure 4 which shows the distribution of manufacturing across Canada today (with the south western Ontario to Quebec City corridor as an inset). The different circles represent different industries but for the purposes of the discussion here, the important point is that more circles as well as larger circles imply higher industrial concentration. Figures 2 and 3 concentrated on eastern and central Canada since there was hardly any population in the west even in the late nineteenth century. However, in Figure 4 it is seen that Vancouver, Calgary, Edmonton and Winnipeg (see Figure 1 for locations) in the west are today larger manufacturing centres than Quebec City, Saint John, or Halifax, significant centres in Figures 2 and 3.

Ontario remains Canada's manufacturing centre with most manufacturers located in the southern part of the province. Quebec is the other major manufacturing centre. This makes sense from a logistics perspective as about 38% of Canada's population lives in Ontario and another 24% lives in Quebec. In addition, most of the population of these two provinces can be found between Windsor, Ontario (just east of Detroit, Michigan, Figure 2) and Montreal. Thus, these areas are also close to the industrial belt of the U.S. Midwest. This geographical location allows for the implementation of effective manufacturing practices such as Just-In-Time (JIT) with U.S. customers and suppliers, as many Canadian companies have practiced.



Source: Government of Canada (<http://atlas.nrcan.gc.ca>)

Figure 4: Industrial Distribution across Canada today.

In the latter half of the twentieth century, the U.S and Canada, along with other countries, moved toward the reduction of tariffs. For example, the signing of the Canada-U.S. Auto Pact in 1965 (where tariffs were reduced if a manufacturer of automobiles or automobile parts did some value added manufacturing in Canada) gave impetus for further growth in the Canadian auto industry (Pomfret, 1981, p. 78).

Changing processes, whether an adoption of existing technology or an improvement of an existing process, has allowed many Canadian companies to produce the same or better products at a lower cost. With the availability of better transportation and communication technology, Canadian firms have become more competitive. Developments in Operations Management (OM) and manufacturing such as Materials Requirement Planning (MRP), JIT, Total Quality Management (TQM), Supply Chain Management (SCM) and Six Sigma methods became available to Canadian companies soon after they were introduced. Examples of current world class practices in Canadian manufacturing may be found in books by Davis et al (2005), Stevenson and Hojati (2004), and Ritzman et al (2004).

International trade agreements such as the North American Free Trade Agreement (NAFTA) and World Trade organization (WTO) policies greatly affected how business was done in Canada starting in the 1980s. The reduction of tariffs means that world-class Canadian companies have new global markets and are able to prosper by investing in or expanding to foreign countries more easily. Similarly, these agreements protect Canadian companies against unjust tariffs imposed by other countries. The tariff reductions introduce challenges as well as benefits: Canadian markets are no longer protected, and thus many companies may not be able to compete against foreign competitors, leading to loss of jobs domestically. The reduction in tariffs also means that Canadian companies will have to be in the forefront of innovation in developing products and services. However, it may be difficult for many industries in Canada to compete against standardized mass produced goods from

low-labour-cost countries such as China and India, which tariffs previously protected Canadian companies from.

At the same time, Canada has to ensure that these agreements do not impede its ability to protect its environment, to ensure the welfare of its citizens, to assure the quality and safety of products and services that it allows into the country, and to prevent unfair business practices by other countries (Demers, 2003).

The Development of Manufacturing in Canada in Specific Industries

This section discusses the development of four different industries in Canada, namely, steel, furniture, clothing, and automobiles. These are chosen as they represent diverse parts of the Canadian economy in the nineteenth and twentieth centuries. Also their positions in the Hayes-Wheelwright product-process matrix and in the value chain were different at particular points in time due to the various unique factors that affected each industry. So an examination of these industries helps analyze some of the factors that affected Canadian manufacturing in more detail and discuss some of the lessons that can be learnt. Each industry is discussed chronologically, along with the unique factors that affected it and is summarized within a framework. This allows later discussion of the dynamics of Canadian manufacturing over time in general within the overall product-process matrix and value chain frameworks.

Steel Industry

Steel processing and manufacturing was one of the emerging industries in Canada in the nineteenth century. As the home market was small, the steel industry was significantly impacted by the vagaries of British imports and American tariffs. For example, in 1872 the rise in an American tariff on a certain type of iron resulted in the shutdown of the plant at the Moistic Iron Company in Quebec due to low demand. The firm subsequently went into liquidation (Donald, 1915, p.47).

Nevertheless, by the latter half of the nineteenth century, Canada was producing a greater quantity of increasingly sophisticated finished steel goods used in manufacturing and transportation such as boilers, engines, springs, axles, tools, rivets, foundry iron works, forges, bolts and nuts (Day, 1864, p.179-85; *Canadian Mining Manual*, 1895, pp. 251-258).

An early integrated steel company in Canada, The Nova Scotia Forge Company was opened in 1872 in New Glasgow, to satisfy the demand for railway iron required for the building of the Intercontinental Railway. The availability of coal and ore in Atlantic Canada made Nova Scotia (NS) an ideal location (see Figure 1). In 1878, the plant moved to Trenton, NS to secure water and more room to expand. It was the first plant in North America to obtain coal from offshore sources (off the coast of Bell Island, Newfoundland, Figure 1) and had many Canadian technological ‘firsts’ (The Nova Scotia Steel and Coal Company, 1912, p. 9; Donald, 1915, p. 194). As one of the first Canadian steel producers, it improved its competitiveness emphasizing new product development using state-of-the-art machinery and processes (The Nova Scotia Steel and Coal Company, 1912, p. 6). It also developed export markets in Europe and America. As a company that forged steel parts, it initially imported purchased steel; later it not only manufactured steel but also mined its own ore, thus becoming an early example of vertical integration in Canadian industry. In 1882, a sister company was formed to produce steel from imported pig iron and scrap steel. In 1889, the two companies merged to form the Nova Scotia Steel and Forge Company. As it was still dependant upon outside sources for its pig iron, some directors of the company, along with others, founded the New Glasgow Iron, Coal and Railway Company in 1891 (a company that owned iron ore deposits and railways), to obtain a secure supply of ore. In 1896, the Nova Scotia Steel and Forge Company merged with New Glasgow and formed the Nova Scotia Steel Company. As coal is required to run iron producing furnaces, a few years later the merged company acquired the metallurgical coalfields owned by the General Mining Association of Sydney Mines, Cape Breton. The newly merged company became the Nova Scotia Steel and Coal Company. Thus, it became a self-contained steel company. By 1912, it employed 6000 people. In the same year, it further vertically integrated, forming the Eastern Car

Company to build railway cars in a plant close to the steel mill (Donald, 1915, p. 197). However in 1917 it was bought out by U.S interests, subsequently underwent mergers, and due to a variety of reasons such as poor demand, poor management and labour strife, ceased to exist by 1930 (<http://collections.ic.gc.ca/coal/history/tdominon.html>).

In general, it appears that the Canadian steel industry was lagging behind that of the U. S. in the nineteenth century (Donald, 1915, p. 64). This lag was due to an insufficient supply of good quality ore and fuel, a shortage of labour, a deficit of technical and managerial skills and experience, inadequate transportation facilities, a lack of capital, and a limited market due to the existence of tariffs.

In the early part of the twentieth century, Canadian iron and steel production increased substantially. In 1900, Canada produced only 0.2% of the world's pig iron and had no steel production. By 1912, Canada produced 1.3% and 1.5% of these products respectively (Donald, 1915, pp.193-4). The cities of Hamilton (see Figure 2) and Sault St. Marie (where Lake Superior and Lake Huron meet in Figure 1, but not labelled), in Ontario became important steel centres. This development could be attributed to the discovery of new ores, availability of capital, better transportation via rail, availability of labour, greater efficiency in production techniques, lowering of tariffs in foreign countries, and aggressive management. The decreases in protection against imports also appear to have forced Canadian manufacturers to become more efficient (Donald, 1915, p. 310). For most of the rest of the twentieth century, most Canadian steel manufacturers did well financially with strong (and mostly protected) markets.

Canadian steel makers had to become more innovative in the face of international competition starting in the 1980s. An important organization in Canadian steel manufacturing, Hamilton, Ontario based Dofasco, began business in 1912, as the Dominion Steel Casting Company. Starting as a foundry (particularly for rail cars), it expanded to produce different types of products and became an integrated steelmaker by the post war era installing blast furnaces and coke ovens

(www.dofasco.com). Thus it was another example of a steel maker that pursued vertical integration. In the late twentieth century, like many other North American steel makers that competed in a standardized high-volume steel market, Dofasco found itself being strongly challenged by companies in China, India and Brazil. Realizing that its current 'competing on cost' strategy (Porter's cost leadership (Porter, 1985)) was untenable, Dofasco then focused its strategy to one that focused on developing new and innovative products and customer solutions for high quality and specialized applications (product differentiation). This business strategy was called Solutions in Steel and focused on operational excellence, technology and innovation, and intimate customer relationships. The strategy also involved developing international joint ventures and partnerships to obtain new technology, as well as purchasing firms involved in innovative metal working technology. As a result, by 1999 Dofasco was the most profitable steel producer in North America. In 2000, it was ranked first in North America among thirty steel suppliers in an independent customer satisfaction survey and was rated one of the best Canadian companies to work for by *Report on Business Magazine*. In early 2006, it was acquired by Arcelor S.A. of Luxembourg.

Of course, Dofasco's transformation did not come without effort, resources, or pain. It spent considerable sums on research and development and facility upgrades. Its work force was reduced from about 13,000 to 7,000. Even while reducing its workforce, Dofasco recognized that highly skilled employees would be critical to success in such a strategy. This recognition was not new. Dofasco's long-term commitment to employee involvement is demonstrated in it being the first Canadian company to offer profit sharing to its employees in 1938. Thus, it invested in employees by training them in problem solving, manufacturing processes, and customer service. In addition, the company invested in health, safety and wellness in the workplace. In 2002, the National Quality Institute awarded Dofasco a Canadian Award for Excellence Healthy Workplace Trophy (DiGiacomo, 2002; www.nqi.com). Quality at Dofasco has meant paying attention to environmental concerns as well. In 2002, Dofasco's Hamilton facilities achieved ISO 14001 certification for environmental standards.

From the Hayes-Wheelwright product-process matrix perspective, it appears that in the early days of the industry, Canadian steel manufacturers generally operated in the low-volume, customized part of the matrix. By the early part of the twentieth century, operating in the high-volume standardized part of the matrix appeared to be viable for at least some manufacturers. Also at least some of these companies pursued vertical integration aggressively, thus getting involved in more of the value chain. However, by the turn of the twenty-first century, it appears that the industry may have come full circle. Successful companies such as Dofasco are again moving toward the lower volume customized part of the matrix, through providing smaller batches of customized products.

However, it would be misleading to directly compare the nineteenth and twenty-first century situations. In the early part of the nineteenth century, Canadian steel manufacturers were producing in low volume because of the restricted market size and lack of skilled labour rather than the need for value added customization. Therefore, from a value chain perspective, they were less value added, manufacturing basic everyday use material. As time went by, goods of increasing sophistication were produced by Canadian companies. The late twentieth and early twenty-first centuries have forced Canadian steel manufacturers to become even more value added. Companies from Brazil, India, and China have challenged the developed countries in the high volume standardized part of the market. Thus, companies like Dofasco have moved to the higher sophistication, customization, service, and quality part of the value chain.

Furniture

Small-scale manufacturing was as much a part of industrialization as were the mass production industries (Berg and Hudson, 1992; Sabel and Zeitlin, 1985; Scranton, 1997), not only in Canada but in the U.S. as well. Forster and Inwood (2003) analyzed the reasons for the existence of many successful small-scale furniture manufacturers in late nineteenth century Ontario. The furniture industry was a classic example of manufacturers being located close to markets, as finished products

were more expensive to transport than wood and other industry inputs. The Ontario economy was undergoing tremendous transformation during this period. The use of steam for rail and water transport was becoming popular (McCalla, 1993) and railways were expanding. As a result, transportation costs of both the raw materials and the finished products were decreasing rapidly (Cruikshank, 1987). This expanding and improving railway network allowed manufacturers to get their wood from further away (Forster and Inwood, 2003, p. 335) and obtain access to more distant geographical markets for finished goods. Some firms tended to specialize in one part of the manufacturing process but also could be linked with others via the use of the developing transportation network.

As the price of capital decreased, productivity-enhancing technologies became more affordable and were implemented. Furniture manufacturing also moved from water to steam power in the late nineteenth century and then to electric power in the early twentieth century. However, the use of assembly lines in the furniture industry appears not to have been widespread until the second half of the twentieth century (Pursell, 1995).

By the 1880s, the mechanization of the furniture industry provided an incentive for local industrialization. In south western Ontario, Guelph's Goldie and McCollough and the Cowan plant in Galt produced an array of machinery for the furniture industry (Robertson, 1986). It was claimed that the Canadian producers of this machinery were as good as the American ones (*Canadian Manufacturer*, 1894). The availability of workers paid less than in the U.S. allowed these smaller furniture manufacturers to survive, but the American market was still protected by high tariffs, making large-scale production infeasible in Canada.

This lack of a large market was further exacerbated by the fact that the furniture market tended to be highly customized, transportation costs for finished goods were high, and the Canadian population was rural and dispersed. Thus, mass manufacturing as described in Chandler (1994) was

very difficult in Canada during that period, with batch production and general purpose machinery being much more common (Forster and Inwood, 2003, p. 363).

Thus, at the turn of the twentieth century, most furniture manufacturers were still very small, unspecialized, unpowered industries which used hand tools and had a limited local distribution. Only a few high-volume goods such as church pews, chairs and desks were mass-produced using specialized labour (Forster and Inwood, 2003, p. 357). However, at times achieving economies of scale with a larger production volume often meant transporting the finished goods over longer distances to access the larger markets, thus offsetting the savings in manufacturing cost (Atack, 1987).

The furniture industry provides an example whereby a Canadian manufacturer in the second half of the twentieth century has found success through free trade, globalization, and custom made products (Davis et al., 2005). Palliser Furniture, which originated in 1944 as a woodworking shop in a Winnipeg basement, is Canada's largest furniture manufacturer employing about 5,000 people worldwide. It has suppliers on four continents, and factories in Canada, the U.S., Mexico, and Indonesia. Its Mexican location, while being low-cost, still has employees experienced in tanning, cutting, and sewing operations, skills valuable to Palliser. In 2000, it opened its first Asian factory in Indonesia to make use of the country's highly skilled labour force and its wood processing tradition. The factory produces wood components for furniture to be assembled in Winnipeg. With the ability to design, produce, and source in different parts of the globe, Palliser provides both inexpensive mass produced offerings and pricier customized goods. Also important is that with three plants in North America, it has the ability to juggle production between plants for the important North American market where it provides two- to four-week deliveries even on custom orders which its Asian competition providing cheaper furniture finds difficult to match.

Thus, compared to the steel industry, Canadian furniture manufacturers historically appear to have been slower in becoming more capital intensive and high volume due to the customized and

bulky nature of the product leading to markets being more local. Thus they tended to be in the customized part of the product-process matrix. They were able to move to high volume manufacturing only when a sizable available market, better transportation and the lowering of tariffs were present, which was well into the twentieth century. Furthermore, in the twenty-first century it appears that high volume standardized manufacturing will face stiff challenges from lower-cost manufacturers from abroad.

Clothing and Shoe Manufacturing

As clothes and shoes are a daily necessity, local industries developed early. Austin (1984) discusses the industry structure of Canadian garment manufacturing during the latter part of the nineteenth century and in the early part of the twentieth century. She found that the big textile mills of U.K. and New England supplied fabric to Canada, but demand was high enough that garment-related industries were among the earliest to develop and became one of Canada's largest employers (Bliss, 1987, p. 234).

Originally, the garment industry operated on a small scale with millers setting up operations to process wool that was spun at home. These millers expanded to organize spinning and weaving at their establishments. Most of the early woollen mills were set up in Ontario, west of Ottawa (Figure 1), where there was good sheep-raising country, skilled Scottish weavers, and good access to customers. In 1851, the first major company in that region that made the transition from milling to manufacturing and employed fifteen people was founded (Bliss, 1987, p. 235).

Entrepreneurs also tried cotton production at this time but had to import their raw cotton, primarily from the U.S. Unfortunately, none of the early cotton mills proved to be very successful until the outbreak of the American Civil War in 1861 when an increased demand for Canada's cheaper, but lower quality cottons arose.

Any tailor could become a clothing manufacturer, without mechanization, simply by expanding production. The sewing machine was introduced in the 1840s, although most households could not afford one. Some clothing could be made at home by hand, typically by women, but some kinds of shirts, hats, heavy coats for the cold winters, gloves, and fine garments were not easy to make this way. By the mid-1850s, large-scale clothing manufacturing companies were typically located in Montreal with one factory employing eight hundred people (Bliss, 1987, p. 236). However, the sewn-garment industry generally consisted of many different companies with smaller production levels because of the ease of entry into the industry. The invention and introduction of knitting machines in the 1860s made it economical for some manufacturers to start producing large quantities of underwear, stockings, scarves and other woollen items in knitting mills in large quantities.

In contrast, ordinary boots and shoes were not easy to make at home. Skilled cobblers and shoemakers did custom work, but production levels were low and prices were relatively high. As a result, even tanners made boots and shoes, often along with saddles and harnesses. This situation changed in the 1850s when sole-sewing machines made it efficient to concentrate shoe manufacturing in steam-driven factories. By the 1860s, there were five major shoe manufacturers located in Montreal that produced the majority of the footwear sold in Canada.

At the turn of the twentieth century, Canada's textile industry, mostly situated around Montreal, was behind its U.K. and U.S. counterparts (Austin, 1986). The Canadian industry started decades later than in the U.K. and U.S. and was not as innovative, since machinery could be obtained from these two countries. As in other industries, the Canadian market was protected by tariffs. The slow growth of the domestic population, however, resulted in these companies not being able to expand, since foreign markets did not exist. Managerial issues included a lack of skilled workers due to a lack of technical education available. Therefore skilled workers had to be imported from the U.K. or U.S.

Structurally, the Canadian mills used British machinery (reputed to be superior) but utilized the American mills' integrated production process. British mills generally tended not to be integrated, and different companies would do the spinning, weaving and finishing aspects of cloth production. This strategy allowed each company to produce a wide variety of goods for the world market in its respective specializations such as spinning. In contrast, American firms generally used an integrated process where spinning, weaving, and finishing was done by one factory. This process allowed for economies of scale but not for flexibility in terms of product range within each facility. As Canadian firms had a limited market, they tended to concentrate on using a few lower grades of cloth (cotton primarily from the southern U.S. or locally produced wool) requiring less skill to work with. Thus, an integrated process (the American model) with some economies of scale was suitable for Canadian firms (Austin, 1986).

The situation with the manufacturing of footwear was similar to that of textile manufacturing. Even as late as 1920, shoe and boot manufacturers had the disadvantages of a small market. As discussed earlier, having Canada's population dispersed throughout distinct geographical and economic environments, with a resulting diversity of ethnicity and culture, created several small and "niche" markets with different needs and tastes. This lack of economies of scale would have prevented Canadian manufacturers from investing in better equipment, thereby putting them at a competitive disadvantage from a U.S. or U.K. perspective (Burgess, 1977). Shoe and boot manufacturers were trying to satisfy all needs and tastes and were failing as a result. This failure was clearly illustrated in a survey by the Canadian Reconstruction Association that was presented to the Shoe Manufacturers' Association of Canada (1920), where they stated:

"The United States' average on this basis appears to be about 667 pairs per day, per factory, as compared with an average production per day, per factory in Canada of about 354.

When distributed over the larger output, overhead expenses per unit are less there. Moreover,

the United States offers a much wider market to the manufacturers, and costs of distribution in general are somewhat smaller than in this country.”

As a result, manufacturers like Kodiak, founded in 1912, achieved success through specialization in winter and working boots (www.kodiakboots.com).

For much of the twentieth century, Canada protected the textile and shoe industries with high tariffs. However, with the reduction and removal of tariffs in the later part of the twentieth century, Canadian manufacturers have been under increasing pressure from countries with lower labour costs, primarily in Asia.

Clothing, like furniture, is an industry that depends on the individual tastes of consumers and is also affected by aspects such as the climate. However unlike furniture it is not bulky and thus can be shipped to distant markets. Also it is a more of a necessity and is less durable. Thus compared to furniture manufacturing, the textile industry moved away from the custom end of the product-process matrix to high volume manufacturing earlier presumably due to the higher demand and the availability of technology. From a value chain perspective, it appears that Canadian clothing manufacturers were less value added concentrating on a few lower grades of cloth and other standard items of clothing.

Like steel and furniture, the clothing industry has been challenged by foreign low cost manufacturing countries in recent years. Thus successful Canadian clothing manufacturers such as Gildan (a well known Montreal based manufacturer and marketer of sports apparel) have moved much of their mass production to lower cost countries. In Gildan’s case, the low cost base is Central America and the Caribbean, with only shorter run, higher value added apparel product lines remaining in Canada (www.gildan.com, press release dated February 1, 2005).

Carriage and Automobile Manufacturing

When the McLaughlin Company initially started assembling carriages in the 1860s, the company imported most parts from the U.S. Unhappy with the quality of the parts, the McLaughlin Company focused on building a better carriage (Robertson, 1995, p. 67). They patented some improvements in 1880 and what initially operated as a local Toronto company started to receive orders from outside Ontario, especially from the expanding West. By the turn of the century, it had branch offices in Saint John, Montreal and Winnipeg. Thus, it became an early example of a product sold nationwide through agents. Like other Canadian industries in the 1890s, McLaughlin had American competitors, such as H.H. Babcock in Watertown, New York, that were “bigger and more up-to-date” (Robertson, 1995, p. 81). However, as the Canadian carriage market was protected by tariffs, McLaughlin was protected from competition. Around the turn of the century, the McLaughlin family, who had by then had the largest carriage manufacturing business in the British Empire, formed the McLaughlin Motor Car Company and started assembling motors cars in partnership with Buick of the U.S. This company became General Motors of Canada in 1918 (Wahl, 2003).

Also in the early 1900s, a group of Ontario investors purchased a 49% interest in the Ford Motor Company of Canada and began assembling cars near Windsor, Ontario from parts imported from Ford’s factory in Detroit (Robertson, 1995, p. 93). The customs duty was less on imported parts than on fully assembled vehicles (Robertson, 1995, p. 113). In fact, Ford later exported Canadian built cars to the U.K., Australia and other parts of the British Empire at preferred tariff rates. However, this advantage proved short lived because as soon as the volume in those countries justified it, Ford built local factories in those countries.

CCM, today known for sporting equipment, produced automobiles in its early years (Holloway, 2003). The company began in 1899 as the Canada Cycle and Motor Co. Ltd. (an amalgamation of the bicycle business of Massey-Harris and four other small manufacturers unable to compete against U.S. imports) producing bicycles and the first true Canadian car in 1903. However,

the economics of the automobile industry proved too much for it and the business was sold in 1915 (it continued with bicycle production until 1983). In 1905, it entered the skate business and within a few years, it had supplanted Swiss and German skates as the Canada's choice for skates.

Today, there is no Canadian automobile assembly factory that is not a subsidiary of a foreign automaker – typically American or Japanese. Interestingly though, Ontario assembled 2.7 million vehicles in 2004, surpassing Michigan and making it the largest automobile producing state or province in North America (Hakim, 2004; Keenan, 2005a). Ontario also has a strong domestic auto parts sector. Magna is the leader of parts manufacturing in Canada as well as a global company. The industry is located primarily in south western Ontario in the Windsor to Toronto corridor (Figure 2).

Part of the advantage that Canada has had over the U.S. in the twentieth century is that companies in Canada did not face the ever increasing cost of health care premiums, as health care is socialized in Canada in a manner similar to Western Europe. However, it is clear that Canadian auto plants compete on other dimensions such as quality and productivity, as evidenced by the fact that in November 2003 Toyota's plant in Cambridge, Ontario became the first plant outside Japan to produce the Lexus RX330 luxury brand sport utility vehicle (Anonymous, 2003). Further, Toyota is building a new automobile assembly plant in Woodstock, Ontario with a planned annual capacity of 200,000 vehicles (Keenan, 2005b).

Thus, the automobile industry provides an interesting example. It is a newer industry than the others studied in this paper, just a century old. Manufacturers moved to the high volume end of the product-process matrix early in the product life cycle. No Canadian automobile manufacturer was able to survive in this industry. However, due to free trade, productivity, health care benefits advantages and, at times, favourable exchange rates, the automobile assembly industry is strong in Ontario. Thus it is one industry where high volume manufacturing is still viable in Canada. Further, these foreign assembly plants have spawned many Canadian owned parts manufacturers such as Magna which have become global companies themselves. These firms include high volume

manufacturers that have become more sophisticated in the value chain by taking on more complex work. For example, in 2002 Intier Automotive of Newmarket, Ontario not only received a contract to supply interiors for the next generation of small cars for General Motors, but it also was able to manage the design and development of the interiors (Keenan, 2002).

The four industries discussed illustrate the dynamics of Canadian manufacturing. In the nineteenth century in general, it appears that high-volume manufacturing was not feasible for Canadian companies. They had to operate in the low-volume customized end of the Hayes-Wheelwright product-process matrix. There were a variety of reasons for this. First, the population was too small and too spread out to justify high-volume manufacturing. Regional conditions impacted the different needs of the customers (who were few in number to begin with). This situation dictated smaller batches. Second, the existence of tariffs made exporting to the U.S. or Europe difficult. Third, the lack of good transportation methods dictated that factories had to be local to avoid long lead times and high costs. From a value chain perspective though, it did not appear that Canadian manufacturers were producing sophisticated goods. Rather, they produced standard goods but in lower volume due to small markets and possibly the lack of skilled labour.

In the twentieth century, Canadian companies became more successful with mass manufacturing (in the assembly line portion of the Hayes-Wheelwright matrix), given the growth in population, better transportation, wars, and new markets created by free trade. However, by the late twentieth century, as in other developed countries, mass manufacturing has been challenged by the emergence of lower cost manufacturing countries, primarily in East Asia. This challenge has resulted in Canadian companies moving away from high volume standardized manufacturing back to lower volume, customized higher quality manufacturing where labour cost is less of an issue. Compared to the nineteenth century however, this lower volume manufacturing has been accompanied by the corresponding move in the value chain to provide more sophisticated products. Where mass manufacturing is still employed, it also appears to be in more sophisticated products such as

automobiles or aircraft manufacturing. These companies have also developed export markets to justify their high volumes. This move to higher end manufacturing has been facilitated by the pool of skilled labour generated by Canadian universities and technical colleges as well as immigration. Some companies have prospered by acquiring or opening facilities in low labour cost countries to maintain mass manufacturing and only producing higher value added, customized products in Canada. However, as Martin and Porter (2001) report, this movement in the value chain may need to be more pervasive in Canadian manufacturing.

Factors that Affected the Growth of Manufacturing in Canada

Supporting Infrastructure Industries

a) Railways

Railway transportation was an integral aspect of manufacturing development. The laying of a railway line contributed to a place becoming a preferred manufacturing location, as the line provided that hub with cheaper access to larger geographical markets. For example, the arrival of the railways helped the Eastern Townships of Quebec prosper as a manufacturing centre. The railways also contributed to manufacturing themselves by operating large manufacturing and repair shops (Traves and Craven, 1983).

Before Confederation in 1867, railway construction proceeded slowly in Canada. By 1850, the United States had 9000 miles of track while Canada had only 66 miles (Pomfret, 1981, p. 99). This low track mileage was due to the availability of waterways and a lack of government subsidies. After Confederation, the government's desire to unify the nation resulted in subsidies for extensive rail construction and contributed to the economic development of the country (Pomfret, 1981, p. 110). In 1880 the Canadian Pacific Railway (CPR) was formed to build the line to British Columbia and land and subsidies were obtained from the government. However, financing such a risky venture proved to be a problem. British financiers, who supported railway ventures all over the world, found it too risky. Eventually, support was obtained from New York financiers (Bliss, 1987, pp. 214-215).

The completion of the line to Vancouver in 1885, along with the existing eastern railways, signified the unification of the country from the Atlantic to the Pacific. At completion the CPR was the longest railway in the world, until the Trans-Siberian railway was finished in 1916. Similar to other Canadian endeavors, the railway depended heavily on American financing and skill: “It was a great Canadian national highway, financed, built, and owned by Americans” (Bliss, 1987, p. 219).

The railway companies, and particularly the CPR, took advantage of the monopoly granted to them by the government in exchange for the risky undertaking of building the rail network throughout Canada. This monopoly was rescinded in 1888 in exchange for a loan from the government, but the other railways that were now allowed to build preferred to fix rates rather than have a price war (Pomfret, 1981, p. 108). The prices charged to Canadian manufacturers for transportation were much higher in Canada than the U.S. These prices reduced the competitiveness and the development of Canadian manufacturing and agriculture (Naylor, 1975, Vol 2, p. 27) and led to charges of freight discrimination against Canadians, especially given the government subsidies offered to the railways.

Freight discrimination that existed within the country also had an effect on industrial location. For example, freight discrimination against Edmonton in favor of Calgary resulted in the latter becoming a more favoured distribution centre in the West for eastern businesses (Royal Commission, 1902) and Calgary remains Western Canada’s distribution hub.

Railways like the CPR and CN were crucial for the development of Canada as a nation and of a viable market for goods manufactured in Central Canada. They also helped the population boom in the Canadian west. Before the CPR, few settlers made the arduous journey to the Canadian prairies from the northern U.S by river or by wagon. It is unclear whether the CPR or any other railway would have undertaken the financially risky and technically complex task of building a railway across thousands of miles of prairie and mountain ranges (the CPR had to do some innovative tunneling to cross the Rockies) without monopoly rights and subsidies. Had it not been for the CPR, western Canada “might have become northern trading extensions of Minnesota, Montana or California” (Bliss, 1987, p. 222). Today in the region of North America consisting of the northern U.S between

Minneapolis and Seattle and southern Canada west of Ontario, most manufacturing centres are Canadian. They include Winnipeg in Manitoba and Calgary and Edmonton in Alberta. This is arguably a testament to the influence of the railway in determining manufacturing locations historically.

In addition, the CPR was responsible for a major innovation in transportation with its development and introduction of intermodal transport in 1952 or 'piggyback'. This trailer (container)-on-flatcar service was designed to expedite the movement of goods by rail at truck rates by using transportation facilities more efficiently. It took four years for this unique Canadian innovation to be adopted coast to coast in the U.S. (Hubbard, 1981).

Given Canada's vast geography and sparse population, the railway undoubtedly played an important role in the development of the country's manufacturing and logistics. Given the importance of the railway, it was not surprising that the government had to intervene occasionally to protect the interests of the country.

b) Electric Power

Canadian industry was helped by the development of electric power (Wylie, 1989). Canada had an abundance of hydroelectric power in the early 1900s (as it still does today), which provided a relative price advantage in relation to the U.S. that relied primarily on thermal based power. While steam had "liberated plants from the constraints of size, seasonality, and location associated with waterpower", purchased electric power allowed for even more increased productivity (Forster and Inwood, 2003, p. 348). First, purchased power allowed manufacturers to avoid buying expensive capital equipment for power generation as was true for steam power. Second, it allowed for a continuous or assembly line process and plant integration because the layout with electric power could be more efficient than with steam power, which had constrained bigger machines to be located close to boilers and engines. Finally, purchased power also allowed companies to invest in

productivity and quality enhancing equipment such as material handling equipment, electric welding and other processes.

The introduction of electric power in most Canadian provinces followed a similar pattern. In the late nineteenth century, entrepreneurs were developing small electrical systems primarily in large urban centers. Often, manufacturing companies would build their own power generators and sell surplus electricity to the surrounding communities. The supply of electricity evolved from many suppliers to a few monopolies to the eventual control of the industry by the governments of the provinces who viewed electricity as vital to economic growth. Also with the development of better technology over time that allowed electricity transmission over long distances with lower losses, the need for locating factories close to generating stations decreased. Thus factories could be more optimally located from a supply chain perspective.

In central and eastern Canada, as well as in Manitoba and British Columbia, water, in the form of hydroelectricity, was the primary source of this power. The use of hydroelectric power is still dominant in these regions, as it is one of the cheapest forms of energy. Over 60% of the electricity produced in Canada is from hydroelectric plants (www.energy.gov.ab.ca). Each province has its own mix of generation methods with coal-fired plants and natural gas the dominant supply source in Alberta and Saskatchewan.

Between 1900 and 1926, the value of Canadian electrical production increased more than five fold (Urquhart, 1986), partly in response to the availability of power and the ability to supply large scale manufacturing. Unfortunately, there were overcapacity issues during the 1930s because of the drop in demand during the depression.

Power was initially limited to the cities and surrounding communities where the population density made distribution more economical and thus manufacturing facilities chose to locate in or near the major cities. It was not until the 1920s and as late as the 1950s that rural areas were serviced through a government mandate or the formation of government utilities (www.hydroquebec.com; www.hydroonenetworks.com; Baker, 1990). This resulted in a delay in rural areas of the adoption of efficient agriculture technology.

By the late 1990s, the North American electricity market became more competitive. Wholesale and retail electricity markets became open, with consumers and manufacturers having a choice of suppliers. There is conflicting evidence whether this has resulted in lower energy prices for companies and consumers (Daniel et al., 2002). Electricity is unlike most consumer goods because it has no shelf life. Electricity is produced in real time as customers demand it. Given that the Canadian and U.S. transmission networks are now mostly integrated, it is imperative that manufacturers today have a reliable source of power since they tend to keep low product inventories and rely on timely electricity supplies. The impact of this was evident in the blackout of 2003 affecting Central Canada and the U.S. Midwest.

Direct Foreign Investment and Innovation

A third factor which has had a sustained effect upon the growth of Canadian manufacturing is direct foreign investment (DFI), mostly by the U.S. According to Pomfret, “Canadian industry is characterized by a degree of foreign ownership unmatched among major economic powers,” (1981, p. 140). The first U.S. branch plant was established in Oshawa, Ontario in 1860 for agricultural implements. The first U.S. DFIs were generally concentrated in resource industries such as mining, pulp and paper, and hydroelectric power. By the turn of the twentieth century, American investment in manufacturing industries became more important than that in resource-based industries and investment in manufacturing expanded rapidly. By 1926, the U.S replaced the U.K. as Canada’s

largest trading partner (Bliss, 1987, p. 400). Naylor attributes the DFI phenomenon to high import tariffs and patent protection (1975, Vol. 2, pp. 38-62). Before Confederation in 1867, Canadian patent laws were lax. This laxity caused much concern among American manufacturers who had their technology stolen (Naylor, 1975, Vol. 2, p. 40). In 1872, patents laws were strengthened but required Canadian patent holders to start manufacturing in Canada within two years to retain the patent. This motivated American firms seeking patents to start manufacturing in Canada. Further, in 1879 the Canadian government increased import tariffs considerably after a prolonged five-year recession. These tariffs gave American firms another incentive to set up branch plants in Canada. However, Pomfret (1981, p. 141) points out that the surge in DFI occurred after 1900. This increase indicates that other factors were also important for DFI, such as the investment of American firms in Canada as part of their natural expansion into nearby markets (Wilkins, 1970; Aitken, 1961). This view is supported by the fact that, at the same time, Americans were also expanding investment into Mexico. As well, British investment in Canada was concentrated in western Canada (Paterson, 1976), while the Americans seem to have concentrated in central Canada. This lends credence to the ‘natural expansion into markets close to the U.S. industrial heartland’ view. A further possible incentive was that American firms could form cartels for export to other parts of the world through their Canadian operations, whereas U.S. antitrust legislation prevented them from forming cartels in the U.S. Additionally, Canadian subsidiaries of American plants had preferential access to the British Empire markets. This access was seen in the Ford example where they produced American cars in their branch plant in Canada for export using Canada’s preferential access to British Empire markets (Pomfret, 1981, p. 141).

Branch plants of prominent American firms (including joint ventures or licensing arrangements) could be found in rubber, transportation, machinery, telecommunication, electrical, and utility industries. The depth of the DFI represented “a form of industrial dependence and a stifling of indigenous innovative capacity. The greater the success achieved in introducing American

technology, the poorer became the record of Canadian achievements” (Naylor, 1975, Vol 2, p. 62). This assertion was supported by a report in Toronto’s *Financial Post* on June 3, 1927, which argued that until World War I, no industrial research was done in Canada. In 1914, more than half the patents issued in Canada were held by U.S. residents, 30% by other foreign residents, and only 14% by Canadian residents (Naylor, 1975, Vol. 2, p. 46). In 1919, only 40% of new machinery for industrial plants was Canadian in origin and much of this was produced under license from U.S. firms (Williams, 1982, p. 25). DFI was not limited to U.S. companies. SKF, the Swedish ball bearing company established a Canadian subsidiary as early as 1917.

Further anecdotal evidence of the lack of innovation can be found in the case of the GM Canada. In the 1920s, the McLaughlin’s approached GM to set up research facilities in Canada but were rebuffed, as Canada was considered a ‘rustic backwater’ (Robertson, 1995, p. 213). However, GM Canada was building custom styled McLaughlin-Buicks for British royalty such as the Prince of Wales that American designers could not match (Robertson, 1995, p. 214) indicating success in designing for a niche market. Naylor’s view that there was little innovation appears different from that of Wylie (1990) and Bliss (1987) who contend that there was technological adaptation in Canada, which Wylie deemed innovation. According to Wylie, “Manufacturing should be counted as one of the successes of Canadian economic development, taking its place alongside the agricultural, mining, and forestry sectors” (1989). On the positive side, as mentioned earlier, the foreign owned automobile assembly plants in Canada have spawned many locally owned suppliers.

One example of a U.S. DFI that has become a recent Canadian success story is that of Toronto based Celestica. Originally set up as an IBM subsidiary it was acquired by Canadian conglomerate Onex Corporation in 1996. Today it is one of the global leaders in electronic manufacturing services (EMS) and has locations in 19 countries (www.celestica.com).

Lack of Skilled Labour

A further factor that might have contributed to repress Canadian innovation was the lack of skilled personnel. As early as 1882, the Canadian Manufacturer's Association warned about the lack of availability of technical education but to no avail (*Canadian Manufacturer*, 1882). By 1913, the Royal Commission on Industrial Training and Technical Education (Royal Commission, 1913, p. 2126) reported that there was a chronic shortage of skilled personnel in virtually every major industry. The Canadian higher education system favoured professional education over technical and vocational training, leading to a glut of doctors, lawyers, and clergyman while there was a shortage of technically skilled personnel (Naylor, 1975, Vol. 2, p. 57). At the same time, the United States was producing many technically skilled people through their higher education system. Canada was slow to respond to the report, with the largest polytechnic school in the country finally opening in Toronto, Ontario in 1948 as Ryerson Institute of Technology, now Ryerson University.

Manufacturing in Canada Today

While many Canadian companies have not been able to survive in this era of free trade and have either been acquired by foreign companies or ceased operation, others have prospered in many different industries and niche markets.

There are various recent examples of Canadian manufacturing successes from across the country. This includes Montreal's Bombardier, a manufacturer of commuter aircraft, railway transportation, and until recent divestiture, in water and snow recreational equipment. There is also Winnipeg's Standard Aero, one of the world's largest independent operators of small gas turbine engine repair and overhaul facilities. These are among the world leaders in their respective fields. They have manufacturing facilities in different countries including the U.S. Magna, based near Toronto, is in the auto-parts industry. It has over 75,000 employees, over two hundred manufacturing divisions and nearly fifty product development and engineering centres around the world. In

addition, it is also a leader in automotive supply chain management ([www. magna.com](http://www.magna.com), Keenan, 2004).

Potash Corp. began in 1975 as an entity owned by the Province of Saskatchewan, (a Crown Corporation) and became a publicly traded company in 1989. Currently, it is the world's largest integrated producer of nitrogen, phosphate and potash for fertilizer production with operations in Canada, U.S., Brazil, Trinidad and Jordan (www.potashcorp.com). McCain's in the province of New Brunswick is a global food processor with more than 55 production facilities on six continents (www.mccain.com). What these organizations have in common in managing processes is that, like their international competitors, they follow world class manufacturing principles such as Just-In-Time/Lean Manufacturing, Six Sigma, and Total Quality Management. One example of a Canadian company that considered the environmental impact of operations nearly a century ago is INCO. By the early twentieth century, INCO was becoming one of the world's premier mining and metals companies. Being concerned about the environmental impact of its business, in 1917 it established its first environmental project, Nickel Park, in Copper Cliff, Ontario where seedlings were planted (Industry Canada, 2004).

A comprehensive list of important Canadian companies can be found in the 75th anniversary publications of *Canadian Business* in 2004 and consists of what the magazine considers the best 75 Canadian companies of all time (manufacturing and non-manufacturing). It is based on the opinions of a number of industry experts and business historians from different Canadian universities. Nevertheless, as we see in the next section, more may need to be done to increase the competitiveness of Canadian manufacturing.

Porter's Study on Canadian Competitiveness and its Follow-up

In 1991, The Canadian Business Council on National Issues and the Canadian Government commissioned Michael Porter and the Monitor Company to study Canadian products and their place in a globally competitive world. In their report (Porter, 1992), the authors stated that Canada was overly dependant on resource based industries and the U.S. economy. They contend the problem with this dependence is that other countries with similar stocks of natural resources but lower labour costs or more efficient automated methods will eventually out-compete Canadian raw material exports. Also, the extraction of natural resources will become far more expensive as the deposits of these resources become more remote and the labour required to operate the antiquated extraction systems becomes more expensive. This concern was not new; the Canadian Manufacturer's Association in 1920 and the Royal Commission on Canada's Economic Prospects in 1957 had expressed similar concerns. Other problems identified included complacency, the lack of productivity, lack of a climate of competition, and a lack of interest in creating greater wealth. Also protectionism and government safety nets were identified as inhibiting growth. According to Porter when firms cannot afford to continue operations in Canada, they will relocate to other countries. Relocation can also limit the pool of expertise from which Canadian industries can draw, because these companies not only take away the jobs they once offered, but also remove valuable skills and expertise. However, Porter also noted that in the 1970s, when many Canadian manufacturers faced similar challenges they had responded successfully by becoming more customized.

In the intervening years since the report, how have Canadian firms responded to Porter's challenge? Based on a follow up report by Martin and Porter (2001) it appears that in general, Canadian firms continue to sacrifice global competitive position. This can be attributed partly to the lack of university research spending and partly to lagging firm spending. Overall, Canada's investment in R&D as a percent of GDP, which was low in 1991, remains low. The report noted that

Canada trailed five of seven G-7 countries and trails many other industrialized countries such as Sweden, Korea, Israel, Singapore and Australia.

It also appears that any loss of protectionist policy or economic assistance did not encourage change, but rather brought about an increased reliance on a weak economy, the resulting low dollar, and government interference to avoid direct competition with global markets to attract customers to its exports. This left Canadian firms with smaller machines, lower labour productivity and lower capital spending compared to their international competitors

Though the Canadian dollar has rebounded strongly since 2004 (usually an incentive for exporters to increase productivity to combat the increased currency value), the booming energy and commodity exports appear to have dulled the need for change (Stanford, 2004). Relative to GDP, Canada's exports of higher value-added merchandise (including machinery and equipment, automotive products, and consumer goods) appear to have declined sharply since 1999 (Stanford). Stanford's observations illustrate the tendency of manufacturers to move their operational focus backwards in their industries' value chains, away from the more advisable strategy of exporting finished products, towards less refined raw materials, components or commodities, because of high resource prices. It also shows that while there are bright spots in some sectors as evidenced by the fact that in 2003 Canada ranked second in the world behind the U.S. in terms of the number of biotech companies (O'Brien, 2003), despite the obvious need to innovate in response to changing economic and political climates, a culture of complacency still exists in Canadian firms.

Conclusion

Very few studies have examined the history of Canadian manufacturing. Largely, they have concentrated on the economic development of Canada in general or have focussed on one industry. This article has concentrated on the major developments in manufacturing in Canada in the past two centuries in a range of industries.

Manufacturing could not have developed on any scale in Canada without the development of a good transportation network, primarily railways. This development happened in the second half of the nineteenth century. In addition, the population of Canada was small and geographically spread out, which made large-scale manufacturing uneconomical. Often, these industries had to be protected by tariffs, and the resulting inefficiencies and higher costs were passed onto consumers. Capital was also often scarce.

The Canadian manufacturing economy was also subject to the vagaries of British and U.S government policy such as preferential access to their markets. This is true even today, despite NAFTA, as the Canadian and U.S. governments disagree on the nature of subsidies provided for products such as softwood lumber.

Wars on foreign soil also helped Canada economically. At the same time, Canada has not had a domestic war for almost two centuries. The Civil War in U.S. and the two world wars resulted in increased demands for Canadian manufactured products and the positive economic effects of these were felt even after the wars ended.

The Canadian economy has always been closely tied to that of the U.S., given that the U.S. was, and continues to be, the largest market for Canadian exports. American skilled immigration, technology, and capital were important to the development of Canadian manufacturing. The growth of the population in the U.S. with resulting demand increases also helped Canadian manufacturers.

Foreign investment in Canada, primarily from the U.S., stimulated much of the development in manufacturing facilities and capacity but perhaps hindered innovation.

The location of manufacturing facilities was also dependent on the type of product manufactured and the availability of transportation. In addition, technological innovations such as steam and electricity introduced flexibility in the location and layout of manufacturing facilities. The influence of these factors was not unique to Canadian manufacturing, however.

Education was also important and Canada's lag, particularly in technical education, resulted in many firms being owned and operated by foreigners, mostly Americans. American investment continued in the 1900s with the change in patent rules and the growth of Direct Foreign Investment incentives. Today, there is recognition of the need for continuous learning in the information economy. For example, an Angus Reid survey in 1997 found 66% of Canadian employees surveyed had taken at least one skills upgrading course within the past year (Angus Reid, 1997).

Manufacturers in Canada have also historically faced some of the same issues that manufacturers everywhere face today such as the extent of vertical integration, supply chain redesign, incorporation of new technology, managing product life cycles and business cycles and disruptions in supply. Though it seems a contemporary problem, Canadian firms' focus in the value chain, on raw materials rather than finished goods has been a relevant and noticeable problem throughout its history. This fact was recognized again more recently by Porter (1992), by Martin and Porter (2001), and by the Alberta Government (in an interview with the Canadian Broadcasting Corporation News, Calgary, April 21, 2004) where the government expressed a preference for exporting processed meat as opposed to live cattle, and processed food as opposed to grain. The advantage of value added manufacturing in the meat industry was clearly illustrated in 2003 when the U.S. closed its market to Canadian cattle in May when a cow infected with BSE (mad cow disease) was detected in Alberta. Though the market ban on processed beef was lifted after a few months, opening the market for live cattle took more than two years and the demand has still not recovered completely. At the same time,

Canadian processed meat producers such as Maple Leaf Foods have been in the forefront of implementing Six Sigma, indicating the use of state-of-the art manufacturing management techniques in industries not generally known for innovation.

In the future just as Canada moved from mass manufacturing to customized manufacturing in industries such as steel, furniture and clothing, it may need to do the same in emerging industries such as biotechnology or other sophisticated industries such as aircraft manufacturing. As low cost countries such as Brazil (whose Embraer competes with Bombardier in the commuter aircraft industry) or China or India develop their capabilities in these industries Canadian firms may have to move to more value added manufacturing leaving low cost production to other countries.

The end of the twentieth century saw freer trade between Canada and the U.S. and in the world in general. The resulting rationalization of manufacturing has meant that many Canadian branch plants have ceased operation, as companies instead consolidated North American production in the U.S. or Mexico. As seen in the auto industry, various Canadian governments have attempted to keep manufacturing facilities open (Tuck, 2003). On the other hand, free trade has provided many Canadian firms with the opportunity to grow beyond the limited domestic market and help the Canadian economy.

We have seen that, although innovation in Canada in general lagged behind the U.S. and European competitors, Canada did have some success stories in innovation. These successes extended to innovative workplace practices. For example Nova Scotian, Samuel Cunard, who founded the great ocean line company Cunard Lines in 1839, felt that if you picked your employees well, paid them well, and treated them well, they would return the favour with loyalty and pride (Franklin, 1967). These practices are those that JIT and leaders in operations and quality management like Deming advocated in the latter half of the twentieth century.

Though Canadian manufacturing has many challenges as mentioned in the Porter (1992), and Martin and Porter (2001) reports, many Canadian manufacturers operate today as competitive global

companies in the low or no tariffs free trade environment. In other cases, many Canadian manufacturers compete successfully in niche markets. Thriving Canadian companies naturally follow world class manufacturing management practices. The challenge for Canada today is to move from a resource-based manufacturing economy to a more value-added manufacturer of finished and consumer goods.

What might industries in other countries that are at a less developed industrial stage learn from the Canadian experience? Naturally, there were some unique aspects in the development of Canada as well as aspects that are common to developments in other countries. For example one of the unique aspects of manufacturing in Canada is the vast availability of resources. There is no doubt that its possession of immense natural resources has allowed Canada to benefit and survive economically. While resource-based industries are important to have, experts on competitiveness as well as industry and government officials today realize the risk in being too reliant on natural resources and not focusing on value added products even within these industries. Many of these industries have exhibited periodic problems that the government, through ongoing or special support programs has had to address. Even the perception of Canada as a resource-based economy has major implications on the exchange value of the Canadian dollar, something that industries are deeply concerned about. Agriculture, meat, petroleum, and minerals are subject to highly cyclical price fluctuations or the vagaries of weather. Poor management of fish stock has depleted the fisheries industry while the same thing can happen in forestry. While most other countries may not have the range or magnitude of resources that Canada has, the problems faced by these industries and Canada's response to it could be examined by other countries to better manage their resources.

On the other hand, aspects such as the ability to adopt technological developments from other countries (particularly the U.S.) has been a hallmark in the development of manufacturing in Canada as well as other countries. Many Canadian firms (as in the Dofasco example discussed earlier) use foreign technology obtained through licenses to develop their own products and market them. As the

Japanese have also shown, adapting foreign technology to further one's own industry can be an effective way to realize industrial growth. It is only when no adoption or improvement is made to the foreign technology over the long term that using this technology can be a disadvantage from an innovation perspective. As the example of the auto industry shows, it is possible to leverage DFI (foreign auto assembly plants) to build a strong and innovative supporting industry of domestic auto parts, some of which are global companies themselves now.

New technology has also come from attracting foreign immigrants (with a focus recently on skilled immigration). This is a factor that countries in the mid-stage, or even later stages, of development such as some of the members of European Union or Asia could focus on – retaining and attracting talent by making the quality of life for both residents and immigrants attractive. Modern amenities such as domestic appliances, indoor entertainment, satellite communication, automobiles, recreational facilities, and air travel have allowed Canada to overcome some of its historical disadvantages such as an inhospitable climate and sparse population. These amenities, along with its reputation for being clean and safe, have allowed Canada to propel itself to the top echelons of the United Nations' quality of life rankings and retaining this status will be important in attracting knowledgeable and skilled workers in manufacturing based industries.

Canada also has used export markets to alleviate the disadvantages of having a small and geographically dispersed population. The lesson for other developing countries with small populations appears to be that while protection in the initial stages can build up industries, in the long term, especially with the global movement towards free trade, opening export markets may be the better path to build an industrial base. While developing a major industry such as automobiles may be difficult, focusing on niche industries and value added products in those industries may be an appropriate strategy. A notable Canadian example of this was Massey-Ferguson who produced world-class agricultural equipment, winning awards for its products in Antwerp in Belgium, London, Paris, and Melbourne in Australia in the late 1800s (The Massey Harris Company, 1920). In the first

decade of the twentieth century, Massey-Ferguson accounted for 15% of Canada's manufactured export (Naylor, 1975, Vol. 2, p.50) and opened offices as far away as Argentina and Australia. However, in the latter half of the twentieth century, Massey-Ferguson had become less focused on agricultural implements thus leading to diseconomies of scale (Maule, 1969) and had inefficient operations (Schwartzman, 1970). As a result, the firm became less competitive and was purchased in 1993 by U.S.-based AGCO. Its demise thus illustrates the importance strategy and operations play in the success of companies.

Canada's experience suggests that it is important for governments to facilitate exports through physical infrastructure, trade missions, research and product development support, and export risk management. Canadian governments are increasingly giving R&D support and other benefits to attract and retain manufacturing. As well, providing physical infrastructure plays an important part in development. The lack of transportation was cited as impediment to the development of industry. On the other hand, the availability of cheaper electric power was an advantage that Canada had. Developing, and indeed even already developed countries, therefore need to build and maintain infrastructure if local industries are to remain competitive.

The Canadian experience has also shown that lack of education can hamper development through a shortage of employee skills. There is general recognition today that education will be critical to surviving in the knowledge based society where innovation, competitiveness, and quality are key success factors. Towards this end, governments (both federal and provincial) support employee skills upgrading, as well as research in the engineering and sciences, medicine, and social sciences. One of the federal research funding granting agencies, the Natural Sciences and Engineering Research Council of Canada (NSERC), considers plans for the training of 'highly qualified personnel' an important factor in its funding decisions. Further, industry-university collaboration in research is also taking on more importance (www.nserc.ca). The Canadian federal and provincial governments also encourage quality in the private, public, and education sectors through awards such

the Canadian Awards for Excellence (the Canadian equivalent of the Malcolm Baldrige Awards in the U.S.). These programs are worth being emulated by other countries.

One unique aspect of Canada's development has been its geographic location next to the mammoth U.S. economy. Given the size of the U.S. economy, it is not surprising that much of Canada's exports go to the U.S. While this pattern is a boon when the U.S. economy is doing well, such over-reliance has caused problems for Canadian industry in general during U.S. recessions or in particular industries when there have been retaliatory tariffs or other protectionist actions by the U.S. These actions may be based on real or perceived damages, depending on which side of the debate one is on. The recent softwood and mad cow disputes are good examples. Thus, there is recognition by governments, industry associations, and firms of the necessity to diversify by finding new export markets. However, diversification involves dealing with often very different ways of doing business as compared to the comfort of dealing with a culturally similar U.S. market. Perhaps a similar situation may be developing in countries surrounding China and India and to a lesser extent Brazil. These countries might look at Canada's experience vis-à-vis the U.S. (who have had much better neighbourly relations than those in Asia or Europe) in charting their strategies.

Thus, our paper describing the journey of Canadian manufacturing from its nascent stage over two centuries ago to its status as one of the G7 countries offers many lessons to various other countries around the globe who hope to be at such a level in the future.

This paper has been written from a historical perspective providing a framework based on information from various sources and anecdotal evidence. Future research could involve studies to validate this framework through empirical evidence, both through surveys and case studies. This type of research will help establish whether and to what extent Canadian manufacturers are thinking strategically within the product-process matrix and value chain perspective about competing in a global economy. Further studies can be done to establish the extent to which manufacturers have considered the concerns stated in the Porter (1992), and Martin and Porter (2001) reports. If there is a

lack strategic thinking within companies, research may help to address how this situation could be rectified. Studies could also be done to determine what strategies undertaken by Canadian companies and various Canadian governments and their agencies have been successful in the global marketplace, thus providing direction for others to follow.

Acknowledgement

The authors are thankful to Ms. Helena Nunes Duarte, Ms. Rebecca Knight, Mr. Larry Bates, and Dr. Linda Sprague, the Special Issue editor for their comments and suggestions. Dr. Ted Regehr, Dr. Edward Silver, Mr. Maurice Elliott and Mr. John Maker helped with an earlier version of this paper. The Natural Sciences and Engineering Research Council (NSERC) of Canada provided financial support.

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