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Profile of the

Automotive Sector

Prepared for the Expert Panel on Skills
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Canada

PROFILE OF THE AUTOMOTIVE SECTOR

Advisory Council on Science and Technology
Expert Panel on Skills

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Abstract

The automotive industry including vehicle assembly and parts production, is a key component of the Canadian economy, contributing about 12 percent of manufacturing gross domestic product (GDP), providing roughly 160 000 jobs (1997 figures) and generating a large surplus on international trade. The industry is the largest single destination of capital investment in plant and equipment in the total Canadian manufacturing sector.

The industry faces a number of challenges in coming years, including economic and market pressures resulting from the globalization of production, and technological issues from the need to reduce fuel consumption, vehicle weight and environmental impacts.

The industry is coping well with these economic and technological issues, and continues to grow, though it will need to address two challenges. The first is to retain its productivity and cost advantage in the assembly sector over U.S. production facilities that lead large auto makers to maintain high levels of investment in Canada. The second is to ensure that levels of design, research and development capability in the parts sector, especially the Tier 2 parts sector, are high enough to ensure a continuing flow of supply contracts from the Tier 1 companies and the major vehicle assemblers.

Both of these challenges require that the industry meet its critical skills needs. In the assembly sector and the larger parts companies the key issues are in design and research and development activities, and in dealing with impending shortages in a range of production-related specialties. This means replacing the large numbers of skilled workers and production specialists such as engineers who are likely to retire over the next two to seven years. For the smaller parts companies, the challenge is to maintain or raise the level of technological sophistication and design capability to ensure sustained sourcing opportunities with the assembly and larger parts companies, and position them to grow into complete system (Tier 1) suppliers.

Both industry and educational institutions have begun to fill these skills needs, with a range of co-op and full-time programs devoted to skilled trades and technologies as well as to managerial and related skills. Whether or not these initiatives will be sufficient to deal with the industry's human resource needs over the next decade remains to be seen.

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INDUSTRY SECTOR CHARACTERISTICS

The Challenge of the Future

The single most important factor affecting investment and jobs in this sector in recent years has been the industry's competitive advantage in terms of productivity, labour costs and quality. The industry has invested heavily in new equipment and processes in recent years, with the result that production facilities involved in vehicle assembly and the larger parts plants are regarded as significantly more productive than equivalent plants in the United States.

Recent estimates undertaken for the Automotive Competitiveness Review suggest that Canadian vehicle assembly plants enjoy a 25 to 30 percent advantage in terms of labour costs. This advantage is attributed to higher productivity, lower wage costs, and factors such as medicare and other social programs that allow companies to socialize employee benefit costs.[1]

Cost-related issues such as these will continue to affect investment decisions in coming years. Measures to ensure that the industry retains its overall cost advantage will be key to its ability to thrive. This is particularly true in a knowledge-based economy, where human capital, innovation, and the continuous development and diffusion of technology are critical to maintaining competitiveness.

Economic and Market Pressures

Globalization means that an increasing proportion of automobile, truck and bus production, including parts, is undertaken through international trade channels. Most large auto, truck and bus companies now produce several lines of "world vehicle" that involve common platforms with internationally sourced components. This further contributes to the rationalization of both assemblers and suppliers, and transforms the relationships among them. As a result, in all segments of the industry, there is significant pressure to lower costs while ensuring quality This pressure is particularly acute for parts suppliers who must compete with offshore suppliers not only in the Canadian market, but also in markets abroad, as assemblers increasingly look to Tier 1 suppliers to follow them as they build facilities in developing markets.

[1] Of the 10 most efficient car assembly plants in North America, in terms of the hours of labour needed to assemble a car, four are in Canada (ranked second, fifth, seventh and tenth). Of the 10 most efficient truck assembly plants (which includes pickups, sport utility vehicles and minivans), one is in Canada, ranked 10th. It should be noted that labour productivity is a result of a combination of factors, including efficiency of the capital used in the process. On average, labour costs in North America are 15 to 20 percent of the overall cost of producing a vehicle. (Source: *Harbour Report*, 1998.)

Global over-capacity in auto assembly may result in further plant closures in the next few years, particularly in North America. Major mergers among auto makers are already influencing how the industry responds to over-capacity and the ongoing battle for market share.

Cost pressures are also driving the changing relationships among vehicle makers and their suppliers. These changes include more outsourcing, a move to modular assembly plants that integrate system suppliers into the assembly line, and more research and design work being shifted to major (Tier 1) parts suppliers, resulting in mergers and consolidation. This may have an impact on skills needs in the parts sector as more technological demands are being placed on both Tier 1 and Tier 2 suppliers.

As a result of consolidation, Canadian-owned parts companies, especially Tier 2 (smaller) suppliers, will feel more intense competitive pressures, for example, when merged Tier 1 companies must rationalize their combined supplier bases to retain only the best companies.

Canada's bus-making sector is affected by declining ridership, production over-capacity, an ageing population, new government regulations and decreasing government funding; all contribute to a reduced demand for urban transit and standard school buses.

The urban bus market is in a more rapid transition to new (low floor) bus designs than originally anticipated. New bus designs will feature the extensive use of advanced materials, as manufacturers try to increase the durability of their products, reduce weight to meet stricter emissions standards and reduce total expenses over the life cycle of the vehicle.

Regulatory and Environmental Issues

The Kyoto Protocol to the UN Framework Convention on Climate Change, which obligates Canada and other nations to reduce greenhouse gas emissions significantly by 2010, presents further challenges and opportunities for the industry. Climate change commitments will continue to be significant drivers of government science and technology policy as well as industry research and development (R&D) efforts, particularly with respect to the development of environmentally sustainable technologies. For example, Canada's leadership in hydrogen fuel- cell technology is setting the standard for clean propulsion systems of the future, and could position Canada to capture a substantial portion of the world market.

There are continuing pressures to reduce fuel consumption for economic and environmental reasons. The Clean Car initiative in the United States, in which most major vehicle and parts companies participate, has a goal of achieving fuel economies that are three to four times as low as current levels. This will mean new electronics, new powertrains, new materials, new production processes and equipment. Some Canadian parts companies are involved, but smaller companies may lose out as a result of these kinds of initiatives.

Safety and emission standards are harmonized between Canada and the United States, but still present a problem for exports to non-NAFTA (North American Free Trade Agreement) countries. The Automotive Dialogue has been established under the Asia-Pacific Economic Cooperation (APEC)'s voluntary sectoral liberalization initiative. One of the objectives of the Automotive Dialogue is the harmonization of standards and regulations among APEC economies. Canada is also actively pursuing agreement on global technical regulations through the United Nations Economic Commission for Europe, Working Party 29.

The plastics industry is expected to benefit from the move to lighter vehicles that is resulting from environmental pressures, but will need to maintain high levels of R&D in order to compete. It will also have to deal with environmental issues such as solid waste management, challenges to the use of PVC, and possible links between plastics and endocrine disrupters.

The management of post-consumer rubber waste continues to be an important issue for the rubber industry. While most of the attention has focussed on scrap tires, all large-volume rubber products will ultimately face the problem of dealing with waste and discarded material.

Since 1965, qualified bus vehicle assemblers have operated under the Auto Pact. However, factors such as the *Buy America Act*, which requires final assembly in the United States and at least 60 percent total U.S. content, biases bus-purchasing decisions. As a result, Canada's bus industry operates on a partially rationalized basis only, and is faced with having to compete in the U.S. market under these terms in order to maintain its manufacturing base in Canada.

In every major market, government policy has an important impact on bus production and sales through technical standards regulation, environmental requirements, urban transit authority funding, school bus purchases, local product preference, intercity carrier regulations and special needs such as handicap access.

Technological Issues

The relatively low level of R&D investment is mentioned in most discussions of this industry. That is, the Canadian industry uses advanced technology but obtains much of it through technology transfer. This is especially true in the assembly sector.

New technologies such as rapid prototyping reduce the design time for parts and vehicles, putting more pressure on smaller parts producers to modernize, and invest in new machinery and processes. The design time for a complete new vehicle has decreased from five to seven years, to three to four years and continues to decrease. The design time of Japanese manufacturers is less than that of North American manufacturers, which puts pressure on both North American assemblers and North American parts producers to change technologies and processes. Also, as responsibilities for design, engineering and innovation are being increasingly passed down from the assemblers to the supplier sector, parts companies must invest even more in technology and skills enhancement.

New warehousing and communications technologies such as electronic data interchange (EDI) and electronic commerce are having a significant impact along the entire automotive supply chain, and may affect the entry level skills required of those working in the industry.

The Canadian bus manufacturing industry is currently the technological leader in North America in terms of low floor design, alternative fuels, and hybrid and fuel-cell technology. However, the U.S. government has provided extensive support to the development of a new generation bus design with R&D funding assistance through its Department of Energy.

In the rubber industry, thermoplastic elastomer technology is producing significant improvements in productivity and product quality. The alternative substances produced by this technology behave like rubber, but under appropriate conditions can be processed like plastics, and may replace rubber for components such as seals, gaskets, hoses, flexible tubing, coated fabrics, boots on steering columns, sheeting, weather stripping, conveyor belting and air ducts in automobiles. This development may require major new investments by rubber companies in order to sustain and develop new markets.

In the plastics industry, rapid technological change is significantly increasing the minimum needed to stay in the market. Although the industry leaders conduct significant amounts of R&D, many companies do not, and as a result may suffer in terms of competitiveness.

Social and Demographic Situation

The major demographic issue is the approaching retirement of a large portion of the automotive work force, including skilled tradespeople and technologists. Shortages are forecast in key trades such as general machinists, tool and die makers, mould makers, millwrights, and industrial electricians. These skilled trades are identified as critical for a range of metal fabricating and manufacturing sectors, which means that the industry will have to compete for a limited supply of skilled tradespeople.

The research conducted for the Automotive Competitiveness Review suggests that the skills shortage will be felt most acutely in small and medium-sized enterprises (SMEs) that produce parts for the industry. This is where Canadian ownership is highest. SMEs typically offer lower wages and fewer training opportunities, and often lose their skilled workers to better-paying companies.

The industry's ability to recruit young people is somewhat limited by the lack of awareness in schools and among highly trained workers of the range of challenging jobs available in this industry, including the fact that many jobs employ advanced technology.

Corporate governance is an issue in the sense that most investment and marketing decisions are made by the large foreign-owned companies that dominate the industry. This is likely to persist as the move continues to standardize vehicles around a few platforms that can be produced globally.[2]

Current Situation

Definition and Size

The automotive industry, as defined for the purposes of this report, includes the assembly of light vehicles (autos, small trucks, minivans and sport utility vehicles); parts and accessories (original equipment makers, or OEM, and aftermarket and replacement parts firms); and truck, bus and heavy vehicle assembly, including some conversion of heavy vehicles for specialized use.

Table 1: Auto Sector by Segment

Industry Sector	Shipments	Plants
Light duty vehicles	$56 billion 2.5 million vehicles	15 assembly plants*
Heavy duty vehicles	$2 billion annually 30 000 vehicles annually	14 assembly plants producing buses and trucks
Vehicle systems, components, parts	$25.4 billion	More than 550 OEM, and roughly 1000 including aftermarket production

*Excluding Volvo plant in Nova Scotia, which is now closed.

Source: Industry Canada, *Statistical Review of the Canadian Automotive Industry,* 1998. All figures are for 1997. Figures do not include shipments of roughly $1.8 billion in tires and tubes in 1997.

Globally, this industry produced some 51 million vehicles annually in the mid-1990s, and Canada is the sixth largest producing nation. While Canada accounts for 16 percent of North American production of light duty vehicles, it accounts for only 8 percent of North American motor vehicle sales.

[2] For instance: In 1998, GM announced that it would divide up its engine and transmission development among four engineering centres. A European powertrain centre in Ruesselsheim, Germany, is responsible for small gasoline engines and transmissions. A North American powertrain centre in Pontiac, Michigan, is in charge of large car and truck gasoline engines and automatic transmissions. Saab Automobile, Alberta, leads GM work on turbochargers for gasoline engines. Finally, all diesel development is assigned to Isuzu Motors Ltd. in Japan. The idea is to take advantage of expertise in regional pockets of a vast corporation and transfer the resulting technologies and design throughout the organization. (Source: Greg Gardner, "Global growing pains: GM Powertrain reshuffles responsibilities," *Ward's Auto World*, Vol. 34, March 1998, p. 42.)

Trade

The Canadian automotive industry has grown significantly in the past 30 years since the Auto Pact, and is fully integrated into the North American market following implementation of the Canada–United States Free Trade Agreement (FTA) and NAFTA. Some 87 percent of Canada's light vehicle production is exported, primarily to the United States.

The industry overall generates a significant surplus on international trade, made up of a large deficit on parts (roughly $17 billion in 1996 and $20 billion in 1997) and a larger surplus on vehicles (roughly $31 billion in 1996 and $31 billion in 1997).[3]

The overall balance on automotive trade with the United States was roughly $12 billion in 1997. Canada's deficit on automotive trade with Japan was roughly $4 billion in 1997. Canada also had an overall deficit on automotive trade with Mexico in 1997 of $3.4 billion, a figure that has been increasing with the implementation of NAFTA. The deficit on automotive trade with Mexico was $674 million in 1989.[4]

Canada accounts for about 16 percent of North American light vehicle and parts production, more than 70 percent of North American bus production, and about 30 percent of the North American heavy duty truck market.

Investment

The automotive industry is the largest single generator of capital investment in plant and equipment, accounting for about 20 percent of manufacturing investment, and about 12 percent of overall manufacturing gross domestic product (GDP).

The automotive sector has the highest level of foreign direct investment in the Canadian economy, of which roughly 86 percent is from the United States, 7 percent from Europe, and 6 percent from Japan. Virtually 100 percent of the assets of the vehicle assembly sector is foreign-owned. Light vehicle assembly is heavily concentrated in Ontario, with 14 assembly plants, and there is one plant in Quebec.

Parts production is similarly concentrated in Ontario, with some production in Quebec, and a smaller amount in British Columbia and Manitoba. Some 43 percent of parts firms have fewer than 50 employees; more than three quarters have fewer than 200 employees; less than one quarter of the firms account for just under 80 percent of shipments and 70 percent of jobs.

[3] Source: Industry Canada, *Statistical Review of the Canadian Automotive Industry*, 1998.
[4] Source: Industry Canada, *Statistical Review of the Canadian Automotive Industry*, 1998.

The Bus Industry

The Canadian bus assembly and components industry is made up of 10 major companies, most of which have plants in both Canada and the United States. There are two intercity, one mini-bus, three urban transit and four major school bus manufacturers. Two companies are located in Manitoba, four in Quebec and four in Ontario.

The intercity and urban transit bus manufacturing sub-sectors are estimated to have about 70 percent of the North American bus market, and Canadian school bus manufacturers have about 11 percent of the North American market.

In contrast to the high-volume car assembly lines, bus plants are low-volume assembly operations and are not highly automated. All three bus manufacturing sub-sectors in Canada are profitable, and the bus market is mature and stable.

The economies of bus manufacturing make every assembler dependent on major independent systems suppliers who gain their economies of scale primarily from supplying the heavy truck manufacturing industry in North America and thus exert a high degree of influence over bus manufacturers.

Bus production in Canada exceeds domestic needs, and exports are sold only in the United States. As a result, most of the Canadian bus manufacturing industry is strongly influenced by U.S. government policies, regulations and subsidies.

Plastics

The plastic products industry includes some parts makers that produce plastic components for the auto industry, and the value of plastic products is reflected in the sales of finished vehicles. The plastics industry is composed of a large number of small establishments that are fully rationalized on a North American basis, but the degree of foreign ownership is less than in other sub-sectors that supply the automotive industry.

Union Matters

The vehicle assembly sector is about 75 percent unionized, because of virtually 100 percent unionization rates in the "big three" vehicle assemblers and their captive parts plants. The Japanese assembly plants are not unionized, except for the CAMI plant, which is a joint venture involving Suzuki and General Motors.

The independent parts sub-sector (i.e. other than the assemblers'captive parts plants) is about 45 percent unionized, while the specialty vehicles sub-sector (which includes heavy trucks, buses, railway equipment, agricultural implements) is about 50 percent unionized. The rubber industry is highly unionized, and the plastics products industry is only about 10 to15 percent unionized.

Canadian Auto Workers (CAW) is the largest union in the sector, and is found in all parts of the industry. Other unions representing significant numbers of workers include the International Association of Machinists (IAM) and the United Steelworkers of America — Canada.

Industry Associations

Major business associations in the sector include Canadian Vehicle Manufacturers' Association (CVMA), representing the 'big three" vehicle assemblers; Japan Automobile Manufacturers Association of Canada (JAMA), which represents Honda, Toyota and Suzuki; Automotive Parts Manufacturers' Association (APMA), which represents the independent OEM parts makers; Automotive Industries Association of Canada (AIA), which represents makers of aftermarket parts and accessories; the Canadian Urban Transit Association (CUTA), which represents bus assemblers; and the Canadian Tooling and Machining Association, which represents the tooling industry (tools, dies, moulds, jigs, fixtures, gauges, machinery, machining systems, robotics, automation equipment, models, patterns, general jobbing machine shop products and cutting tools).

MANAGEMENT PRACTICES

Employment

Employment in the manufacturing sector of the Canadian automotive industry has remained relatively constant since 1985, while output has increased significantly, as a result of productivity increases.

The majority of employment in both parts and assembly is in Ontario, where the bulk of manufacturing facilities exist. However, Manitoba and Quebec have some employment in bus and truck production, and there is one auto assembly plant in Quebec. In parts, almost all of the large Tier 1 production and employment are concentrated in Ontario, with a smaller concentration in the Montréal area. Tier 2 suppliers are important in the Manitoba economy as well.

Table 2: Auto Sector Employment by Segment

Business Segment	1965	1985	1996	1997
Vehicle assembly	43 000	57 000	50 000	51 000
Parts and components, including aftermarket	3 000	84 000	102 000	92 000
Truck body and trailer	5.000	11 000	15 000	16 000
Total	80 000	152 000	167 000	159 000

Source: Industry Canada, *Statistical Review of the Canadian Automotive Industry*, 1998. Figures for 1997 are derived from the Survey of Employment, Payrolls and Hours (SEPH); previous figures are from the Census of Manufacturers.

Changes in the relative size of the vehicle assembly and parts sectors are partly due to the fact that manufacturers have outsourced parts and components, and have sold off some parts production to independent producers.

Skilled Work Force

The 1985 *Report of the Automotive Industries Task Force* found that roughly 12 percent of hourly workers in the vehicle sector and 13 percent of hourly workers in the parts sector could be defined as skilled workers — those requiring two or more years of training. No data exists on the current work force in the auto industry based on the same definition.

Recent member surveys by the APMA suggest that about 8 percent of the hourly paid work force in the parts manufacturing sector are skilled tradespersons such as mould makers, pattern makers, tool and die makers, industrial electricians and millwrights.

Shortages are current and projected over the next two to seven years in most of these skilled trades. Apprenticeship programs in these trades are well developed and widely used, although the number of certifications appear to fall short of the number of positions available. The auto industry competes with other industrial sectors, especially the metal fabricating and related industries, for many types of apprenticed trades.

Engineering and Technical Personnel

There is no data available on the employment of highly skilled scientific and engineering personnel in assembly and parts, but the numbers are assumed to be considerably below those in other industries, where higher levels of domestic R&D is conducted.

The *Report on the Automotive Industries Task Force* noted that roughly 22 percent of the work force in the manufacturing sector was composed of salaried workers, including managers, clerical workers, and scientific and engineering personnel; and another 17 percent were technical personnel, including computer, electronic, robotic, laboratory and other technicians and technologists. Since these surveys reflect the work force and work practices of the mid-1980s, it is not clear whether or not these proportions can be taken as currently applicable. Policy work relating to highly skilled personnel in this industry would benefit from more recent estimates.

Demographics

Overall, women make up about 11 percent of GM's work force, and this is probably typical of the other auto makers, at least within the "big three."[5] Estimates of other demographic characteristics in assembly and parts are not available, and there is no particular indication that the age distribution of the automotive manufacturing work force is different from manufacturing as a whole.

Recent downsizings, especially those involving semi-skilled production workers, have largely been accomplished through early retirement programs, which are virtually universal in the unionized sector. At the same time, some expansion has taken place (for instance, the Chrysler expansion in Bramalea, Ontario). As a result, the proportion of the semi-skilled production work force aged 55 and over is probably less than in manufacturing as a whole.

[5] Source: Tanya Gadzik, "A firm believer in teamwork: Maureen Kempston Darkes," *Ward's Auto World*, Vol. 32 , April, 1996, pp. 36-37.

Pay and Benefits

The unionized sector of this industry has been characterized by numerous initiatives in work environment innovations, including innovations in pensions and benefits, shorter work time experiments, and phased retirement.

Wages and salaries are generally higher than for manufacturing as a whole, and are heavily affected by collective bargaining. In the unionized vehicle assembly sector, average hourly wages exceed $25 per hour, some 65 percent higher than the economy-wide average, and about 25 percent higher than in manufacturing as a whole. These wages and benefits are set exclusively through collective bargaining, and generally have an impact on non-unionized segments of the industry as well.

The average hourly wage in the parts sector is roughly $17 to $18, with wages in the unionized sector being higher than in the non-unionized sector, although the differential among smaller parts companies is not large.

The average hourly wage in the specialty vehicle segment (heavy trucks, buses, railway equipment, agricultural implements, and other specialty vehicle producers) was slightly more than $16 per hour in 1996 — somewhat lower than in other transportation equipment manufacturing sectors. However, for this sub-sector, wages vary widely across industries. They are higher in heavy truck and bus, and lower in the truck body and agricultural implements areas, especially in the relatively large number of non-union facilities in these industries.

Hourly wages in the plastic products industry tend to be lower than in other manufacturing industries, and considerably below the average hourly wage in auto manufacturing as whole.

Quality Initiatives

The industry put forward numerous initiatives in new work practices and processes, including Total Quality Management (TQM), just-in-time production and cellular manufacturing. In fact, most of the early initiatives of these types originated in this industry, and literature on these practices is extensive.

The major North American vehicle companies have cooperated on an industry-specific version of ISO 9000, known as QS 9000. This system has been widely introduced in the industry and has had a major impact on work organization and quality standards.

Most major (Tier 1) parts producers now adhere to the QS 9000 standard as a condition of supply contracts with the major vehicle assemblers, and QS 9000 standards are gradually spreading among Tier 2 suppliers. The adoption of this standard is likely to have an impact on work practices and minimum skill levels. Moreover, whether or not they are able to adhere to the standard will affect the smaller parts producers' ability to stay in the market.

Training Capacity

Evidence from interviews with industry officials and from industry literature indicates that both the assembly and parts sectors place a high priority on a steady supply of trained workers. Firms regard the impending shortage of skilled tradespersons as the single most important impediment to the industry's ability to grow over the next two to seven years.

In an effort to address anticipated shortages, the industry has engaged in a number of cooperative efforts with universities, colleges and high schools to develop training programs.

Most of the larger companies have in-house training programs devoted to employee training and upgrading. Interviews with industry officials suggest that a large percentage of companies in this sector are active in accepting apprentices in a range of skilled trades.

Larger companies such as the "big three," Japanese manufacturers and Tier 1 companies such as Magna have also developed their own in-house management development systems. These initiatives are described in the section entitled "Best Practices and Case Study Profiles."

CRITICAL SKILL NEEDS AND GAPS

Skill Needs

Both assembly and parts companies require a relatively highly skilled production work force, and training and skill upgrading are closely related to the ability to maintain competitive facilities. Much of this training, especially of production staff, is done in-house and often to proprietary standards. For a broad range of production jobs, an industry-wide occupational standard does not exist; however, this issue is under discussion within provincial jurisdictions.

As a result of the adoption of more sophisticated equipment and processes, minimum literacy and numeracy standards for some of these jobs are increasing, even for assembly line production jobs.

Interviews with industry officials on behalf of the Panel in the late spring of 1999 suggest that the need for design and engineering employees is growing, particularly among Tier 1 and 2 companies. The supply of persons with the required technical skills is adequate, but firms seek those who combine technical excellence with good management and interpersonal skills. The supply of those who possess the full package of desired skills is more limited.

In the plastic products industry, there are current shortages of process engineers, set-up people, mould and die makers, and maintenance personnel. A recent study projects that, without corrective action, this imbalance will become greater. Throughout the industry, a large number of the lower-skilled machine operators lack basic skills in polymer science, computers, communications and mathematics — all of which are becoming increasingly important. Industry Canada reports suggest that some segments of the industry appear to have minimal commitment to training. Although the plastic products industry has been making some progress in these areas, the consensus is that the momentum must be maintained and efforts expanded, as the industry continues to raise its level of technological sophistication.

Skill Gaps

The impending shortage of skilled tradespeople is the single most important issue in this industry. The APMA estimates that in Ontario the demand for skilled trades in the overall manufacturing sector over the next two to seven years will be about 35 000, of which the educational and apprenticeship system is capable of supplying only 20 000. The APMA estimates that, of the resulting shortfall of 15 000, roughly one quarter will occur in the automotive industry, with the remaining shortfall absorbed by other industrial sectors.[6]

[6] Source: APMA figures, used in the presentation by Ann Herten to the APMA conference.

It takes roughly four years of post-secondary training and experience to certify most skilled trades. Industrial electricians, for instance, require four and a half years of apprenticeship in addition to several formal courses, usually offered by community colleges. Inuustrial millwrights, mould makers, pattern makers, and tool and die makers, require similar periods of training and apprenticeship.

Interviews with industry officials suggest that the skills most difficult to find among design and engineering employees are project management, problem-solving, and budget management/cost control. Most companies expect to train personnel in these skills.

An issue not discussed in the literature is whether or not the lack of managerial skills and training impedes the industry's ability to improve productivity. The literature on work organization suggests that the successful introduction of programs such as lean production, just- in-time inventory, and TQM depends on buy-in and cooperation from management, especially front-line supervisors.

Interviews with industry officials suggest that shortages of managerial skills constrain productivity growth. Several companies in the industry, including General Motors, Ford and Chrysler, have reacted to this problem by setting up in-house management development programs. Magna, a Tier 1 parts supplier, has recently established an in-house management development training program.

RECRUITMENT, TRAINING AND DEVELOPMENT PATTERNS

Recruitment

Industry representatives feel that attracting youth into the industry, and into the skilled trades used in the industry, is an important issue. However, analysis has shown that there is little awareness in schools and among highly trained technology workers of the career opportunities in the automotive industry. This lack of awareness alone can limit the industry's ability to attract young people and encourage them to acquire the basic entry-level skills needed to work with the advanced technology employed in the sector.

Industry representatives suggest that current immigration policies make recruiting skilled workers from abroad difficult, because of problems associated with the immigration of spouses and families. The recognition of skills and certification from non-Canadian sources is also a problem for which no solution has yet been found. Further, there are no firm estimates of the numbers involved.

Training and Development

Given the large numbers of unskilled or semi-skilled production workers in the manufacturing sector of this industry, much training is done on the job, but cooperative skills training programs with secondary and college-level institutions are becoming more common. Most large vehicle companies, and some larger parts companies, have in-house training facilities for both technical and management skills.

A major effort, much of it in cooperation with the union, is currently being undertaken to upgrade production workers' foundation skills of literacy, numeracy, and English and French as second languages. The largest union in the sector, the CAW, operates an active educational program, much of which is directed at foundation skills and health and safety. The unionized sector of the industry in Ontario is a major user of programs such as Basic Education and Skills Training (BEST), offered by the Ontario Federation of Labour.

Given the rising minimum standards for literacy and numeracy, the proportion of employees whose first language is neither English nor French is an important issue. No reliable estimates are available on the language profile of the work force, although recent census material may be useful in this regard.

In the United States, numerous specialized higher education facilities exist (for instance, the General Motors Institute, GMI, which awards basic and advanced degrees in automotive engineering); established institutes such as MIT, Caltech and Wayne State University have specialized programs for training advanced automotive personnel. Although such an extensive training infrastructure does not exist in Canada at this level, most parts of the Canadian industry have access to these U.S. facilities. Furthermore, some advanced research and training institutes have been established in recent years, most notably the University of Windsor Automotive R&D Centre, which pursues niche research in new automotive technologies. Associated with this, Chrysler Canada has recently established new research chairs in alternative fuels and in design at the University of Windsor. Ford Canada, with the Natural Sciences and Engineering Research Council (NSERC), has established the Ford/NSERC Industrial Chair in Light Metals Casting Technology at the University of Windsor to promote advanced research and graduate training in this area.

OVERVIEW: KEYS AND OBSTACLES TO SUCCESS

The Canadian automotive industry is competitive and in a strong position to grow and prosper over the next few years. Employment, production and investment are currently at record levels. However, a number of significant issues must be addressed to ensure that the industry is able to maintain its productivity and cost advantage, both of which are essential to continued investment and growth.

Most segments of the industry have ready access to modern equipment and process technology because of the high level of foreign control and the global nature of the large companies that dominate this industry. To meet the challenge of rapidly evolving technology, however, the industry will have to focus on ensuring that workers are able to upgrade their skills or develop new skill sets. Solutions will involve innovative approaches to on-the-job training, such as distance learning, and making sure that these approaches are accessible to smaller companies.

Although there are clearly some skill shortages at the managerial level, as well as in the highly advanced specialties in science and engineering, the most pressing issue is the supply of skilled trades. In particular demand are skilled tradespersons who are able to integrate competency in industrial skills and trades with the ability to use advanced computer technology. A new generation of skilled workers is urgently needed to continue to support the growth of this industry.

Success in ensuring that Canada's automotive work force and skills pool continue to represent a competitive advantage for the industry is also dependent on raising the level of awareness of the career opportunities available in the automotive industry. This can be achieved by engaging all stakeholders — industry, unions, governments, educators, counsellors and parents — in a concerted effort to promote these opportunities and attract young people to the industry.

BEST PRACTICES AND CASE STUDY PROFILES

Because most R&D and design work in this industry is not done in Canada, educational programs for advanced personnel are not yet as well developed in Canada as in other countries such as the United States and Germany; however, they do exist. Co-op and apprenticeship programs are well developed and widely used.

The Windsor Experiment refers to a number of activities carried out by Chrysler Canada with government and educational institutions. Activities include benchmarking best practices in training and education in Europe in order to apply them to skills development programs in Canada. An example of initiatives that have come out of the Windsor Experiment include the Automobile Manufacturing Skills Initiative (AMSI), at St. Clair College, supported by Chrysler, the CAW and the federal government. It includes on-the-job and off-the-job learning programs and combines industry-specific knowledge with skills development and advanced computer technologies. The program will give participants a community college diploma in electronics engineering technology and an industrial electrician apprenticeship certificate.

A wide variety of co-op programs are in use in the industry, for example at Georgian College, which houses the Centre of Expertise for Automotive Parts Design and Manufacturing Technology. The centre is a collaborative partnership between business and industry, governments, the education and training sector, and the R&D community. The program, when fully operational, will have the capacity to turn out 90 graduates per year in automotive manufacturing, 90 in auto parts design, 120 in tool and die, and 300 in advanced engineering design. The college will also provide customized training and upgrading workshops and seminars on a continuing basis. Auto parts design, auto parts manufacturing technology, and skilled trades apprenticeship programs in tool and die, robotics and automation, millwright, electronics and system design are part of the program.

Manufacturing technology programs are offered in Ontario at Sheridan College, which offers engineering technology courses with and without co-op placement options. Among the activities at Sheridan College are a partnership with IBM and Pratt and Whitney to do training in Computer-Assisted Three Dimensional Interactive Application (CATIA), a suite of software applications that is becoming the standard for design work.

Mohawk College and McMaster University are currently offering a joint program leading to a Bachelor of Manufacturing Technology. This program is geared to current engineering personnel who require upgrading, and students may include engineering technology graduates, as well as graduate engineers wanting to upgrade or change their specialty. This program is not specific to the automotive industry but includes placements in the automotive industry. The program is offered on both a part-time (two-year) and a full-time (one-year) basis. Key players in the auto sector were involved in the development of this program, and the auto industry is expected to be a major destination for program graduates.

A number of training and upgrading initiatives have been developed by specific companies to meet their own needs, when these are not met by other institutions. Toyota University, for instance, is part of an overall initiative to instil a learning culture and develop resources for the continuous upgrading of production staff. It emphasizes distance learning, combined with some on-the-job and classroom instruction.

The Woodbridge Group operates the Woodbridge Institute for Learning (WIL) in cooperation with Sheridan College. Woodbridge has a policy of avoiding off-the-shelf training programs as much as possible, and works with Sheridan to design custom programs that meet a company's specific needs. The programs include manufacturing and technical programs, including advanced quality planning; health safety and environmental programs; management and supervisory programs; and a variety of specific functional programs such as finance and materials management. Teaching staff (referred to as learning facilitators) are almost entirely chosen from current Woodbridge employees.

Magna Corp has recently established the Magna Technical Training Centre in Markham, Ontario. The centre works in partnership with Durham College and Humber College, which provide theoretical training as part of a process leading to certification to both Canadian and European standards in a range of technical specialties. The current capacity of the centre is roughly 50 students in the inaugural program (40 tool and die and 10 industrial electronic), although this number will increase in coming years. All students are Magna employees and are hired at the plant level and assigned to the centre for further training. After the training program at the centre, students rotate through actual production jobs as part of the certification process. Magna is currently in the process of setting up a management development centre to meet its non-technical training and upgrading needs.

APPENDIX I: SOURCE DATA

Automotive Industries Association of Canada. *The Automotive Aftermarket Industry in Canada. Outlook Study. 1997.* Summary version available on Industry Canada's Web site. (Background analysis undertaken as part of Automotive Competitiveness Review).

Automotive Parts Manufacturers' Association. *Automotive Components Industry Outlook.* June 1997. Summary version available on Industry Canada's Web site. (Background analysis done as part of Automotive Competitiveness Review).

Automotive Parts Manufacturers' Association. *Moving Ahead. High Tech Manufacturing Careers in Canada,* 1998.

Automotive Parts Manufacturers' Association. *Statistical Analysis of the Skilled Trades People Workforce in the Ontario Auto Parts Manufacturing Industry,* April 1998.

Automotive Parts Manufacturers' Association. *The Competitiveness of Canada's O.E. Parts Sector: A Survey and Comparative Study. 1997.* Summary version available on Industry Canada's Web site. (Background analysis done as part of Automotive Competitiveness Review).

Chrysler Canada. *The Link Is Forged. Windsor Experiment III,* 1998.

Employment and Immigration Canada. *Canadian Automotive Parts Industry.* Human Resource Study, 1991.

Employment and Immigration Canada. *Report of the Automotive Industry Human Resources Task Force,* 1986.

Ernst and Young and Angus Reid Group. *Ontarians' Attitudes Towards Careers and the Skilled Trades,* 1998.

Gravelle, Michelle. *Skills Challenges Facing Key Sectors of the Canadian Economy. A Consultation Report.* Industry Canada, August 1998. [Typescript].

Harbour and Associates. *The Harbour Report, North America.* 1997, 1998. Summary and analysis contained on Harbour Web site (**http://www.harbourinc.com/**)

Herten, Ann. *Our Education System: Our Supply Base.* Slide show presentation to the APMA Human Resources Development Committee, 1998.

Industry Canada. *Automotive Industry. Part 1 — Overview and Prospects.* Sector Competitiveness Frameworks Series, 1996.

Industry Canada. *Automotive Sector Summary Report: Report on Consultations,* June 1998.

Industry Canada. *Canadian Industry Overviews.* Available on Industry Canada's *Strategis* Web site.

Industry Canada. *Canadian Industry Statistics.* Available on Industry Canada's *Strategis* Web site.

Industry Canada. *The Automotive Competitiveness Review. A Report on the Canadian Automotive Industry.* June 1998.

Industry Canada. *The Automotive Competitiveness Review. Industry Identified Issues,* June 1998.

Industry Canada. *The Canadian Automotive Industry Today*, 1997 Edition. Automotive and Transportation Branch, Industry Canada. Available on Industry Canada's Web site.

McGinn, Daniel andAdam Rogers. "The Car of the Future." *Newsweek*, November 23, 1998.

Robinson, Aaron. "Methanol-powered minivan puts GM in the fuel-cell race." *Automotive News*, October 1998.

Sangster, Derwyn. "Critical Skills in Five Canadian Industries: A Summary Report of Sectoral Interviews." Paper prepared for the Expert Panel on Skills, Advisory Council on Science and Technology, June 1999.

Tooling & Production. "Connecting on quality." *Tooling & Production*. Vol.63, April 1997. pp. 53-54.

United States Department of Commerce. Office of Technology Policy. *The U.S. Automobile Manufacturing Industry*. "Meeting the Challenge: U.S. Industry Faces the 21st Century," December 1996.

Ward's Auto World: (list of articles follows)

"Global engineering: solving the puzzle," *Ward's Auto World*, Vol. 34, 1998. pp. 37-123.

"Is Ste. Therese the next GM plant on the bubble?" *Ward's Auto World*. Vol. 34, 1998. pp. 22-23.

"Suppliers want more sharing of costs and benefits from systems engineering." *Ward's Auto World*. Vol. 34, 1998.

Gardner, Greg. "Crunch time for skilled trades." *Ward's Auto World*. Vol. 34, 1998.

Gardner, Greg and Tom Murphy. "Chrysler's Sidlick philosophical about supplier consolidation " *Ward's Auto World*. Vol. 34, 1998.

Gardner, Greg and Tom Murphy. "Supplier technology adds fourth leg to GM's stool." *Ward's Auto World*. Vol. 34, 1998.

Gazdik, Tanya. "A firm believer in teamwork." *Ward's Auto World*. Vol. 32, April 1996, pp. 36-37.

Green, Jeff. "Canada: view from the roof." *Ward's Auto World*. Vol 32, October 1996, p. 81.

Green, Jeff. "Multitude of technologies via for new generation vehicle." *Ward's Auto World*. Vol. .34 March 1998, p. 63.

Murphy, Tom. "Close enough to perfect." *Ward's Auto World*. Vol. 34, 1998.

Murphy, Tom. "Rapid cost cuts." *Ward's Auto World*. Vol. 34, 1998.

Murphy, Tom. "Welcome to the table." *Ward's Auto World*. Vol. 34, February 1998, p. 46.

Nauss, Donald W. "Ballard battling to break through." *Ward's Auto World*. Vol. 34, March 1998, pp. 75-76.

Sharf, Stephan. "Wake-up call." *Ward's Auto World*. Vol. 34, 1998.

Shuldiner, Herb and Drew Winter. "Big global growth predicted for plastics within five years." *Ward's Auto World*. Vol. 34, 1998, pp. 53-53A.

Winter, Drew. "Cleaning up the auto industry's other tailpipes." *Ward's Auto World.* Vol. 34, 1998.

Winter, Drew. "Lightweight structures in limelight: vehicles may get lighter even without mandates." *Ward's Auto World.* Vol. 34, 1998, p. 125.

Winter, Drew. "Turning up the juice." *Ward's Auto World.* Vol. 34, 1998.

Web Sites

Industry Canada's *Strategis* Web site: **http://strategis.ic.gc.ca**

Canadian Auto Workers (CAW): **http://www.caw.ca**

Automotive Parts Manufacturers' Association: **http://www.capma.com/apma.home.html**

Harbour and Associates: **http://www.harbourinc.com/**

Interviews

Anne Cool, Director of Human Resource Development, and President of Skills Canada

Ann Herten, Director of Human Resources Woodbridge Group

Pat Lang, Vice-President Academic, Georgian College

John Morrissey, Vice-President, Van Rob Stampings.

Don Amos, Executive Vice-President for Administration and Human Resources, Magna Corp., and member of Industry Canada Automotive Industry Advisory Group, and Max Amtmann, Manager of the Magna Technical Training Centre