
State of Automotive Parts Manufacturing Industry in Ontario, Canada

Competitive Pressures, Managing Change and Adaptation to a Global
Environment

Applied research to fulfill the requirements of applied project for the MBA
degree at ATHABASCA UNIVERSITY

Written by: Victor Manea

Applied Project Supervisor: David Norton

Applied Project Coordinator: Jim Dunn

Date: April 30, 2007

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY
2. INTRODUCTION
3. BACKGROUND INFORMATION
4. RESEARCH OBJECTIVES and QUESTIONS
5. LITERATURE REVIEW AND ANSWERS TO RESEARCH QUESTIONS
6. CONCLUSION
7. REFERENCES

EXECUTIVE SUMMARY

Ontario-based transportation equipment suppliers are hurt by high currency and loss of market share to low-cost countries. Durable manufactured goods exports are dropping and imports rising, while the Canadian GDP is stagnant.

The natural inverse relationship between the currency and the increasing rate of imports (economic theory suggest that a currency should decrease as more of it is available to others outside the country who then would have to sell it to pay the foreign goods producers) does not hold due to the presence of an economic condition called the Dutch Disease. As such, the high currency will continue to hamper the ability of manufacturers to export their products for at least as long as the energy and mineral commodities prices remain high. The proof for the presence of the Dutch Disease is the fact that the imports have been increasing steadily while the currency has also appreciated.

To survive and grow Ontario based manufacturers must address both the short-term perspective and the longer term. This paper examines and suggests that:

1. Given the role that manufacturing in general and transportation equipment in particular hold in the Canadian economy, it cannot be neglected out of existence since the replacement jobs created in the service sector fail to offset the losses of jobs to off shoring in terms of GDP growth.
2. The short-term suggestion is to shift supply capacity from the Big 3 (American-based OEM's whose market share and fortunes have been steadily shrinking) to the New Domestic OEM's (Japanese, Korean, Europeans) given the latter's continued success in the market place and better understanding of the market places demands (quality, green vehicles. etc.).
3. The long-term suggestion is to take advantage of the strengths of the Ontario Transportation equipment manufacturing (highly educated and loyal labour force, generous government-sponsored R&D programs, lower than US costs, etc.) to revolutionize the transportation industries through the development and deployment of new or improved technologies in the fields of hybrids, electrics and other environmentally friendly technologies.

1. INTRODUCTION

Manufacturing in US and Canada has its roots in the European industrial revolution. The variety of emigrants coming from Europe brought with them a variety of skills and crafts which enabled them to establish a thriving industrial base. Throughout the period covering World Wars I and II, while most of the industrialized nations of Europe and Far East had their economies and therefore their manufacturing base, destroyed, US and Canada enjoyed a booming business.

Never before (or since) has there been such focus by the business community, governments and the nations themselves to provide the necessary condition for manufacturing to supply the abundance of material required to win the war. The efficient and vastly manned war time manufacturing facilities were easily converted to civilian goods production, from bombers and tanks to passenger planes and tractors just as they were converted in the opposite direction at the beginning of the war effort.

As the only two industrialized economies to survive the wars with their economic base unscathed, the US and Canadian manufacturers saw unprecedented demand for goods of all categories resulting in tremendous growth in manufacturing operations.

In the late 1940's and beyond, the demand for manufactured goods was so high that production volume, quantity, was the management's main driver, while quality was primarily an afterthought. The pioneering work in the field of industrial statistics performed by the likes of Deming, Juran, etc. that ensured the required quality performance of the war material, was quickly abandoned. Inspecting quality into a product (quality control concept) is the main quality approach instead of a preventive approach (quality assurance concept). As such the relative quality of the US and Canadian products started declining steadily.

While the US and Canadian manufacturers were busy trying to supply all markets (at home and abroad), the help supplied by US via the Marshall Plan to Western European and Japanese economies created a revived industrial base with unprecedented drive to succeed.

Soon enough, those re-born industries in the European and Japanese economies became strong competitors to the established US and Canadian manufacturers and it became apparent that a leapfrog effect was taking shape. Since they were re-building from scratch in most cases, both Europeans and Japanese business would in fact employ the latest technology available, while the American and Canadian manufacturers were using previous generation technologies due to the capital investment already made.

In time, overseas manufacturers developed similar or higher capabilities than North American business, driven primarily by efficient use of resources (the Toyota Production System is a great example) and adoption of management techniques that were forgotten in the US and Canada (i.e. Deming's teachings¹)

¹ http://www.asq.org/about-asq/who-we-are/bio_deming.html

Taking advantage of these capabilities, North American companies started outsourcing progressively higher value added content of their products to the overseas manufacturers, primarily in the Far East. Large segments of the manufacturing of consumer electronics and manufacturing and testing of electronics components moved to the Far East (Taiwan, Korea, Malaysia, Singapore, etc.) starting in the 1960's.² Meanwhile, Japan's METI (Ministry of Economy, Trade and Industry, previously called Ministry of International Trade and Industry, MITI) defined the electronics industry as one of the strategic growth areas, heavily supported the acquisition of Western technologies and administered the development of a national industry.³ The net result of both these actions is that US and Canada no longer have any domestic consumer products manufacturing capabilities and most of the newly created competitors have moved from knowledge integration to knowledge creation. One cannot buy or assemble/build a personal computer today without Taiwanese made motherboards, Korean memory and LCD screens and Malay or Singapore made hard drives.

In the 1970's, competition came strongly on the shores of North American manufacturers in the form of imported Japanese automobiles. While these vehicles were niche products and their penetration into the market place was small indeed, this step symbolizes the typical "management frog conundrum": progressively higher temperatures applied at a moderate pace resulting in the failure of the frog to recognize the deadly threat. While their initial foothold in the US and Canada was gained by means of imports, resulting in a corresponding reduction in sales and production by the local OEM's, the Japanese OEM's moved quickly to establish a local manufacturing footprint in North America. With design and manufacturing facilities spread throughout the US and Canada, the Japanese have become as much "local OEM" as the original Big Three. Following the Japanese example, starting in 2005 Korean carmakers established their first presence in North America through the opening of the Hyundai Montgomery plant in Alabama. The net result of this localization, for these makers, was that they became US or Canadian Made as opposed to imports and a corresponding increase in public good will through the localized job creation process.

The next period of significant outsourcing of US and Canadian jobs started in the 1990's when manufacturer and providers of services discovered the growing potential that India and China brought to the table. Advances in technology (Internet communications, etc.) was the enabler for the new migration while opening of the potentially gigantic markets that these countries represent, was the dream. However, increased imports of those manufactured goods and services whose local production is decreasing, suggest to the writer that, at least for the present time and visible future, the move of the jobs to overseas markets was not intended to capture the local market but to re-import into US and Canada.

Globalization trends are greatly influencing the future of manufacturing industries in most industrialized countries. The automotive parts manufacturing sector of Ontario is

² http://www.wtec.org/loyola/em/05_03.htm

³ Johnson C. (1982), MITI and the Japanese Miracle. Stanford University Press: Stanford.

going to have to contend with the changing trends in international trade in addition to a runaway currency and stiff competition from Newly Industrialized Countries.

1.1 – What is the effect of a reduced manufacturing base?

What is the effect of losing manufacturing jobs in Ontario? Related fields like engineering and R&D will probably be off shored next, since the natural development process of the manufacturing sector here is what prompted the development of an infrastructure (education, R&D, etc.) to support it. Manufacturing and related innovation is what drove the tremendous improvements to the standard of living in the industrialized countries.

What is at stake? Given the fact that Canadian direct manufacturing employment continue to decrease at an alarming rate (14.9% of total employment in 2001 and 13.6% in 2005,⁴) and given the halo effect of manufacturing (four indirect jobs are maintained by each direct manufacturing job) in our economy, it can be easily seen that our standard of living is at stake.

Proponents of globalization have told us for years that de-industrialization of the industrialized world is a natural by-product of the productivity increased experienced by the manufacturing sector and the standard of living of those countries is assured through the continued creation of services.

“...deindustrialization is principally the result of higher productivity in manufacturing than in services.

And,

“...advances in the service sector, rather than in the manufacturing sector, are likely to encourage the growth of living standards in the advanced economies in the future.”⁵

However, the research arm of the CIBC World Markets Investment firm publishes a monthly report titled “Canadian Employment Quality Index. The research seeks to:

“...combine information on the distribution of part-time vs. full-time jobs; self-employment vs. paid employment; and the compensation ranking of full-time paid employment jobs in more than 100 industry groups. ...index measures not only the quality of new jobs, but more importantly, the changing dynamics and quality of existing jobs.

The February 1, 2007 edition contains the following descriptive relative the type of jobs currently created by the Canadian economy:

⁴ Statistics Canada, CANSIM, table (for fee) 282-0008 and Catalogue no. 71F0004XCB. Last modified: 2006-01-25.

⁵ Robert Rowthorn and Ramana Ramaswamy (1997) – *Deindustrialization – Its Causes and Implications* - ©1997 International Monetary Fund, September 1997

*“- There appears to be a major disconnect between the job market in Canada and the economy. The job market is creating jobs at an impressive pace, with the unemployment rate at a three-decade low. It seems that nowadays, anybody who wants a job can find one. At the same time, real GDP growth continues to disappoint with fourth quarter GDP growth likely to advance by an annual pace of less than one percent. **Clearly, those newly employed Canadians do not add much to the nation’s overall production capacity.**”⁶*

Statistics Canada’s research paper titled “Earnings Losses of Displaced Workers: Canadian Evidence from a Large Administrative Database on Firm Closures and Mass Layoffs”⁷ determines that even after five years since the job loss occurred:

“High-seniority displaced men experience long-term earnings losses that represent between 18% and 35% of their pre-displacement earnings. For their female counterparts, the corresponding estimates vary between 24% and 35%.”

And,

“Worse still, it seems very likely that the earnings of displaced workers do not return to their expected levels at any time.”

Another question that requires investigation is how far does the reach of off shoring extend into the Canadian (and the US) economies? Does off shoring affect other industrial sectors or just manufacturing? The answer to those questions can be found in a study performed by the US Bureau of Labor Statistics, titled “Accounting for off shoring in Occupational Employment Projections”⁸ The study identifies 40 occupations, ranging from data entry to most of the engineering fields that are “*susceptible to significant risk of off shoring*”.

In addition, the study also concludes that

“...the vast majority of positions in the middle two quartiles that will be those most likely to be successfully off shored.”

Given the fact that the US and Canadian economies and lifestyles are very similar in scope and structure, it is possible to extrapolate from the US study and conclude that those Canadian between the 26th percentile to the 75th percentile are susceptible to significant risk of losing their jobs. Based on the Statistics Canada 2004 Family Income, by family type⁹, summary table, those families earning between \$37,000 and \$95,000 could be affected by off shoring.

Summarizing the above discussion, due to the wide spread reach of the potential displacement (middle two quartiles, the middle class), as well as the failure of the services industries to make up the difference in GDP growth and the likelihood that about 30% of the displaced workers never return to the previous pre-displacement

⁶ http://research.cibcwm.com/economic_public/download/eqi-cda-022007.pdf - Emphasis mine

⁷ by René Morissette, Xuelin Zhang and Marc Frenette - Catalogue no. 11F0019MIE — No. 291

⁸ <http://www.bls.gov/emp/optd/optd002.pdf>

⁹ <http://www40.statcan.ca/l01/cst01/famil106a.htm>

income level, it would make sense that alternative strategies must be devised to ensure the continue existence and indeed growth of the Canadian manufacturing base.

Since it will be difficult to review the complete Canadian manufacturing base with sufficient detail to suggest a pertinent course of action, the remainder of this paper will investigate specifically an important component of the Ontario manufacturing base, specifically the automotive component manufacturers. Typically, the statistics that provide data for this important segment of the Ontario economy is classified under “Transportation Equipment, Parts and Components”.

2. BACKGROUND INFORMATION

Ontario is Canada's most populous province with over 12.5 million people in 2005 and is home to people from 170 different ethnic backgrounds who speak more than 100 different languages. It is the manufacturing and financial powerhouse of Canada. Ontario produces over 42% of the national GDP, driven primarily by financial sector followed closely by the manufacturing sector¹⁰.

The transportation component is responsible for most of the durable goods manufacturing output of the province. With 14 assembly parts and close to 500 component supplier firms, it produces more than one sixth of the North American market vehicles¹¹.

While the American Big Three have the oldest and largest presence in the province, the New Domestic (Toyota, Honda and Suzuki) are constantly increasing the number of vehicles assigned to the Ontario assembly plants.

Toyota's Cambridge facility is the only manufacturing location outside Japan trusted to build a Lexus vehicle, while Honda's Alliston plant was chosen for the launch of a the successful Ridgeline SUT, the largest vehicle the company has ever built.

Toyota Motor Manufacturing of Canada's president, Ray Tanguay describes briefly the drivers for his company's decision to add a new assembly plant in Ontario:

"- Ontario is a great place to build cars, we couldn't have expanded into Woodstock without access to a skilled labour pool, excellent transportation system and a very supportive Ontario government."

Given the historical successes, what are some of the factors that will adversely affect the future of the Ontario transportation equipment industry? Specifically, for the smaller and medium sized component manufacturers, what are the hurdles likely to affect their survivability?

The following factors are likely to have a negative impact:

1. **Exchange rates** – Are very high relative to the Canada's main market for manufactured goods, the US market. Over a period 2002-2007, our currency has appreciated by close to 40%.¹²
2. **Tremendous competitive pressures from low wage countries**
3. **Increasing energy costs** – Years of provincial-wide mismanagement of the electricity grid has left Ontario with a large debt and severely constrained supply capacity.¹³

¹⁰ <http://www.2ontario.com/facts/fact02.asp#2>

¹¹ <http://www.2ontario.com/software/brochures/automotive.asp#8>

¹² <http://www.bank-banque-canada.ca/en/rates/exchange-avg.html>

¹³ <http://repec.economics.utoronto.ca/files/tecipa-205-1.pdf>

4. **Dependence on the US Big 3** – The US-based companies have seen their market share declining for decades. In addition, questionable business practices (little protection for intellectual property, etc.) makes dealing with the Big 3 a difficult and indeed a money-losing proposition.

The following factors are advantages to the industry that can be used to ensure the future of automotive parts manufacturing in Ontario since a renewed emphasis has been placed on protecting manufacturing jobs by the government:

1. **Scientific Research and Experimental Development** - (SR&ED) is administered by Canada Revenue Agency and defined as a “*Tax Incentive Program: Supporting Canadian Innovation*”. This federal program is available to any Canadian-Controlled private corporation that would be entitled to receive up to 35% investment tax credit of the first \$2 million qualified expenditures for SR&ED carried out in Canada, and 20% on any excess amount thereafter.¹⁴
2. **Education** – Renewed focus on post secondary education has translated into a program that will see the investment of CDN \$2.6 billion to create more than 135,000 new student spaces at colleges and universities throughout the province. In addition 74 new post-secondary capital projects on campuses across Ontario, many in the rapidly growing fields of sciences and high-technology, are scheduled for implementation¹⁵.
3. **Re-Focused Electricity system** – In order to regain the advantage of inexpensive electricity availability, the latest provincial government has undertaken to:
 - a. Provide incentives for green energy generation. The introduction of the largest standard offer contract in North America¹⁶ will allow for the harnessing of 1 GW over a 10 year period. One of the world’s largest solar farms (40 MW Capacity) has been given the green light to proceed.
 - b. Emphasize conservation – even as far as banning incandescent bulbs for sale in the province.
 - c. Retain open the possibility of using expanded nuclear generation capacity¹⁷ in the future through completion of long-term feasibility studies and approval process.
4. **Provincial Apprenticeship Program** – Structured around the concept of a Training Tax Credit concept, it will reimburse 25% salaries and wages for new apprentices for the first 36 months of the training programs and increase the number of apprentices to 26,000 annually.
5. **Lower costs** – A study performed by KPMG indicates a 5.1% cost advantage over US on automotive parts manufacturing sector.¹⁸
6. **Loyalty and Work Ethic** – Industry Week says in its April 4, 2007 edition:

¹⁴ <http://www.cra-arc.gc.ca/taxcredit/sred/aboutus-e.html>

¹⁵ <http://www.2ontario.com/facts/fact13.asp>

¹⁶ http://www.energy.gov.on.ca/index.cfm?fuseaction=english.news&body=yes&news_id=146

¹⁷ http://www.energy.gov.on.ca/index.cfm?fuseaction=electricity.nuclear_targets

¹⁸ http://www.mmkconsulting.com/compalts/reports/2006_compalt_execsum_en.pdf

“- Loyal autoworkers are why Ontario facilities are consistent winners of both the J.D. Power and Associates initial Quality Survey and the Harbour Report productivity survey. In 2006 two Ontario assembly plants ranked first and second in quality in North America, out of 84 facilities. DaimlerChrysler's Windsor plant captured silver and General Motors' Oshawa No. 2 plant took gold for the second year in a row--less than a week after finishing second among all North American plants for productivity.”¹⁹

¹⁹ <http://www.industryweek.com/ReadArticle.aspx?ArticleID=13882>

3. RESEARCH OBJECTIVE and QUESTIONS

Manufacturing is closely related to Ontario's ability to contribute significantly to the well being of Canada. Together with other "have" provinces (Alberta, BC, etc.); Ontario is the economic engine that drives the high standard of living we commonly enjoy in Canada.

It is not conceivable the Canadian population representing the 26th-75th percentile (based on income) will easily be re-deployable to other, non-manufacturing segment of the economy and retain their buying power and level of contribution to the GDP growth. Therefore, it becomes necessary to look at what are the alternatives available to maintain the manufacturing sector as a strong and vibrant contributor to the overall well being of Canadians.

This paper will focus on the automotive parts manufacturers and will explore alternative solutions to just attempting to compete on price alone with the suppliers from newly industrialized countries.

The following research questions are considered:

1. What are the strengths of the Ontario-based automotive parts manufacturers?
2. What is the optimum short-term strategy?
3. What operations tools should be used or deployed to support this strategy?
4. What is the optimum long-term strategy?
5. What items should be addressed now to position manufacturers to take advantage of this long-term strategy?

4. LITERATURE REVIEW AND ANSWERS TO RESEARCH QUESTIONS

The starting point for the literature review has to be the data provided by various organizations within the different levels of government, primarily provincial and federal.

Statistics Canada is the organization charged by the federal government with collecting and providing “-statistics that help Canadians better understand their country, its population, resources, economy, society and culture”²⁰. As the most reliable source of data that tracks the course of the Canadian economy and its changes, this paper will draw heavily from its databanks.

4.1 – Status of Manufacturing Sector and Current Course

EFFECT OF CURRENCY ON THE MANUFACTURING SECTOR

4.1.1 – Why do we have a Run-Away Currency

The Canadian economy appears to have all of the symptoms of the dreaded Dutch Disease. What is the Dutch Disease and what are its implications for the Canadian economy?

The theoretical model of the economic phenomenon currently called the Dutch Disease was developed by W.M. Corden and J.P. Neary in 1982 and published under the title “Booming sector and de-industrialization in a small open economy”²¹. In their model there are two components, the traded goods sector and the non-traded goods sector. A smaller division within the traded goods sector provides for a booming sector (gold mine) and an underperforming sector (manufacturing). The symptoms typically are:

- a. Increases in natural resources revenues
- b. Increases in real exchange rate
- c. Lagging tradable sector (i.e. manufacturing)

The economic version of the Dutch Disease is defined as the de-industrialization of a nation due to a rather sudden increase in wealth caused by external inflows of capital²². The newfound riches have the effect of making the country’s value-added goods and services less competitive on the international markets, resulting in reduced exports and a surge in now cheaper, imports. The inflows are caused by either tremendous natural resources discovery (i.e. oil, gas, mineral deposits) and or,

²⁰ <http://www.statcan.ca/english/about/overview.htm>

²¹ Economic Journal, 92, December 1982

²² <http://www.imf.org/external/pubs/ft/fandd/2003/03/ebra.htm>

drastic appreciation of certain commodities prices (coffee, sugar, etc.) on the world markets.

A typical scenario of the development process of the Dutch disease includes variations on the following steps:

1. Newfound wealth – Either caused by recent significant discoveries of new resources or the significant increase in market value of certain resources and commodities.
2. Relatively sudden and significant appreciation of the local currency relative to other free-floating currencies.
3. Significant move of resources in the new found “gold mine” resulting in increased costs across the industrial base. Costs of value-added goods and services increases significantly.
4. Resulting from above, the locally produced goods and service become too expensive for either local consumption or export resulting in a drastic demand reduction.
5. Value-added exports are drastically reduced while imports are increasing rapidly.
6. Manufacturers close, resulting in unemployment amongst those human resources that do not poses or can acquire the skills necessary for the newfound “gold mine”.
7. When the newfound “gold mine” is emptied out or geopolitical events elsewhere result in a drastic decrease in the value of resource or commodity-based revenues, the economy implodes, often with disastrous human results. This is not yet the case in Ontario (or Canada for that matter) as the boom in oil revenues has only been apparent since the \$40/barrel profitability threshold was met for the Albertan tar sands. Should we wait for confirmation?

Some modern day examples of these types of economic episodes are:

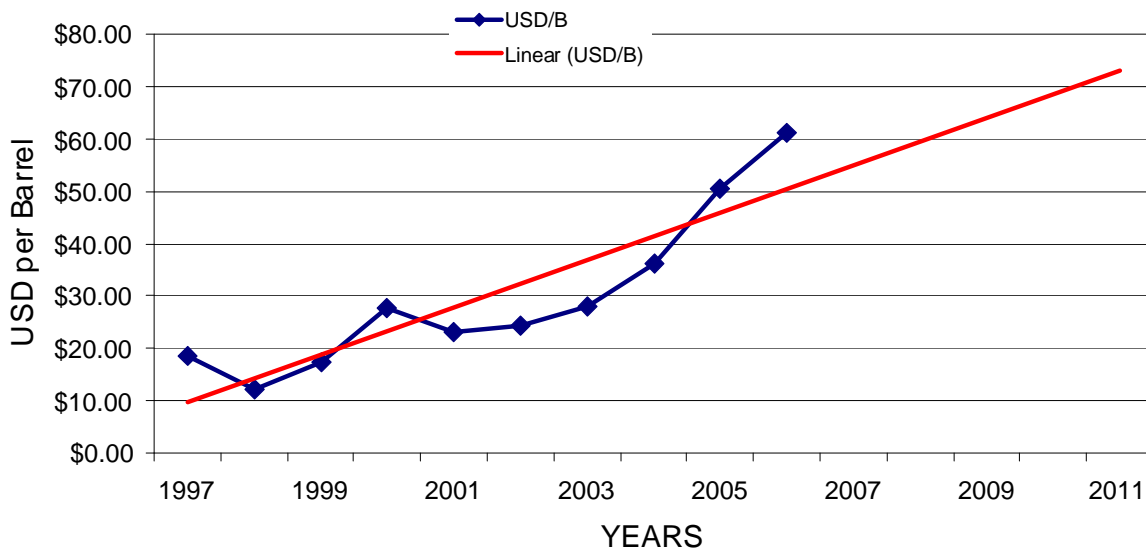
- The original Dutch Disease country of Netherlands ignited by discoveries of large natural gas deposits in the North Sea in the 1960s and well into 1970's.
- Great Britain in the 1980's when quadrupling of oil prices on the world markets allowed for the profitable exploration of the North Sea oil deposits.
- Brazil's coffee crop suffered severely from a 1975 frost. This resulted in increased demand and therefore world prices. Countries that exported coffee, (i.e. Colombia) saw an immediate and drastic increase in foreign revenue with the associated problems of poorly managed new riches.

By looking further back in history we can be successfully say that the demise of the demise of the 16-th century superpower (Spain) was caused by the tremendous and uncontrolled influx of gold and silver from the American expeditions. The gold was used to procure industrial and consumer goods that Britain and the Netherlands readily supplied thereby strengthening their own industrial base at the expense of Spain who as the purchaser was relegated to the role of consumer.

Current situation in Canada appears to meet the three criteria as follows:

1. Increases in natural resources revenues – The dramatic upsurge in energy prices, especially after the invasion of Iraq, meant that the \$40 profitability²³ threshold for Alberta’s tar sands was crossed. In addition to the tar sands Canada’s offshore reserve have made Canada the US’s largest energy supplier.

World Oil Prices 1997 to 2006



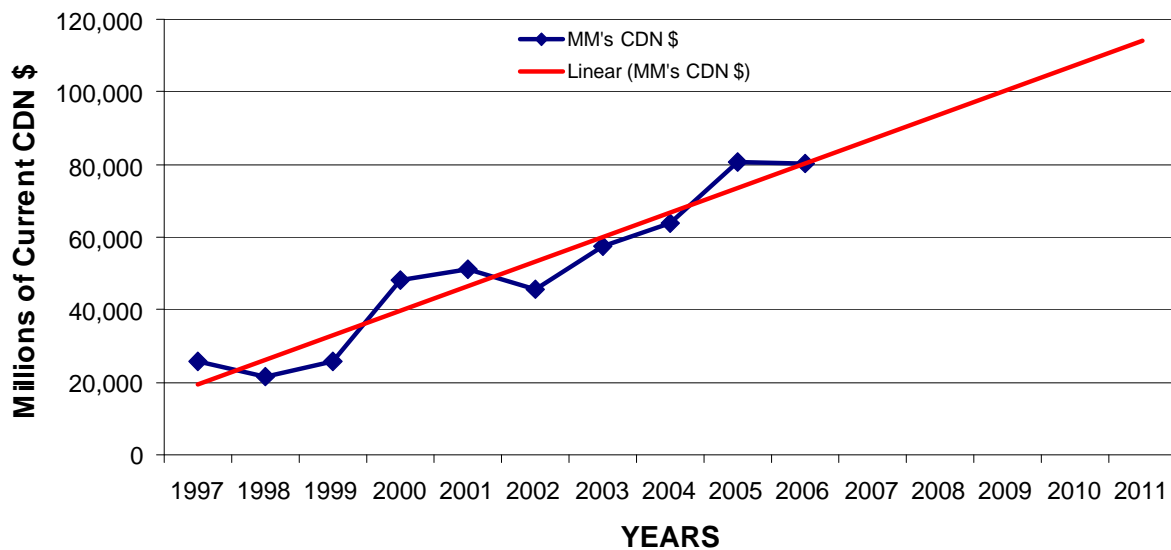
Data from: OPEC (<http://www.opec.org/home/basket.aspx>)

The requirement for the first ingredient of the Dutch Disease is satisfied as an increase in world energy prices generated a significant increase in Canada’s revenues. The significant inflection point for the current run-up in oil prices is 2001. However, given the extra high costs of extracting of oil from the Albertan tar sands, there was no dramatic effect on the Canadian currency. The oil prices did have an effect on the Canadian currency due to the increased exports of the cheaper to extract conventional oil deposits located throughout Canada.

²³

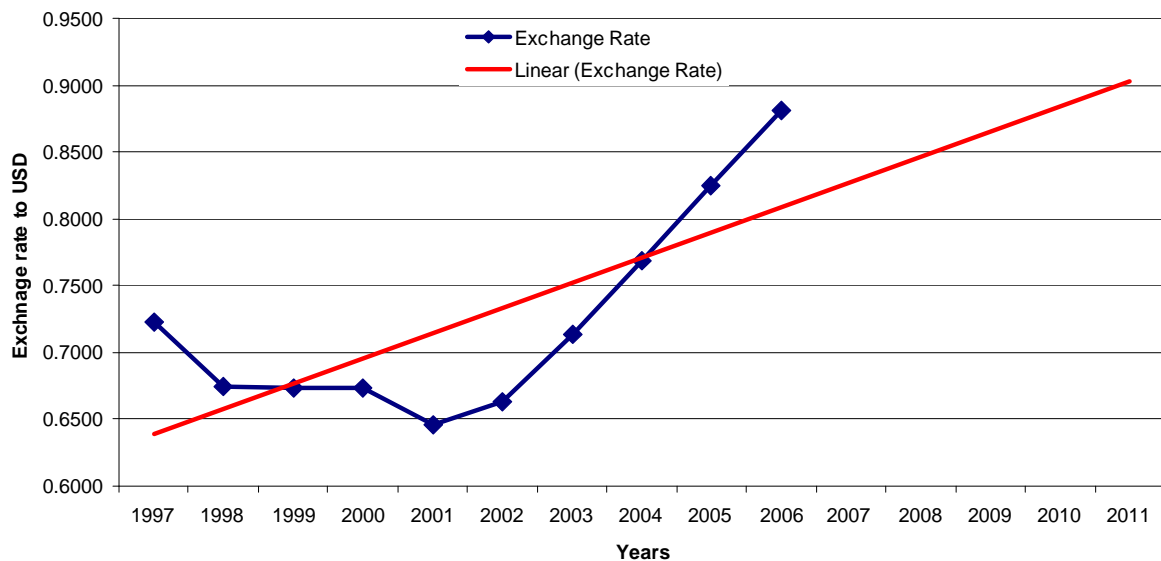
http://www.neb.gc.ca/energy/EnergyReports/EMAOilSandsOpportunitiesChallenges2015_2006/EMAOilSandsOpportunities2015QA2006_e.htm

Canadian Oil Exports 1997-2006



2. Increases in real exchange rate – Does Canada's increasing role of an energy power player in the world markets have an impact on its currency? The short answer is a resounding YES! The currency markets have reacted significantly to Canada's new found riches by increasing the value of the Canadian currency versus the its US counterpart by more than 30% in less than 4 years.

Canadian \$ Gains against the US \$



3. Lagging tradable sector is manufacturing

Canadian Manufacturing Jobs

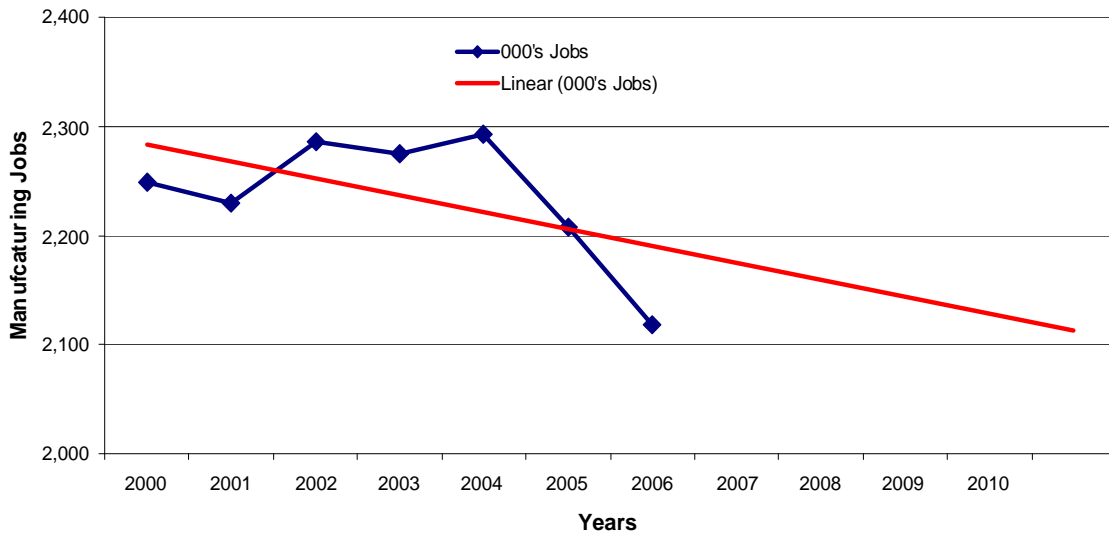
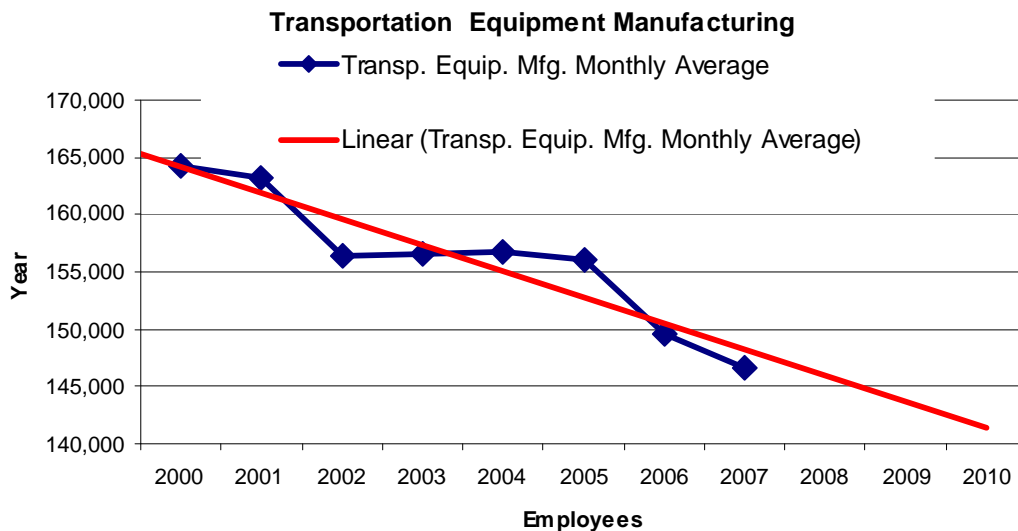


Figure 4 – Data from Statistics Canada - Manufacturing Jobs 2002-2006

The above graph clearly indicates that the number of manufacturing jobs in Canada in general has declined significantly and the pace appears to be accelerating.

The same conclusion can be drawn from the Ontario's transportation equipment manufacturer's data from below.



Data from: Statistics Canada - Monthly Employment by Industry

4.1.2 – Likelihood of Continued Strong Canadian Currency

This question can be answered through the perspective of the fact that Canada is currently perceived by the world markets as a net energy supplier with vast reserves, and the increasing worldwide outlook for fossil energy demand.

On the supply side, the Canadian Association of Petroleum Producers²⁴ states in their 2006 Canadian Crude Oil Forecast:

“Total Canadian oil production is projected to increase from 2.5 million barrels per day (b/d) in 2005 to 4.6 million b/d in 2015 – an increase of 750,000 b/d from CAPP’s 2005 forecast. Growth after 2015 will bring total Canadian production to nearly 4.9 million b/d by 2020.”

On the demand side, the International Energy Agency through their World Energy Outlook 2006²⁵:

“Global primary energy demand in the Reference Scenario is projected to increase by just over one-half between now and 2030 – an average annual rate of 1.6%. Demand grows by more than one-quarter in the period to 2015 alone.”

Summarizing, given the 50% demand increase over the next 25 years and the ability of the Canadian oil Industry to double its output within the same period, we can conclude that the Canadian currency will continue to be known as a “Petro-Dollar”

4.2 – Competitive Environment

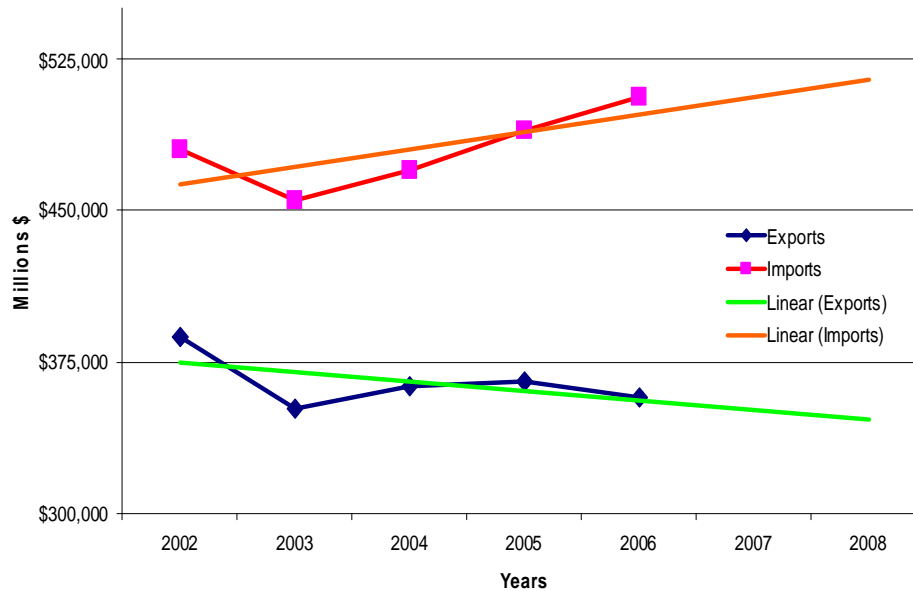
The globalization efforts organized in the name of free trade and increased prosperity for all have significantly affected the manufacturing industries of Canada.

The high Canadian dollar resulted in increased imports of all products but for the purposes of this research, the graph below displays only durable goods data. Simultaneously, the exports dropped to a lower level

²⁴ http://www.capp.ca/default.asp?V_DOC_ID=1169

²⁵ <http://www.worldenergyoutlook.org/WEO%202006%20website.pdf>

Canadian Manufactured Goods - Exports vs. Imports



Data analysed excludes resources and commodities, focuses on industrial and consumer manufactured goods.

Data Sources :Statistics Canada (<http://www40.statcan.ca/l01/cst01/gblec05.htm>, <http://www40.statcan.ca/l01/cst01/gblec04.htm>)

What is the rate of change between imports and exports? The trend between exports and imports is a negative one. Where in 2002 imports were 24% higher than exports, in 2006 that ratio increased to 41%. The higher currency is clearly favouring the imports at the expense of the exports.

The interesting trend here is that although the imports have increased significantly and continue to do so at an accelerating pace, the incremental GDP expected from this condition is not reflect in reality. The CIBC-WM study clearly point to the disappointment of Canada having almost complete employment and yet not being able to increase the GDP. Is this indicative that the newly created jobs in the service industry have failed to fully compensate for loses in the export producing industries?

4.2.1 – Is Price the answer?

The National Association of Manufacturers/MAPI (US) states that

“ - Compared to our nine largest trading partners, U.S. manufacturers face higher costs in the areas of taxation, employee benefits, tort claims, natural gas and government regulation. A recent study by The Manufacturing Institute, NAM and the Manufacturers Alliance/MAPI shows that these costs add 31.7 percent to the cost of doing business in the United States.”²⁶

²⁶ http://www.nam.org/s_nam/bin.asp?CID=201507&DID=227168&DOC=FILE.PDF

While Canadian based automotive parts suppliers have a small competitive cost advantage (5.1% according to the 2006 KPMG *Competitive Alternatives* study²⁷) over their US counterparts, it is reasonable to expect that they cannot compete with Manufacturers from low cost countries on pricing alone. The study is clearly defining the labour component for manufacturing costs to be between 55%-73% of total costs.

The KPMG study determines that amongst the nine countries surveyed (G7 plus Singapore and Netherlands) Canada has the following advantages:

1. Second lowest (following Singapore), fully burdened labour costs.
2. Lowest cost for land and industrial facility construction.
3. Lowest electricity costs.
4. Fourth lowest effective income taxes
5. Significant R&D tax incentives.

The BIG Three have constantly increased their demands for cost reductions and have stated plainly their willingness to shop the world to get the lowest costs parts and components. Should the Ontario automotive parts manufacturers attempt to compete on pricing alone? Is this a viable long-term strategy? The answer is no. The Ontario automotive parts manufacturers cannot hope to compete on price alone as low significantly lower labour costs in other parts of the world coupled with other incentives would make this a losing proposition.

The long-term viability of this important sector of the economy is based on the following actions:

1. Effective immediately, focus on shifting the customer mix from predominantly American OEMs (and their shrinking market share) to the Japanese OEM's and their continuously increasing market share.
2. Concurrently, develop the necessary technologies for market segments that are evolving and holding the higher promise for the future. Electric and hybrid vehicle technology is likely to be at the forefront of the market for the future given the current trends in energy prices. Battery technology, flywheel and regenerative braking systems as well as compact and efficient electrical motors are all examples of technology that can be easily marketed given the current international energy situation and the strength of the environmental movement.

To help understand the short-term proposal and the long-term solution, a SWOT analysis is employed, shown below.

²⁷ http://www.mmkconsulting.com/compalts/reports/2006_compalt_execsum_en.pdf

SWOT Analysis for short-term opportunity: Shift marketing to New Domestic

<p style="text-align: center;">Strengths</p> <ol style="list-style-type: none">1. <i>Currently supplying components and systems to all New Domestic OEM's.</i>2. <i>Located close to most New Domestic assembly plants.</i>3. <i>Medium to large manufacturers, adopted early on most Japanese production management techniques (i.e. Lean, etc.)</i>4. <i>Cost advantages over US-based firms.</i>	<p style="text-align: center;">Weaknesses</p> <ol style="list-style-type: none">1. <i>Longer term required to establish working relationship with buyers (unless currently doing business with one).</i>2. <i>Not all manufacturers have adopted Lean based or similar production systems.</i>
<p style="text-align: center;">Opportunities</p> <ol style="list-style-type: none">1. <i>Re –allocate the bulk of the capacity currently provided to US Big 3 to New Domestic, both in Canada and the US.</i>	<p style="text-align: center;">Threats</p> <ol style="list-style-type: none">1. <i>Keiretsu system which brought a significant number of Asian parts manufacturers to North America.</i>

**SWOT Analysis for Long-term opportunity: Move up the food chain
through development and deployment of new automotive technologies
(i.e. hybrid, electric, etc.)**

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none">• <i>Established company level design and benchmark centres.</i>• <i>Established and growing government sponsored and supports academic (basic research) centres.</i>• <i>Educated labour force.</i>• <i>Generous R&D tax credit programme.</i>	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none">• <i>Lacking a formal, focusing effort to kick-start a meaningful program, province-wide.</i>
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none">• <i>Develop new transportation equipment technologies that meet the expectation of the new paradigm market place (environmentally friendly, economic, etc.)</i>	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none">• <i>Staying-power (survival) to achieve commercialization of the new technologies while significant business (represented by Big 3 volume) declines dramatically.</i>

In order to successfully make the switch to supplying Japanese OEM's primarily (as opposed to current situation where the largest customers are the Big 3), Ontario automotive parts manufacturers will be required to prove efficiency in processes and management strategies that have given the Japanese manufacturers a tremendous edge in the market place. The next section discusses a number of these techniques.

4.3 – Changes required to succeed in the short-term

The tools required for achieving these ambitious cost-cutting targets and facilitate the flexible and reconfigurable goals of the manufacturing enterprise are listed, described, and discussed below.

4.4.1 – Lean Manufacturing – Its originators²⁸ defined “LEAN” as a system that while combining the advantages of craft and mass production uses “***-less of everything, compared with mass production,***

half the human effort in the factory

half the manufacturing space

half the needed inventory,

half the investment in tools,

half the engineering hours to develop a new product, and,

half the time to develop a new product

To proponents and those familiar with the Toyota Production System (TPS) where lean has its roots, the main thrust of the lean process is to remove any and all forms of waste that do not add any value to the customer. There are typically seven types of waste (Japanese, MUDA) that are recognized as primary form of non-value added costs:

Motion – poor ergonomics resulting in potentially health and safety issues.

Time – productive work stoppages while awaiting the arrival of materials from other processes or operation.

Conveyance – having to move materials, tools or equipment. Also, having to move materials more than once at each process step or to get at the needed materials

Overproduction – producing items to store in inventory as opposed to immediate consumption and further processing.

Defects – poor quality production

Over Processing – using equipment and processes that are in excess of required products characteristics.

Inventory – Not an asset but a cost in Lean, tying-up scarce resources than can be best used elsewhere.

In addition, there are other forms of waste that have been recognized as such after the “Original Seven Sins” This would include inefficient use of the environmental resources (waste of energy, water, land, generating pollution, etc.), and underutilization of human resources.

²⁸ James P. Womack, Daniel T. Jones and Daniel Roos (1991) – ***The Machine that Changed the World – the Story of Lean Production*** - HarperPerennial

4.4.2 – The Theory of Constraints (developed by Dr. Eliyahu Goldratt)²⁹ is based on the premise that given the scarcity of resources, all manufacturing systems (and indeed all organizations) have at least one (likely more) constraints that limit the systems performance relative to its goal of making money. These constraints can be classified as either an internal constraint or a external (market) constraint. In order to manage the performance of the system, the constraint must be identified and managed correctly in accordance with the Five Focusing Steps.

Identify the system's constraint – The weakest link of the chain must be identified and prioritized as the main focus.

Decide how to best EXPLOIT the constraint – Ensure that the constrained resource is utilized at full capacity all the times

SUBORDINATE everything else to the above decision – Align the rest of the system to maximize constrained resource utilization

ELEVATE the system's constraint – Add constrained resource capacity to remove constraint.

PREVENT INERTIA from becoming the system's constraint. If, in a previous step, a constraint has been broken, go back to step 1. Continuous improvement, virtuous cycle.

To understand the TOC methodology, one must understand three fundamental concepts as applied:

- a. Throughput is defined as the rate of revenue generation from production sales.
- b. Inventory is defined as the capital invested into intermediary inputs of the system that are intended for conversion into sales.
- c. Operating Expense is defined as overall capital that is required to turn inventory into throughput.

Based on the above definitions, the Theory of Constraints then stipulates that the operational goal of a firm is to increase throughput while minimizing inventory levels and operating expense.

Optimized Production Technology (OPT) a tool for implementing the Theory of Constraints concepts, OPT refers to a software algorithm intended to produce a production schedule for a facility by taking into account all of the systems constraints in terms of equipment, personnel, tools, etc.

4.4.3 – Six Sigma – In its own right, the methodology called Six Sigma has been defined as a reincarnation of Total Quality Management or Statistical Process control on Steroids. Moreover, both of these simplifications have a seed of truth to them since the actual components of the Six Sigma toolbox are not new at all. To most practitioners, Six Sigma is a data-driven method of reducing variability of a process with the stated goal of meeting and exceeding the customers' expectation almost

²⁹ Eliyahu M. Goldratt – *Theory of Constraints* – December 1999 – North River Press

always (we would be allowed to fail only 3.4 times out of a million customer opportunities, experiences or products).

The core principles of Six Sigma are:

- Understanding and managing customer requirements
- Aligning key business processes to achieve those requirements
- Utilizing rigorous data analysis to minimize variation in those processes
- Driving rapid and sustainable improvement to business processes.

Developed by Motorola Inc. in the mid-1980s as a means of reducing product quality problems, Six Sigma is based on the following methodology:

Define improvement opportunity – Prioritized identification of a problem that would require attention.

Measure performance – Collect data that describes accurately how the process is working currently is gathered and analyzed in order to produce some preliminary ideas about what might be causing the problem.

Analyze opportunity - Based upon these preliminary ideas, theories are generated as to what might be causing the problem and, by testing these theories, root causes are identified.

Improve performance – Removing root causes through product or process re-design.

Control performance – New controls are designed and implemented to ensure that old problems do not return and that the improvements made are permanent.

Transfer best practices – to other areas of the organization of process.

4.4 – Changes required to insure a successful implementation of the long-term solution

I believe that the following items will need to be addressed to place an Ontario automotive supplier into the position to pursue development of new transportation technologies. Please note that since a complete strategy session is required to address these issues, the brief questionnaire below is not exhaustive and therefore it is assumed that the companies looking at adopting the phase two (long-term plan) of the proposal have already experience in the development and deployment of new technologies. I suggest that these items are addressed preferably in concurrence with the phase one of the proposal (switch capacity to the New Domestic).

1. Determine the strength of the company's R&D department.
 - a. Does the company have a business plan that defines innovation as a core value and allocates sufficient resources?
 - b. Does it currently engage in R&D activities or is limited to incremental improvements to proven technology?
 - c. Does the company currently take advantage of the SR&ED program?
2. Determine the desired path of new technological development.
 - a. Is the new technology going to expand the company's current offering?

- b. Is the new technology going to complement the exiting offering into a new field (system or module as opposed to component level)?
 - c. If yes, what safety gates are in place to ensure successful launch and deployment in the new field?
- 3. Determine the marketing strategy of the new technology.
 - a. Is the new technology going to be offered through the existing channels or to new customers?
 - b. Is the technology developed going to shift the company's place in the hierarchy of suppliers (tier 1, 2, etc.)? If yes what are the implications (for example when one goes from tier 2 to tier 1, a company must expect that OEM's will demand a sharing agreement for field repairs costs, which can be very large as opposed to limited liability to the actual product supplied)

4.5 – How to Survive – Note and ideas on implementation of a survival plan

- 4.5.1 – Lean manufacturing is, by definition, a fragile system. Since it lacks all of the components of the safety net present in mass production systems (high inventory levels, extra space, equipment, people, etc.), and is accepted to require a long period of time for proper implementation - 10 years - (p. 243 Womack, et. al), implementing lean requires a long-term, proven commitment. Even simple tasks such as accounting practices, must change to reflect the changes occurring on the shop floor since a simple item such as inventory that under GAAP is considered an asset will be re-classified as a liability under Lean.
- 4.5.1 Some of the other obstacles that one must account for when developing the lean implementation strategy are changes in job descriptions for every manager and worker as well as the need to re-allocate the newly redundant resources. In the absence of a growth opportunity, the inability to provide secure employment for those resources that by lean definition must continually explore ways to eliminate them, will likely result in a drastic reduction of effort and therefore negative results, over time. Redundant human resources that given the mass production system division of labour lack easily transferable skill sets, would need to be refocused and retrained, likely by means of a job bank program or similar.
- 4.5.2 – Theory of Constrains implementations requires a slightly different mind set as compared to traditional mass production process. Where in a typical mass production system the emphasis tends to be on improving each resource efficiency, working close to full capacity, TOC teach to balance material flow through the process. In essence, managers that are accustomed to cracking the whip to see everybody running around “being busy”, will have a hard time understanding that unless the idle worker just observed is assigned at a constrained resource, it is OK!

Goldratt posits that running at full capacity in all process steps without increasing the actual sales (throughput) is wasteful through the creation of work in process or finished goods inventory that is a cost and not a saleable asset (throughput).

In addition to the somewhat “reversed” thinking of subordinating everything to the constrained resources as opposed to running flat out at all process steps, there seems to be a somewhat confusing difference between the Lean concepts and the TOC concepts. Experts of either one, would point out the difference between the –Improve everything - concept of Lean versus the – Focus on what is broken - concept of TOC. The author submits that there is no disconnect between the two apparently opposing view if one takes into consideration the following:

1. Speed of implementation – TOC would likely result in faster positive results when applied to a process of multiple manufacturing steps constrained at a bottleneck. Lean would like succeed equally fast if applied (as a deployment start-up) to a self-contained manufacturing cell or individual process.
2. Push vs. Pull – When confronted by traditional mass production system (push), optimizing non-bottleneck operations would actually increase waste. This system, at least in the short term, would benefit from a TOC implementation, at least until it matures into a pull system when Lean becomes the preferred approach.

4.5.3 – Many large organizations (Motorola, GE, Allied Signal/Honeywell, etc, have reported large cost savings and significant customer satisfaction improvements after implementing the Six Sigma process.³⁰

Implementing Six Sigma across a medium size organization requires a significant commitment of time and resources. Although most analytical tools (ANOVA, design of experiments, etc.) are not new at all and have been deployed in industry in a variety of contexts, the Six Sigma way requires a much higher level of discipline than Statistical Process Control or even Total Quality Management. The commitment is required since the deployment process would consist of the following steps:

1. Defining processes, key customer requirements, and process “owners”.
2. Measuring performance against customer requirements and key performance indicators.
3. Analyzing data to enhance measures and refine the process management mechanisms.
4. Controlling process performance by monitoring process inputs, process operation, and process outputs, and responding quickly to problems and process variations.

³⁰ <http://www.isixsigma.com/library/content/c020729a.asp>

In addition, a fairly lengthy period of time is required to gather sufficient data to establish each process's base line that would be indicative of all source of variation, both common and special.

While implementing the Six Sigma thought process one occasionally runs into the debate about which is better: Six Sigma or Lean Manufacturing? The author believes that the reason for the territorial battles ensuing is due to the poor understanding of either methodologies scope of work and application. Just like the Theory of Constraints and Lean manufacturing are really complimentary, so are Six Sigma and Lean. So a better approach to business survival would be to define a home-grown version of a Lean Sigma methodology that could comprise the tools of both, without overlapping. For example while both methodologies strive to understand the current state of the subject process, it can be successfully argued that a value stream map is capable of conveying more pertinent information than a process map.

5. CONCLUSION

Manufacturing in general and transportation equipment manufacturing in particular have provided Ontarians with a great standard of living for two generations. Representing 62% to 71% of the durable goods production in the province of Ontario, the automotive sector is a large and important economic driver that employs a significant segment of the middle class through direct and indirect employment. The value of total shipments of this sector peaked in 2002 and has been declining since.

As, the Canadian currency started climbing aided by the tremendous increase in energy and metals prices on the world markets, most local manufacturers found themselves marginalized, primarily on cost.

What is the future of the Canadian Currency? As the demand for energy products is forecasted to continue rising³¹ and the demand for minerals and metal will continue to remain robust³², the likelihood of the Canadian currency remain strong against the US currency is very high.

Significantly lower cost products are increasingly available from the new industrialized countries. Compounding the problem, most Ontario based automotive suppliers are supplying primarily the Big 3 (GM ford and DaimlerChrysler) whose market share is shrinking steadily.

A study titled "*Momentum – 2007 KPMG Global Auto Executive Survey*" describes the expected dynamics of the international automotive sector as follows:

*"The winners in global market share gains will be, in this order, Chinese, Indian, and other Asian brands. The losers: North American brands. European brands will hold their ground."*³³

As the big 3 have had their share of problems over the last couple of decades, they have sought relief in their traditional safe heaven of supplier price reductions (not cost reductions) and givebacks.

When suppliers started going bankrupt, there was no more to give. According to a study by AlixPartners, a global corporate-advisory firm, discussed at an Original Equipment Suppliers Association (OESA) meeting in 2006:

"No less than 38 percent of all auto suppliers in North America are in "fiscal danger," meaning that they could face insolvency within 24 months or less unless they take urgent counteractive measures. ... 24 percent of all suppliers globally

³¹ http://www.eia.doe.gov/oiaf/aeo/pdf/trend_2.pdf - Annual Energy Outlook 2007 with Projections to 2030

³² <http://www.imf.org/Pubs/FT/weo/2007/01/pdf/text.pdf> - IMF - World Economic and Financial Surveys - World Economic Outlook - Spillovers and Cycles in the Global Economy Apr 07

³³ <http://www.kpmg.ca/en/industries/cib/industrial/documents/Momentum2007Global.pdf>

face the same danger. That would be in addition to the \$60 billion in major supplier bankruptcies in the U.S. alone since 2001.”³⁴

Now the Big 3 have turned to triple their parts purchases from low cost countries³⁵ as a way to survive. And in doing so, some suppliers have taken to off shore jobs to help reduce the wage costs.

This paper discusses two alternatives that together form the basis for stabilizing the Ontario transportation equipment manufacturers present situation and help chart a course for their future.

The short-term proposal is to focus on shifting as much as possible of the available capacity from the BIG 3 to the New Domestics (Japanese and Korean manufactures). This transition will be aided by the following facts:

1. Most medium to large size suppliers currently supply the New Domestics, albeit in a smaller percentage of their business volume, and,
2. They have adopted and implemented at least segments of the LEAN manufacturing techniques common to most Japanese OEM's and their suppliers.

However, a potential threat (or opportunity awaiting a solution) is the significant and growing presence of the Japanese OEM's keiretsu partners. The system generally favors the commitment to their business partners at the expense of local suppliers.

However, as the New Domestics will increase their market share, their keiretsu suppliers would require additional production capacity. In the context of guaranteeing contracts for periods of time required to justify the payback on new capital investments versus buying from local sources, I believe that the local sources have the advantage. As local suppliers (Ontario and North American automotive parts manufacturers) have most of their capacity already in place, there will likely be no requirements for additional capital investments. Therefore their pricing structure will offer them a competitive advantage. This advantage coupled with diligently pursuing additional cost savings through the constant and continuous pursuit of Lean deployment, should buy these firms the necessary time to implement the second phase.

The second phase or the long-term proposal is : Development of new technologies and products that will resonate with a marketplace turning towards more energy efficient products.

Capitalizing on a highly educated and loyal labour force while taking advantage of generous government-assisted R&D tax credits and enjoying a cost advantage over US locations, the Ontario based companies have the necessary tools to make significant new discoveries and innovations. The new technologies can be deployed internally (on the North American market) or exported internationally, if the issue of intellectual

³⁴ <http://www.automotive.com/features/90/auto-news/21223/index.html>

³⁵ <http://www.iht.com/articles/2006/10/26/bloomberg/sxford.php>

property rights is resolved at a satisfactory level, given the expected growth of the Chinese and Indian domestic markets.

The new technologies coupled with a move further up the food chain by offering systems and modules as opposed to components, would help prevent “price alone” sourcing decisions. By offering a “better mouse trap” the Ontario automotive suppliers will help ensure their continued success and therefore the continuation of the current standard of living for the middle class it employs.

This paper does not address the following areas and each (or together) could constitute an area of further research into an economic sector and industry that is vital to Canada in general but Ontario in particular due to the highest content of middle quartile jobs at the highest risk of losing (being off shored) in the globalization effort, without being replaced by equal jobs.

1. What percentage of the Ontario automotive suppliers has deployed the Lean toolkit and how complete is their deployment. The answer to this question might offer insight into how many of these companies would have a better chance in penetrating the keiretsu system and shift their capacity from the BIG 3 to the New Domestics.
2. What percentages of Ontario automotive suppliers have well defined and staffed R&D functions capable of developing the needed new technologies? The answer to this question would offer insight into the longevity and adaptability of the sector.
3. Some of the larger suppliers are supplying almost all of the components of a car, therefore given their know-how, is it possible or feasible to focus those resources into actually delivering a fully assembled vehicle under a contract manufacturing agreement or even private label? A potential start fresh approach that is not handicapped by legacy costs and poor decisions of the past. The Greenfield approach has worked well for the New Domestics OEM's.

REFERENCES:

1. Statistics Canada – **The Daily - Labour Force Survey** – Nov. 03, 2006
<http://www.statcan.ca/Daily/English/061103/d061103a.htm>
2. Export Development Corporation – **Global Export Forecast – Fall 2006** -
http://www.edc.ca/english/docs/ereports/gef/country_information_efindex.htm
3. Eliyahu M. Goldratt – **Theory of Constrains** – December 1999 – North River Press
4. Eliyahu M. Goldratt – **The Goal** – July 2004 – North River Press; 3rd edition
5. Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh (2002) – **The Six-Sigma Way Team-Field book – An Implementation Guide for Process Improvement Teams** - McGraw Hill
6. Robert Rowthorn and Ramana Ramaswamy (1997) – **Deindustrialization – Its Causes and Implications** - ©1997 International Monetary Fund, September 1997
7. Masaaki Imai – **KAIZEN – The Key to Japan’s Competitive Success** – The KAIZEN Institute, 1986
8. James P. Womack, Daniel T. Jones and Daniel Roos (1991) – **The Machine that Changed the World – the Story of Lean Production** - HarperPerennial
9. James P. Womack and Daniel T. Jones(1996) – **Lean Thinking – Banish Waste and Create Wealth in your Corporation** - Simon and Schuster Inc.
10. W. Edwards Deming – **Out of the Crisis** – 19-th printing – 1992 MIT – Centre for Advanced Engineering Study, Cambridge, Massachusetts.
11. http://www.asq.org/about-asq/who-we-are/bio_deming.html
12. http://www.wtec.org/loyola/em/05_03.htm
13. Johnson C. (1982), MITI and the Japanese Miracle. Stanford University Press: Stanford.
14. Statistics Canada, CANSIM, table (for fee) 282-0008 and Catalogue no. 71F0004XCB. Last modified: 2006-01-25.
15. Robert Rowthorn and Ramana Ramaswamy (1997) – **Deindustrialization – Its Causes and Implications** - ©1997 International Monetary Fund, September 1997
16. http://research.cibcwm.com/economic_public/download/eqi-cda-022007.pdf - Emphasis mine
17. by René Morissette, Xuelin Zhang and Marc Frenette - Catalogue no. 11F0019MIE — No. 291
18. <http://www.bls.gov/emp/optd/optd002.pdf>
19. <http://www40.statcan.ca/l01/cst01/famil106a.htm>
20. <http://www.2ontario.com/facts/fact02.asp#2>
21. <http://www.2ontario.com/software/brochures/automotive.asp#8>
22. <http://www.bank-banque-canada.ca/en/rates/exchange-avg.html>
23. <http://repec.economics.utoronto.ca/files/tecipa-205-1.pdf>
24. <http://www.cra-arc.gc.ca/taxcredit/sred/aboutus-e.html>
25. <http://www.2ontario.com/facts/fact13.asp>
26. http://www.energy.gov.on.ca/index.cfm?fuseaction=english.news&body=yes&news_id=146
27. http://www.energy.gov.on.ca/index.cfm?fuseaction=electricity.nuclear_targets

28. http://www.mmkconsulting.com/compalts/reports/2006_compalt_execsum_en.pdf
29. <http://www.industryweek.com/ReadArticle.aspx?ArticleID=13882>
30. <http://www.statcan.ca/english/about/overview.htm>
31. Economic Journal, 92, December 1982
32. <http://www.imf.org/external/pubs/ft/fandd/2003/03/ebra.htm>
33. http://www.neb.gc.ca/energy/EnergyReports/EMAOilSandsOpportunitiesChallenges2015_2006/EMAOilSandsOpportunities2015QA2006_e.htm
34. http://www.capp.ca/default.asp?V_DOC_ID=1169
35. <http://www.worldenergyoutlook.org/WEO%202006%20website.pdf>
36. http://www.nam.org/s_nam/bin.asp?CID=201507&DID=227168&DOC=FILE.PDF
37. http://www.mmkconsulting.com/compalts/reports/2006_compalt_execsum_en.pdf
38. <http://www.isixsigma.com/library/content/c020729a.asp>
39. http://www.eia.doe.gov/oiaf/aeo/pdf/trend_2.pdf - Annual Energy Outlook 2007 with Projections to 2030
40. <http://www.imf.org/Pubs/FT/weo/2007/01/pdf/text.pdf> - IMF - World Economic and Financial Surveys - World Economic Outlook - Spillovers and Cycles in the Global Economy Apr 07
41. <http://www.kpmg.ca/en/industries/cib/industrial/documents/Momentum2007Global.pdf>
42. <http://www.automotive.com/features/90/auto-news/21223/index.html>
43. <http://www.iht.com/articles/2006/10/26/bloomberg/sxford.php>