

Logistics and Supply Chain Management (SCM) Key Performance Indicators (KPI) Analysis

A Canada/United States Retail and Consumer Product Goods (CPG) Supply Chain Perspective



November 2006

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Executive Summary

The retail and consumer product goods (CPG) supply chain is a complex world divided between large retailers establishing integrated supply chain practices with manufacturers and wholesalers, and smaller specialized retailers emphasizing customized or unique products and services delivered in a Just-In-Time (JIT) manner to their customers.

The desire to react more rapidly to an ever-more demanding and less loyal customer, ever shortening profit and product life cycles, global sourcing to low cost countries and the need to avoid even smaller gross margins across the CPG supply chain are the key factors for developing logistics and supply chain management (SCM) collaboration models.

Measurement of logistics and SCM key performance indicators (KPI) is an essential part of the global supply chain CPG collaboration concept. The two most preferred KPI measured by North American (NA) CPG lean manufacturers are logistics and SCM JIT related (on-time delivery and inventory turns) while traditional lean floor plant measures, such as cost per unit and manufacturing cycle time, are far behind⁴.

It is estimated that 37 percent of NA firms that put in place corporate wide measurement of logistics and SCM KPI achieved a decrease of 15 percent or more in shipment delays compared to only 7 percent of firms that do not measure those KPI consistently¹.

While inventory turns is the main KPI for evaluating supply chain agility, logistics cost KPI allow firms to evaluate the efficiency of their logistics and SCM operations. The combination of supply chain agility and efficient SCM practices is key to long term competitiveness and prosperity of Canadian firms in a global supply chain (GSC) context.

Inventory Turns

Between 1999 and 2003, Canada was behind its U.S. neighbour in a proportion of 30 percent to 40 percent in terms of inventory turns. This is a major productivity gap between the two countries.

Inventory turns remained at the same level in the retail sector, both in Canada and in the United States, between 1999 and 2003, like in the wholesale sector. The Manufacturing sector increased its inventory turns by more than 20 percent between 1992 and 2005 while wholesale and retail inventory turns were stable. This means that the inventory was not moved from the wholesalers to the retailers, and that a real productivity increase occurred in the Manufacturing-Wholesale-Retail supply chain⁹.

It is important to note that 63 percent of NA CPG firms that are part of supply chain collaborative initiatives do not measure the value of these initiatives at all³. The lack of measurement and understanding of the benefits of collaborative KPI, such as sales increase, stock-out ratios and inventory management across the CPG value chain, can

have an important impact on the innovation and productivity of the Retail and CPG sector.

Logistics Costs

Canada has total and internal logistics costs in Retail that are, respectively, 16 percent and 19 percent higher than in the U.S.. On the other hand, the U.S. Retail sector outsources more logistics activity, by a ratio of three times, than the Canadian Retail sector¹³.

For the third cost component, Canada's retail sector has a larger inventory carrying cost than the U.S. by 31 percent. This is explained by the fact that Canadian firms have lower inventory turns compared to their U.S. counterparts¹³.

Technology and Investment

SCM technology adoption is still at an infancy stage in Canada; only 14-19 percent of Canadian CPG Manufacturers implemented new logistics and SCM processes between 2002 and 2004²¹. In order for CPG firms to achieve the benefits of their respective logistics and SCM collaboration drivers, the adoption of logistics and SCM technology and processes across the supply chains is a key component for developing efficient collaboration networks.

The risk level of investing in logistics and SCM technology and processes is still limited and firms do not achieve concrete improvements from them. More than 65 percent of NA initiatives to reduce inventory and assets required, or to improve supply chain flexibility, either met or exceeded initial expectations (only 3 percent of them failed) while 80 percent of NA CPG and Retail sectors that implemented a Lean logistics strategy saw a decrease as per or above expectations in SCM costs⁴.

Although the logistics and SCM technology investment level has been low in Canada, the Retail sector is starting to respond to the increase in complexity of logistics and SCM by increasing their investment into value added distribution centers and freight terminal infrastructure. Canadian retail investments in warehousing and freight terminals increased by more than 222 percent from 2001 to 2003⁷.

In order to benefit from the productivity of logistics and SCM, individual firms must develop their own personal roadmap. It would consist of documenting the long-term perspective into specific action items linked to deliverables, performance indicators objectives, returns on investment and a project time frame.

Table of Contents

Executive Summary	3
Introduction.....	6
I - Industry Productivity and Competitiveness via Logistics and SCM.....	7
II-Inventory Management and Just-in-Time Key Performance Indicators.....	10
A. Inventory turns comparison: Canada vs. U.S.....	10
B. Sector Specific Analysis: The Canadian Food Supply Chain.....	12
C. Sector Specific Analysis: The Canadian Furniture Supply Chain	13
D. In-depth Analysis: Canadian Retail Sector	15
E. Technology	16
III-Logistics and SCM Cost KPI Analysis	18
F. Internal Logistics Costs.....	18
G. Logistics Outsourcing	20
H. Inventory carrying costs.....	21
I. Total Retail Logistics Cost.....	22
J. Importance of Logistics Technology in Cost Reduction	22
IV- Final Remarks.....	23
Annex I - Methodology	24
Annex II - Definitions	28
Annex III – Inventory Management Data	31
Annex IV –Logistics Internal Cost Data.....	38
Annex V - References	39

Introduction

Retail and Consumer Product Goods (CPG) global supply chains (GSC) are driven by a customer-centric reality, global sourcing from low cost countries, smart border requirements, logistics mandates (such as Radio frequency identification (RFID)) from large corporations and mass customisation in a Just-In-Time (JIT) manner. Logistics and supply chain management (SCM) are thus expected to play a key role in CPG GSC and contribute dramatically to productivity growth of Canadian firms within the next few years.

Although Canadian CPG firms have used logistics performance indicators internally for decades, there has never been any tool for Canadian firms to benchmark themselves to their supply chain partners, competitors, sectors and U.S. counterparts.

Manufacturers, retailers and wholesalers in CPG sectors need quality information on logistics and SCM costs as well as performance indicators in order to facilitate the development of best practices and benchmarks, justify investment and innovation, and monitor industry performance.

Industry Canada has partnered with Supply Chain and Logistics Association of Canada (SCL) Research Committee and the Retail Council of Canada to launch a national logistics and SCM performance indicators initiative.

The objective of this study is to propose a Logistics and SCM key performance indicators (KPI) analysis that can be used as a benchmarking tool for firms and policy makers. This analysis will help firms understand where they are located with respect to leading enterprises, firms within their own sector and the U.S., and what steps they must undertake in order to become more competitive.

Logistics and SCM functions can either be performed from internal activities or outsourced to a third party logistics (3PL) service provider, via wholesale distribution, or in combination. The following report will guide supply chain managers through these different key components in order to provide them with a global view of their supply chain KPI.

Analysis is initiated by a general section on industry productivity and competitiveness indicators via logistics and SCM. This will be followed by specific sections on inventory management and Just-in-Time KPI, and a logistics and SCM cost KPI analysis that includes three components: logistics internal, outsourced and inventory carrying costs.

Finally, sector specific KPI, complete with methodology, calculations and definitions will be tabled in Annexes in order to provide details to help individual firms' policy makers develop applicable benchmarking tools.

I - Industry Productivity and Competitiveness via Logistics and SCM

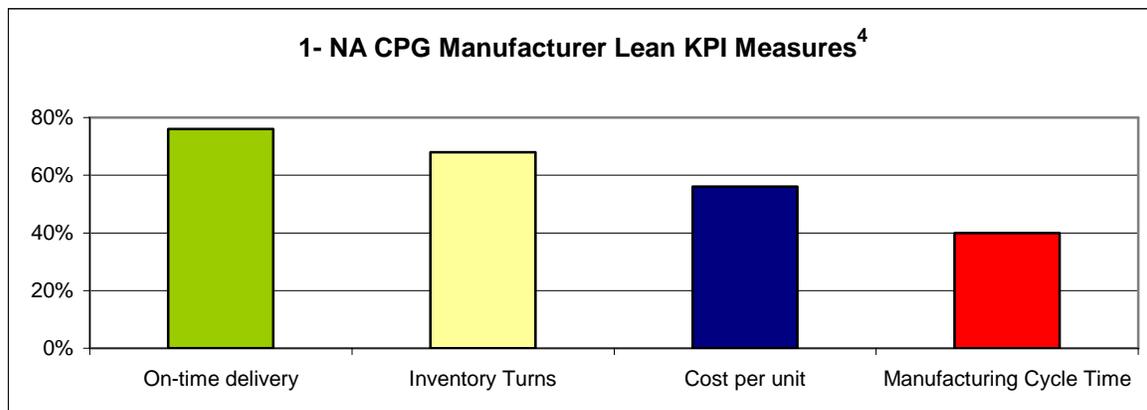
The retail and CPG supply chain is a complex world divided between large retailers establishing integrated supply chain practices with manufacturers and wholesalers, and smaller specialized retailers emphasizing customized or unique products and services delivered in a JIT manner to their customers.

These two CPG supply chain models differ while being triggered by the same force: responding to a customer centric environment. Customers are driving the demand and product/service levels by requesting complex customised products while at the same time expecting lower prices. The desire to react more rapidly to an ever-more demanding and less loyal customer, ever shortening profit and product life cycles, global sourcing to low cost countries and the need to avoid even smaller gross margins across the CPG supply chain are the key factors for developing logistics and SCM collaboration models.

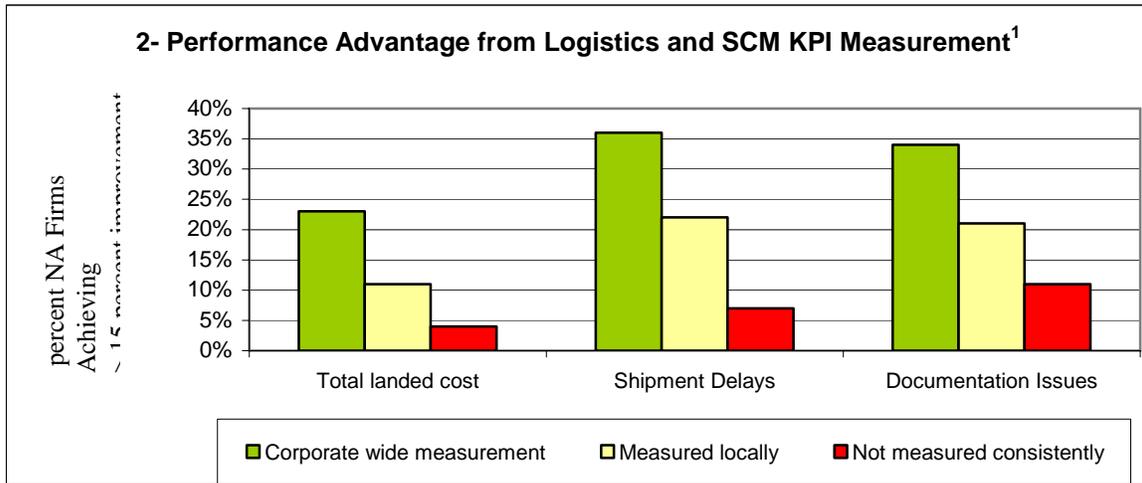
Retail and CPG logistics and SCM collaboration is also extremely complex due to both market pressures of delivering rapid response, and long lead times related to low cost country sourcing. In fact close to 88 percent of North American (NA) CPG players are expecting low cost country savings eroded by logistics and supply chain costs¹.

The Chinese share of imports for key CPG sectors in Canada has more than doubled in the short period between 2000 and 2004². Best in class retailers that are turning to low cost offshore sourcing, such as China, are looking far up the supply chain to reduce lead times as much as possible and mitigate the effect of complex and less predictable logistics and SCM operations within the value chain, as shown in Figure 2³.

Measurement of logistics and SCM KPI is an essential part of the global supply chain CPG collaboration concept. The two most preferred KPI measured by North American (NA) CPG lean manufacturers are logistics and SCM JIT related (on-time delivery and inventory turns) while traditional lean floor plant measures, such as cost per unit and manufacturing cycle time, are far behind⁴.

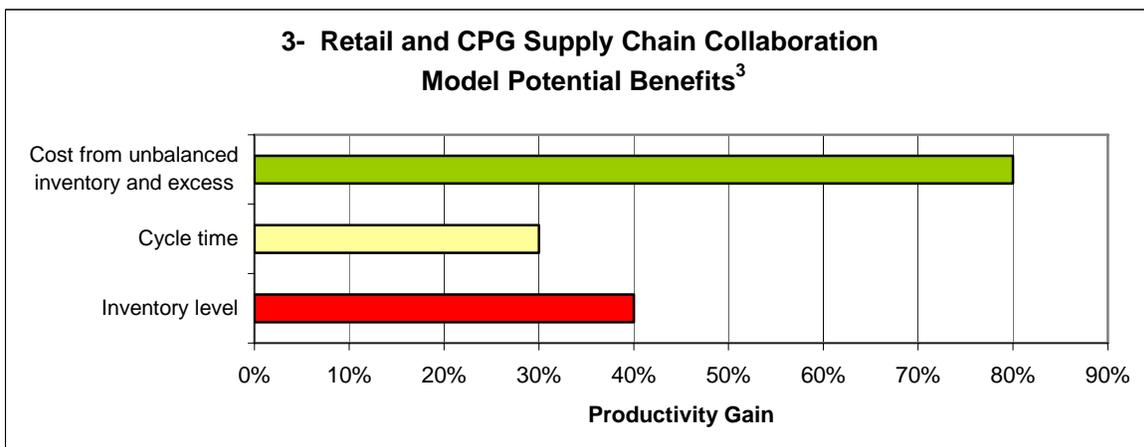


In terms of KPI measurement processes, 37 percent of NA firms that have put in place logistics and SCM corporate wide measurement achieved a decrease of at least 15 percent or more in shipment delays compared to only 7 percent of firms that did not measure lean logistics KPI consistently. NA firms that measured SCM KPI also outperformed their industry counterparts on document issues, which is a key component of Smart Border solutions¹.



It is important to note that 63 percent of NA CPG firms that are part of supply chain collaborative initiatives do not measure the value of these initiatives at all. The lack of measurement and understanding of the benefits from collaborative KPI, such as sales increase, stock-outs ratios and inventory management across the CPG value chain, can have an important impact on the innovation and productivity of the Retail and CPG sector³.

SCM processes and technology enable leading CPG supply chain players to develop new business practices that will fundamentally change the way their value chain plans and responds to consumers. The concept of connecting the retail store to its whole supply chain is based on the Collaborative Planning Forecasting and Replenishment (CPFR)



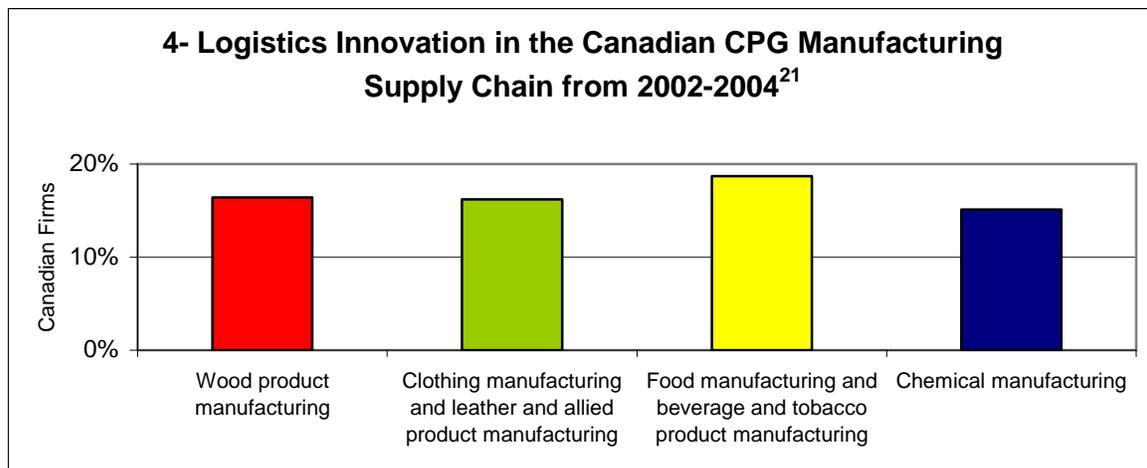
model where partner companies (distributors, manufacturers, suppliers, logistics service providers and retailers) exchange information on product sales and forecasts in order to synchronize their operational plans. This approach also integrates the downstream information flow to take account of manufacturing constraints.

As an integrated approach to demand and replenishment in the CPG sector, connecting stores to all supply chain players is expected to yield high benefits to firms across the retail and CPG value chain⁵.

Collaboration applications are also key for the small specialized retail sector. The capability to provide Available To Promise (ATP), mass customisation and JIT in small quantity to specific end customers requires an enhanced level of synchronisation between value chain participants.

Canadian retailers have also embraced the Internet into their logistics and SCM processes. The two key benefits of conducting business over the internet in the Canadian CPG sector are reaching new customers, followed closely by better co-ordination with suppliers and/or customers and/or partners (a key CPFR foundation principle)¹⁹.

SCM technology adoption is still at an infancy stage in Canada⁶; only 14-19 percent of Canadian CPG Manufacturers have implemented new logistics and SCM processes between 2002-2004²¹.



Although the logistics and SCM technology investment level has been low in Canada, the retail sector is starting to respond to the increase in complexity of logistics and SCM by investing more intensively into value added distribution centers and freight terminal infrastructure with an increase of 222 percent between 2001 and 2003⁷.

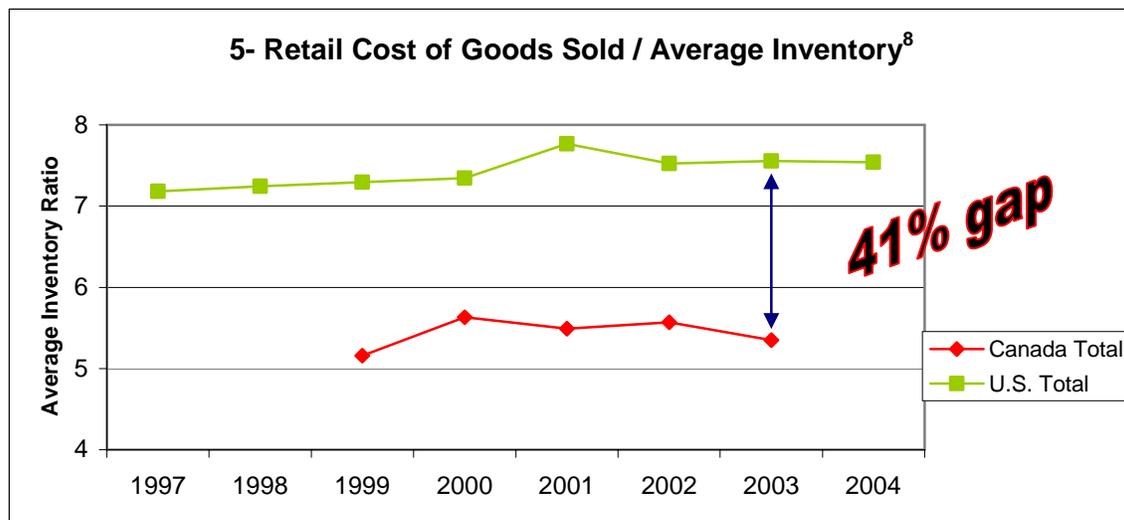
II-Inventory Management and Just-in-Time Key Performance Indicators

A. Inventory turns comparison: Canada vs. U.S.

Key to the success of an agile CPG supply chain is the speed and flexibility with which these activities can be accomplished and the realization that customer needs and customer satisfaction are the very reasons for the network itself to exist. Achieving agility starts with the physical flow of parts, from the point of supply, through the factory, and shipment through agile distribution channels.

The main logistics and SCM KPI to measure supply chain agility in the CPG supply chain is inventory turns. Inventory turns can be defined as how many times a year the average inventory for a firm changes, or is sold. This ratio is a common industry standard KPI in inventory management performance analysis.

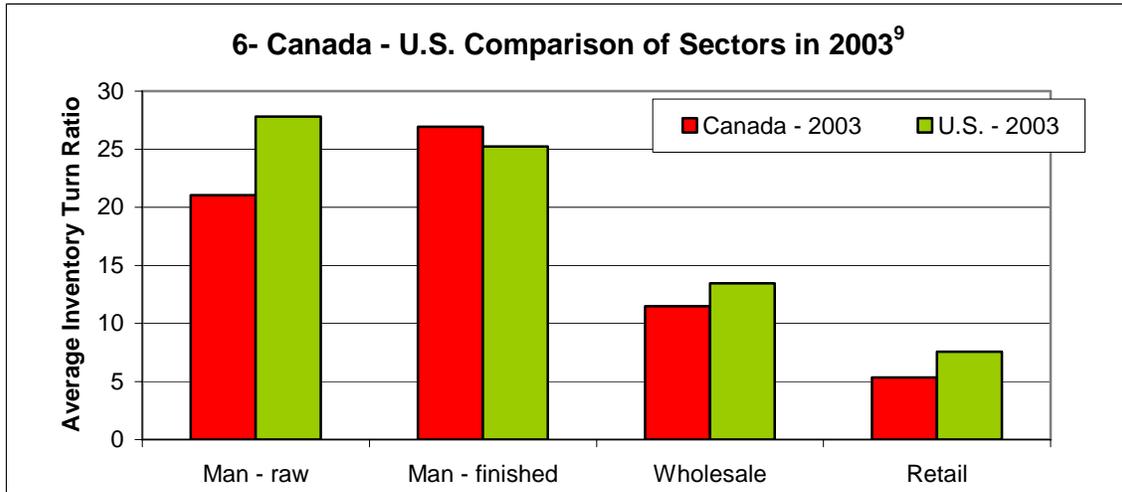
Inventory turns remained at the same level in the retail sector, both in Canada and in the United States, between 1999 and 2003, like in the wholesale sector. Between 1999 and 2003, Canada was behind its U.S. neighbour in a proportion of 30 percent to 40 percent in terms of inventory turns⁸. This is a major productivity gap between the two countries.



Levelled inventory turns are actually good news in a total supply chain perspective. The Manufacturing sector increased their inventory turns by more than 20 percent in the period of 1992-2005 while wholesale and retail inventory turns were stable. It means that the inventory was not moved from the wholesalers to the retailers, and that a real productivity increase occurred in the Manufacturing-Wholesale-Retail supply chain. Decreasing inventory turns could have meant that the inventory shifted from one link (the wholesalers) in the supply chain to the next one (the retailers).

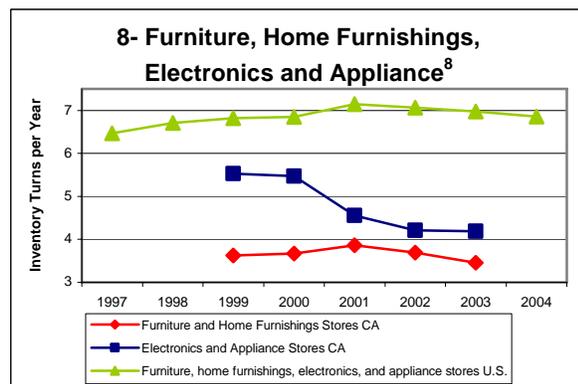
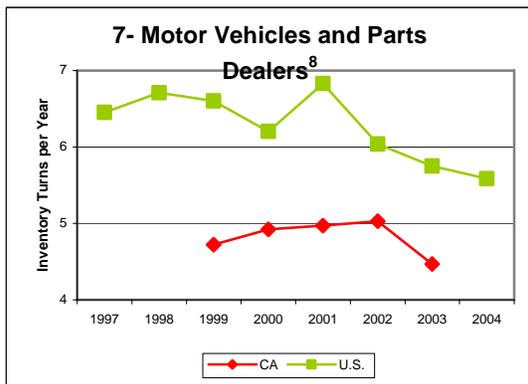
Going one step further and comparing the 2003 inventory turns ratios data between Canada and U.S. for the Manufacturing, Wholesale and Retail sectors can lead us to two main conclusions. First, Canada is not as efficient as the U.S. in three out of the four

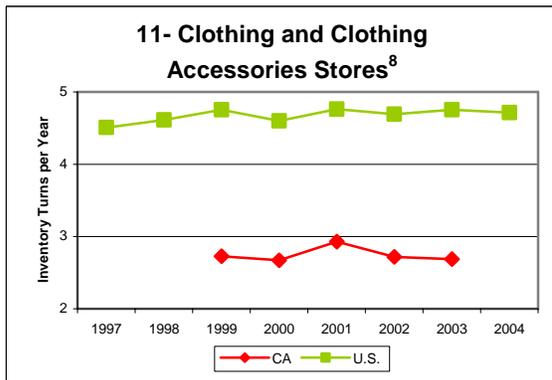
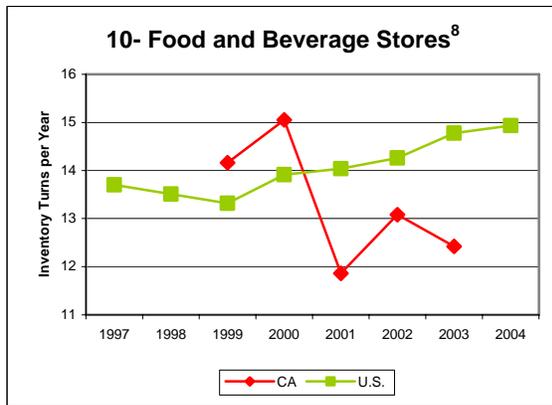
sectors. As can be seen in Figure 6, Canada is slightly more efficient than the U.S. in the Manufacturing-Finished sector, but lags in Manufacturing-Raw, Wholesale and Retail sectors⁹. The second conclusion is that there is much more inventory in retail than in wholesale, and much more inventory in wholesale than in manufacturing.



This last situation suggests that the principles of JIT are applied more by the manufacturing sector than by wholesalers and retailers, since they are moving their inventories faster than in the other two sectors. Although most gains in efficiency were realized in the manufacturing sector, this should certainly influence positively the whole supply chain for the future.

The next six figures display retail sub-sectors comparison of Canada vs. U.S. data.



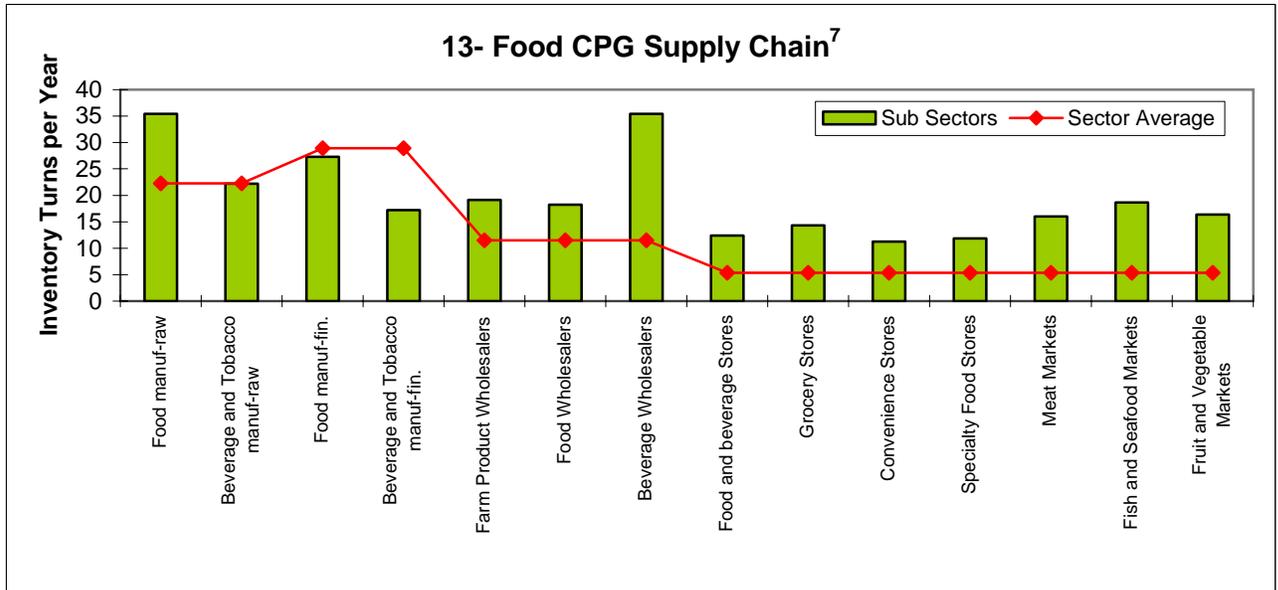


It is clear from those figures that Canada is behind the U.S. in most of the cases. The only exception was the Food and Beverages retail sector in 1999 and 2000, but even that sector is now behind the U.S. in terms of inventory turns per year⁸. The Motor Vehicles and Parts Dealers and the Food and Beverages Canadian sub sectors needed to improve their turns by 28 percent and 19 percent respectively in order to catch up with the U.S., while the total Retail sector was behind the U.S. by 41 percent in 2003⁸.

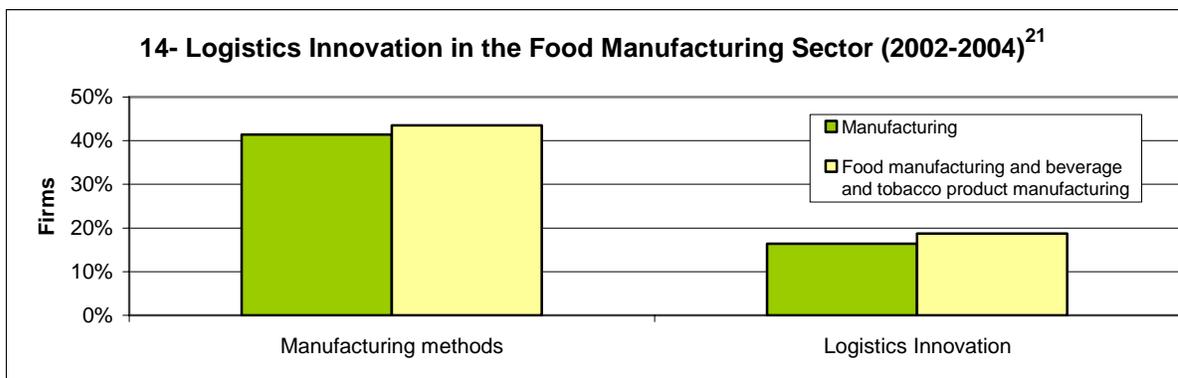
B. Sector Specific Analysis: The Canadian Food Supply Chain

The food CPG supply chain is driven by larger retailer's logistics and SCM mandates such as Efficient Consumer Response (ECR), RFID and other visibility and traceability initiatives. The Canadian food CPG supply chain is mainly North American with 60-70 percent of imports and exports being from and to the U.S.².

In terms of logistics inventory productivity KPI, the wholesale and retail sectors are performing above their respective industry sector average by 20 to 250 percent. This can be the result of implementing JIT processes for fresh and highly perishable products in recent years².



On the other hand, the food supply chain manufacturing sub sector is performing below the manufacturing industry average with the exception of raw materials. The increase in turns from 1992 to 2004 was very moderate in all these manufacturing sub sectors compared to the total manufacturing sector⁷.

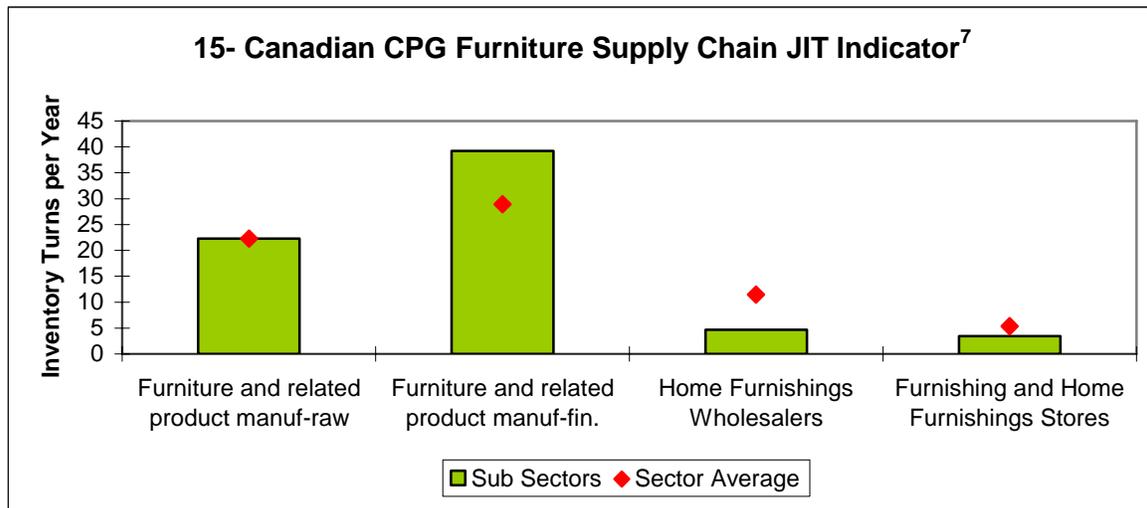


Innovation processes in production methods and logistics for Food manufacturing, between 2002 and 2004, was slightly higher than the manufacturing average²¹. The focus of these innovations was mainly based on quality and traceability mandates from large retailers in comparison to cost and productivity for other sectors of the economy, which explains that inventory turns increase was extremely moderate for that specific sub sector of the food supply chain⁵.

C. Sector Specific Analysis: The Canadian Furniture Supply Chain

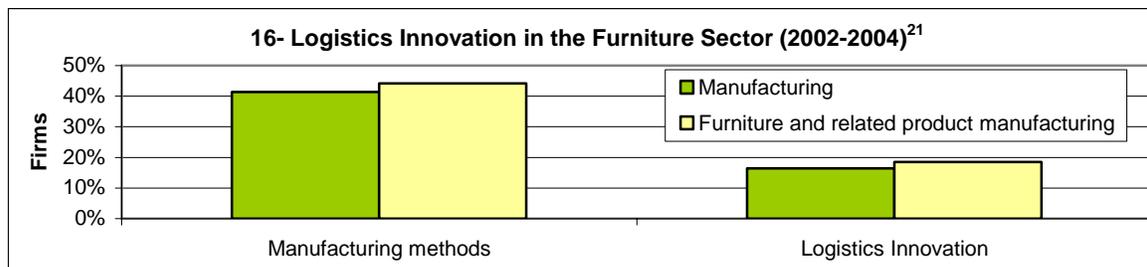
The Canadian furniture CPG supply chain sector is part of a complex global supply chain driven by low cost standardised products from foreign countries versus mass customisation requirements and small production batches.

In terms of performance indicators, furnishing wholesalers and stores inventory turns are below their respective industry average. This can be explained by the shift of imports provenance in that sector. Chinese share of imports in the household and institutional furniture and kitchen cabinet sector has increased from 22 percent in 2000 to 47 percent in 2004, replacing mainly U.S. imports, thus making the logistics processes more complex and less flexible².



The furniture manufacturing sector has been improving its velocity with an increase of 89 percent of its inventory turns of raw materials (compared to 25 percent for the manufacturing sector average) and 44 percent for its finish products inventory turns from 1992 to 2005 (compared to 28 percent for the manufacturing sector average)⁷. This increase in productivity allows Canadian manufacturers to have more supply chain agility and flexibility in activities such as mass customisation, which is becoming a key value added and differentiating factor.

Innovation in production and logistics methods is key to productivity in the Furnishing manufacturing sector. Although only 19 percent of these manufacturers have invested in logistics innovation from between 2000 and 2004 (compared to 44 percent in manufacturing methods), this represents an increase of 13 percent when benchmarked against the total manufacturing process (compared to an increase of only 7 percent for the manufacturing methods)²¹.



D. In-depth Analysis: Canadian Retail Sector

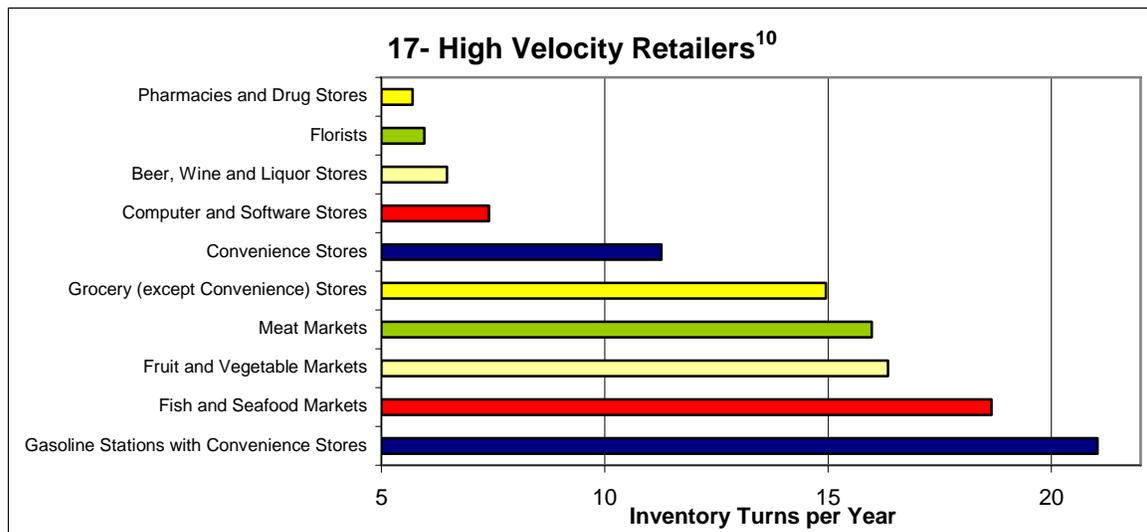
The next figures will look more closely at the Canadian Retail sub sectors, by comparing the sub sectors that have the highest velocity in terms of inventory turns to those that have the slowest ones.

The type of industry, its distribution processes, the corporate strategies adopted internally and the global supply chain strategy, will all have an impact on the quantity of inventory that is deemed required. The following comparisons in terms of inventory turns do not suggest one sub class is better than another, but show that they are quite different indeed.

The Gasoline stations with Convenience Stores sub sector scores an inventory turns ratio of 21.04, followed by the Fish and Seafood Markets sub sector with an inventory turns ratio of 18.66¹⁰.

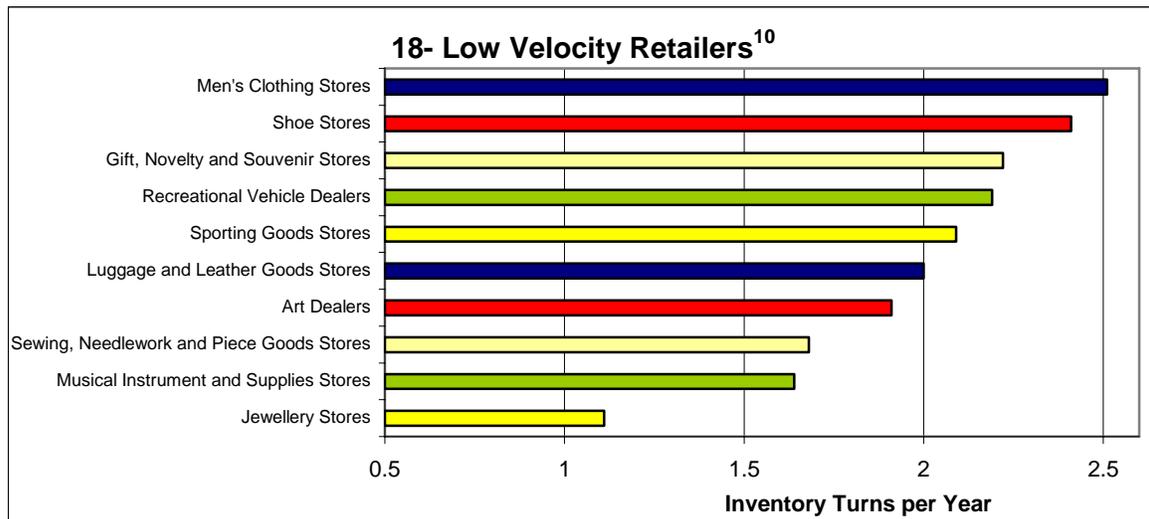
The food industry has a strong presence on the first graph below. That industry must definitely keep a strong focus on its inventory turns, since goods that are not fresh will not sell. That is displayed in reality by inventory turns ratios, in average, more than twice as high than those of the average Retail sector.

Still there is a significant difference in percentage when comparing the highest velocity retailers amongst themselves. In fact, Canadian retailers that display the highest velocity of their inventories keep approximately between 2 ½ weeks and 2 months of inventory.



Canadian retailers displaying the slowest velocity of their inventories keep approximately between 5 months and a year worth of inventory, as per the figure below. The average for the Retail sector, as displayed in the previous section, was a little over 2 months worth of inventory. Musical Instruments and Jewellery Stores sub sectors carry respectively

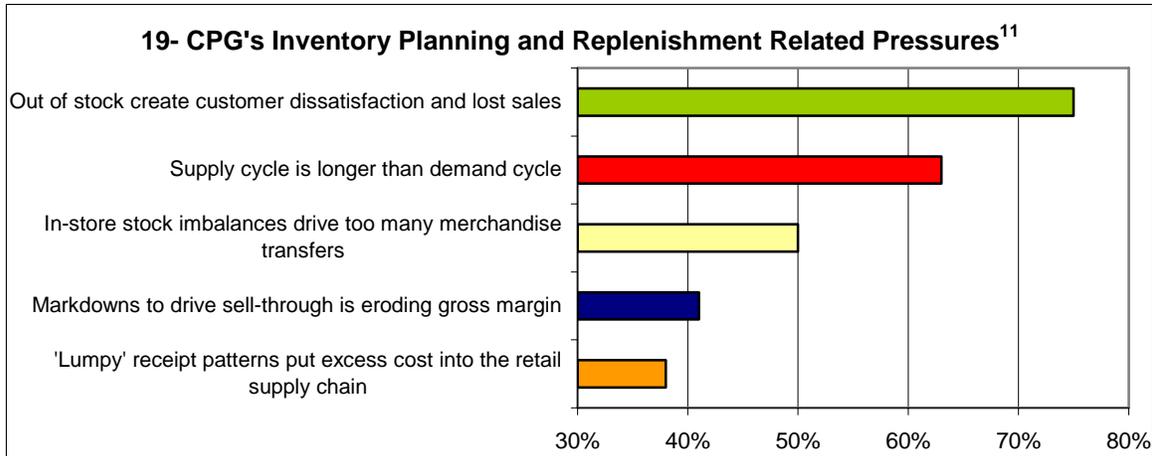
between half-a-year and almost a year worth of inventory, which is in average three to four times more inventory than the average for the Retail sector¹⁰.



This section compared different categories of retailers in terms of inventory turns. While having high inventory turn rates seems to be a good thing at first glance, it is important to understand that this could lead a retailer to display empty store shelves. Without the appropriate planning and help of CPFR technologies, a retailer focusing solely on increasing his inventory turns could realize that this is done at the expense of his in-stock position, thus leading him to a different kind of problem.

E. Technology

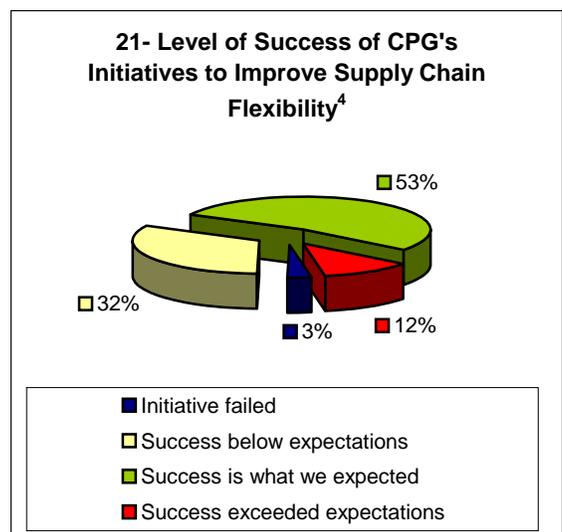
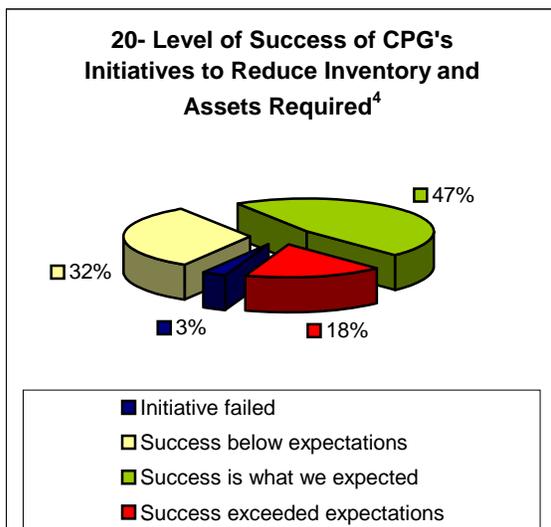
Following are displayed some of the most important challenges faced currently by the CPG's supply chain, all related to inventory management. It is clear from next figure that Out-of-Stocks are considered by most actors in the CPG's supply chain as a key item to improve as goods move from different suppliers to the end customer¹¹. Too often, out-of-stock items mean lost sales, and lost sales affect directly bottom lines as well as customer loyalty.



Another key challenge is the fact that the supply cycle ends up being longer than the demand cycle. This is not a new phenomenon, but what keeps the CPG's supply chain under pressure is that improvements on the supply side often cannot keep up with the erosion of the demand cycle by demanding customers.

The concept of supply chain collaboration introduced earlier is indeed a good way to lessen CPG's planning and replenishment related pressures but is extremely complex. Collaboration along the supply chain's actors helps reduce all of the items above, namely: out-of stocks, supply cycles, merchandise transfers, markdowns and 'lumpy' receipt patterns¹¹.

Initiatives related to inventory management help CPG's actors to become more efficient. As per the two figures below, 65 percent of the initiatives to reduce inventory and assets required, or to improve supply chain flexibility either met or exceeded initial expectations¹². In fact, less than 3 percent of those initiatives failed, which means that the vast majority of inventory management initiatives bring tangible gains to the actors participating in them⁴.



III-Logistics and SCM Cost KPI Analysis

While inventory turns is the main KPI for evaluating supply chain agility, logistics cost KPI allow firms to evaluate the efficiency of their logistics and SCM operations. The combination of supply chain agility and efficient SCM practices is key to long term competitiveness and prosperity of Canadian firms in the emerging GSC context.

Logistics costs occur internally within firms, are outsourced to logistics service providers and occur via inventory carrying cost. The sum of these three components will enable firms to evaluate their sector total costs and benchmark themselves against their own industry, their U.S. counterparts and other key sectors that share similar logistics and SCM processes.

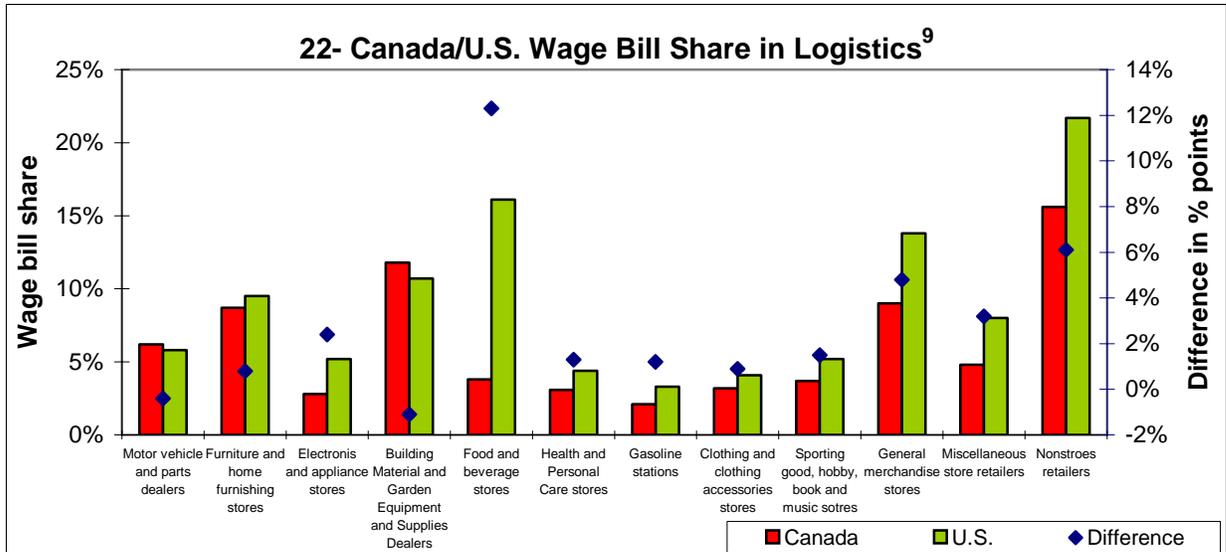
The mix of internal, outsourced and inventory carrying costs will also allow firms to evaluate their own logistics and SCM cost structure while enabling them to rethink their business model, if deemed necessary.

F. Internal Logistics Costs

Internal SCM and logistics costs encompass all logistics activities that occur within a firm. It excludes all outsourced logistics activities and all production processes. Comparisons between Canada and the U.S. were done in constant Canadian based factor: by bringing the U.S. economy to a comparable level with Canada, which meant downsizing the U.S. economy so that when comparing both countries, it is done for two economies of similar size.

One of the benchmarks of logistics cost KPI is the logistics wage bill. In most sectors, Canada has a larger internal logistics wage bill than that of the U.S. In most retail sectors the U.S. has a larger wage bill share in logistics than Canada. However, this is not the case for Motor Vehicle and Parts Dealers and for Building Material and Garden Equipment and Supplies Dealers.

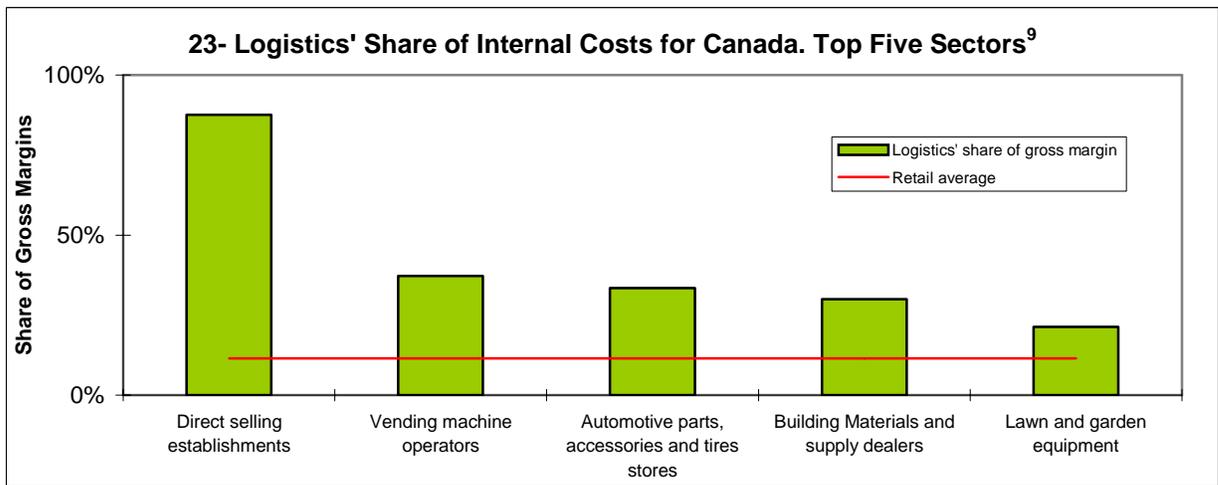
The sectors in which there is the largest difference are Food and Beverage Stores, General Merchandise Stores and Non-Stores Retailers, the difference being largest for Food and Beverage Stores (12.3 percentage points)⁹.

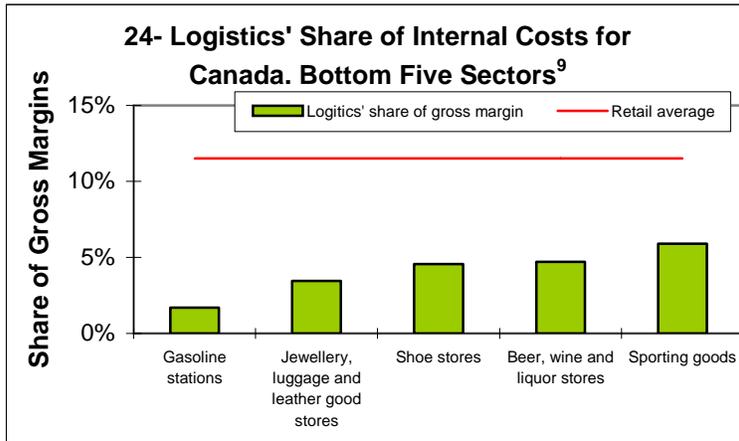


The analysis of logistics costs is done in percentage of sector's Gross Domestic Product (GDP) and by percentage of sales. Internal cost in percentage of GDP represents the logistics activity that occurs within a firm compared to all internal value added activities. It excludes all service and product sourcing costs. This is the most precise indicator of the size of the logistics activity that occurs within a firm.

Looking at the Canadian economy in a more detailed manner, the following two figures show the top and bottom five retail sectors with respect to logistics as share of internal costs (measured through gross margins).

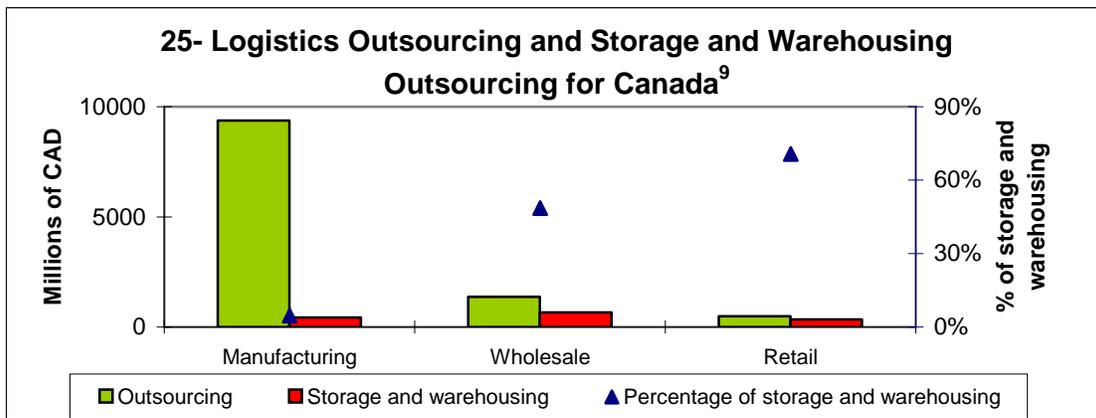
On the other hand, the gross margin ratio allows firms to benchmark themselves more easily. The percentage of sales ratio includes all the internal costs in addition to service and product sourcing; this often creates some multiple counting issues, which explains why the ratios displayed are quite smaller than the percentage of GDP.





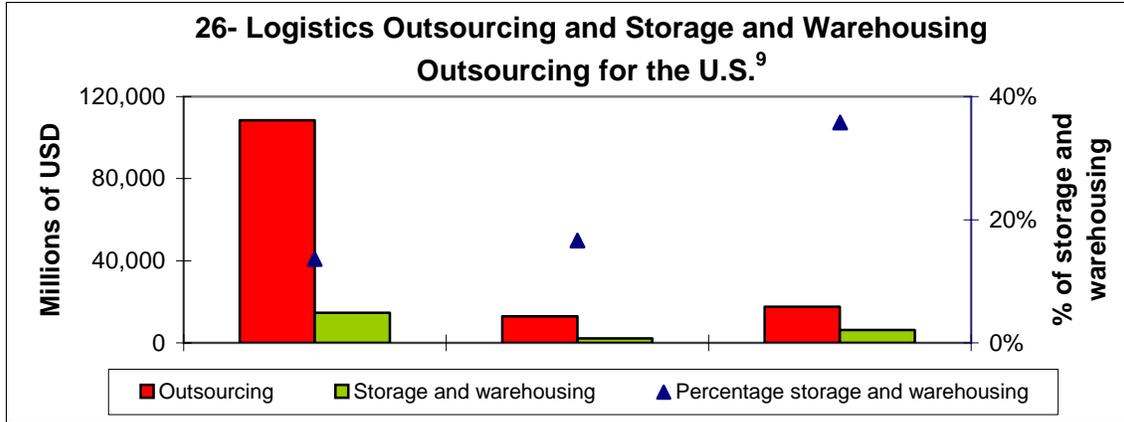
Surprisingly enough, Gasoline Stations is the sector that has the lowest share of logistics in internal costs. This may be explained by the fact that logistics activities related to energy distribution in this area are carried out by the wholesale and manufacturing sectors.

G. Logistics Outsourcing



The Canadian economy has logistics outsourcing costs that are largest for Manufacturing. However, the percentage of storage and warehousing included in logistics outsourcing costs is largest for the retail sector, where it represents 70 percent of logistics outsourcing costs⁹.

The U.S. economy has the same characteristics as the Canadian one with respect to logistics outsourcing. Although logistics outsourcing is higher in the Manufacturing sector, the percentage of storage and warehousing in logistics' outsourcing is highest for the retail sector.



H. Inventory carrying costs

Inventory carrying costs are defined as a series of costs that compose a company’s supply chain management costs. They include opportunity costs, shrinkage, insurance and taxes, total obsolescence (for raw materials, work in process (WIP), and finished good inventory), channel obsolescence and field service parts obsolescence. It excludes all distribution cost related to warehousing, which are captured in the internal and outsourced logistics costs.

Canada’s Retail sector has an inventory carrying cost that is 31 percent larger than that of the than the U.S. This is explained by the fact that Canadian firms have lower inventory turns compared to their U.S. counterparts. In terms of sector specific analysis, sectors that are adopting JIT processes with high inventory turns, such as the Fish and seafood markets sector, have significantly lower inventory carrying cost compared to the total Retail and other key sectors such as Men’s clothing and Pharmacies and drug stores⁹.

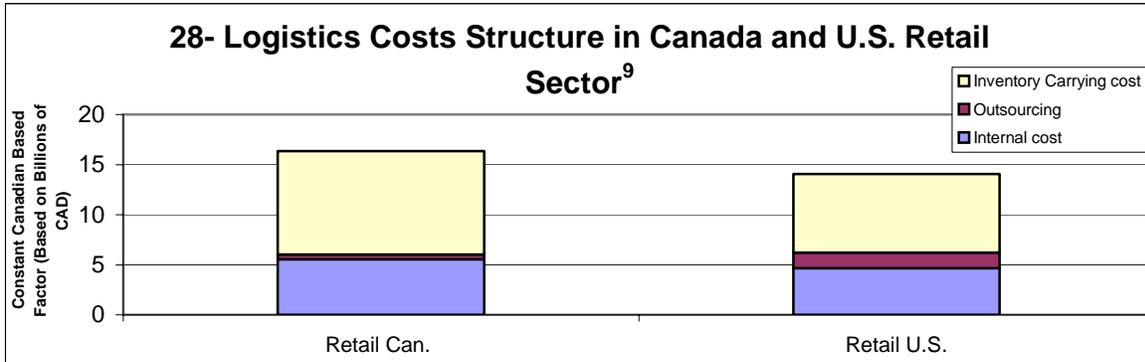


However, it is important to keep in mind that inventory carrying costs cannot be used to compare the size of the economic activity of a sector since they mainly represent

accounting based costs, therefore they should not be calculated in percentage of sector GDP

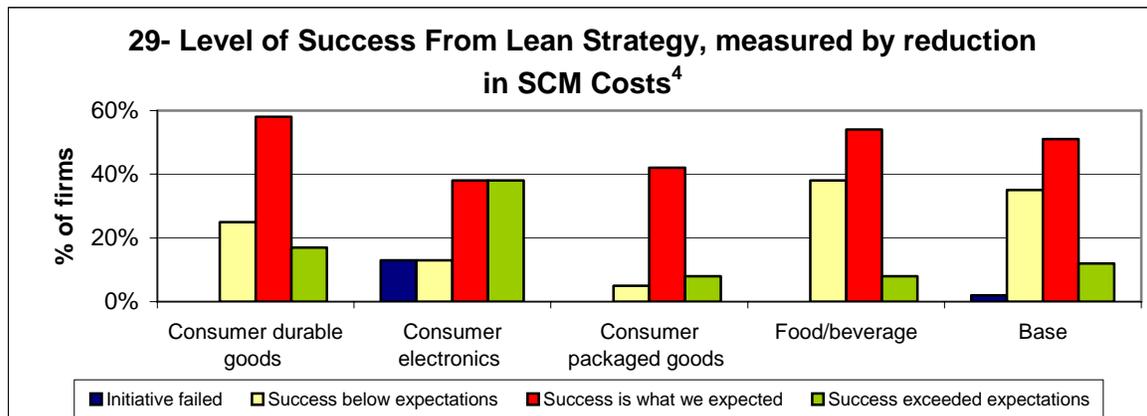
I. Total Retail Logistics Cost

Canada has total and internal logistics costs in Retail that are, respectively, 16 percent and 19 percent higher than in the U.S.. On the other hand, the U.S. Retail sector outsources more logistics activity, by a ratio of three times, than the Canadian Retail sector¹³.



J. Importance of Logistics Technology in Cost Reduction

Logistics and SCM cost indicators are amongst those that help evaluate the success of a Lean Strategy¹⁴. The following figure shows how firms who applied a Lean Strategy in the CPG supply chain were able to reduce manufacturing and SCM costs.



In general terms, 80 percent of NA CPG and Retail sectors that implemented a Lean Logistics Strategy saw a decrease as per or above expectations in SCM costs⁴.

IV- Final Remarks

In order to benefit from the productivity of logistics and SCM, individual firms must develop their own personal action plan. The final step in a business case is to make recommendations and develop a roadmap for implementing the proposed action plan. The roadmap exercise consists of documenting the long-term perspective into specific action items linked to deliverables, performance indicators objectives, return on investment and a project time frame.

For some firms, the first roadmap action item could be an internal evaluation of their logistics KPI with some participation in associations and networking activities. For others, it could be implementing a pilot project with a customer and a supplier. In all cases, a well-documented roadmap allows firms to gain the support of all their stakeholders for their logistics and SCM competitiveness strategy and to solicit their involvement in the implementation phases of the firm's logistics and SCM action plan.

Proposed Action Plan:

- 1- Evaluate internal firm logistics and SCM KPI based on the indicators listed in this document.
- 2- Map out business processes, global supply chain and technology adoption.
- 3- Benchmark your firm's KPI to your industry KPI in Canada and in the U.S..
- 4- Assess firm's performance KPI to industry taking into consideration supply chain processes.
- 5- Benchmark firm's KPI to other industries KPI in Canada and in the U.S. that share the same logistics and SCM processes and drivers.
- 6- Create a multi-function project team. Senior management buy-in could determine the success rate of this initiative, as will a champion at the initial stage.
- 7- Develop a logistics and SCM competitiveness roadmap.
- 8- Develop performance measurements of the roadmap initiatives.
- 9- Educate your company executives across departments, supply chain partners and service providers on the value of the roadmap for each specific stakeholders.
- 10- Increase supply chain collaboration initiatives that drive value in your specific sector.
- 11- Partner with supply chain partners to develop with you the technology, processes and information solutions needed to manage the process.
- 12- Implement KPI program with frequent use of measures focused on cost-effective customer-driven satisfaction issues with supply chain partners.

Annex I - Methodology

SCM & Logistics Costs Methodology

Every company measures its costs related to marketing, human resources, research and development, etc. Interestingly, very few know how much their logistics costs really are. The last decade saw a growth in interest for concepts such as JiT, Lean manufacturing and Efficient Consumer Response, all of which, in addition with the globalization of the supply chains, brought the importance of Logistics and Supply Chain Management (SCM) from an operational status, often to a strategic status for the company and its partners.

It is for this reason that Supply Chain & Logistics Canada's (SCL) Research Committee and Industry Canada have partnered with Jacobson Consulting to launch a logistics cost methodology research initiative. By combining the industry know-how of SCL with the supply chain research experience of Industry Canada and the economical modeling specific expertise of Paul Jacobson, a former director at Infometrica, the partners have developed an optimal research team for this initiative.

One of the main sources of logistics costs' data available until now is the *Annual State of Logistics Report*, published in the U.S., which is sponsored by the Council of Supply Chain Management Professionals (CSCMP). This report provides annual data on the cost of the U.S. business logistics system in relation to their Gross Domestic Product (GDP). The data provided goes back to 1984 and is mainly available on a macro level, with categories available such as Inventory Carrying Costs, Transportation Costs and Administrative Costs, but does not look at the sector-level data.

It is important for a company to understand the nature and the costs of its logistics and SCM operations. Furthermore, companies should be able to access that type of information on each industrial sector for comparison purposes. Comparing the information to GDP is essential to understanding the importance of logistics on a given sector, while comparing the information to the Gross margin allows companies to benchmark their logistics and SCM costs to their sector, their partners and their competitors.

Gross margin = total operating revenue - cost of goods sold

Total operating revenue = sales of goods purchased for resale + commission revenue + sales of goods produced + repair and maintenance revenue + revenue from rental and leasing + other operating revenue.

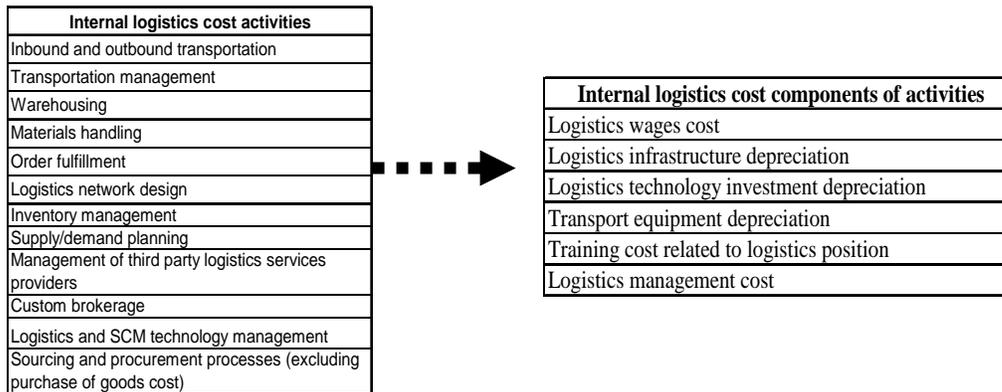
Cost of goods sold = Opening inventory + Purchases - Closing inventory.

Here, the research initiative will focus on providing sector level information of logistics and SCM costs that occur internally through firms (such as in the manufacturing, wholesale and retail sectors), as well as evaluating supply chain's functions that are outsourced by sectors, and their relative inventory carrying costs. By combining these three categories, individual firms will have the opportunity to have a global view of supply chain management costs by sectors and of the outsourcing trends, thus allowing them to benchmark themselves to their competitors, partners and other sectors in Canada and in the U.S..

SCM and logistics costs can be broken down in three separate, but complementary pieces: internal costs, outsourcing costs and inventory carrying costs. Each one is described below, with its methodology and an example when appropriate.

Internal SCM and logistics costs:

Internal SCM and logistics cost encompass all logistics activities that occur within a firm, such as a manufacturer, wholesaler or retailer. It excludes all outsourced logistics activities and all production process. Individual firms can evaluate their internal logistics cost by adding their respective logistics cost activities and their components as stated in the table below.



Internal SCM and logistics costs are the most complex to calculate since no organization accounts for these. The estimates of internal logistics costs in this report were compiled via the following methodology:

- 1- Determine the occupational types related to logistics, and link those to logistical activities. In total, twenty-one occupations were found and assigned to one of the four logistics activities namely: Distribution Centers (DC), Office work, Truck transportation and Other transportation (rail, etc.). For example, material handlers are linked to DC activities, while customs & ships brokers and industrial engineering and manufacturing are part of office related activities.
- 2- Find for each industrial sub sector the number or persons in each occupational sub category. There are sixty sub sectors in manufacturing, thirty in wholesale and thirty in retail.
- 3- Find the logistics' suppliers equivalent to the four logistics' activities from above. For example, under Office work were included the consulting services' and support to transportation and warehousing' personnel.
- 4- Calculate the wage bill of the four logistics activities after occupations were linked to them. The ratio of the total costs divided by the wage bill is then charged to the sixty sub sectors in manufacturing, to the thirty sub sectors in wholesale and to the thirty sub sectors in retail. For example, for each dollar spent in salaries, we know that in average 2\$ are spent on infrastructures, technologies and management costs.

All this allows the estimation of the logistics and SCM costs for each industrial sub sector.

Outsourcing costs:

Outsourcing costs encompass activities assigned to a third-party. Outsourcing costs come from input-output tables from Statistics Canada that indicate how much each industry requires of the

production of each other industry in order to produce each dollar of its own output by compiling the purchases of logistics services by users.

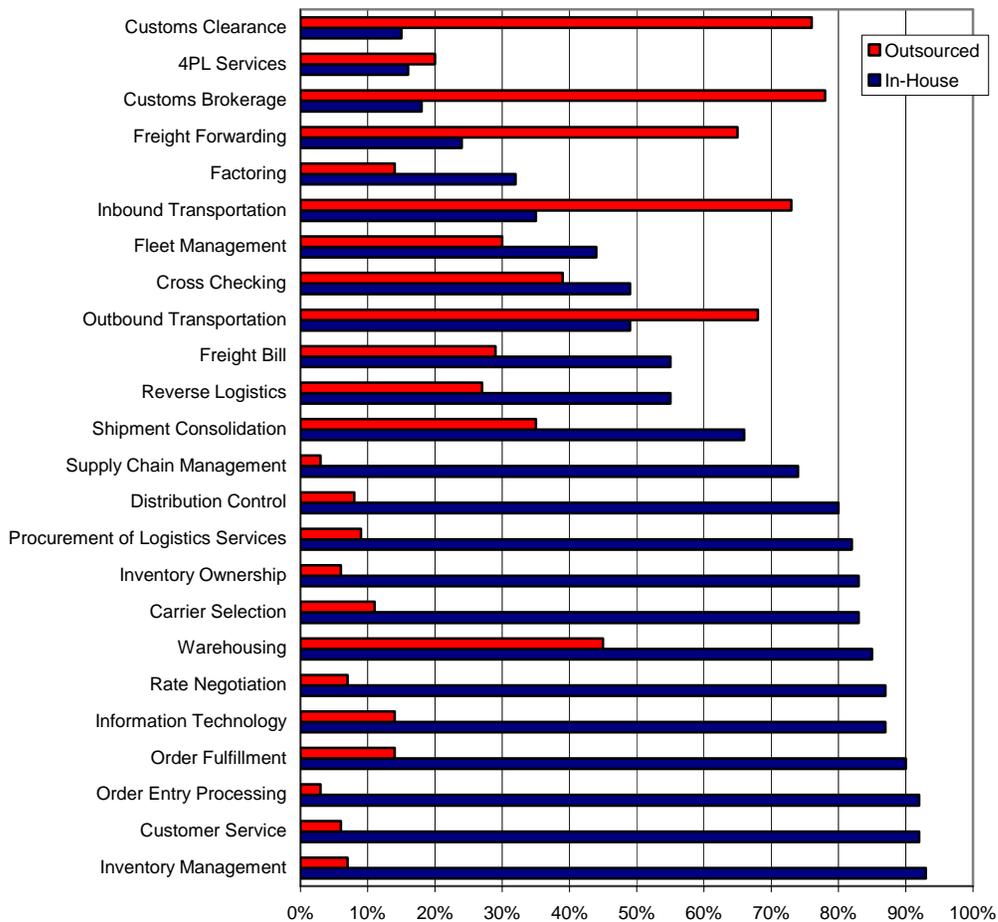
Using the purchases that originate as part of logistics activities is appropriate, instead of using the sales, because it avoids multiple counting.

Example

A manufacturing firm writes a check for \$10 million to a 3PL to assume all its distribution activities for the current year. That 3PL does not actually own trucks, and hire a transportation broker to actually contract the required vehicles as necessary, for that same amount. The transportation broker will sign multiple deals during that year with transportation companies, again totaling \$10 million. By looking at the sales figures in the input-output tables, the logistics activity in that scenario would now total \$30 million. Utilizing instead the purchases of logistics services allows isolating the real logistics activity, which is indeed \$10 million.

An example of the activities that are outsourced and/or done inside a company is displayed in the chart below.

In-House and Outsourced Supply Chain Activities in Canada²⁰



As can be seen, outsourcing differs largely according to the type of activity. Certain activities are largely outsourced, such as Customs Clearance or Customs Brokerage, and others are mainly done in-house, such as Inventory Management and Customer Service.

Inventory Carrying Cost:

Lexi-Com's *Glossary of Logistics Terms* defines inventory carrying cost as follows. One of the elements comprising a company's total supply chain-management costs. These costs consist of the following :

- 1) Opportunity Cost : The opportunity costs of holding inventory. This should be based on your company's own cost of capital standards using the following formula. Calculation : Cost of Capital x Average Net Value of Inventory
- 2) Shrinkage : The costs associated with breakage, pilferage, and deterioration of inventories. Usually pertains to the loss of material through handling damage, theft, or neglect.
- 3) Insurance and Taxes : The cost of insuring inventories and taxes associated with the holding of inventory.
- 4) Total Obsolescence for Raw Material, WIP, and Finished Goods Inventory : Inventory reserves taken due to obsolescence and scrap and includes products exceeding the shelf life, i.e. spoils and is no good for use in its original purpose (do not include reserves taken for Field Service Parts).
- 5) Channel Obsolescence: Aging allowances paid to channel partners, provisions for buy-back agreements, etc. Includes all material that goes obsolete while in a distribution channel. Usually, a distributor will demand a refund on material that goes bad (shelf life) or is no longer needed because of changing needs.
- 6) Field Service Parts Obsolescence : Reserves taken due to obsolescence and scrap. Field Service Parts are those inventory kept at location outside the four walls of the manufacturing plant i.e., distribution center or warehouse.

What inventory carrying costs do not consist of :

- all the necessary handling of the goods and/or materials,
- the depreciation of the goods and/or materials.

Those are actually already included in the internal logistics costs above.

Inventory Carrying Cost Rate: The inventory carrying cost rate is applied on the average annual inventory in order to estimate the cost of having inventory into a specific firm or industry. The average industry accepted and used rate is estimated at 20 percent¹⁷.

$$\frac{\text{TOTAL SCM \& LOGISTICS COSTS}}{\text{INTERNAL COSTS + OUTSOURCING COSTS + INVENTORY CARRYING COSTS}} =$$

Inventory carrying costs and outsourcing costs cannot be put in terms of GDP, since they are accounting-based, and not a real economic activity. Both are compared to gross margins. On the other hand, internal costs can be compared both to GDP and to gross margin.

Logistics and SCM costs vary widely by sector. The proportion of internal costs, outsourcing costs and inventory carrying costs is also different between sectors. For example, in a JiT mode, internal costs tend to increase, but this is balanced by a reduction in the inventory carrying costs; this happens in volatile sectors, such as upscale clothing, computers and perishable goods.

Annex II - Definitions

Collaborative Planning Forecasting and Replenishment (CPFR): Trademark registered by the VICS (Voluntary Interindustry Commerce Standards) in 1996 designating an approach of collaboration and integration of the forecasting and planning processes between customers and suppliers. A certain number of test operations have been conducted between manufacturers and distributors in the area of mass consumer products, but it is also starting to be used between manufacturing companies. Partner companies (distributors, manufacturers, suppliers, etc.) exchange information on product sales and forecasts in order to synchronize their operational plans. This approach also integrates the downstream information flow to take account of manufacturing constraints.

Fill Rate: The percentage of order items that the picking operation actually fills within a given period of time.

Forecast: An estimate of future demand. A forecast can be determined by mathematical means using historical data; it can be created subjectively by using estimates from informal sources; or it can represent a combination of both techniques.

Gross margin: This value is obtained by calculating: total operating revenue- cost of goods sold.

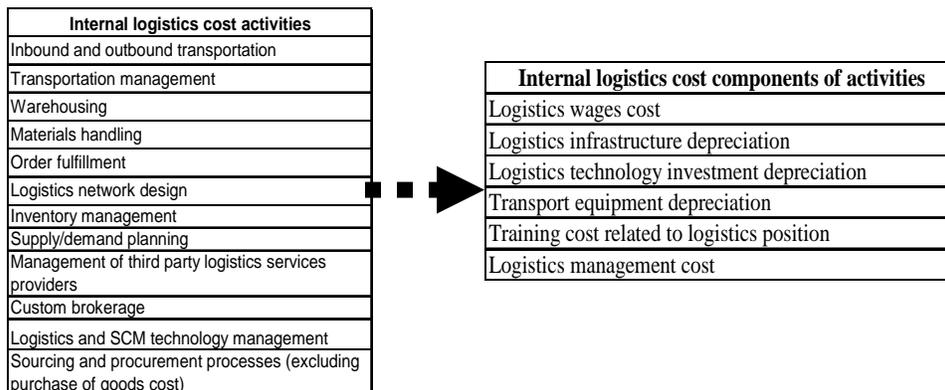
Total operating revenue: The sum of sales of goods purchased for resale, commission revenue, sales of goods produced, repair and maintenance revenue, revenue from rental and leasing and other operating revenue.

Cost of goods sold: This value represents the cost value of goods sold and recognized in revenue, during the reporting period. It is determined by calculating: Opening inventory + Purchases - Closing inventory.

Hub: A reference for a logistics network as in “hub and spoke”, which is common in the airline and the trucking industry.

Input: The sum of all goods and services purchased by a firm or an industrial sector.

Internal logistics cost: Internal logistics cost encompasses all logistics activities that occur within a firm, such as a manufacturer, wholesaler and retailer. It excludes all outsourced logistics activities and all production process. Individual firms can evaluate their internal logistics cost by adding their respective logistics cost activities and their components as stated in the table below.



The estimates of internal logistics cost in this report were compiled via that specific methodology:

- 1- Estimate the selected occupation share of the compensation for the third-party logistics sectors (the components of transportation and storage) at the most detailed sector level for which GDP is available
- 2- Apply this share to sector GDPs to get an aggregate GDP weight for the logistics wage bill
- 3- Calculate the logistics wage bill based on selected occupations for total manufacturing, for the selected level of manufacturing detail, for wholesaling and retailing
- 4- Apply the GDP weight to the estimated logistics wage bill to get an estimate of own-account in each of the required GDP aggregates

Intermodal Transport: Use of two or more different carrier modes in the through movement of a shipment.

Inventory Carrying Cost: One of the elements comprising a company's total supply chain-management costs. These costs consist of the following :

- 1) Opportunity Cost : The opportunity costs of holding inventory. This should be based on your company's own cost of capital standards using the following formula. Calculation : $\text{Cost of Capital} \times \text{Average Net Value of Inventory}$
- 2) Shrinkage : The costs associated with breakage, pilferage, and deterioration of inventories. Usually pertains to the loss of material through handling damage, theft, or neglect.
- 3) Insurance and Taxes : The cost of insuring inventories and taxes associated with the holding of inventory.
- 4) Total Obsolescence for Raw Material, WIP, and Finished Goods Inventory : Inventory reserves taken due to obsolescence and scrap and includes products exceeding the shelf life, i.e. spoils and is no good for use in its original purpose (do not include reserves taken for Field Service Parts).
- 5) Channel Obsolescence: Aging allowances paid to channel partners, provisions for buy-back agreements, etc. Includes all material that goes obsolete while in a distribution channel. Usually, a distributor will demand a refund on material that goes bad (shelf life) or is no longer needed because of changing needs.
- 6) Field Service Parts Obsolescence : Reserves taken due to obsolescence and scrap. Field Service Parts are those inventory kept at location outside the four walls of the manufacturing plant i.e., distribution center or warehouse.

Inventory Carrying Cost Rate: The inventory carrying cost rate is applied on average annual inventory in order to estimate the cost of having inventory into a specific firm or industry. The average industry accepted and used rate is estimated at 20 percent¹⁵.

Inventory Turns: The cost of goods sold divided by the average level of inventory on hand. This ratio measures how many times a company's inventory has been sold during a period of time. Operationally, inventory turns are measures as total throughput divided by average level of inventory for a given period; how many times a year the average inventory for a firm changes, or is sold.

Just-in-Time (JIT): Lean Manufacturing model developed initially by the engineer Taiichi Ohno at Toyota which consists of monitoring and controlling the production system to eliminate all sources of waste, in particular related to intermediate stocks and poor quality. Production is thus equal to demand at all stages of the process.

Key Performance Indicators (KPI): A measure which is of strategic importance to a company or department. For example, a supply chain flexibility metric is Supplier-On-time Delivery Performance which indicates the percentage of orders that are fulfilled on or before the original requested date.

Lead Time: Quantitative indicator measuring the time difference between stimulus and response. This indicator can be applied to different levels of the logistics process, for example to measure the actual time taken between the placing of an order and the delivery of a product.

Lean Logistics: Characterized by high frequency replenishment and freight consolidation utilizing networks of crossdocks and milkruns. It promotes continuous flow of products from origin to destination by the pull of actual consumption and thereby eliminates wastes. The results are low inventory, high availability, resource smoothing, and improved asset utilization at low costs.

Lean manufacturing: A management philosophy focusing on reduction of the 7 wastes (Over-production, Waiting time, Transportation, Processing, Inventory, Motion and Scrap) in manufactured products. By eliminating waste (muda), quality is improved, production time is reduced and cost is reduced. Lean "tools" include constant process analysis (kaizen), "pull" production (by means of kanban) and mistake-proofing (poka yoke).

Outsourcing: Corporate decision to assign activities, previously performed internally, to a third-party (for example, a Logistics Service Provider). Initially, the shippers (manufacturing or commercial companies) outsourced transport, and then progressively did the same for more value-added logistics services (Co-packing for example).

Radio Frequency Identification (RFID): RFID is a data collection technology that uses electronic tags to store identification and a wireless transmitter and reader to capture it.

Six Sigma Quality: A term used generally to indicate that a process is well controlled, i.e. tolerance limits are ± 6 sigma (3.4 defects per million events) from the centerline in a control chart.

Supply Chain Management (SCM) Collaboration: Approach to managing and synchronizing all the processes enabling one or more customer / supplier systems to take into account and respond to expectations of the end customers (from the supplier of the supplier to the customer of the customer). This approach is designed to increase the value created for the customer and improve the economic performance of the participating companies.

Warehouse Management System (WMS): Computer application, and component of SCE packages, with the goal of managing and optimizing warehouse operations.

Annex III – Inventory Management Data

Manufacturing Sector - Historical Inventory Turns Ratios					
Raw Materials			Finished Goods		
	Canada	U.S.		Canada	U.S.
1992	17.87	23.73	1992	22.47	22.77
1993	19.31	24.26	1993	25.07	23.63
1994	19.97	24.86	1994	26.62	24.94
1995	19.78	24.38	1995	26.76	24.61
1996	19.59	24.51	1996	26.05	24.41
1997	20.3	25.71	1997	26.24	25.45
1998	19.47	25.25	1998	26.49	25.34
1999	21.24	26.3	1999	29.01	25.61
2000	21.15	25.7	2000	29.31	24.95
2001	20.05	25.05	2001	26.16	23.6
2002	21.18	26.79	2002	27.47	24.87
2003	21.03	27.8	2003	26.94	25.24
2004	22.28	29.44	2004	28.92	26.65
2005	21.57	29.31	2005	27.83	26.69

Wholesale Sector - Inventory Turns ratio - 2003			
Canada		U.S.	
Wholesale Trade Total	11.47	Wholesale Trade Total	13.46
Farm Product Wholesaler-Distributors	19.12	Farm Product Raw Materials	11.46
Petroleum Product Wholesaler-Distributors	55.62	Petroleum and Petroleum Products	47.93
Food, Beverage and Tobacco Wholesaler-Distributors	18.76	Grocery and Related Products	19.00
Personal and Household Goods Wholesaler-Distributors	7.72	Furniture and Home Furnishings	7.93
Motor Vehicle and Parts Wholesaler-Distributors	15.77	Motor Vehicle and Motor Vehicle Parts and Supplies	9.23
Building Material and Supplies Wholesaler-Distributors	7.99	Lumber & Other Construction Materials	10.78
Machinery, Equipment and Supplies Wholesaler-Distributors	7.23	Machinery, Equipment, and Supplies	4.96

Retail Sector - Inventory Turns ratio - 2003			
Canada		U.S.	
Retail Trade Total	5.35	Retail Trade Total	7.55
Motor Vehicle and Parts Dealers	4.47	Motor vehicle and parts dealers	5.75
Furniture and Home Furnishings Stores	3.46	Furniture, home furnishings, electronics, and appliance stores	6.98
Electronics and Appliance Stores	4.19		
Building Material and Garden Equipment Dealers	4.03	Building material and garden equipment and supplies dealers	6.92
Food and Beverage Stores	12.42	Food and beverage stores	14.78
Clothing and Clothing Accessories Stores	2.69	Clothing and clothing accessories stores	4.75
Sporting Goods, Hobby, Book and Music Stores	2.34	Department stores	5.80
General Merchandise Stores	4.81	General merchandise stores	7.04
Convenience Stores	11.27		
Gasoline Stations with Convenience Stores	21.04		
Gasoline Stations	26.99		
Health and Personal Care Stores	5.49		

Retail Inventories - Canada - 2003		
NAICS Code Number	NAICS description	Cost of Goods Sold - Average Inventory
		Ratio
4	Retail Trade	5.35
44	Retail Trade - Store sub-total (NAICS 44)	5.76
441	Motor Vehicle and Parts Dealers	4.47
4411	Automobile Dealers	4.76
44111	New Car Dealers	4.75
44112	Used Car Dealers	4.97
4412	Other Motor Vehicle Dealers	2.43
44121	Recreational Vehicle Dealers	2.19
44122	Motorcycle, Boat and Other Motor Vehicle Dealers	2.58
4413	Automotive Parts, Accessories and Tire Stores	3.66
44131	Automotive Parts and Accessories Stores	3.07
44132	Tire Dealers	4.42
442	Furniture and Home Furnishings Stores	3.46
4421	Furniture Stores	3.43
4422	Home Furnishings Stores	3.51
44221	Floor Covering Stores	4.72
44229	Other Home Furnishings Stores	2.88
443	Electronics and Appliance Stores	4.19
4431	Electronics and Appliance Stores	4.19
44311	Appliance, Television and Other Electronics Stores	3.66
44312	Computer and Software Stores	7.41
44313	Camera and Photographic Supplies Stores	4.94
444	Building Material and Garden Equipment Dealers	4.03
4441	Building Material and Supplies Dealers	4.05
44411	Home Centres	4.11
44412	Paint and Wallpaper Stores	3.95
44413	Hardware Stores	3.53
44419	Other Building Material Dealers	4.51
4442	Lawn and Garden Equipment and Supplies Stores	3.78
44421	Outdoor Power Equipment Stores	2.71
44422	Nursery and Garden Centres	4.44
445	Food and Beverage Stores	12.42
4451	Grocery Stores	14.34
44511	Grocery (except Convenience) Stores	14.95
44512	Convenience Stores	11.27
4452	Specialty Food Stores	11.82
44521	Meat Markets	15.98
44522	Fish and Seafood Markets	18.66
44523	Fruit and Vegetable Markets	16.34
44529	Other Specialty Food Stores	6.88
4453	Beer, Wine and Liquor Stores	6.47
446	Health and Personal Care Stores	5.49
4461	Health and Personal Care Stores	5.49
44611	Pharmacies and Drug Stores	5.7
44612	Cosmetics, Beauty Supplies and Perfume Stores	4.07

Retail Inventories - Canada - 2003		
NAICS Code Number	NAICS description	Cost of Goods Sold - Average Inventory
		Ratio
44613	Optical Goods Stores	3.99
44619	Other Health and Personal Care Stores	4.47
447	Gasoline Stations	26.99
4471	Gasoline Stations	26.99
44711	Gasoline Stations with Convenience Stores	21.04
44719	Other Gasoline Stations	30.03
448	Clothing and Clothing Accessories Stores	2.69
4481	Clothing Stores	3.36
44811	Men's Clothing Stores	2.51
44812	Women's Clothing Stores	3.75
44813	Children's and Infants' Clothing Stores	3.61
44814	Family Clothing Stores	3.73
44815	Clothing Accessories Stores	2.72
44819	Other Clothing Stores	2.43
4482	Shoe Stores	2.41
44821	Shoe Stores	2.41
4483	Jewellery, Luggage and Leather Goods Stores	1.18
44831	Jewellery Stores	1.11
44832	Luggage and Leather Goods Stores	2
45	Retail Trade - Store - sub-total (excluding NAICS 454)	3.91
451	Sporting Goods, Hobby, Book and Music Stores	2.34
4511	Sport, Hobby and Musical Instrument Stores	2.07
45111	Sporting Goods Stores	2.09
45112	Hobby, Toy and Game Stores	2.72
45113	Sewing, Needlework and Piece Goods Stores	1.68
45114	Musical Instrument and Supplies Stores	1.64
4512	Book, Periodical and Music Stores	3.55
45121	Book Stores and News Dealers	3.43
45122	Pre-Recorded Tape, Compact Disc and Record Stores	3.8
452	General Merchandise Stores	4.81
4521	Department Stores	4.43
4529	Other General Merchandise Stores	5.23
45291	Warehouse Clubs and Superstores	
45299	All Other General Merchandise Stores	
453	Miscellaneous Store Retailers	3.11
4531	Florists	5.96
4532	Office Supply, Stationery and Gift Stores	2.91
45321	Office Supplies and Stationery Stores	3.63
45322	Gift, Novelty and Souvenir Stores	2.22
4533	Used Merchandise Stores	1.88
4539	Other Miscellaneous Store Retailers	3.66
45391	Pet and Pet Supplies Stores	4.13
45392	Art Dealers	1.91
45393	Manufactured (Mobile) Home Dealers	3.17
45399	All Other Miscellaneous Store Retailers	4.05

NAICS	Manufacturing Sector - Inventory Turns ratio - 2005	Canada	
		Raw Materials	Finished Goods
31-33	Manufacturing	21.6	27.8
	Non-durable goods industries	26.0	23.1
	Durable goods industries	19.1	33.1
311	Food manufacturing	34.5	25.9
3111	Animal food manufacturing	21.1	69.4
31111	Animal food manufacturing	21.1	69.4
3112	Grain and oilseed milling	37.7	27.5
31121	Flour milling and malt manufacturing	28.4	22.4
31122	Starch and vegetable fat and oil manufacturing	46.5	36.7
31123	Breakfast cereal manufacturing	36.0	20.9
3113	Sugar and confectionery product manufacturing	21.4	28.9
31131	Sugar manufacturing	13.6	34.0
31132	Chocolate and confectionery manufacturing from cacao beans	47.2	33.6
31133	Confectionery manufacturing from purchased chocolate	31.6	33.8
31134	Non-chocolate confectionery manufacturing	15.8	21.9
3114	Fruit and vegetable preserving and specialty food manufacturing	25.9	11.7
3115	Dairy product manufacturing	51.3	18.6
3116	Meat product manufacturing	51.7	45.0
31161	Animal slaughtering and processing	51.7	45.0
311611	Animal (except poultry) slaughtering	54.9	44.5
311614	Rendering and meat processing from carcasses	36.2	58.8
311615	Poultry processing	69.8	38.0
3117	Seafood product preparation and packaging	30.0	24.2
3118	Bakeries and tortilla manufacturing	39.9	63.0
31181	Bread and bakery product manufacturing	64.0	79.4
31182	Cookie, cracker and pasta manufacturing	19.4	39.9
311821	Cookie and cracker manufacturing	12.3	81.5
311822	Flour mixes and dough manufacturing from purchased flour	31.2	50.0
311823	Dry pasta manufacturing	23.7	18.9
31183	Tortilla manufacturing	N/A	N/A
3119	Other food manufacturing	20.4	17.8
31191	Snack food manufacturing	28.9	24.0
31192	Coffee and tea manufacturing	15.0	9.0
31193	Flavouring syrup and concentrate manufacturing	18.5	N/A
31194	Seasoning and dressing manufacturing	18.6	N/A
31199	All other food manufacturing	19.6	26.0
312	Beverage and tobacco product manufacturing	20.9	15.0
3121	Beverage manufacturing	25.7	20.3
31211	Soft drink and ice manufacturing	37.5	22.2
31212	Breweries	65.5	39.4
31213	Wineries	7.0	6.0
31214	Distilleries	7.0	10.9
3122	Tobacco manufacturing	12.7	7.9
313	Textile mills	17.0	15.5
3131	Fibre, yarn and thread mills	17.9	18.5
3132	Fabric mills	14.6	14.9
31321	Broad-woven fabric mills	13.8	11.3
31322	Narrow fabric mills and Schiffli machine embroidery	18.6	37.5
31323	Nonwoven fabric mills	15.6	27.2
31324	Knit fabric mills	14.8	22.4
3133	Textile and fabric finishing and fabric coating	24.3	15.1
31331	Textile and fabric finishing	33.2	12.1
31332	Fabric coating	14.8	37.0
314	Textile product mills	10.6	14.6
3141	Textile furnishings mills	10.7	12.3
31411	Carpet and rug mills	22.6	15.5
31412	Curtain and linen mills	5.6	9.1
3149	Other textile product mills	10.3	20.8
31491	Textile bag and canvas mills	6.6	20.6
31499	All other textile product mills	13.5	20.9
315	Clothing manufacturing	13.3	9.3
3151	Clothing knitting mills	16.8	5.4
31511	Hosiery and sock mills	19.3	5.4
31519	Other clothing knitting mills	15.3	5.4
3152	Cut and sew clothing manufacturing	13.0	10.3
31521	Cut and sew clothing contracting	33.5	96.7

31522	Men's and boys' cut and sew clothing manufacturing	13.4	7.6
315221	Men's and boys' cut and sew underwear and nightwear manufacturing	5.6	N/A
315222	Men's and boys' cut and sew suit, coat and overcoat manufacturing	16.2	6.7
315226	Men's and boys' cut and sew shirt manufacturing	16.7	5.4
315227	Men's and boys' cut and sew trouser, slack and jean manufacturing	11.8	9.5
315229	Other men's and boys' cut and sew clothing manufacturing	12.8	12.0
31523	Women's and girls' cut and sew clothing manufacturing	11.8	11.9
315231	Women's and girls' cut and sew lingerie, loungewear and nightwear manufacturing	3.9	11.8
315232	Women's and girls' cut and sew blouse and shirt manufacturing	179.9	N/A
315233	Women's and girls' cut and sew dress manufacturing	14.3	22.0
315234	Women's and girls' cut and sew suit, coat, tailored jacket and skirt manufacturing	12.0	11.1
315239	Other women's and girls' cut and sew clothing manufacturing	12.5	7.7
31529	Other cut and sew clothing manufacturing	7.6	5.6
3159	Clothing accessories and other clothing manufacturing	11.0	14.9
316	Leather and allied product manufacturing	9.1	8.6
3161	Leather and hide tanning and finishing	13.2	8.5
3162	Footwear manufacturing	9.0	7.4
3169	Other leather and allied product manufacturing	7.8	17.3
321	Wood product manufacturing	14.4	20.9
3211	Sawmills and wood preservation	13.1	16.9
32111	Sawmills and wood preservation	13.1	16.9
321111	Sawmills (except shingle and shake mills)	11.8	16.8
321112	Shingle and shake mills	25.5	17.6
321114	Wood preservation	93.8	17.6
3212	Veneer, plywood and engineered wood product manufacturing	17.2	28.9
32121	Veneer, plywood and engineered wood product manufacturing	17.2	28.9
321211	Hardwood veneer and plywood mills	12.3	6.7
321212	Softwood veneer and plywood mills	16.3	40.1
321215	Structural wood product manufacturing	13.0	32.4
321216	Particle board and fibreboard mills	18.9	19.5
321217	Waferboard mills	22.9	156.1
3219	Other wood product manufacturing	14.7	25.1
32191	Millwork	13.4	26.1
321911	Wood window and door manufacturing	14.2	49.1
321919	Other millwork	13.0	21.2
32192	Wood container and pallet manufacturing	12.6	19.2
32199	All other wood product manufacturing	20.8	25.0
322	Paper manufacturing	18.1	18.8
3221	Pulp, paper and paperboard mills	16.1	19.4
32211	Pulp mills	14.3	15.1
32212	Paper mills	16.6	22.0
322121	Paper (except newsprint) mills	14.5	16.5
322122	Newsprint mills	17.9	26.2
322123	Paperboard mills	20.4	22.4
3222	Converted paper product manufacturing	24.9	17.7
32221	Paperboard container manufacturing	25.9	18.7
322211	Corrugated and solid fibre box manufacturing	25.7	32.1
322212	Folding paperboard box manufacturing	23.6	9.2
322219	Other paperboard container manufacturing	30.7	17.0
32222	Paper bag and coated and treated paper manufacturing	20.3	14.7
32223	Stationery product manufacturing	25.8	15.5
32229	Other converted paper product manufacturing	32.2	22.0
322291	Sanitary paper product manufacturing	33.9	26.5
322299	All other converted paper product manufacturing	27.7	14.2
323	Printing and related support activities	31.1	72.7
3231	Printing and related support activities	31.1	72.7
32311	Printing	29.7	68.8
323113	Commercial screen printing	10.6	N/A
323114	Quick printing	26.6	N/A
323115	Digital printing	57.8	N/A
323116	Manifold business forms printing	19.5	15.8
323119	Other printing	31.2	85.6
32312	Support activities for printing	90.4	353.8
324	Petroleum and coal products manufacturing	47.7	37.2
3241	Petroleum and coal products manufacturing	47.7	37.2
32411	Petroleum refineries	51.1	38.7
32412	Asphalt paving, roofing and saturated materials manufacturing	28.8	20.7
32419	Other petroleum and coal products manufacturing	16.1	22.7
325	Chemical manufacturing	20.0	18.0
3251	Basic chemical manufacturing	34.1	21.2
32511	Petrochemical manufacturing	36.3	19.3
32512	Industrial gas manufacturing	123.0	65.6

32513	Synthetic dye and pigment manufacturing	18.6	14.2
32518	Other basic inorganic chemical manufacturing	20.9	35.5
32519	Other basic organic chemical manufacturing	63.9	17.7
3252	Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing	48.5	21.7
32521	Resin and synthetic rubber manufacturing	52.9	22.9
32522	Artificial and synthetic fibres and filaments manufacturing	24.4	13.4
3253	Pesticide, fertilizer and other agricultural chemical manufacturing	15.3	14.2
32531	Fertilizer manufacturing	14.9	16.6
32532	Pesticide and other agricultural chemical manufacturing	17.7	8.0
3254	Pharmaceutical and medicine manufacturing	10.3	12.9
3255	Paint, coating and adhesive manufacturing	17.5	13.1
32551	Paint and coating manufacturing	18.5	12.3
32552	Adhesive manufacturing	15.5	15.8
3256	Soap, cleaning compound and toilet preparation manufacturing	13.5	29.6
32561	Soap and cleaning compound manufacturing	22.0	49.0
32562	Toilet preparation manufacturing	9.9	21.6
3259	Other chemical product manufacturing	20.6	21.4
32591	Printing ink manufacturing	11.9	10.7
32592	Explosives manufacturing	19.0	12.4
32599	All other chemical product manufacturing	22.4	25.2
326	Plastics and rubber products manufacturing	24.8	25.4
3261	Plastic product manufacturing	25.2	22.9
32611	Plastics packaging materials and unlaminated film and sheet manufacturing	20.5	21.1
32612	Plastics pipe, pipe fitting, and unlaminated profile shape manufacturing	26.2	11.7
32613	Laminated plastics plate, sheet (except packaging), and shape manufacturing	17.8	27.4
32614	Polystyrene foam product manufacturing	27.1	20.6
32615	Urethane and other foam product (except polystyrene) manufacturing	17.0	41.7
32616	Plastic bottle manufacturing	29.2	25.8
32619	Other plastic product manufacturing	28.1	28.4
326191	Plastic plumbing fixture manufacturing	17.7	22.9
326193	Motor vehicle plastic parts manufacturing	41.1	54.5
326198	All other plastic product manufacturing	24.7	22.5
3262	Rubber product manufacturing	23.3	48.9
32621	Tire manufacturing	27.9	113.9
32622	Rubber and plastic hose and belting manufacturing	13.0	24.6
32629	Other rubber product manufacturing	24.6	32.4
327	Non-metallic mineral product manufacturing	22.7	25.2
3271	Clay product and refractory manufacturing	30.3	11.6
3272	Glass and glass product manufacturing	13.5	18.3
32721	Glass and glass product manufacturing	13.5	18.3
327214	Glass manufacturing	49.1	10.3
327215	Glass product manufacturing from purchased glass	8.8	42.2
3273	Cement and concrete product manufacturing	30.3	28.5
32731	Cement manufacturing	15.9	42.7
32732	Ready-mix concrete manufacturing	50.3	139.7
32733	Concrete pipe, brick and block manufacturing	30.8	7.1
32739	Other concrete product manufacturing	33.0	17.5
3274	Lime and gypsum product manufacturing	16.2	32.5
3279	Other non-metallic mineral product manufacturing	19.9	29.7
32791	Abrasive product manufacturing	10.5	12.2
32799	All other non-metallic mineral product manufacturing	23.0	37.9
331	Primary metal manufacturing	19.4	25.0
3311	Iron and steel mills and ferro-alloy manufacturing	14.4	16.6
33111	Iron and steel mills and ferro-alloy manufacturing	14.4	16.6
3312	Steel product manufacturing from purchased steel	14.2	12.2
33121	Iron and steel pipes and tubes manufacturing from purchased steel	21.1	13.2
33122	Rolling and drawing of purchased steel	6.2	9.4
331221	Cold-rolled steel shape manufacturing	6.5	16.3
331222	Steel wire drawing	6.1	8.1
3313	Alumina and aluminum production and processing	18.1	78.1
33131	Alumina and aluminum production and processing	18.1	78.1
331313	Primary production of alumina and aluminum	14.0	87.3
331317	Aluminum rolling, drawing, extruding and alloying	44.8	64.1
3314	Non-ferrous metal (except aluminum) production and processing	32.1	35.5
33141	Non-ferrous metal (except aluminum) smelting and refining	30.3	35.4
33142	Copper rolling, drawing, extruding and alloying	90.4	34.3
33149	Non-ferrous metal (except copper and aluminum) rolling, drawing, extruding and alloying	23.2	51.3
3315	Foundries	32.9	23.9
33151	Ferrous metal foundries	23.4	17.4
331511	Iron foundries	23.4	14.7
331514	Steel foundries	23.3	42.9
33152	Non-ferrous metal foundries	44.4	31.5

332	Fabricated metal product manufacturing	16.8	33.4
3321	Forging and stamping	20.2	35.3
33211	Forging and stamping	20.2	35.3
3322	Cutlery and hand tool manufacturing	15.1	26.7
3323	Architectural and structural metals manufacturing	12.7	44.6
33231	Plate work and fabricated structural product manufacturing	11.9	82.4
332311	Prefabricated metal building and component manufacturing	17.9	62.7
332314	Concrete reinforcing bar manufacturing	7.0	N/A
332319	Other plate work and fabricated structural product manufacturing	12.3	77.1
33232	Ornamental and architectural metal products manufacturing	13.6	29.8
332321	Metal window and door manufacturing	11.3	22.1
332329	Other ornamental and architectural metal products manufacturing	15.1	35.8
3324	Boiler, tank and shipping container manufacturing	17.0	28.4
33241	Power boiler and heat exchanger manufacturing	22.4	62.4
33242	Metal tank (heavy gauge) manufacturing	12.2	69.1
33243	Metal can, box and other metal container (light gauge) manufacturing	19.3	15.9
3325	Hardware manufacturing	23.0	45.3
3326	Spring and wire product manufacturing	16.7	30.4
3327	Machine shops, turned product, and screw, nut and bolt manufacturing	24.0	40.7
3328	Coating, engraving, heat treating and allied activities	39.0	56.8
3329	Other fabricated metal product manufacturing	15.6	15.0
333	Machinery manufacturing	15.4	24.6
3331	Agricultural, construction and mining machinery manufacturing	14.8	15.3
33311	Agricultural implement manufacturing	10.7	8.9
33312	Construction machinery manufacturing	10.6	16.7
33313	Mining and oil and gas field machinery manufacturing	27.3	24.5
3332	Industrial machinery manufacturing	17.0	36.5
33321	Sawmill and woodworking machinery manufacturing	20.8	19.6
33322	Rubber and plastics industry machinery manufacturing	17.1	27.7
33329	Other industrial machinery manufacturing	15.8	73.3
3333	Commercial and service industry machinery manufacturing	11.1	31.4
33331	Commercial and service industry machinery manufacturing	11.1	31.4
3334	Ventilation, heating, air-conditioning and commercial refrigeration equipment manufacturing	11.9	22.3
33341	Ventilation, heating, air-conditioning and commercial refrigeration equipment manufacturing	11.9	22.3
3335	Metalworking machinery manufacturing	22.1	75.5
33351	Metalworking machinery manufacturing	22.1	75.5
3336	Engine, turbine and power transmission equipment manufacturing	19.3	31.1
33361	Engine, turbine and power transmission equipment manufacturing	19.3	31.1
3339	Other general-purpose machinery manufacturing	15.8	23.1
33391	Pump and compressor manufacturing	23.9	13.4
33392	Material handling equipment manufacturing	13.1	35.8
33399	All other general-purpose machinery manufacturing	15.8	24.9
334	Computer and electronic product manufacturing	8.9	31.8
3341	Computer and peripheral equipment manufacturing	6.0	29.0
33411	Computer and peripheral equipment manufacturing	6.0	29.0
3342	Communications equipment manufacturing	6.8	22.0
33421	Telephone apparatus manufacturing	4.5	13.1
33422	Radio and television broadcasting and wireless communications equipment manufacturing	11.8	54.5
33429	Other communications equipment manufacturing	11.4	33.6
3343	Audio and video equipment manufacturing	6.7	10.8
33431	Audio and video equipment manufacturing	6.7	10.8
3344	Semiconductor and other electronic component manufacturing	15.5	156.8
33441	Semiconductor and other electronic component manufacturing	15.5	156.8
3345	Navigational, measuring, medical and control instruments manufacturing	12.8	33.2
33451	Navigational, measuring, medical and control instruments manufacturing	12.8	33.2
3346	Manufacturing and reproducing magnetic and optical media	34.6	42.5
33461	Manufacturing and reproducing magnetic and optical media	34.6	42.5
335	Electrical equipment, appliance and component manufacturing	10.2	21.8
3351	Electric lighting equipment manufacturing	14.2	21.2
33511	Electric lamp bulb and parts manufacturing	23.6	15.2
33512	Lighting fixture manufacturing	12.8	23.8
3352	Household appliance manufacturing	13.1	20.0
33521	Small electrical appliance manufacturing	10.2	16.1
33522	Major appliance manufacturing	13.7	20.7
3353	Electrical equipment manufacturing	16.5	34.0
33531	Electrical equipment manufacturing	16.5	34.0
335311	Power, distribution and specialty transformers manufacturing	9.7	27.6
335312	Motor and generator manufacturing	36.5	34.1
335315	Switchgear and switchboard, and relay and industrial control apparatus manufacturing	16.4	38.2

3359	Other electrical equipment and component manufacturing	6.3	16.5
33591	Battery manufacturing	8.8	10.8
33592	Communication and energy wire and cable manufacturing	4.9	15.2
33593	Wiring device manufacturing	29.4	19.1
33599	All other electrical equipment and component manufacturing	8.7	31.7
336	Transportation equipment manufacturing	35.0	67.4
3361	Motor vehicle manufacturing	92.5	299.3
33611	Automobile and light-duty motor vehicle manufacturing	118.4	484.5
33612	Heavy-duty truck manufacturing	27.9	59.3
3362	Motor vehicle body and trailer manufacturing	16.3	34.0
33621	Motor vehicle body and trailer manufacturing	16.3	34.0
336211	Motor vehicle body manufacturing	18.8	50.1
336212	Truck trailer manufacturing	14.2	32.2
336215	Motor home, travel trailer and camper manufacturing	15.4	19.8
3363	Motor vehicle parts manufacturing	23.3	49.2
33631	Motor vehicle gasoline engine and engine parts manufacturing	40.5	66.1
33632	Motor vehicle electrical and electronic equipment manufacturing	27.1	49.1
33633	Motor vehicle steering and suspension components (except spring) manufacturing	112.6	73.1
33634	Motor vehicle brake system manufacturing	17.4	15.3
33635	Motor vehicle transmission and power train parts manufacturing	27.5	27.2
33636	Motor vehicle seating and interior trim manufacturing	98.7	261.6
33637	Motor vehicle metal stamping	36.7	42.7
337	Furniture and related product manufacturing	23.0	38.1
3371	Household and institutional furniture and kitchen cabinet manufacturing	21.0	31.1
33711	Wood kitchen cabinet and counter top manufacturing	35.6	180.0
33712	Household and institutional furniture manufacturing	17.5	22.1
337121	Upholstered household furniture manufacturing	10.0	39.7
337123	Other wood household furniture manufacturing	23.8	18.8
337126	Household furniture (except wood and upholstered) manufacturing	9.0	15.5
337127	Institutional furniture manufacturing	17.5	43.0
3372	Office furniture (including fixtures) manufacturing	28.5	56.5
33721	Office furniture (including fixtures) manufacturing	28.5	56.5
3379	Other furniture-related product manufacturing	19.1	41.2
33791	Mattress manufacturing	26.4	39.4
33792	Blind and shade manufacturing	11.8	46.0
339	Miscellaneous manufacturing	12.2	16.0
3391	Medical equipment and supplies manufacturing	17.1	42.7
33911	Medical equipment and supplies manufacturing	17.1	42.7
3399	Other miscellaneous manufacturing	10.8	12.3
33991	Jewellery and silverware manufacturing	8.8	12.6
33992	Sporting and athletic goods manufacturing	13.9	6.2
33993	Doll, toy and game manufacturing	89.9	22.2
33994	Office supplies (except paper) manufacturing	4.9	28.5
33995	Sign manufacturing	20.6	54.6
33999	All other miscellaneous manufacturing	7.0	16.2

Source: Statistics Canada, CANSIM, Table 304-0014, seasonally unadjusted data.

Annex IV –Logistics Internal Cost Data

Logistics Aggregate Data

	Manufacturing Can.	Manufacturing U.S.	Wholesale Can.	Wholesale U.S.	Retail Can.	Retail U.S.
Internal cost	15.154	8.3347	9.69	7.2675	5.544	4.65696
Outsourcing	9.366	16.6703	1.366	1.422917	0.491	1.559647
Inventory Carrying cost	9.881985	8.908321	7.817786	6.661961	10.32336	7.84517
Source: Statistics Canada, Jacobson Consulting and Authors Calculations, in Canadian Based Factor (based in billions of Canadian dollars)						

Logistics Internal Cost Data

Internal costs in Logistics for Canada		
	Share of Gross Margin	Share of GDP
Retail Trade	11.5 percent	19 percent
Motor Vehicles and parts dealers	14.9 percent	
Furniture and home furnishing stores	15.3 percent	
Electronics and appliance stores	9.2 percent	
Building materials and garden equipment and supplies dealers	29.2 percent	
Food and beverage stores	7.0 percent	
Health and personal care stores	7.5 percent	
Gasoline stations	1.7 percent	
Clothing and clothing accessories stores	5.8 percent	
Sporting goods, hobby, book and music stores	7.3 percent	
General merchandise stores	18.4 percent	
Miscellaneous store retailers	11.6 percent	
Non-store retailers	24.3 percent	
Source: Statistics Canada, Census, Input-Output Data and Jacobson Consulting Calculations		

Annex V - References

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