# COVID-19 SUPPLY CHAIN IMPACT STUDY REPORT

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CM&E CANADIAN MANUFACTURERS & EXPORTERS

Vehicle Technology CENTRE

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# FOREWORD

On March 11, 2020, the World Health Organization (WHO) classified COVID-19 as a pandemic. One day later, Manitoba confirmed its first three cases of the virus, all due to travel. Then, on March 20, Premier Brian Pallister declared a state of emergency across the Province. After a gradual "re-opening" of Manitoba during spring and summer, by mid-November the Province was under level red restrictions. By January 30, 2021, Manitoba had been afflicted with nearly 30,000 cases of COVID-19 – and 825 Manitobans had lost their lives to the virus.

The pandemic also threatened the existence of many businesses, especially small, consumer services, such as fitness centres and specialty shops. Suddenly, Manitoba manufacturers faced a more uncertain future. Global trade plummeted; travel restrictions mounted. Manufacturing is the largest industrial sector in Manitoba, with annual revenues approaching $20 billion. The sector directly employs approximately 64,000 Manitobans, and enables numerous additional indirect job opportunities. While the manufacturing sector has largely remained "essential" in terms of government policy, many firms have faced declining demand and/or supply shortages, on top of lingering workforce and skills shortages.

In response, federal and provincial governments have supported the industry with programs such as the Canada Emergency Wage Subsidy and tax deferrals. During 2020, the provincial government invested over $200 million in Manitoba companies to support production and procurement of various medical supplies, including N95 masks, face shields, reusable gloves and hospital gowns. Despite the disruption, many Manitoba manufacturers have been resilient.

Due to the global nature of modern supply chains, the pandemic has had a pervasive impact. In search of cost savings, many manufacturers have adopted single sourcing and low-cost country sourcing strategies. They have also implemented "lean" production techniques to eliminate waste, including excess inventory. Lean techniques work best under stable conditions. Indeed, single sourcing and lean production make companies vulnerable to shortages when disruptions (like pandemics) occur. You've got fewer eggs, and they're all in one basket …

In the midst of this pandemic crisis, Canadian Manufacturers and Exporters (CME) – Manitoba, together with the Vehicle Technology Centre (VTC) assembled a team of industry experts to study the effect of COVID-19 on manufacturing supply chains in Manitoba. This report presents and interprets results of in-depth interviews with fifty-eight Manitoba manufacturers. The report ends with a series of specific recommendations to enhance the resilience of manufacturing – Manitoba's largest industrial sector.

Paul D. Larson, Ph.D.
CN Professor of SCM
University of Manitoba

# About the Authors

**Ron Koslowsky -** Ron has been the Vice President, Manitoba Division of the Canadian Manufacturers & Exporters since April 2007. Prior to that he spent over 21 years at Palliser Furniture in a variety of roles including Vice President of Human Resources. He has extensive experience in manufacturing, construction, insurance and business consulting as well as serving on various boards including 15 years on the CME board.

**Ron Vanderwees – P.Eng. -** Ron has 35 years' experience in management of operations, production engineering, research and development, warranty, and service, 25 of these years were in the Manitoba heavy vehicle manufacturing sector. Currently serving as the Program Director for Manitoba's Vehicle Technology Centre.

**Ray Hoemsen – FEC, P.Eng. -** Ray began his career in Manitoba's agricultural tractor industry in 1977, over the last three decades he has worked in the public sector supporting technology transfer, applied research and innovation in many fields, including the heavy vehicle sector. Most recently, Ray was the Executive Director of Research Partnerships & Innovation at Red River College and currently is President & Managing Director of Nexus Manitoba.

**Kevin Dickson – P.Eng. -** Kevin has over 35 years in the design and manufacturing of Electronic systems, the last 25 of which were focused on direct applications for heavy duty vehicles. He managed a global engineering group encompassing 5 countries and has spearheaded several International Business development opportunities. Currently semi-retired and focusing on consulting in the areas of vehicle technology.

**Gustavo Zentner, MBA, CITP -** Gustavo has over 25 years of international trade and global business expansion expertise. Leading strategic development and execution of global projects in the manufacturing, processing, and technology sectors across multiple platforms, he focusses on product development through commercialization. Gustavo currently supports CME through Executive Councils and is President of InterPOC.

**Bob Hastings CD P.Eng. -** Bob has over 40 years of experience in the aerospace and defence public and private sector. He has worked extensively in establishing R&D and developmental test programs and infrastructure. Most recently his work has been focused on advanced digital manufacturing competency development and business implementation. Bob is President of PointMan Canada Ltd and CEO of WestCaRD.

**Paul D. Larson, Ph.D. -** Paul is the CN Professor of Supply Chain Management (SCM) at the University of Manitoba. From 2005-2010, he served as Head of the SCM Department and Director of the University of Manitoba Transport Institute (UMTI). In 2008, Larson led a pandemic planning research team, yielding the report: *Manitoba Nutrition Supply in Event of a Pandemic*. This pandemic study inspired his Supply Chain Risk Evaluation and Management (SCREAM) framework. Dr. Larson lectures and conducts research on sustainability, supply chain risk management and logistics.

**Andrea Aiello -** Andrea has over 25 years of experience in the manufacturing industry, primarily Human Resources focused. As the Director of Workforce Development at CME, she works to ensure there is a steady supply of skilled talent available to Manitoba manufacturers. Andrea makes connections with government, industry, post secondary academic and service providers, to close workforce gaps whether new training curriculum, new sources of talent or preparing manufacturers for the future of work. Andrea is also the Chair of the Coalition for Advanced Manufacturing Academic Committee.

# Acknowledgements

The COVID-19 Supply Chain Impact Study Team would like to thank the individuals and organizations who generously shared their time, knowledge and experience for the purposes of this project. Senior company personnel from 58 companies in Manitoba voluntarily shared their insight and observations on the supply chain impact that occurred as a result of this global pandemic. This report would not have been possible without their support and participation.

The Study Team would also like to thank the personnel of Western Economic Diversification Canada whose foresight enabled the project definition and initiation of the study and whose funding supported all activities of the project.

The content of this report is based on the insights offered by the companies interviewed and as summarized by the Study Team. The recommendations and conclusions have been developed by our team and do not necessarily represent the official views of Western Canada Diversification or the Government of Canada.

The Study Team would also like to thank Dr. Paul Larson, the CN Professor of Supply Chain Management at the University of Manitoba Asper School of Business who provided subject matter expertise and invaluable guidance in the performance of the study and the generation of the final report.

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# EXECUTIVE SUMMARY

## Study Objectives

The primary objective of this study is to assess the impact of the COVID-19 pandemic on Manitoba's manufacturers in order to develop policy and processes that promote the resiliency of Manitoba's manufacturing supply chain. This report presents an assessment of qualitative and quantitative supply chain impacts and appraises broader Manitoba manufacturing sector characteristics that impact the supply chain and its resilience in the face of major disruptions.

## Manitoba Manufacturing

Manitoba's manufacturing sector is substantial, robust and diverse with over 1,380 manufacturing establishments operating within the Province. There are some predominant Manitoba clusters within approximately 18 manufacturing sub-sectors based on three-digit North American Industrial Classification Systems (NAICS) codification. By employee size, 91% of Manitoba manufacturers are small businesses with less than 100 employees, 96 or 7% are mid-sized (100 to 500 employees), and 22 or 1.7% are large enterprises (more that 500 employees). Across Canada, only 0.6% of manufacturing companies are large enterprises, a lower percentage than in Manitoba. It is also notable that large Manitoba companies are not typically operating in the same market space, which expands opportunities for collaborative activities and supply chain development within Manitoba as well as externally.

Additionally, Manitoba manufacturers have generally and deeply embraced Lean processes and have thus withstood this pandemic, and previous global market perturbations, reasonably well. This manufacturing process efficiency provides an excellent foundation for the further growth and strengthening of the Manitoba manufacturing cluster in the future.

While Manitoba's manufacturing sector is reasonably healthy, there are external forces which pose challenges in the future, e.g. an aging manufacturing workforce, a diminishing pool of people interested in manufacturing careers, and digital manufacturing based productivity improvements that have been embraced by many industrialized nations. Nevertheless, with foresight and aggressive industry/ government/ academic cooperation, Manitoba is well positioned to increase manufacturing productivity and competitiveness for integration into both external and internal-to Manitoba value chains.

## Study Methodology

This study was motivated by and supported by Western Economic Diversification and was performed jointly by Canadian Manufacturers and Exporters (CME) – Manitoba and the Vehicle Technology Centre (VTC). The study team consisted of 6 individuals with extensive manufacturing industry and academic experience, who have extensive experience within Manitoba's manufacturing ecosystem. Expert advice and input was provided to the study by Dr. Paul D. Larson, the CN Professor of Supply Chain Management at the University of Manitoba.

A holistic approach to the study was undertaken to ensure that regardless of company understanding of supply chain matters, the knowledge and health of the supply chain could be inferred from all relevant manufacturing performance parameters. The study approach was to seek statistical and qualitative feedback from as broad a community of manufacturers as possible, representing the diversity of Manitoba's manufacturing sector.

**Surveyed Company Size Classification**

The intent of the study was to canvass a representative sample of companies across all size classes and manufacturing subsectors to the greatest extent possible. Of the 58 companies surveyed, 18 were small (< 100 employees), 24 were medium (100 to 499 employees) and 16 were large (500 or more employees). While this employee size distribution was skewed to the large company end of the spectrum, it was felt to be appropriate to the intent of the study. Smaller and medium size companies were selected based on their supply chain involvement and operations such that they would be representative of the small to medium sized enterprise community across Manitoba.

## Surveyed Manufacturing Sectors

Companies from 15 North American Industrial Classification System (NAICS) manufacturing codes were surveyed as part of this study. The three-digit NAICS codes are often not sufficiently specific. However, to optimize the presentation of data, three-digit codes were used to bin the companies while 4 and 6-digit codes are also captured as part of this study. Refer to Appendix II for a list of companies surveyed, along with their 3-, 4- and 6-digit NAICS classifications and company size classes.

## Conclusions

Generally speaking, the majority of Manitoba manufacturers have not suffered significant business losses as a result of COVID-19, and many expect recovery to pre-COVID-19 levels by the end of 2020 or 2021 at the latest.

However, some sectors have experienced significant business activity reductions. The business disruptions were found not to be due solely or primarily to supply chain challenges but more so to a confluence of factors related to global demand, geo-political issues, etc. A number of companies operate in sectors where demand can be cyclical and vary greatly from year-to-year. Some of these companies identified that COVID-19 coincided with an expected cyclical upturn, which was not realized due to the pandemic. Agricultural equipment manufacturing is one cluster affected in this manner.

Across the various manufacturing sectors, Manitoba manufacturers have a widely varying understanding of their supply chains and supply chain concepts in general. Some companies had made prescient supply chain decisions on multiple-sourcing and finding suppliers not in China prior to COVID-19. These companies did not suffer the full effects of COVID-19 supply chain disruptions. Some manufacturers reacted early to develop and pursue innovative ways to lessen supply chain disruptions. Those companies are implementing the lessons learned from the pandemic to improve future business operations. Notwithstanding these pockets of brilliance, the general lack of supply chain understanding is problematic in a global marketplace where suppliers must increasingly be integrated vertically and horizontally, often across multiple sectors in order to achieve growing profitability and economic success. There is little doubt that a better understanding of supply chain processes needs to be developed at all levels within businesses, with particular emphasis on small to medium sized firms.

Feedback on the benefits of government programs varied widely. While Manitoba's manufacturers found that financial assistance helped in some ways, the variability in regulations posed some unexpected challenges to company operations. This observation was true for both federal and provincial programs and communications environments although specific addressable issues were not broadly identified by respondents. The strengths and weaknesses of the various government programs should be captured in a focused fashion to inform policymaking ahead of future market upheavals.

The pandemic understandably caused a great deal of worker anxiety which some companies managed extremely well, generating significant operational dividends. It would be of great value to document these

best practices, share them with other manufacturers, and weave them into future pandemic relief policy making.

A globally pervasive prognosis in advanced manufacturing nations is that COVID-19 will accelerate the digitalization of industrial processes, due to a confluence of factors including this and future pandemics, an aging workforce demographic and the continuing push for productivity/competitiveness improvements. It was clear that the need for and benefits of adopting digital manufacturing processes and technologies is not well understood by many companies. Regarding digitalization of manufacturing and future-proofing manufacturing operations through a digitally based supply chain, there were varying perceptions of the benefits or the accelerating necessity for advanced digital manufacturing processes, including the need for universal supply chain integration. Such integration, encompassing comprehensive vertical and horizontal integration within the entire value chain and across the product life cycle, is an opportunity for Manitoba manufacturers to build a strong position at the head of the pack moving forward from this pandemic.

In general, this pandemic posed more, and more significant challenges than previous market disruptions. The one noted exception to this was September 11, 2001. However, it was not always clear that the root causes were well understood by the companies. They were busy developing innovative work-arounds that off-set pandemic challenges and, in a number of cases, offered opportunities for business and product growth. In many cases, what was not said, or an incongruity of responses to inter-related questions offered insight into the true impact of the COVID-19 impact on the supply chain, highlighting future-proofing and supply chain resilience building opportunities.

## Recommendations

The following four recommendations are offered to improve Manitoba manufacturing supply chain performance and resilience:

**1. Leverage the Manitoba Manufacturing Network**

- Establish and facilitate regular meetings bringing together executives responsible within manufacturing for the purpose of learning how to improve supply chains and expand trade.
- Refine and enable networking designed to connect Manitoba manufacturers for business development, B2B relationship building or revenue generation.
- Aggregate holistic supply chain interests or needs that would benefit suppliers in Manitoba and provide avenues by which manufacturers can effectively collaborate - opportunities for value added manufacturing, dual-sourcing, performance improvement including group buying, joint bids, and transportation cost sharing to be more globally competitive.
- There is variability in Manitoba manufacturer supply chain maturity that would benefit from expanded support of local single, dual, cross and multi-sourcing initiatives to assist in achieving greater supply chain growth and resilience through support for achieving required quality standards as well as re-tooling and setup costs.

**2. Operational Practices Tools and Resource Repository including Disaster/Emergency Responses**

- Introduce a benchmarking tool comparing a company's supply chain to other worldwide companies to assist corporate leaders in assessing vulnerabilities and enable creation of measurable strategic improvement initiatives.

- Educate and provide tools for Manitoba manufacturers to better assess the true cost of importation and properly weighted KPIs to allow their company to make more informed global supply chain decisions.
- Scan and develop an inventory of available resources to address needs.
- Develop or identify tools, templates, SOP's, checklists, tips, implementation guides etc. that can be used to assist SMEs in dealing with emergencies as well as supply chain improvement.

**3. Supplier Development Program**

- Develop / refine a holistic supplier assessment tool, allowing Manitoba manufacturers to compare their capabilities and readiness to compete on a local as well as a global basis, including all facets of the business, e.g. quality, productivity, technology, etc.
- Identify gaps arising from the assessment and develop a company action plan to address gaps between current capacities and global competitive standards.
- Communicate and share best practices.
- Establish peer-to-peer councils to identify, prioritize, and enable supply chain competency development.

**4. Manufacturing Technology Roadmap(s) to support supply chain development and integration by Manitoba manufacturers**

- Create a knowledge base of relevant advanced technology needs, especially for digital manufacturing.
- Identify opportunities for collaborative applied research, training and pilot projects.

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# Acronyms

CETA - Comprehensive Economic and Trade Agreement
CME – Canadian Manufacturers and Exporters
CN - Canadian National Railway
CPTPP - Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CUSMA - Canada-United States-Mexico Agreement
FX - Foreign Exchange
ISO – International Standards Organization
NAICS - North American Industrial Classification Systems
PPE – Personal Protective Equipment
VTC – Vehicle Technology Centre

# Document Organization

This report is presented in the following order:

- ***Executive Summary:*** A lengthened Executive Summary is provided to introduce the study objectives, Manitoba manufacturing sector characteristics, the study methodology, observation highlights, and recommendations for follow on actions arising from the study. The Executive Summary is intended to be a mini-report, focusing on the conclusions and recommendations while also providing a route map should the reader wish to explore the sources of the concluding material.
- ***Study Objectives***: The explicit and implicit objectives of the study are presented first in the main body of the report. The explicit objectives relate specifically to supply chain matters that were stipulated in the study contract, and the implicit objectives are relevant to broader manufacturing sector characteristics which impact the supply chain and manufacturer understanding of supply chain characteristics.
- ***Manitoba Manufacturing:*** A brief profile of Manitoba's manufacturing sector are provided to set the stage for study parameters relating to sub-sectors as well as company size class.
- ***Study Methodology:*** An overview of how the study was undertaken is next provided to identify the rationale for selecting companies involved in the study as well as some of the parameters which formulated the study approach including the study questionnaire.
- ***Observations:*** This section begins with generalized observations that derive from a quantitative analysis of responses to the study questionnaire, as well as discussion notes for each of the interview questions. The second portion of the observations section presents each question, along with corresponding discussion guidance points. A summary of the interview discussions for each question is also included in this section.
- ***Recommendations:*** The conclusion section of the report provides a list of recommendations proposed for follow-on actions to this study. The recommendations are focused both on specific supply chain subjects as well as broader manufacturing sector characteristics and parameters that impact supply chain mapping and resilience.

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Analysing the supply chain impact of COVID-19 in isolation of a number of interdependent variables was recognized as being a challenge to this study. One example is that some sectors display demand cycles that have periodicities of several years. Gaining an understanding of where 2020 occurred in those cycles and its incremental supply chain impact needs to be further explored but was considered to be beyond the scope of the study. Nevertheless, an attempt was made within the study to identify the relevant supply chain impact of the pandemic of these broader characteristics.

Past experience, reinforced by this study, also indicates considerable variability in the level of understanding of supply chain processes. While large companies and some medium-sized companies have dedicated supply chain resources and well-founded supply chain capabilities, some smaller and

medium firms rely on the owner/entrepreneur or non-dedicated resources to manage business processes, including supply chain management. In times of major market upheaval such as is being experienced as a result of COVID-19, addressing rapidly changing business forces presents challenges to any operation but more so to companies in which dedicated supply chain resources are not available. As such, this study takes a holistic view of the COVID-19 supply chain impact including broader manufacturing operations and market pressures on the supply chain.

# Manitoba Manufacturing

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The primary study mechanism was a questionnaire consisting of 17 questions addressing a range of indicators of general business as well as specific supply chain performance impacts due to the COVID-19 pandemic and any significant interdependent external market forces. The questionnaire was discussed with each company so that clarification could be sought for the various perspectives offered. Each

question provided multiple answer options as discussion guidance. Prior to its use, the questionnaire was reviewed and refined by Dr. Paul D. Larson.

Seventy-three companies were originally identified for participation in the survey, with 58 companies, or approximately 80% of the targeted participants, eventually participating in the study. Company contacts were at executive/ senior management levels or heads of corporate supply chain activities. The survey/questionnaire, with numerical result summaries, and a condensed summary of interview discussion points forms the main body of this report under the heading Observations. The survey questions are provided in Appendix I.

# Observations

The Observations section of the report presents data in the following order:

- Surveyed company size classification;
- Surveyed manufacturing sectors, organized by NAICS codes; and
- Survey Data Summary which provides a summary of the qualitative and quantitative results for each survey question.

Survey questions are italicized and in bold print, with answer options/discussion guidance from the interviews provided for each question.

## Surveyed Company Size Classification

The intent of the study was to canvass a representative sample of companies across all size classes and manufacturing subsectors to the greatest extent possible. Of the 58 companies surveyed, 18 were small (< 100 employees), 24 were medium (100 to 499 employees) and 16 were large (500 or more employees). While this employee size distribution was skewed to the large company end of the spectrum, it was felt to be appropriate to the intent of the study. Smaller and medium size companies were selected based on their supply chain involvement and operations such that they would be representative of the small to medium sized enterprise community across Manitoba.

In question 2, companies were requested to identify their annual revenues. This information is commercially sensitive, as such, the companies were classified in relatively broad bands of annual revenue. As seen in the figure below, only 3 or 5.2% of interviewed companies had annual revenues less that $10M, 24 or 41.4% generated revenues between $10M and $30M, and 31 or 53.4% had revenues of greater than $30M.

***1. How many people does your company employ in Manitoba?***

a. 1 to 99
b. 100 to 499
c. 500 or more

Table 1. Number of Employees

| Number of Employees | Frequency | Percent |
|---|---|---|
| 1 to 99 | 18 | 31% |
| 100 to 499 | 24 | 41% |
| 500 or more | 16 | 28% |

***2. What are your company's annual (2019) revenues from products manufactured in Manitoba?***

a. Under $10 million
b. $10 million to $29,999,999
c. Over $30 million

Table 2.

| Annual Revenue | Frequency | Percent |
|---|---|---|
| Under $10 million | 3 | 5.2% |
| $10 mil. to $30 million | 24 | 41.4% |
| Over $30 million | 31 | 53.4% |

## Surveyed Manufacturing Sectors

Companies from 15 North American Industrial Classification System (NAICS) manufacturing codes were surveyed as part of this study. The three-digit NAICS codes are often not sufficiently specific. However, to facilitate the presentation of data, three-digit codes were used to bin the companies while 4 and 6-digit codes are also captured as part of this study. Refer to Appendix II for a list of companies surveyed, along with their 3, 4 and 6-digit NAICS classifications and company size classes.

Figure 1 on the following page provides a breakdown of numbers of small, medium and large surveyed companies for each of the 3-digit NAICS code involved in the study:

North American Industry Classification System

(https://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart_code=31&search=2017%20NAICS%20Search)

311 Food Manufacturing

315 Apparel Manufacturing

321 Wood Product Manufacturing

322 Paper Manufacturing

323 Printing and Related Support Activities

326 Plastics and Rubber Products Manufacturing

331 Primary Metal Manufacturing

332 Fabricated Metal Product Manufacturing

333 Machinery Manufacturing

335 Electrical Equipment, Appliance, and Component Manufacturing

336 Transportation Equipment Manufacturing

337 Furniture and Related Product Manufacturing

423 Merchant Wholesalers, Durable Goods

523 Securities, Commodity Contracts, and Other Financial Investments and Related Activities

811 Repair and Maintenance

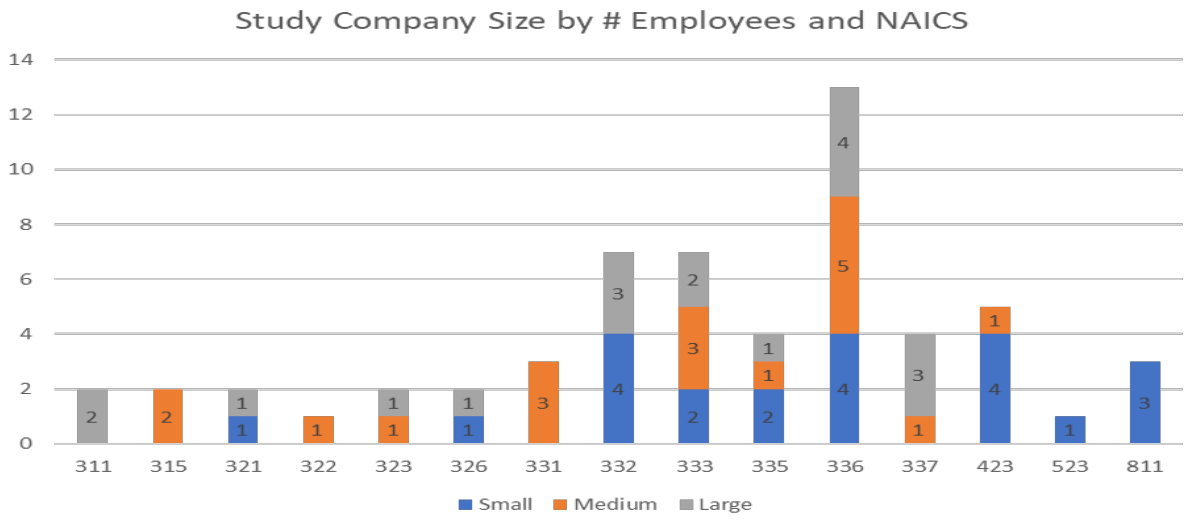


Figure 1.

# Survey Data Discussion

The next survey questions asked if companies had a pandemic or disaster response plan on January 1st 2020 and whether or not they now do.

***3. On January 1, 2020, did your company have a pandemic preparedness and response plan?***

Figure 2.

a. Yes
b. No
c. I don't know

***Does your company now have a pandemic preparedness and response plan?***

a. Yes
b. No
c. I don't know

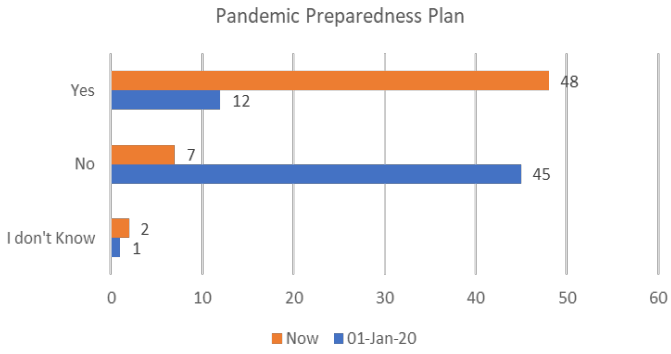


Figure 2.

As indicated in Figure 2, most companies (45/58) did not have a pandemic response plan prior to COVID-19 on January 1, 2020. However, a majority have subsequently generated or revised some form of pandemic response plan. Many acknowledge that a more detailed plan is still required in the future to address pandemics and other large-scale market upheavals. Some companies that have a pandemic response plan indicated that it had been developed during the SARS pandemic (2002-2004) but had not been refreshed in the intervening years and was found to be inadequate to address COVID-19 challenges.

Disaster recovery plans are often a supplier qualification requirement of larger/purchasing companies, and such plans are required to address pandemics and other large-scale business disruptions, such as fires, earthquakes, etc.

One company interviewed invested heavily in on-site medical screening and testing as well as in-plant continuous contact tracing using pendants developed with a small company for this purpose. They

credited their proactive response to an increase in business in 2020 and the fact that there were no COVID-19 illnesses in their workforce of 1500 at one site.

The lack of rigorous pre-COVID-19 disaster plans is an opportunity to support companies of all sizes in developing disaster preparation and response plans, including pandemic relief plans. This would also support broader supplier development initiatives and/or a learning network for collaborative development of such plans, as well as sharing of best practices. These same processes could also provide input to governments to enable identification of support policy strategies that work best for industry in response to different types of disasters.

***4. Overall, how is your business doing today compared to objectives or expectations?***

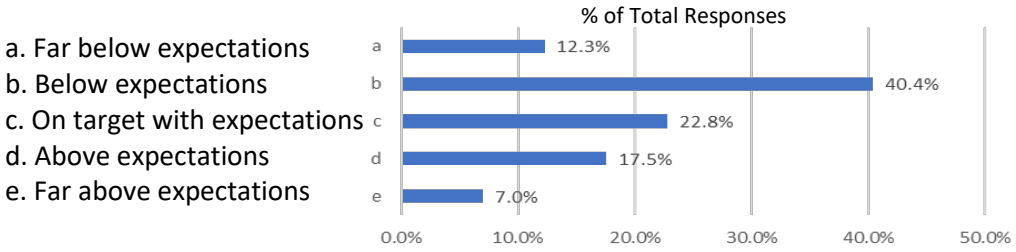


Figure 3.

Some companies indicated that they suffered significantly in 2020. However, as shown in Figure 4 above, it was about 50/50 for companies that met or exceeded revenue expectations and those who did not. Separating the effects of COVID-19 from the multiplicity of concurrent and inter-related factors was difficult based on overall business health.

It was noted by a number of companies in the agricultural manufacturing sector that the past three years have seen a large cyclical downturn and it was difficult to discriminate any additional COVID-19 impact. In fact, when asked if their company was hitting targets, the response was yes, but that much reduced revenue targets were being achieved, rather than pre-COVID-19 strategic planning targets.

Combining far below and somewhat below responses could also be misleading, as somewhat below is not sufficiently definitive. It was thought that a correlation with NAICS codes might yield some granularity in terms of adverse business outcomes, but the sample size wasn't large enough to generate valid observations. In exploring whether company size had an effect, of the 7 companies which identified achieved "Far Below Expectations", 4 companies were in the large and 3 in the small size class, and zero in the medium size class.

It was therefore difficult to assess specific supply chain impacts on overall business performance. While many manufacturers have fared reasonably well thus far in the COVID-19period, that may be due to the pervasive Lean manufacturing culture and some innovative approaches to supply chain disruptions that were subsequently noted in the interview discussions. The primary conclusion taken is that while the Manitoba manufacturing sector has a fairly resilient supply chain, continued duress may be problematic.

***5. Has your firm experienced supply chain disruptions during the COVID-19 pandemic?***

***__ Yes __ No:***

Forty-four of the 58 or 76% of the companies surveyed identified that they had experienced some level of supply chain disruption due to COVID-19.

***Question 5 Discussion Guidance***

***If yes, which of the following factors made you vulnerable to these disruptions?***

a. Your firm's (single-)sourcing strategies
b. Lack of end-to-end supply chain visibility
c. Unavailability of transportation and logistics services
d. Your inventory strategies
e. Your people
f. Your country sourcing strategy
g. Other, please specify

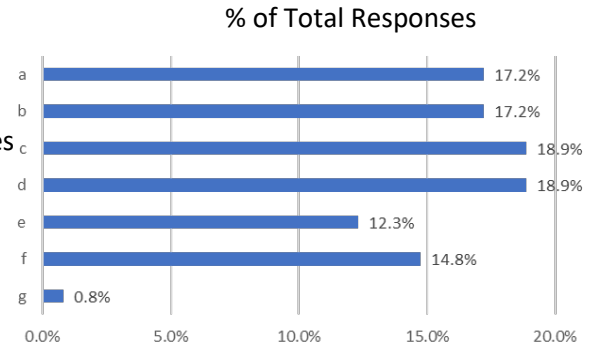


Figure 4.

Although few responses indicated severe supply chain disruptions, Figure 4 indicates that many businesses had to slow production to manage a number of concurrent production workforce and supply chain issues that arose. Some businesses had to shut down for an extended period of time. They often needed to use downtime to determine how to bring staff back safely, ensure adequate supply of PPE, reconfigure assembly processes, and address vendor supply issues. Advanced preparedness through comprehensive disaster planning could have mitigated the COVID-19 supply chain impacts during the initial stages of the disruption.

Overall, the root causes of the disruptions encountered were fairly evenly split between the factors identified above as discussion guidance. Many companies indicated several disruption factors. Few "other" cause factors were noted, which may suggest that the question guidance options primed company responses.

End-to-end supply chain visibility, a breakdown in logistics and single sourcing strategies were the disruptive factors most often noted during the actual interviews when amplification was sought. Regarding the single source supply issues, the problems occurred with sole source components in which sub-components were sourced off-shore from the supplier, the end-to-end supply chain lack of visibility only made apparent when the sourcing issues arose. While multiple sourcing was often indicated as a possible rectification strategy, it was a common position that Canadian suppliers are often not available and when they are, they are more expensive. In many cases finding another source of supply of specialized inputs was noted as not practical due to sub-component compliance issues or where multiple sourcing is not possible due to market control by a single source.

A number of companies identified COVID-19 related absenteeism at vendors and shipping ports as supply chain disruption cause factors in discussions with the interviewees. Some companies noted that they will be identifying critical or long-lead items and adjusting inventory levels of critical components to ensure that future supply disruptions can be more efficiently managed.

Generally speaking, larger companies tend to invest more resources in developing and managing their entire supply chain compared to smaller companies. Some smaller company supply chain strategies consist simply of purchasing and expediting, with a lack of forward supply chain planning. Given the strategic approach that some of the larger companies described, there should be opportunities for Manitoba manufacturers to integrate with their supply chains. This offers an element of a supplier development initiative that ideally would be prefaced with a competency building initiative and a best practices networking arrangement.

There were a number of companies who had decided to seek alternate/multiple suppliers prior to COVID-19, even if more expensive, in order to secure reliable supply. There was evidence that supply chain stress tests may have been conducted prior to the pandemic although the results were not always fully integrated. Again, a continuing forum for exchange of supply chain best practices would be advisable. This network could also be used to increase the development of large supply chains within Manitoba.

***6. Which of the following are among the outcomes of COVID-19 disruptions?***

a. Plant shutdown
b. Production slowdown
c. Supply shortages
d. Opportunity to produce new products or provide new services
e. None of the above
f. Other, please specify

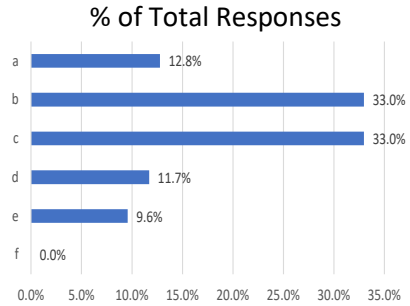


Figure 5.

As shown in Figure 5 above, production slowdowns and supply shortages were both reported as outcomes of the pandemic disruption by 33 percent of the respondents.

Another 13% of companies had to shutdown operations for varying periods of time. Given the need for a shut-down for COVID-19 proofing of production processes, some companies used plant shutdowns, and advanced maintenance shutdowns to mitigate effects on business operations. This time was used to reconfigure production workstations for employee health, as well as to establish the means for employees to work from home where feasible, and to secure sufficient components to enable operational re-start.

Logistics issues led to an increase in the cost of inputs either due to increased shipping costs or due to last minute alternate sourcing or expedited supply pricing points. There were a number of companies who expedited using air freight, even for very bulky and heavy components. These companies typically successfully pursued cost sharing of the air freight and other increased logistics costs.

COVID-19 related absenteeism at vendors and shipping ports were reported as cause factors in several discussions with the interviewees. Not many supply disruptions were noted from US based suppliers although, as mentioned previously, there were some exceptions where it was found that some components sourced in the US had significant off-shore inputs which caused supply disruptions.

In summary, almost 80% of companies reported some level of COVID-19 related business disruption. Manufacturers are adaptable and quickly able to modify operations to cope. The relatively minor business effects in many sectors are a testimony to the agility of Manitoba's manufacturing sector. A pervasive Lean culture enables this agility. The verbal input received during the interviews generated a number of follow-on activity recommendations that are provided in the recommendations section.

***7. Explain how demand for your product changed in 2020.***

a. No improvement
b. Slight improvement
c. Moderate improvement
d. Demand is back to normal
e. Demand has risen above pre-COVID-19 levels

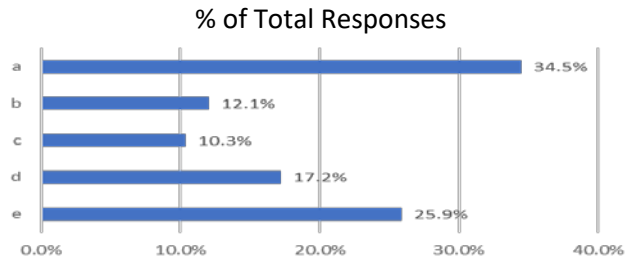


Figure 6.

September 11 was felt to have had a greater impact on manufacturing operations than COVID-19 for some companies. Throughout this analysis, geo-political/trade considerations were felt by manufacturers to have often had a more significant impact, particularly for OEMs, compared to factors that could be directly attributed to supply chain issues. Some companies did pivot to new products and services offerings as a result of COVID-19, but that was the exception rather than the rule.

Another contributing factor, defence related demand, especially for companies with long-term contracts in place, as well as companies with pre-booked orders, did not see the more severe demand drop-offs of less diversified and non-defence product portfolios.

Some sectors such as agricultural equipment and construction were coming off cyclic low periods in 2020. In business planning prior to the pandemic, 2020 was anticipated to be a year for recovery from the typical cyclic lows in their sectors. An extended low period, caused by COVID-19 will have potentially increasing adverse effects, particularly if the pandemic is not controlled. Also, the low demand levels characteristic of low cycle years such as 2019, adversely affected the calculations of possible governmental support.

Other sectors, such as furniture and landscaping materials, saw an increase in demand for their products associated with people working from home or furloughed. However, there were significant but periodic shortages in the availability of wood products as well as tools during the summer of 2020 due to COVID-19 related production challenges.

Given the lessons learned from the COVID-19 pandemic it would be appropriate for governments to build more flexibility into support programs for future pandemic or equivalent large scale market perturbations that address sector demand cycles.

***8. How has availability (supply) of critical materials and components changed, compared to the lowest availability you encountered since COVID-19 emerged in March 2020?***

a. No improvement
b. Slight improvement
c. Moderate improvement
d. Supply is back to normal
e. Supply has risen above pre-COVID-19 levels

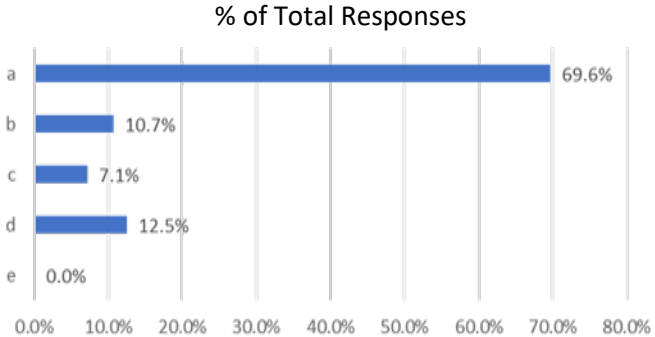


Figure 7.

There is a strong perception that COVID-19 disrupted the supply chain, particularly in higher visibility areas related directly to logistics with examples being given of shipments backing up at ports, shortages of sea containers, etc. This was particularly true for receiving inputs from countries/regions where COVID-19 lockdowns were in place. There were a variety of responses to these disruptions. Further, it is difficult to gauge the current state of these disruptions, since the pandemic persists and in many cases has worsened in severity.

Several suppliers noted that they have worked closely with the OEMs to ensure that the supply of critical components (e.g. engines, power train components) could be maintained throughout the pandemic and in the future. Cost-sharing air freight costs from Europe on components which would normally have be sent by ship was cited on a couple of occasions. This was true even for large and heavy components that were previously considered impractical to ship by air. The supply chain collaborations that evolved during the pandemic demonstrate that there are strategic relationships developing between larger companies and their values chains. This is a best practices example which needs to be disseminated to Manitoba manufacturers. It is also a potential supplier development opportunity.

The larger companies seemed to be able to aggressively minimize supply chain challenges and their effects earlier in the pandemic. Examples were provided whereby larger firms adapted their production schedules to maximize use of available inputs and components, while deferring production of products for which inputs were not available. One option that was considered to have higher potential for supply chain disruption mitigation was dual or multiple sourcing inputs. However, it was pointed out by numerous companies that due to product specialization and vendor/component qualification issues, sole sourcing is difficult or impossible in some cases. This perspective is felt to be more of an issue of supplier development and needs to be addressed in downstream government policy and support program development.

In summary, lead times have almost always been extended with most if not all suppliers, on a global basis. While effects were well managed in Manitoba, as recovery is progressing, there is now competition for raw materials in many sub-sectors. Another area of concern for supply chain and operational recovery relates to workforce availability and skills. However, in general, availability of workers in factories was not a significant factor in 2020. Going forward, optimism about recovery may be affected if there is continued stress on the workforce from areas outside of what is traditionally considered the supply chain, including at-home schooling, elder care and a myriad of other factors.

***9. Please estimate the percent of your inputs that are imports, i.e. come from sources outside Canada:***

Based on input from this study, Figure 8 depicts that the average Canadian content of Manitoba products and manufacturing services is approximately 47% across all company size classes. Twenty-five of the 58 companies interviewed indicated that they import more than 50% of their manufacturing inputs from outside of Canada

Generally, the larger the company, the greater the imported manufacturing input, particularly for some sectors where qualified Canadian sources are simply not available.

While some companies were very knowledgeable about the source countries or regions of their manufacturing inputs, six companies did not report the percentage of inputs imported (although some of those ranked the source countries or regions).

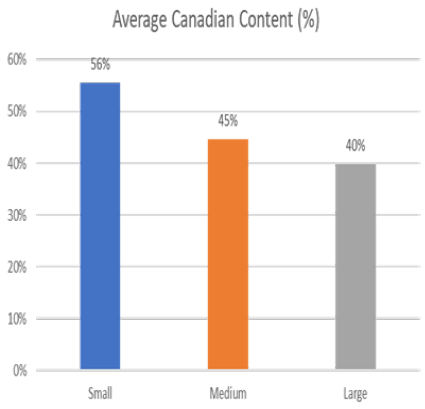


Figure 8.

While there was considerable concern about distant off-shore manufacturing input sourcing, it was found, not surprisingly, that there is heavy dependence on US inputs, as illustrated in Figure 9 below. There are many reasons for this; however, there are also geo-political changes happening for which Canada needs to prepare if it is to maintain and grow its manufacturing capacity. Highlighting this dependence on US inputs, as depicted in the chart below, 40 companies identified the US as their number 1 ranked source of manufacturing inputs compared to 14 number one rankings from all other regions.

Although few companies identified significant supply chain problems, there is a relatively large percentage of imported manufacturing input. Further analysis of the magnitude and reasons for sourcing such a large percentage of US inputs is required, particularly for SME imported inputs. SME's would prefer to source in Canada but often are geographically restricted or cannot find local or Canadian inputs, a comment that was noted by several companies. There is also a need to recognize from a supply chain perspective, that imports from the US are often indicative of a lack of availability of certain components or raw materials in Canada, examples given included for foundries, specific aluminum alloy or steel alloy availability.

Another aspect that needs to be studied further is that a number of Manitoba SME's have operations in USA and do much of their business in the USA. The USA operations range from sales offices to manufacturing operations which may offer broader market opportunities. While further analysis may be beyond the scope of this supply chain study, it is worthy of inclusion in any subsequent best practices and/or learning or collaboration network formation.

Examining Manitoba's manufacturing imported sourcing issues beyond COVID-19, it is noted that Canada's relationship with the USA is now governed by a new set of rules, the Canadian US Mexico trade agreement (CUSMA), instead of the North American Free Trade Agreement (NAFTA). Considering the heavy reliance on USA sourced inputs and the trade barriers and border crossing issues noted in the surveys, there could be new and/or increased challenges to post COVID-19 cross border operations. This will potentially expose other challenges, with possibly far more costly implications. This is particularly critical when overlaid with tariff penalties, tax drawbacks, and other payments, all of which directly impact cash-flow. This is an area where a learning or collaborative network could greatly benefit small to medium sized manufacturers.

Furthermore, this high dependency on the US market could also put Manitoba manufacturers at risk if the US economy starts to ramp up more quickly than Canada, with greater emphasis and priority is given to domestic US production, as has been proposed by the new US administration. US demand for manufacturing inputs could thus potentially cause shortages and increase the costs of inputs imported from the US.

Another area where smaller firms often lack an understanding relates to foreign exchange issues such as currency fluctuations. These matters are often overlooked in business operations where owners must manage operational and financial functions within companies. A significant number of companies, and their expected exports, are based on foreign currency transactions. Even if the majority of those were to be concluded in USD, significant market and currency fluctuations can affect Canadian manufacturers' ability to compete and remain profitable. This is particularly relevant if there are multiple currencies involved in imports and exports – e.g. USD, Yuan, Euro, etc.

Maintaining an understanding of tariffs which are ever-changing, some temporary while others are constant, is another looming concern. This is an area requiring analysis, where government/non-government support mechanisms could be developed.

Yet another area of concern, evident by the absence of comments by interviewees, is the changing network of trading blocks. While there is a continuing focus on the Canada-United States-Mexico Agreement (CUSMA), the survey data indicates that the majority of imported goods into Manitoba

originate in the US, with a low level of inputs from Mexico. Is CUSMA of significance in light of this low level of interaction, or is a lack of end-to-end supply chain visibility making inputs from Mexico not apparent to Manitoba manufacturers?

Although 52 Manitoba companies imported inputs from China (32) and the rest of Asia (20), there was no mention of concerns about the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). While manufacturing inputs from the European Union were less significant, there may be concerns (or opportunities) regarding Brexit. Again, no mention was made of Brexit or the Comprehensive Economic and Trade Agreement (CETA). This may either pose challenges or present opportunities for Manitoba exporters, and warrants further analysis.

***10. In the following table, list your top three source countries (e.g. Canada or China), in terms of % volume of inputs. How severely has logistics performance, such as on-time delivery and lead time, been impacted by COVID-19 in each of the three countries?***

In question 10, Manitoba manufacturers were asked to rank their top 3 countries or regions where inputs are sourced. While not all companies ranked their source countries/regions, those who did identified a total of 18 countries. In Figure 9 below "Other Asia" includes not specified within Asia, Taiwan, Japan, Vietnam, "Europe excluding UK" includes not specified within Europe, Germany/Austria, Switzerland, Italy and Poland, and, "Other" includes Bangladesh, Brazil, Turkey, Mexico, South Africa and India. The UK was separated out although only one interviewed company indicated that they receive inputs from the UK, as it was sought to infer what worst case scenarios could result from Brexit.

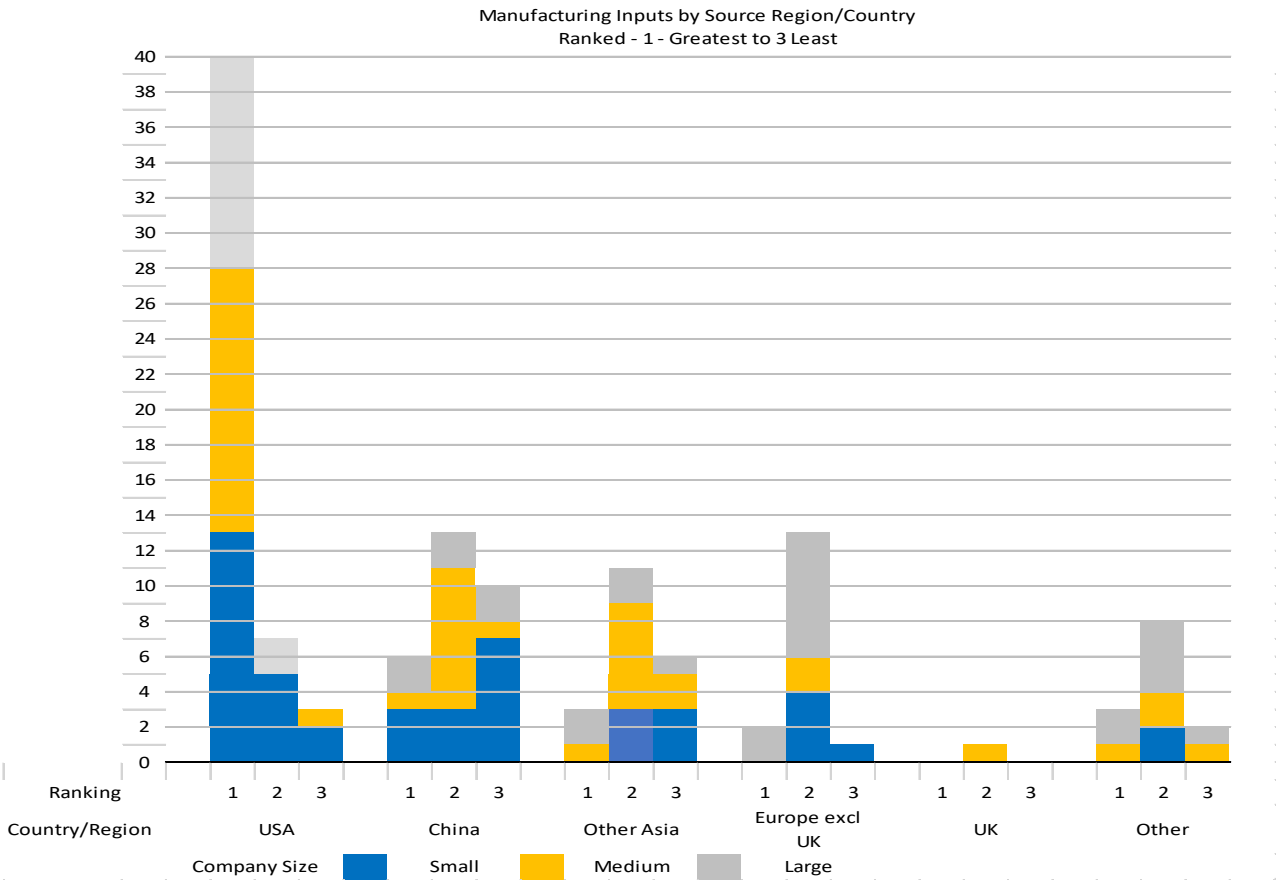


Figure 9.

As mentioned earlier, and evident in Figure 9, the USA is overwhelmingly the primary source for manufacturing inputs. Targeting the high source import countries could be a subject for follow-on work to enlarge the Manitoba manufacturer supply base.

Several manufacturers disclosed that despite weaknesses in the current supply chain, changing vendor/suppliers is not an easy endeavour, primarily due to various ISO standards, other company specific technical specifications or other quality standards required somewhere in the final component/product specification.

Further, supplier development programs are not yet optimized, which is a concern for manufacturers that need to build more resilient supply chains yet are unable to deal efficiently with suppliers. The presumed lowest cost, easiest path is chosen rather than nearshoring or on-shoring. A structured collaboration network could benefit Manitoba manufacturers by replacing foreign sourced inputs with products manufactured in Manitoba or elsewhere in Canada.

In an ideal world, nearshoring should represent an easier and faster flow of receiving manufacturing input. However, travel restrictions and border crossing were a significant problem during COVID-19 and will continue to make it challenging for companies to go to the US to inspect products, to facilitate/receive technicians (entry into Canada), to complete installation or to conduct maintenance work in Canada. While nearshoring reduces risks associated with distance, transportation, and increased shipping costs from Asia, particularly increased air freight costs during the early weeks of pandemic, Manitoba manufacturers are still concerned with exposure and other difficulties crossing the Canada/US border. While 50 companies sourced inputs from the USA, 53 Manitoba companies import from Asia (29 from China and 24 from the rest of Asia). However, no mention was made about the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). Furthermore, 21 Manitoba companies import inputs from Europe, primarily from six countries. There was no mention of UK Brexit concerns or the Comprehensive Economic and Trade Agreement (CETA) as an advantage to our companies.

Increased awareness of various export/import issues is required, particularly regarding new trade agreements and how they will affect Manitoba's manufacturing operations.

In summary, awareness, education and support resources are required particularly for SME's regarding:

- Foreign exchange rate (FX) fluctuations,
- Tariff changes,
- Geo-political risks, and
- Other trading block issues (CUSMA, CETA and CPTPP).

### *11. How will your 2020 corporate revenues be affected by supply chain issues?*

a. There will be a strong negative effect.
b. There will be a slight negative effect.
c. There will no effect.
d. There will be a slight positive effect.
e. There will be a strong positive effect.

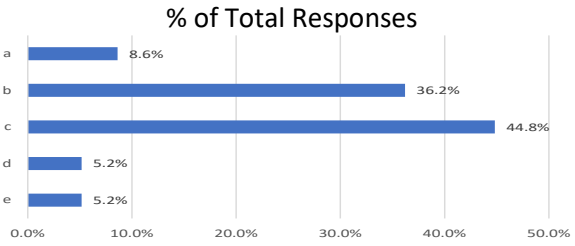


Figure 10.

Based on survey responses the impact on corporate revenues was slight and did not seem to be related to either company size or manufacturing sector, with some exceptions. 55.2% of companies interviewed indicated that there would be no or a positive impact on corporate revenues during 2020. Negative revenue impacts were largely a result of reduced customer demand, not directly due to the supply chain challenges. Responses to this question were challenging to interpret because many companies re-forecast revenue projections throughout 2020, enabling them to meet their "new" targets.

As with other survey questions, the answers to this question may be more indicative of a lack of supply chain awareness. This highlights the need for a broader perspective on the supply chain to integrate "total cost of ownership" for analysing barriers to and opportunities within the manufacturing sector. Supply chain competency building, information exchange councils and a repository of supply chain best practices would surely benefit Manitoba manufacturing supply chain performance.

e. ***When do you expect your business to recover to pre-COVID-19 levels?***

a. It already has recovered (What enabled a quick recovery)
b. It will recover by end of 2020
c. It will recover by end of 2021
d. it will recover sometime after 2021
e. It will never recover

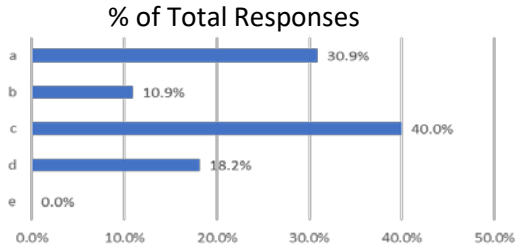


Figure 11.

The general consensus was that most firms expect to recover by the end of 2021, and some have already recovered or surpassed this year's expectations due to competitor weaknesses in other regions.

However, full recovery in the global aerospace sector is not expected prior to 2025. Post pandemic after-shocks will also be experienced caused by such issues as the European anti-air travel lobby which will be more strongly felt in some regions. Thus, service sectors such as travel and tourism will be negatively impacted both directly and indirectly.

Of the 58 companies surveyed, it is worthwhile noting that none were of the opinion that their businesses/sectors would never recover from the COVID-19 pandemic.

***13. Looking forward what is your business outlook? (In the next year (2021)?***

a. Very challenging
b. Challenging
c. Neutral
d. Optimistic
e. Very optimistic

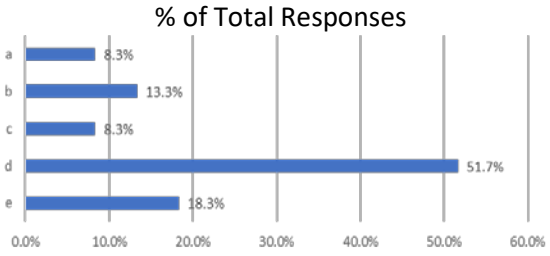


Figure 12.

There is considerable optimism concerning the future business outlook, as 70% of the companies surveyed indicated that their business outlook in the next year to be either "optimistic" or "very optimistic". In general, companies were able to pivot quickly and make adjustments to their business processes to

compensate for supply chain disruptions, reduction in product demand, availability of PPE supplies, staffing, Government health directives, and other COVID-19 factors affecting Manitoba manufacturers.

Manitoba companies were quite flexible and creative in responding to COVID-19-related supply chain issues to ensure production was maintained. The manufacturing world has learned significant lessons from this pandemic, and it is evolving. Changes external to Manitoba are happening at an accelerating pace as the China-USA and other market conflicts increase. Where there is strength there will be opportunities to grow market share. Conversely, companies that have not done well will likely suffer more in the pandemic aftermath.

This positive outlook for Manitoba manufacturers during the pandemic is not a reason for complacency. If existing workforce shortages are worsened by an accelerating retirement of the existing and aging workforce, and others take greater advantage of the digitalization of manufacturing processes, then Manitoba's innovative advantage will be lost. Weakness elsewhere in supply chains within Manitoba and external to Manitoba need to be identified and pursued with rigour to generate greater market share.

***14. Did government (Federal or Provincial) programs assist your company in overcoming COVID-19 induced supply chain impact:***

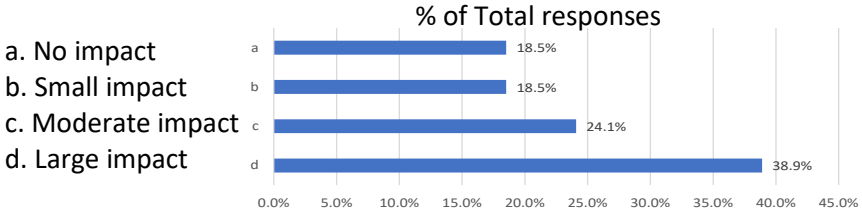


Figure 13.

Perhaps the government decision most appreciated by Manitoba manufacturers was the designation of manufacturing as an essential industry. The confusion that would have resulted if this decision was not taken and the resulting adverse effects would have been significant.

Most companies indicated that government programs were generally beneficial. The Canada Emergency Wage Subsidy (CEWS), as well as the workshare programs were perceived to be very positive. A number of companies felt that the Canada Emergency Response Benefit (CERB) was less positive as it ended up adversely affecting some worker shortages. Also, as recovery has begun, the CERB program has made it difficult to engage new employees or to bring some employees back to work due to the attractiveness of CERB. It is noted that some companies were hiring throughout 2020 and developed new business in new markets.

Another factor, seemingly unforeseen by governments, concerned the support eligibility basis. Because government support was based on the drop in sales from the previous year, there were some companies, due to the cyclical nature of their business or anomalies such as a fire in the previous year, that couldn't qualify for support, as 2020 was not significantly worse than 2019. When future pandemics occur, there must be a more flexible way of determining the impact of the market perturbation other than solely on previous year's revenues.

Although greater work output was possible, some companies noted that production was limited by worker availability. This will be a growing challenge with or without COVID-19.

***15. What could the government do to better support your company as a result of COVID-19***

a. Training/certification
b. Regulatory/bureaucratic red-tape
c. Financing
d. Insurance
e. Access to capital

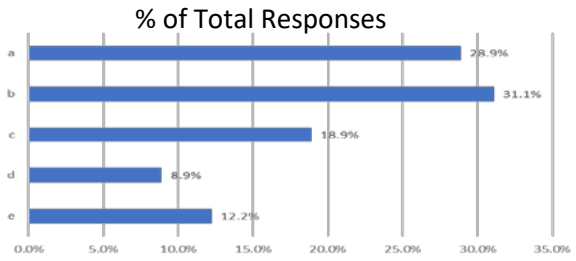


Figure 14.

Many companies, particularly small and medium sized companies had difficulties accessing and understanding government programs and regulations. The programs were said to be cumbersome and difficult to understand, particularly for small and medium businesses which lack dedicated staff and familiarity with government processes in general. Future government programs would be well-advised to provide program supports tailored to smaller companies and to provide dedicated resources for direct assistance to smaller firms in understanding and applying for support.

Specific complaints included application complexity, inflexibility of some existing programs such as workshare to accommodate pandemic effects, and apparent program variability and changing requirements as the pandemic dragged on. Alignment between federal and provincial policy and regulations was often too complicated or at least not well understood by companies who were busy surviving. Many of these complaints seem to be primarily communications related and not due solely to the program characteristics. Thus, future efforts should be more accommodating to small and medium sized companies.

Training and certification was identified as important areas for government involvement from a number of perspectives, including future-proofing, technology adoption, and more environmentally benign technologies and processes. The training and certification theme is ubiquitous in the manufacturing sector which is experiencing skilled workforce shortages at a time when new technologies and processes are needed for productivity improvements to remain competitive. This is an area which needs to be addressed more broadly and with urgency in light of the manufacturing sector's criticality to Canada's economy.

The most cited areas for improvement in government's support to the manufacturing sector were regulatory process complexity and red-tape involved in taxation, health and safety, and permitting. These were the most significant challenge areas noted in the interviews.

It was also felt the government needs to do more regarding investment in advanced technologies, new product development and productivity improvements. A holistic approach will not only address environmental issues (beyond simply taxing greenhouse gas emissions) but also enable industry to be more globally competitive and better survive future challenges such as the pandemic. Simply taxing manufacturers for emissions will limit cash available for sustainable investments, driving business out of our country/region. Also, if carbon taxation is to be pursued, companies need to be incentivized. The government must ensure a level playing field in that imported products be similarly taxed for environmental reasons.

Although the areas for enhanced government involvement noted above were those most often stressed by respondents, there were also a number of other examples noted. Infrastructure investment supporting supplier competitiveness is needed in Manitoba, as is improved rural community connectedness to enable

more workers to work from home. Business-like flexibility/agility is also needed in the event of future pandemics or similar stress events, enabled by activities such as:

- Improving import/export flow by analysing bottlenecks and implementing common-sense fixes on a real time basis, or
- Rapid testing rather than simple two-week quarantines. These are examples of ways government involvement could support a very critical economic sector – manufacturing.

***16. How has your company's sourcing strategy changed? (Check all that apply)***

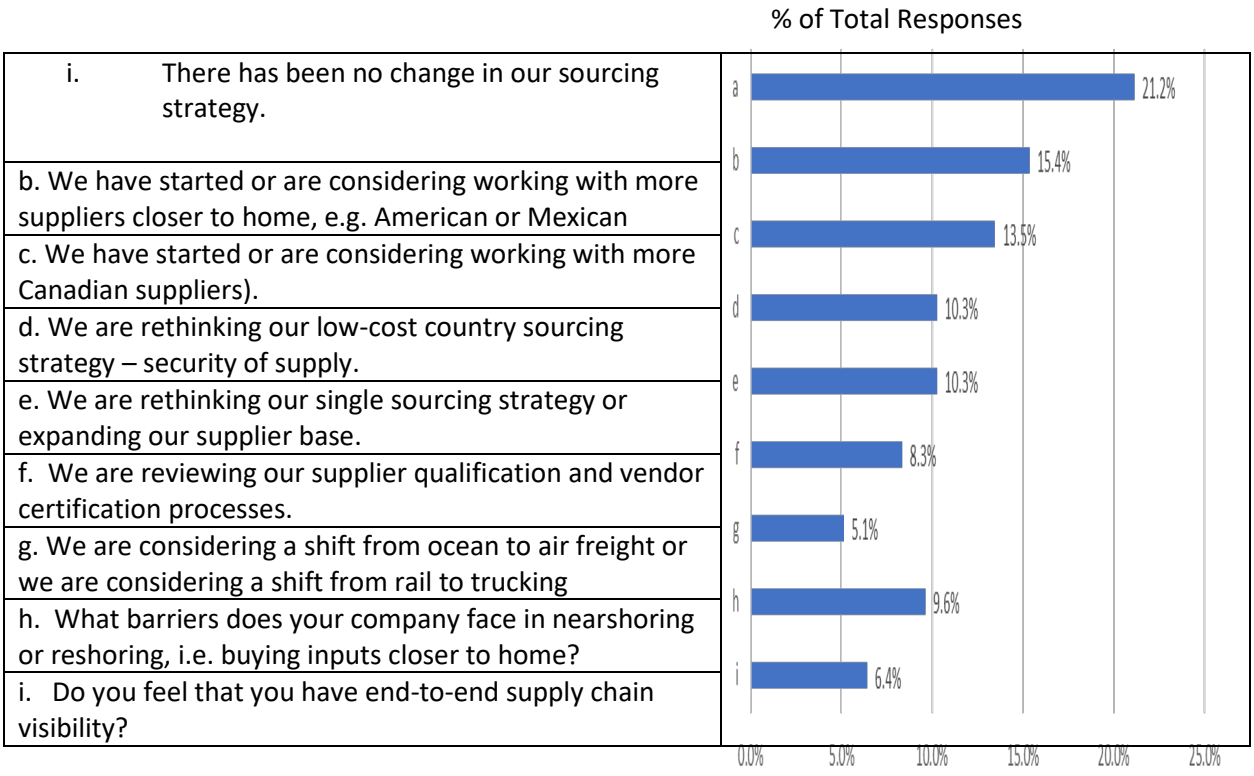


Figure 15.

The most significant strategic sourcing changes that were noted are explained in the following points:

- More Canadian suppliers need to be developed or established, and they must be competitive in all respects. Some of the larger companies surveyed indicated that Canadian suppliers are typically more expensive than off-shore suppliers. A supplier development program is needed that considers where large Manitoba manufacturers are purchasing their manufacturing inputs and why. The supplier development program also needs to address vendor qualification requirements focusing on responsiveness, cost and quality.
- More North American suppliers are also needed to support the larger companies operating in Manitoba. This aspect of supplier development should enable a better understanding of supply chain opportunities for Manitoba manufacturers both in meeting the needs of the larger companies directly and in developing collaborative operations with other North American suppliers.

- A value-chain strategy is needed for Manitoba that builds on existing supply chain concepts to integrate digital manufacturing concepts of horizontal/vertical integration – Logistics 4.0. This approach would identify the need for multi-source value chains and how to establish them, as well as re-thinking low-cost oriented sourcing strategies.

Implicit in the foregoing is the need for a suppler development program that incorporates companies of all sizes to understand and develop supplier qualification/certification methodologies and processes that enable re-shoring and near-shoring.

There were several other supply chain strategic changes noted by various companies and discussed in the narrative responses to the interview questions. A sample of some of the comments made are offered below:

- It was noted that becoming a qualified vendor to a large aerospace firm is a long and expensive process as vendors must qualify to AS9100 as well as company specific process validations. Quick changes to the supply chain are simply not feasible in some sectors;
- Longer term strategic relationships, not transactional, with suppliers are desired and this approach will be expanding;
- More attention is now being paid to dual/multiple sourcing. However, during several interviews it was noted that dual sourcing (due to design and/or performance considerations) is not always feasible/possible, especially for heavy vehicle OEMs;
- Inventory strategy has changed, more inventory is being maintained, particularly for low-cost consumables where problems (e.g. shortages) were experienced; and
- Up to COVID-19 there had been a push to reduce the supplier base. Many companies are now looking at multiple sources and are finding that costs will increase if the supplier is Canadian. Larger companies noted that they will begin multiple sourcing and will work with new sources to keep them engaged; and
- Larger companies stressed that end-to-end supply chain visibility is an integral aspect of delivering quality products. However, it was evident that smaller and some medium sized companies lack that visibility of their supply chains.

The danger is that an increase in Manitoba manufacturing supply chain integration will not occur as the effects of the pandemic wane and companies are lured to return to low cost off-shore suppliers based only on cost. A competitive Manitoba/Canada supplier development program is required.

***17. What programs / services would help your company become a world class global supplier?***

***Best practices benchmarking, Checklist, Supplier Development Program, etc.***

This question was intended to elicit free-form responses from the surveyed companies. Three discussion guidance options were identified: Best practices/benchmarking, Checklist, and supplier development. There was a strong, positive and fairly consistent set of responses to this question which are briefly discussed below.

- Twenty-six companies identified that some form of benchmarking/best practices/checklist type initiative would be beneficial to their strategic business plans. This was the most prevalent response clearly identifying where companies feel most vulnerable. One issue with this is that there was

evidence that some respondents lack understanding of the fundamental concepts that need to first be addressed.

- The second most often voiced request for support concerned supplier development. Twenty-five companies indicated they would benefit from a supplier development initiative that enabled them to become qualified vendors. Various quality and business standards were noted including ISO, AS9100, Lean etc. Embedded within these comments was an implicit statement of need for supplier education.
- Fourteen companies identified a need for training support related to Lean, automation, marketing, export support and supply chain management;
- Eight companies identified a requirement for support with international and Canadian tax processes, as well as new Enterprise Resource Planning (ERP) systems that offer total company process integration; and
- Seven companies identified a need for international sales support and understanding what tools are available and how to access those support mechanisms.

# Conclusions

Generally, the majority of Manitoba manufacturers have not suffered significant business losses as a result of COVID-19, and many expect recovery to pre-COVID-19 levels by the end of 2020 or 2021 at the latest.

However, some sectors have experienced significant business activity reductions. The business disruptions were found not to be due solely or primarily to supply chain challenges but to a confluence of factors related to global demand, geo-political issues, etc. A number of companies operate in sectors where demand can be cyclical and vary greatly from year-to-year. Some companies identified that COVID-19 coincided with an expected cyclical upturn, which was not realized due to the pandemic. Agricultural equipment manufacturing is one cluster affected in this manner.

Across the various manufacturing sectors, Manitoba manufacturers have a widely varying understanding of their supply chains and supply chain concepts in general. Some companies had made prescient supply chain decisions on multiple-sourcing and finding suppliers not in China prior to COVID-19. These companies did not suffer the full effects of COVID-19 supply chain disruptions. Some manufacturers reacted early to develop and pursue innovative ways to lessen supply chain disruptions. Those companies are implementing the lessons learned from the pandemic to improve future business operations. Notwithstanding these pockets of brilliance, the general lack of supply chain understanding is problematic in a global marketplace where suppliers must increasingly be integrated vertically and horizontally, often across multiple sectors to achieve growing profitability and economic success. There is little doubt that a better understanding of supply chain processes needs to be developed at all levels within businesses, with particular emphasis on smaller to medium sized firms.

Feedback on the benefits of government programs varied widely. Manitoba's manufacturers found that while financial assistance helped in some ways, the variability in regulations posed some unexpected challenges to company operations. This observation was true for both federal and provincial programs and communications environments although specific addressable issues were not broadly identified by respondents. The strengths and weaknesses of the various government programs should be captured in a focused fashion to support policymaking ahead of future market upheavals.

The pandemic understandably caused a great deal of worker anxiety which some companies managed extremely well thus generating significant operational dividends. It would be of great value to document

these best practices, for sharing among manufacturers and weaving into future pandemic relief policy making.

A globally pervasive prognosis in advanced manufacturing nations is that COVID-19 will accelerate the digitalization of industrial processes, due to a confluence of factors including this and future pandemics, an aging workforce demographic and the continuing push for productivity/competitiveness improvements. It was clear that the need for and benefits of adopting digital manufacturing processes and technologies is not well understood by many companies. Regarding the future-proofing of manufacturing operations through a digitally based supply chain, there were varying perceptions of benefits or the accelerating necessity for advanced digital manufacturing processes, including the need for universal supply chain integration. Universal supply chain integration, encompassing comprehensive vertical and horizontal integration within the entire value chain and across the product life cycle, is an opportunity for Manitoba manufacturers to build a strong position at the head of the pack moving forward from this pandemic.

In general, this pandemic posed more, and more significant challenges than previous market disruptions. The one noted exception to this was September 11, 2001. However, it was not always clear that the root cause were well understood by the companies who were busy developing innovative work-arounds that off-set pandemic challenges and, in a number of cases, offered opportunity for business and product growth. In many cases, what was not said, or an incongruity of responses to inter-related questions offered insight into the true impact of the COVID-19 impact on the supply chain, highlighting future-proofing opportunities and supply chain resilience building opportunities.

# Recommendations

The following four recommendations are offered to improve Manitoba manufacturing supply chain performance and resilience:

**1 Leverage the Manitoba Manufacturing Network**

- Establish and facilitate regular meetings bringing together executives responsible within manufacturing for the purpose of learning how to improve supply chains and expand trade.
- Refine and enable networking designed to connect Manitoba manufacturers for business development, B2B relationship building or revenue generation.
- Aggregate holistic supply chain interests or needs that would benefit suppliers in Manitoba and provide avenues by which manufacturers can effectively collaborate - opportunities for value added manufacturing, dual-sourcing, performance improvement including group buying, joint bids, and transportation cost sharing to be more globally competitive.
- There is variability in Manitoba manufacturer supply chain maturity that would benefit from expanded support of local single, dual, cross and multi-sourcing initiatives to assist in achieving greater supply chain growth and resilience through support for achieving required quality standards as well as re-tooling and setup costs.

**2. Operational Practices Tools and Resource Repository including Disaster/Emergency Responses**

- Introduce a benchmarking tool comparing a company's supply chain to other worldwide companies to assist corporate leaders in assessing vulnerabilities and enable creation of measurable strategic improvement initiatives.

- Educate and provide tools for Manitoba manufacturers to better assess the true cost of importation and properly weighted KPIs to allow their company to make more informed global supply chain decisions.
- Scan and develop an inventory of available resources to address needs.
- Develop or identify tools, templates, SOP's, checklists, tips, implementation guides etc. that can be used to assist SMEs in dealing with emergencies as well as supply chain improvement.

**3. Supplier Development Program**

- Develop / refine a holistic supplier assessment tool, allowing Manitoba manufacturers to compare their capabilities and readiness to compete on a local as well as a global basis, including all facets of the business, e.g. quality, productivity, technology, etc.
- Identify gaps arising from the assessment and develop a company action plan to address gaps between current capacities and global competitive standards.
- Communicate and share best practices.
- Establish peer-to-peer councils to identify, prioritize, and enable supply chain competency development.

**4. Manufacturing Technology Roadmap(s) to support supply chain development and integration by Manitoba manufacturers**

- Create a knowledge base of relevant advanced technology needs, especially for digital manufacturing.
- Identify opportunities for collaborative applied research, training and pilot projects.

# APPENDIX 1 – STUDY QUESTIONNAIRE

The document below was provided to companies who participated in the study prior to their interviews. The study questionnaire is on the following page.

CM&E CANADIAN MANUFACTURERS & EXPORTERS

**COVID-19 Supply Chain Impact Study**

Vehicle Technology CENTRE

**Study Introduction**

This study is being undertaken by CME-Manitoba and the Vehicle Technology Centre.

The purpose of this study is to identify and understand COVID-19 related Manitoba manufacturing company's supply chain vulnerabilities as well as to understand other than COVID-19 supply chain changes.

The results of this survey (which is funded through Western Economic Diversification) will be used to develop recommendations to the Government of Canada. The final report will be used to propose initiatives to address the gaps found and identify opportunities for Manitoba manufacturers to increase competitiveness through re-shoring, near-shoring and/or on-shoring and other supply chain changes taking place.

You are being invited to participate in this study because you are an important contributor to Manitoba's manufacturing sector.

Approximately one-half hour of your time will be needed to take part in the survey/interview in the Fall of 2020.

All information will be kept confidential and will not be attributed to you or your company.

If you have any questions about this study, please contact either of the undersigned:

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| **COVID-19 Supply Chain Impact Study Questionnaire** |
|---|
| **1. How many people does your company employ in Manitoba?** |
| a. 1 to 99 |
| b. 100 to 499 |
| c. 500 or more |
| **2. What are your company's annual (2019) revenues from products manufactured in Manitoba?** |
| a. Under $10 million |
| b. $10 million to $29,999,999 |
| c. Over $30 million |
| **3. On January 1, 2020, did your company have a pandemic preparedness and response plan?** |
| a. Yes |
| b. No |
| c. I don't know |
| **Does your company now have a pandemic preparedness and response plan?** |
| a. Yes |
| b. No |
| c. I don't know |
| **4. Overall, how is your business doing today compared to objectives or expectations?** |
| a. Far below expectations |
| b. Below expectations |
| c. On target with expectations |
| d. Above expectations |
| e. Far above expectations |
| **5. Has your firm experienced supply chain disruptions during the COVID-19 pandemic?** |
| __ Yes __ No |
| **If yes, which of the following factors made you vulnerable to these disruptions?** |
| a. Your firm's (single-)sourcing strategies |
| b. Lack of end-to-end supply chain visibility |
| c. Unavailability of transportation and logistics services |
| d. Your inventory strategies |
| e. Your people |
| f. Your country sourcing strategy |
| g. Other, please specify: _____ |
| **6. Which of the following are among the outcomes of COVID-19 disruptions?** |
| a. Plant shutdown |
| b. Production slowdown |
| c. Supply shortages |
| d. Opportunity to produce new products or provide new services |
| e. None of the above |
| f. Other, please specify: _____ |
| **7. Explain how demand for your product changed in 2020?** |
| a. No improvement |
| b. Slight improvement |
| c. Moderate improvement |
| d. Demand is back to normal |
| e. Demand has risen above pre-COVID-19 levels |

| **COVID-19 Supply Chain Impact Study Questionnaire** |
|---|
| **8. How has availability (supply) of critical materials and components changed, compared to the lowest availability you encountered since COVID-19 emerged in March 2020?** |
| a. No improvement |
| b. Slight improvement |
| c. Moderate improvement |
| d. Supply is back to normal |
| e. Supply has risen above pre-COVID-19 levels |
| **9. Please estimate the percent of your inputs that are imports, i.e. come from sources outside Canada: ___ %** |
| **10. In the following table, list your top three source countries (e.g. Canada or China), in terms of % volume of inputs. How severely has logistics performance, such as on-time delivery and lead time, been impacted by COVID-19 in each of the three countries?** |
| **11. How will your 2020 corporate revenues be affected by supply chain issues?** |
| a. There will be a strong negative effect. |
| b. There will be a slight negative effect. |
| c. There will no effect. |
| d. There will be a slight positive effect. |
| e. There will be a strong positive effect. |
| **12. When do you expect your business to recover to pre-COVID-19 levels?** |
| a. It already has recovered (What enabled a quick recovery) |
| b. It will recover by end of 2020 |
| c. It will recover by end of 2021 |
| d. it will recover sometime after 2021 |
| e. It will never recover |
| **13. Looking forward what is your business outlook? (In the next year (2021)?** |
| a. Very challenging |
| b. Challenging |
| c. Neutral |
| d. Optimistic |
| e. Very optimistic |
| **14. Did government (Federal or Provincial) programs assist your company in overcoming COVID-19 induced supply chain impact:** |
| a. No impact |
| b. Small impact |
| c. Moderate impact |
| d. Large impact |
| Please explain the impact of federal programs: |
| **15. What could the government do to better support your company as a result of COVID-19** |
| a. Training/certification |
| b. Regulatory/bureaucratic red-tape |
| c. Financing |
| d. Insurance |
| e. Access to capital |
| **16. How has your company's sourcing strategy changed? (Check all that apply)** |
| a. There has been no change in our sourcing strategy. |

| **COVID-19 Supply Chain Impact Study Questionnaire** |
|---|
| b. We have started or are considering working with more suppliers closer to home, e.g. American or Mexican suppliers. |
| c. We have started or are considering working with more Canadian suppliers). |
| d. We are rethinking our low-cost country sourcing strategy – security of supply. |
| e. We are rethinking our single sourcing strategy or expanding our supplier base. |
| f. We are reviewing our supplier qualification and vendor certification processes. |
| g. We are considering a shift from ocean to air freight for input materials and components or we are considering a shift from rail to trucking for input materials and components. |
| h. What barriers does your company face in nearshoring or reshoring, i.e. buying inputs closer to home? |
| i. Do you feel that you have end-to-end supply chain visibility? |
| **17. What programs / services would help your company become a world class global supplier?** |
| Best practices benchmarking, Checklist, Supplier Development Program, etc |

# APPENDIX II – COMPANIES SURVEYED

| Company Name | NAICS 3-Digit Code | NAICS 4 Digit Code | NAICS 6 Digit Code | Small | Medium | Large |
|---|---|---|---|---|---|---|
| Acrylon Plastics Inc. | 326 | 3261 | 326199 | 1 | | |
| AGI | 332 | 3326 | 332618 | | | 1 |
| Ancast Industries | 331 | 3315 | 331511 | | 1 | |
| Arnes | 336 | 3362 | 336212 | | 1 | |
| ATI | 336 | 3361 | 336120 | 1 | | |
| Barkman Concrete | 423 | 4233 | 423320 | | 1 | |
| Boeing Canada Operations Ltd. | 336 | 3364 | 336413 | | | 1 |
| BOMImed Inc. | 423 | 4234 | 423450 | 1 | | |
| Brunswick Steel | 423 | 4234 | 423510 | 1 | | |
| Buhler/ Versatile | 333 | 3331 | 333111 | | 1 | |
| Cadorath | 336 | 3364 | 336413 | 1 | | |
| Carte International Inc. | 335 | 3353 | 335311 | | 1 | |
| Champ Metal Fabrication | 423 | 4235 | 331221 | 1 | | |
| Conviron | 337 | 3371 | 337127 | | 1 | |
| Decor Cabinet Company | 337 | 3371 | 337110 | | | 1 |
| Duxton Windows | | | | 1 | | |
| Elmer's Manufacturing | 333 | 3331 | 333111 | 1 | | |
| Fort Garry Fire Trucks Ltd. | 336 | 3361 | 336120 | | 1 | |
| Friesens Corporation | 323 | 3231 | 323117 | | | 1 |
| Graphic Packaging International Canada | 322 | 3221 | 322130 | | 1 | |
| Herd North America | 336 | 3363 | 336390 | | 1 | |
| HyLife | 311 | 3116 | 311611 | | | 1 |
| International Truck Body - Food Trucks Int | 336 | 3362 | 336211 | 1 | | |
| Ironmen Industries | 332 | 3323 | 332312 | 1 | | |
| JCA Industries Inc. | 335 | 3353 | 335314 | 1 | | |
| Lode King | 336 | 3361 | 336120 | | 1 | |
| Loewen Enterprises Ltd. | 321 | 3219 | 321911 | | | 1 |
| MacDon Industries Ltd. | 333 | 3331 | 333111 | | | 1 |
| Mackow Industries | 332 | 3329 | 332999 | 1 | | |
| Magellan Aerospace, Winnipeg | 336 | 3364 | 336413 | | | 1 |
| Malach Metal & Machining | 332 | 3323 | 332322 | 1 | | |
| MasterBrand Cabinets Inc. | 337 | 3371 | 337110 | | | 1 |
| McCain Foods Canada | 311 | 3114 | 311411 | | | 1 |
| MCI | 336 | 3361 | 336120 | | | 1 |
| Micro Tool & Machine Ltd. | 333 | 3339 | 333999 | | | 1 |

| Company Name | NAICS 3-Digit Code | NAICS 4 Digit Code | NAICS 6 Digit Code | Small | Medium | Large |
|---|---|---|---|---|---|---|
| Monarch Industries Ltd. | 333 | 3339 | 333995 | | 1 | |
| NFI | 336 | 3361 | 336120 | | | 1 |
| Nordstern Group/Custom Castings | | | | | 1 | |
| Novid Inc | 332 | 3324 | 332420 | 1 | | |
| Nutri-Pea LP | 523 | 5231 | 523140 | 1 | | |
| Palliser Furniture Ltd. | 337 | 3371 | 337121 | | | 1 |
| Parker Hannifin Canada, Electronic Controls Div | 335 | 3353 | 335314 | | | 1 |
| Peerless Garments | 315 | 3152 | 315210 | | 1 | |
| Price Industries Limited | 332 | 3326 | 332618 | | | 1 |
| Prolific Group | 323 | 3231 | 323111 | | 1 | |
| PTI Manitoba | 335 | 3353 | 335311 | 1 | | |
| Quest Metal Products Ltd. | 333 | 3333 | 333318 | 1 | | |
| Richlu | 315 | 3152 | 315220 | | 1 | |
| Russel Metals Inc. | 423 | 4235 | 423510 | 1 | | |
| StandardAero | 811 | 8111 | 811111 | | | 1 |
| The CTD Group /Integra Castings | 331 | 3315 | 331511 | | 1 | |
| The Eastside Group of Companies | 811 | 8111 | 811121 | 1 | | |
| Triple E | 336 | 3362 | 336214 | | 1 | |
| Vidir Solutions Inc. | 333 | 3339 | 333999 | | 1 | |
| Walinga Inc. | 336 | 3362 | 336211 | 1 | | |
| West End Radiators | 811 | 8111 | 811118 | 1 | | |
| WGI - Behlen Industries | 332 | 3323 | 332312 | | | 1 |
| Winpak | 326 | 3261 | 326113 | | | 1 |