# RETOOLING FOR THE FUTURE

Integrating Automation into the Manufacturing Sector in Ontario

## Abstract

Automation in the manufacturing industry has been a transformative force, reshaping the way goods are produced and businesses operate. Ontario, has long been known as a region with a rich history of manufacturing and an innovative approach to production. This paper delves into the profound impact of automation on manufacturing processes in Ontario, exploring the drivers, challenges, and implications of this technological transition, specifically in relation to the workforce. This paper will discuss how automation has disrupted traditional practices, improved efficiency, and positioned the province as a global leader in advanced manufacturing. This exploration is not only a reflection of Ontario's industrial journey but also a glimpse into the future of manufacturing as automation continues to shape the industry's landscape.

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**Background**

Manufacturing in Ontario, has a significant history that dates back to the early 19th century. This industry began with small-scale operations producing goods like textiles, food products, and lumber. By the mid-19th century the manufacturing sector was booming, largely due to the expansion of transportation networks, including railways and waterways, which facilitated the movement of raw materials across supply chains and directly to the consumer.

During both World Wars, Ontario's manufacturing industry played a crucial role in supplying the equipment and machinery. This further accelerated industrial growth and helped to create a shift towards more advanced manufacturing, including electronics, aerospace, and high-tech industries during the post-war period.

The late 19th and early 20th centuries saw Ontario's manufacturing sector diversify further, with the emergence of automobile production in cities like Windsor. The economic spin-off of automobile production in Ontario has helped to build manufacturing ecosystems that support strong communities as well as strengthened supply chains. Development announcements such as the NextStar electric vehicle (EV) battery plant, announced in March of 2022, and the Volkswagen electric vehicle battery manufacturing plant, announced in April of 2023 indicated a $5 billion investment and 2,500 jobs. This announcement following the 2018 Oshawa GM plant closure and reopening in 2021 exemplifies the sector's transition into new technologies.

Ontario has continued to evolve, with a focus on innovation and automation. The province is known for its automotive sector, with major companies having a significant presence. Today, Ontario remains a hub for advanced manufacturing, contributing significantly to the Canadian economy and playing a vital role in the country's industrial landscape. According to the Canadian Manufacturing Outlook 2023, the manufacturing sector contributes 10% of the Country's GDP and 68% of Canada's exports and nearly three quarters of the Canadian manufacturing businesses that were surveyed

forecasted growth in the next three years. However, the greatest threats to this growth that were identified include economic factors, cyber-security, and talent.

For decades, smaller towns and settlements in Ontario have relied heavily on the manufacturing presence to support thriving communities and local distribution of wealth. Many ghost towns in Ontario  that were either abandoned or absorbed into adjacent communities were a result of manufacturing employers that closed their operations, serving as a testament to the critical impact of the manufacturing sector, especially in rural Ontario. Communities such as Point Anne (home of the Lafarge Cement, closed in 1973), O'Donnell (home to the Canadian Copper Company roasting yard, closed in 1930), Burchell Lake (home to Coldstream Copper Mines, closed in 1967), and Indiana (home to the Grand River Navigation Company that bankrupted in 1861), are just a few examples of Ontario communities that did not survive the closures of their primary manufacturing businesses. These businesses were often one of the largest employers, some of the best paying jobs, and their absence was critical to the tax base and all ancillary businesses surrounding them, especially businesses involved in distribution.

The closure of these manufacturing businesses occurred for a number of reasons; transportation routes being re-routed, poor environmental practices, bankruptcies, advancement of technology or product obsoletion etc. however, the result remains the same. It can be incredibly difficult for communities to rebound after these types of departures. This is a growing concern in regards to Ontario's workforce crisis. Without the proper skilled workforce complement, these small and medium manufacturing businesses are at risk and require intervention to support sustainable production.

### The Workforce Conundrum

Talent acquisition and retention has been a critical issue for nearly a decade for all sectors, but the manufacturing sector more than most. Statistics Canada has reported the ratio of new hires to vacancies declining over time with issues like shortage of labour force and retention of skilled

employees expected to continue to be a barrier to success in all provinces. There have been substantial federal and provincial government efforts to support the ongoing workforce issues. Some of these programs include training incentives such as the Canada-Ontario Job Grant, the Achievement Incentive, the Skills Development Fund and more. These programs are effective in building a skilled workforce, but a large component of the workforce issue particularly relevant to small and medium manufacturing enterprises is the limited pool of skilled workforce to attract. This is also compounded by the aging workforce with roughly 22% of the workforce nearing retirement.

The Unemployment Rate in Canada has risen from 5.1% (Jan. 2023) to 5.7% (Oct. 2023), currently 6.2% in Ontario and is forecasted to continue to rise at the end of the year. This coupled with the manufacturing sector reporting a loss of $13 billion to Canada's economy as a result of labour and skill shortages, has identified that labour attraction and retention is a critical impediment to overall growth and requires immediate attention.

**Reshoring**

In recent years, there has been substantial effort in reshoring within the Canadian manufacturing sector. Starting with the 2008 Global Financial Crisis and more recently the 2020 COVID-19 Pandemic many existing issues were brought to the forefront including global market volatility, the increased cost of importing goods, and supply chain disruptions. The act of reshoring refers to bringing back manufacturing and other operations from overseas and is driven by various factors such as cost considerations, supply chain resilience, and the intent to support the local economy. Reshoring aims to strengthen domestic business operations and creates job opportunities, contributing to the overall GDP, but can also improve product quality as well as reduce transportation costs. While reshoring can be seen as a positive effort for the Canadian Manufacturing sector and Ontario Manufacturing businesses, a sufficient workforce complement is required to support this. With the current and forecasted workforce trends, this may present a challenge.

**The Rise of Automation and Artificial Intelligence**

Automation in the Canadian Manufacturing sector involves the integration of advanced

technologies and robotic systems to perform tasks traditionally carried out by the workforce. While the

concept of incorporating automation has created some trepidation surrounding job security for the

human workforce in the past, at a time when the human workforce is trending downward in

employment, this could be a reasonable solution to mitigate the current strain on small and medium-

sized manufacturing businesses. The rise of automation raises questions about what the impact on the

workforce will look like. While the adoption of new tech can lead to job displacement in some areas, it

often creates new opportunities for skilled workers who can operate, program, and maintain these

automated systems.

The growing prevalence of automation in Ontario's manufacturing sector has been a notable

trend in recent years. Many manufacturers are increasingly adopting automated technologies to

improve efficiency, reduce costs, and enhance productivity. This shift towards automation is driven by

several factors, including the need to stay competitive in a global market, rising labour costs, and the

demand for higher precision and consistency in production processes. Automated systems can handle

high volumes of repetitive tasks with speed and accuracy without the interference of human error,

leading to increased output and quality.

Government initiatives, educational programs, and industry collaborations are integral to

supporting the workforce transition and ensuring that automation benefits the manufacturing sector as

a whole. Post-Secondary Institutions such as Loyalist College have taken the opportunity to develop

programming in partnership with Siemens Automation Company that addresses the local need for

skilled workforce that has been identified within the Bay of Quinte Region. The Mechatronics Diploma

Program incorporates a combination of mechanical, electrical, and computer software skills as well as

the globally recognized Siemens Mechatronics Systems certification in response to the need for skilled

workforce that can support manufacturing businesses in their transition to adopt new technology and

automation. Another example of this is the Regional Future Workforce Program, a program created in partnership with St. Clair College, Robotics Canada, Invest Windsor-Essex, and other stakeholders and funded by the Ontario Vehicle Innovation Network. This is a pilot program looking to encourage students to explore career options in STEM and the automobility sector.

Ontario's manufacturing landscape has seen investments in smart factories and the integration of industry 4.0 technologies, which involve interconnected systems and data exchange in manufacturing. This overall shift in the manufacturing sector reflects infinite opportunities for tech adoption and a broader global trend towards leveraging technology to transform traditional manufacturing processes and stay at the forefront of innovation.

**Automation Inventory**

Automation is defined as "the technique of making an apparatus, a process, or a system operate automatically". The primary benefit of automation is that a desired result may be achieved with little to no human intervention once the delivery method has been programmed. Automation has the capacity to enhance efficiency, reduce production costs, improve product quality and consistency and remain competitive in the global market. Automation can be categorized into four different segments:

| Type of Automation | Description |
|---|---|
| **Fixed Automation** | A system that delivers one command, from start to finish, and then repeats. Example: a conveyor belt moving product/widgets from one location to another Benefit: lower cost per unit, consistent quality Disadvantage: higher startup cost, limitations in variety of tasks completed, human intervention required for process changeover |
| **Programmable Automation** | Software and computer-controlled equipment that can be programmed to complete a range of different tasks. Example: Robotics technology used for production line activities such as packaging Benefit: can manufacture larger range of products with better flexibility Disadvantage: high cost of equipment, fewer units per production process |

| Flexible Automation | Machines that can not only perform a variety of tasks but can also adjust how those tasks are performed. Example: CNC machines Benefit: wider range of products can be manufactured and modifications to process can be made, low downtime, minimal changeover procedure Disadvantage: highest cost per unit, requires custom machinery |
|---|---|
| Integrated Automation | All machines that are automated are connected to one central hub that indicates how all tasks are performed. Example: Small batch production Benefit: can control all aspects of process and have the most customizability Disadvantage: the most expensive and complex to install |

## Automation and Technology Assessment

Manufacturing businesses have access to a variety of automation technologies that enhance

efficiency, productivity, and overall operational performance. Here are some key automation

technologies commonly used in manufacturing:

1. Robotics:

- Industrial robots perform tasks such as welding, assembly, packaging, and material handling.

    They enhance precision, speed, and consistency in manufacturing processes.

2. Programmable Logic Controllers (PLCs):

- PLCs automate control of machinery and processes. They are used to monitor inputs and control

    outputs, ensuring precise and reliable automation in manufacturing.

3. Computer Numerical Control (CNC) Machines:

- CNC machines automate machining processes like milling, turning, and cutting. They receive

    instructions from computer programs, allowing for high precision and repeatability.

4. Artificial Intelligence (AI) and Machine Learning (ML):

- AI and ML technologies optimize production by analyzing data, predicting maintenance needs,

    and improving overall decision-making processes in real-time.

5. Internet of Things (IoT):

- IoT connects devices and sensors in the manufacturing environment, facilitating data exchange and monitoring. This can lead to better insights, predictive maintenance, and overall process optimization.

6. Human-Machine Interface (HMI):

- HMI systems provide a user-friendly interface for operators to monitor and control automated processes. Touchscreens and graphical displays enhance communication between humans and machines.

7. Augmented Reality (AR) and Virtual Reality (VR):

- AR and VR technologies are used for training, maintenance, and troubleshooting. They provide immersive experiences that enhance learning and collaboration.

8. Sensors and Vision Systems:

- Sensors monitor and collect data on various aspects of the manufacturing process, such as temperature, pressure, and position. Vision systems use cameras and image processing to perform inspections and quality control

9. 3D Printing/Additive Manufacturing:

- 3D printing allows for the layer-by-layer creation of physical objects based on digital models. It is used for prototyping, customization, and production

10. Automated Guided Vehicles (AGVs) and Drones:

- AGVs are often used in warehouses and production lines, while drones may provide aerial surveillance or deliver materials

11. Collaborative Robots (Cobots):

- Cobots work alongside human workers, enhancing collaboration and flexibility in tasks. They are designed to be safe and easy to program for various applications

12. Cloud Computing:

- Cloud platforms enable remote monitoring, data storage, and analysis. Manufacturers can access real-time information and analytics, fostering better decision-making

Adopting a combination of these automation technologies can significantly transform manufacturing processes, making them more efficient, flexible, and responsive to market demands. The specific technologies chosen depend on the industry, production needs, and business objectives.

## Considering the Needs

The needs and capacity of Ontario manufacturing businesses to adopt automation methods to supplement the workforce vary. A critical component of the process of integrating automation is determining where the need exists. Employers may already have an overall awareness of where the obstacles are within their workforce, however a Needs Checklist has been created to help identify barriers to success as part of this Toolkit. This checklist will help the employer to analyze the composition of their workforce and identify where they are experiencing these barriers that are detrimental to their daily operations.

After having identified the source of the issue the employer can then identify the roles that they are struggling to fill and the associated tasks and deliverables that are not being met or are being reassigned to ensure completion. For example, if the role that the employer is having the most difficulty filling is a Facility Maintenance Technician role, the tasks may include basic maintenance and repair of the facility, including interior, exterior, and facility systems (plumbing, electrical, ventilation). Once this has been identified, this allows the employer to move forward to identifying where automation can be integrated to support these operations. This could include installation of a central control hub that ensures all machinery, fleet, equipment, etc. is operating effectively (Rogers Business Internet of Things), an autonomous cleaning system to maintain a hygienic working environment (AvidBots Neo

Autonomous Floor Scrubbing Robot), or automating the energy management system to monitor energy consumption and identify conservation benchmarks (GE Digital Control System IEMS).

Once an employer has determined where they intend to integrate automation into their process, they will need to identify the support required. Many businesses that have created technology and software to allow manufacturing businesses to adopt new tech into their process, provide onboarding and training for staff. This presents two different options for the employer to consider, the employer can determine where the responsibility of managing the new process can be reassigned to or the employer can re-evaluate the original job description to reflect the new process and a higher level of skill. Proper care must be made to ensure that the investment into adopting new technology is supported and sustainable. The purpose is not to remove the need for the workforce entirely, it is to determine the lower skilled tasks that are being reassigned or not completed that can be automated and be done more efficiently and with less human intervention.

Based on the Labour Market Partnership Industry Outreach Initiative (Industrial BR+E) conducted by Bay of Quinte Economic Development, 91% of Manufacturing businesses in the Bay of Quinte Region are "Implementing or planning on purchasing new technology, equipment and automation". Further to this outreach initiative, interviewed manufacturers identified the highest need for Production Associates at over 300 vacant positions. This is an example of how a business can identify their intent, their need, and ultimately find their solution. If these organizations are in greatest need of Production Associates, this creates the opportunity to determine an integrated production automation that reduces the need of production associates to deliver the same volume of output. Whether this is a material handling machine, a robotics system, or an automated quality assurance process, the corresponding reduction in labour requirement will support a more efficient workflow and more effective allocation of human resources.

## Financial Implications

The cost of implementing automation in manufacturing can vary widely based on factors such as the scale of automation, type of technology, and the specific needs of the business. Initial costs typically include the purchase of automation equipment, software, and integration with existing systems. Additionally, there are expenses related to employee training for operating and maintaining automated systems. It's essential for businesses to carefully assess their requirements, consider potential returns on investment, and develop a comprehensive budget that accounts for both upfront and ongoing costs associated with implementing automation in manufacturing.

While automation can lead to long-term cost savings through increased efficiency and reduced labor costs, the upfront investment can be significant. Small and medium-sized enterprises may find the initial costs challenging, but larger manufacturers often view automation as a strategic investment to enhance competitiveness and adapt to evolving market demands. There are programs established by the provincial and federal governments to support innovation, modernization, and costs such as research and training involved in the process of integrating new technologies. These funding programs are continuously being updated to meet the demand for support, and can be loans, tax credits, and/or non-repayable funding. This list is not exhaustive but identifies some of the types of programs available:

- Eastern Ontario Development Fund (EODF) / Southwestern Ontario Development Fund (SWODF)

- Ontario Automotive Modernization Program (O-AMP)

- Canada Job Grant (CJG)

- Business Scale-up and Productivity Program (BSP)

- Strategic Innovation Fund (SIF)

- Industrial Research Assistance Program (IRAP)

- CMEs Technology Investment Program

**Adoption Framework**

A *tech adoption framework* for new technology will provide a manufacturing business with a

structured approach and guidelines designed to facilitate the successful implementation and integration

of a new technology, process, or methodology. It will create a systematic way to plan, execute, and

manage the adoption process. This framework includes four stages; assessment and planning,

implementation, and evaluation. The goal is to streamline the adoption process, manage risks, and

ensure that the change is effectively embraced by all parties involved. An adoption framework should be

agile enough to accommodate a manufacturing business adopting most forms of new technology or

process updates.

## Assessment and Planning

- Evaluate current processes and identify areas suitable for automation

- Set clear goals and objectives for automation, considering efficiency, cost reduction, and quality

  improvement

- Define Requirements, clearly outline the technical specifications and requirements for the

  integrated automation system

- Ensure compatibility with existing infrastructure and systems

- Determine the budget for automation implementation, considering costs for equipment,

  software, training, and potential downtime

- Choose appropriate automation technologies by determining what will produce the best results

- Provide comprehensive training for employees to ensure they can operate and maintain the

  new automated systems

## Implementation

- Pilot Testing, conduct a small-scale pilot test of the automation system to identify and address any issues before full-scale implementation

- Gradual Implementation of automation helps to minimize disruptions. Start with less critical processes before moving to more critical ones

- Ensure seamless integration with existing systems to maintain workflow continuity

- Implement monitoring tools to track the performance of the automated processes

- Continuously optimize the system for improved efficiency and effectiveness

- Ensure that the integrated automation complies with industry regulations and safety standards

## Evaluation

- Foster communication between different departments involved in the automation process to address challenges and ensure smooth integration

- Collect feedback from employees and stakeholders and be prepared to adapt the automation strategy based on lessons learned

- Establish a culture of continuous improvement, regularly reviewing and updating the automation processes to stay current with technological advancements

**Justification**

The adoption of new technology and automation in the manufacturing industry is justified for several compelling reasons:

1. Increased Efficiency:

- Automation enhances production efficiency by performing repetitive tasks with speed and precision, reducing cycle times and improving overall workflow efficiency.

2. Cost Reduction:

- Automation can lead to significant cost savings by minimizing labor costs, reducing errors, and optimizing resource utilization. Over time, this can contribute to a more competitive cost structure.

3. Improved Quality and Consistency:

- Automation ensures consistent and high-quality output, minimizing variations in production. This leads to improved product quality, reduced defects, and enhanced customer satisfaction.

4. Enhanced Productivity:

- Automated systems operate 24/7 without the need for breaks, leading to increased production output and overall productivity. This is particularly beneficial in meeting high-volume demands.

5. Flexibility and Adaptability:

- Automation systems can be programmed and reconfigured to adapt to changes in product design or manufacturing requirements, providing flexibility in production processes.

6. Safety Improvements:

- Automated systems can handle hazardous tasks, reducing the risk of workplace accidents and injuries. This contributes to a safer working environment for employees.

7. Faster Time-to-Market:

- Automation accelerates the manufacturing process, enabling faster production cycles. This can be crucial in meeting market demands and launching products more quickly.

8. Data-Driven Decision Making:

- Automation generates real-time data on production metrics, allowing manufacturers to make informed decisions, optimize processes, and identify areas for improvement.

9. Competitive Advantage:

- Companies that embrace automation gain a competitive edge by staying ahead of industry trends, offering better products, and responding more quickly to market changes.

10. Resource Optimization:

- Automation optimizes the use of resources such as raw materials, energy, and time, contributing to sustainability efforts and reducing the environmental impact of manufacturing processes.

11. Skilled Workforce Focus:

- By automating routine tasks, employees can focus on higher-value, creative, and complex activities, leading to a more skilled and engaged workforce.

12. Adaptation to Industry 4.0:

- Embracing automation aligns with the principles of Industry 4.0, incorporating digital technologies, connectivity, and smart systems to create a more interconnected and efficient manufacturing ecosystem.

13. Meeting Customer Demands:

- Automation enables quicker response to changing customer demands, customization requirements, and market trends, ensuring manufacturers can meet diverse customer needs.

14. Return on Investment (ROI):

- While there are initial costs associated with automation, the long-term ROI in terms of increased efficiency, reduced costs, and improved quality often justifies the investment.

**Strategic Recommendations**

The following are strategic recommendations for a small or medium sized manufacturing enterprise that is looking to move forward in integrating automation into their processes and daily operations.

## Comprehensive Needs Assessment

This is a document that will analyze the current process and identify specific pain points or areas for improvement. This document should include clearly articulated goals and objectives whether it's

improving efficiency, reducing costs, supplementing an unfilled job, or enhancing product quality, this will assist in selection of appropriate technology. This assessment will need involvement from other departments to ensure a holistic understanding of the impact of the problem and how all considerations can be addressed through the implementation process.

## Implementation Plan

A technology implementation plan will outline the approach and steps for integrating new technology into a manufacturing process. While the comprehensive needs assessment will analyze and identify where the integration should take place, the integration plan will develop a timeline, allocate resources, identify training needed to operate, and monitoring progress to ensure a smooth and successful implementation.

## Monitoring Schedule

A technology integration monitoring schedule is a structured plan specifying when and how the progress of a technology implementation will be assessed. It includes regular checkpoints to evaluate key milestones, identify challenges, and ensure alignment with project timelines. This schedule helps track the integration process, make adjustments as needed, and ensure that the technology is effectively integrated into the existing systems or processes.

**Automation Toolkit**

The attached Automation Toolkit is designed to support small and medium manufacturing enterprises in integrating automation into their processes. This toolkit will help to build a plan and is created in a way that it can be repurposed for any type of integration. The successful implementation of new technology is a process that requires consultation and commitment from all parties involved, but by incorporating automation, robotics, and other machinations to support efficient processes, these enterprises can remain competitive in a rapidly changing market. Manufacturing remains a critical

component of the Canadian economy and innovation is continuously becoming more accessible to SMEs

in a way that it wasn't previously. Innovation in manufacturing drives economic growth and supports

healthy, thriving communities as the economic landscape continues to shift.

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# Needs Assessment

| | |
|---|---|
| Define Goals & Objectives for Tech Adoption | |
| Assess Current Processes to identify areas for improvement | |
| Consider Integration and Compatibility | |
| Budget and Financial Implications | |
| Security and Compliance | |
| Training | |
| Key Performance Indicators | |
| Contingency Planning | |
| Proposed Timeline | |

# Implementation Plan

Name of Business:

Number of Employees:

Established (year):

Project Manager:

Summary:

> *Provide a brief overview of the identified need and the proposed technology adoption.*

Objectives:

> *Clearly define the objectives of the technology implementation. What are the goals to be achieved?*

Scope:

> *Define the scope. Which departments will be involved? What is the proposed timeline for the entire implementation process?*

Stakeholder Engagement:

> *Identify the key stakeholders. Who will be using this technology once it has been implemented?*

Technology Selection:

> *What is the chosen technology and why have you chosen this one?*

Training:

> *What training will be required for the key operators?*

Contingency Planning and Risk Management:

> *Identify potential risks and the strategies to mitigate them.*

Project Implementation:

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# Monitoring Schedule

Pre-Implementation

1. Assessment (Weeks 1-2)
    a. Establish user expectations and KPIs
2. Communication (Weeks 3-4)
    a. Create stakeholder communication plan

Implementation

3. Pilot Phase (Weeks 5-8)
    a. Collect feedback during pilot phase
4. Training (ongoing)
    a. Provide training as needed
5. Report an Issue (ongoing)
    a. Develop a reporting process for issues

Post-Implementation

6. Feedback (Months 2-4)
    a. Conduct survey for all users  and analyze feedback
7. Performance (Months 3-6)
    a. Measure progress against KPIs
8. Updates (Months 6-8)
    a. Identify and implement adjustments

Process Check-ins

- Create check-in schedule on quarterly basis to identify any evolving needs
- Conduct full evaluation on annual basis including security updates, training needs, and overall impact