



Summary Report

Accelerating Digital Transformation in Canada's Advanced Manufacturing Sector

Summary Report of Digital Technology Adoption Roadmaps for Canada's Manufacturing Industries



Produced by the Information and Communications Technology Council (ICTC)
in collaboration with Next Generation Manufacturing Canada (NGen)

Preface:

ICTC and NGen are proud to present this series of digital technology adoption roadmaps, and this accompanying overarching summary report, which covers five Canadian advanced manufacturing industries (automotive, aerospace, biomanufacturing, fabricated metal products, and food and beverage). These roadmaps detail practical steps and business considerations for Canadian advanced manufacturing firms, particularly small- and medium-sized enterprises, interested in adopting advanced digital technologies, including artificial intelligence (AI), big data analytics, cloud computing, cybersecurity, digital twins, sensors and Internet of Things, and advanced robotics and industrial automation. This summary report provides a rationale for the development of the roadmap series and compares the current state of digital technology adoption across the advanced manufacturing industries studied.

Digital technology adoption roadmaps available for Canadian manufacturers in this series:



About ICTC:

The Information and Communications Technology Council (ICTC) is a neutral, not-for-profit national centre of expertise with the mission of strengthening Canada's digital advantage in the global economy. For over 30 years, ICTC has delivered forward-looking research, practical policy advice, and capacity-building solutions for individuals and businesses. The organization's goal is to ensure that technology is utilized to drive economic growth and innovation and that Canada's workforce remains competitive on a global scale.

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About NGen:

Next Generation Manufacturing Canada (NGen) is the industry-led, non-profit organization leading Canada's Global Innovation Cluster for Advanced Manufacturing. One of five national networks supported by Canada's ambitious Global Innovation Clusters Initiative. We are founded on the principle that digital transformation in advanced manufacturing will enrich the lives of Canadians, delivering better products and good jobs while generating the economic growth essential to a better future.

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Executive Summary

Emerging digital technologies, including artificial intelligence (AI), big data analytics, cloud computing, cybersecurity, digital twins, sensors and Internet of Things (IoT), and robotics and industrial automation, have the potential to greatly disrupt the manufacturing sector, while also unlocking significant value and opportunities for forward-looking Canadian manufacturing firms. These digital technologies hold promise for helping manufacturing enterprises achieve tangible benefits, including cost savings, revenue growth, product and process innovation, and risk reduction.

A 2025 ICTC survey of Canadian manufacturers found that those adopting digital technologies and embarking on digital transformation journeys were driven by a desire to improve profitability, meet customer expectations, and enhance product quality.

Manufacturers who can effectively adopt novel digital technologies can enjoy significant competitive advantages relative to peers that are slower or less effective at adopting digital technology into their manufacturing operations. A purposeful, strategic, and integrative approach to adopting digital technologies across a business enterprise is referred to as digital transformation, which is proving to be a crucial business competency for Canadian manufacturers.

This report highlights key findings from a study of Canadian advanced manufacturing practices carried out in partnership between the Information and Communications Technology Council (ICTC) and Next Generation Manufacturing Canada (NGen). The study was carried out in consultation with representatives from the manufacturing industry, including senior executives, technology leaders, and advanced manufacturing consultants.

In addition to this overarching summary report, the study also resulted in five digital technology adoption roadmaps covering Canada's automotive and automotive parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing industries.

Sectoral digital technology adoption roadmaps tailored for individual Canadian manufacturing industries can help implement digital technology

adoption, while bridging the gap between high-level vision and strategy around technology investment and successful implementation on the factory floor.

The digital technology disruption taking place in manufacturing comes at a time of significant economic uncertainty for the Canadian manufacturing sector. Like other sectors of the Canadian economy, manufacturing is suffering from lagging productivity, slow or stagnant GDP growth across critical manufacturing industries, and low levels of digital technology implementation. Furthermore, significant numbers of Canadian manufacturers in economically critical industries have no current plans to adopt key digital technologies, such as AI, digital twins, cloud computing, and IoT.

ICTC research finds that the adoption of digital technology in Canadian manufacturing poses challenges and notable barriers. Only 23% of Canadian manufacturers surveyed by ICTC enjoyed fully successful digital technology implementation initiatives over the past five years. Common obstacles encountered by manufacturers undergoing digital transformation include high purchase costs, market uncertainty, and uncertain economic returns. Recruiting, developing, and retaining a skilled manufacturing digital technology workforce is also a challenge identified by Canadian manufacturers.

Instituting workforce development and training initiatives, change management strategies, and embracing a learning culture can help Canadian manufacturers overcome digital transformation challenges and barriers.

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Digital Technology in Canadian Manufacturing

Canadian manufacturing has entered an era of significant technological change, driven by novel, emerging digital technologies, such as artificial intelligence (AI) and advanced robotics, and the need to invest in and integrate these technologies on the factory floor and across the manufacturing enterprise.

These technologies promise to create tangible benefits for manufacturers, such as cost savings, revenue growth, product and process innovation, risk reduction and management. Yet, as many of the digital technologies being adopted by Canadian manufacturers right now are still emerging and subject to rapid change, there is uncertainty about measuring impact and return on investment (ROI), and unclear or unproven use cases in a manufacturing environment.

This comes at a time when Canada faces a productivity crisis throughout its economy, while Canada's business community is encountering rapidly changing market dynamics. Key Canadian manufacturing industries have faced years of economic stagnancy. Could adopting new digital technologies help overcome economic malaise, reduce uncertainty, and improve productivity?

This report covers a study the Information and Communications Technology Council (ICTC) carried out in collaboration with Next Generation Manufacturing Canada (NGen) to study digital transformation in the Canadian manufacturing sector and the adoption of key digital technologies

across five industries (automotive and automotive parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing) within the Canadian manufacturing sector. The study resulted in the development of a series of five digital technology adoption roadmaps for each industry covered, and this summary report on common trends across the five industries.

The Five Manufacturing Industries Covered

Given their prominence in the Canadian manufacturing sector, ICTC and NGen selected the automotive and automotive parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing industries for study and development of digital technology adoption roadmaps. Figure 1 outlines the five manufacturing industries covered in the study, along with associated descriptions based on Statistics Canada's North American Industry Classification System (NAICS) classification codes.

Figure 1. The Five Canadian Manufacturing Industries Covered in Study and Associated Statistical Definition

Industry	Description
Automotive and automotive parts manufacturing	Including motor vehicles, vehicle body and trailers, and vehicle parts manufacturing.
Aerospace manufacturing	Including aircraft and aircraft parts, engine and propulsion systems, and space vehicle manufacturing, as well as aircraft factory overhaul and conversion.
Bio manufacturing	Including biotechnology and biology research and development laboratories, genetics research and development laboratories, drugs and medicines manufacturing, and blood derivatives manufacturing.
Fabricated metal products manufacturing	Including machine shops, hardware manufacturing, spring and wired product manufacturing, nut and bolt manufacturing, and architectural and structural metals manufacturing.
Food and beverage manufacturing	Including food manufacturing/processing operations, bakeries, and beverage manufacturing, including breweries, distilleries, and wineries.

Source: Statistics Canada.¹

Defining Advanced Manufacturing

Deep Tech Canada notes that advanced manufacturing consists of “manufacturing processes that adopt new, innovative technologies to create new products or enhance processes,” noting that, unlike traditional manufacturing, firms engaged in advanced manufacturing “make use of recent scientific and technical advances to produce high-tech end products.”² In a 2015 report, Boston Consulting Group defines advanced manufacturing technologies “as a set of highly flexible, data-enabled, and cost-efficient manufacturing processes.”³

The Trillium Network for Advanced Manufacturing observes that, while there is no precise, consensus definition of what constitutes advanced manufacturing, it should display the following attributes:⁴

- › Advanced manufacturing firms employ a “technologically proficient workforce” and hire heavily for “STEM-related occupations”
- › Advanced manufacturing firms are “R&D intensive” and make “higher-than-average investments in R&D”
- › Advanced manufacturing firms enjoy “relatively high rates of productivity” and rely on “leading-edge production and design technologies” to drive their operations
- › Advanced manufacturing firms utilize “leading-edge production technologies” and engage in “higher-than-average levels of capital expenditures.”

¹ Statistics Canada (Government of Canada), “North American Industry Classification System (NAICS) Canada 2022 Version 1.0,” last update August 6, 2024, <https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1369825>.

² Deep Tech Canada, “What Constitutes Advanced Manufacturing?,” accessed April 13, 2026, <https://deeptechcanada.ca/news/what-constitutes-advanced-manufacturing/>.

³ Harold L. Sirkin, et al., “Why Advanced Manufacturing Will Boost Productivity,” Boston Consulting Group, January 30, 2015, <https://www.bcg.com/publications/2015/lean-and-manufacturing-production-why-advanced-manufacturing-boost-productivity>.

⁴ Brendan Sweeney, “Does a consensus definition of advanced manufacturing exist?,” Trillium Network for Advanced Manufacturing, April 27, 2021, <https://trilliummfg.ca/initiatives/news/definition-of-advanced-manufacturing/>.



What is Digital Transformation?

Digital transformation describes a purposeful, strategic, and long-term approach to digitalizing an organization's entire enterprise. In Canada's manufacturing sector, digital transformation involves integrating emerging digital technologies, such as AI, digital twins, and cloud computing, across a manufacturing firm's entire operations and business model.

More than simply the purchase and adoption of new technology, digital transformation seeks to transform an entire enterprise—as IBM describes it, digital transformation “evaluates and modernizes an organization's processes, products, operations and technology stack to enable continual, rapid, customer-driven innovation.”⁵ According to IBM, digital transformation is carried out across a business enterprise, affecting business operations, processes, and products, as well as the customer and employee experience (Figure 2).

Figure 2. Cross-Enterprise Domains of Digital Transformation



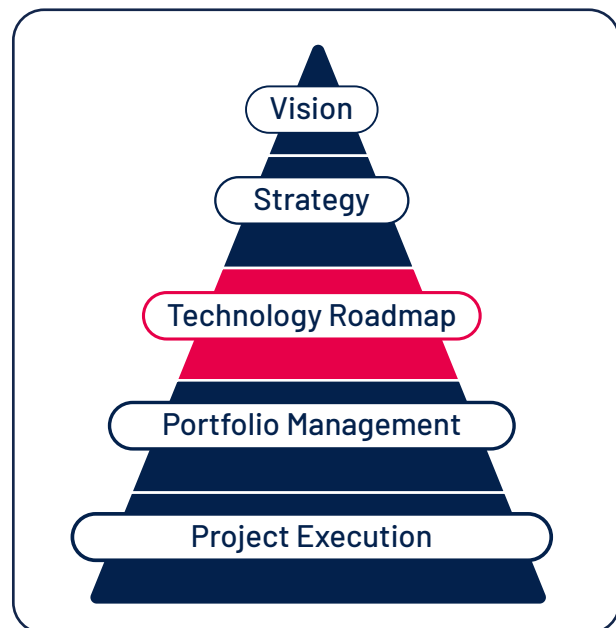
Source: Adapted from IBM, 2024.⁶

Digital transformation involves a significant change in how manufacturing firms do business. A change management strategy that includes considerations such as internal and external communications, workforce training and development, assessing pressures on an organization's design and structure, and the potential tensions that could be placed on an organization's culture pending a digital transformation should be developed.

What are Technology Roadmaps?

Technology roadmaps serve as an intermediary, linking individual technology projects and initiatives to enterprise-level vision and strategy (Figure 3). For this reason, technology roadmaps can be used across a business and entire economic sector, such as manufacturing, to identify opportunities, mobilize resources, and create buy-in from stakeholder groups.

Figure 3. Technology Roadmaps within a Firm's Strategic Innovation Hierarchy



Source: Adapted from McKinsey & Company, 2017.⁷

ICTC and NGen's series of digital technology adoption roadmaps were written at an industry level, being specific enough that they provide industry-specific, real-world examples and context of digital technology adoption in Canadian manufacturing, while also being generalized enough that individual Canadian manufacturers can find relevant information and guidance to inform their own digital transformation journeys.

For this reason, each roadmap in the series includes an in-depth case study on how real manufacturing firms across Canada are currently adopting digital technology into their manufacturing operations and how they are approaching the digital transformation of their businesses.

⁵ IBM, "What is digital transformation?," September 9, 2024, <https://www.ibm.com/think/topics/digital-transformation>.

⁶ Ibid.

⁷ McKinsey & Company, "Building an integrated technology road map to drive successful innovation," February 21, 2017, <https://www.mckinsey.com/capabilities/operations/our-insights/building-an-integrated-technology-road-map-to-drive-successful-innovation>.

Each roadmap also provides examples of practical planning tools to help Canadian manufacturers plan and execute their digital transformation journeys, including:



Digital technology use case matrix: highlighting practical uses of the seven digital technologies in the Canadian manufacturing sector.



Return on investment (ROI) measurement framework: outlining example metrics to assess ROI on digital technology adoption in categories including operational effectiveness, workforce productivity, capital productivity, market access, innovation, health and safety, and ESG measures, and align them with strategic firm objectives and investment inputs.



Change management checklist and digital transformation project phase gate framework: providing a systematic, phased approach to developing organizational change management strategies and technology pilots to support digital transformation.



Risk management tools: demonstrating contemporary risks manufacturing firms may face when undergoing digital transformation in today's market, as well as an example risk register and risk management trigger scenarios.



Talent and workforce training insights to support digital transformation: overviewing baseline digital competencies for advanced manufacturing, workforce training and delivery models for manufacturers, and organizational strategies to foster digital competencies in the manufacturing workforce.



Advice for developing strategic partnerships to advance digital transformation: discussing key partnership verticals and example partnership models, as well as key considerations for data-sharing when developing strategic partnerships.



What Were the Seven Key Digital Technologies Studied?

While the following seven core digital technologies are not the only emerging digital technologies that are poised to affect Canada's manufacturing sector in the coming years, they are technologies that are essential to advancing Canadian manufacturing going into the immediate future:

Artificial Intelligence (AI) and Machine Learning (ML)	AI-enabled systems can quickly parse large volumes of data, helping to optimize processes and predict outcomes, and automate decision-making tasks that would normally require human cognition. Machine learning models can ingest training data and learn to make predictions or correct decisions without explicit, hard-coded programming.
Big Data Analytics	Methods and tools used to collect and curate, process and integrate, and analyze extremely large volumes of data across a manufacturing operation to glean insights and improve decision-making.
Cloud Computing	On-demand, off-site computing services to access and store data, process information, and serve software applications via the internet. Cloud computing also allows manufacturers to dynamically scale their computing infrastructure as required.
Cybersecurity (IT and OT)	Protecting sensitive networks and data from threats. In a manufacturing environment, cybersecurity encompasses protecting both information technology (IT), such as networks and data, and operational technology (OT), such as machinery, control systems, and sensors.
Digital Twins	A virtual representation or model of a real-world asset, such as a piece of machinery, a production line, a manufactured product, or an entire manufacturing facility, continuously updated with new data, allowing the digital twin to mirror the real-world asset's status and condition.
Sensors and Internet of Things (IoT)	Machinery, sensors, and other electronic devices can be interconnected to gather and share real-time data across a factory or supply chain, often referred to as the Internet of Things (IoT) or the Industrial Internet of Things (IIoT).
Robotics and Industrial Automation	Automation technologies have long been used in some metal product manufacturing applications, but advanced robotics, including cobots and humanoid robots, can be used across a variety of manufacturing applications and integrated with technologies such as AI and IoT networks.

While any one of the seven digital technologies would be consequential on its own to the state of advanced manufacturing in Canada, what makes these seven technologies truly impactful is how they interact with one another. These seven technologies can be digitally networked across a manufacturing operation or even across an entire manufacturing supply chain, yielding significant gains in operational excellence and efficiency, productivity, safety, innovation, and market responsiveness.

For example, sensors deployed across a manufacturing operation, on industrial robots and other machinery, can collect significant amounts of real-time data (i.e., big data analytics), which can be hosted in a cloud environment. The data can be used to create digital twins of individual pieces of machinery and robots, manufacturing processes, and even entire manufacturing facilities. The data can also be used to train AI models and run inference to help manage and optimize manufacturing operations.



Manufacturers unlock the most business value from these digital technologies when they adopt them as integrated tech stacks. As a manufacturing firm carries out a digital transformation of its business over time, it can adopt the technologies in three maturity tiers (Figure 4).

Canadian manufacturers and industry experts interviewed by ICTC reported that firms that build

realistic time horizons for digital technology adoption and phase in technology through pilot programs tend to succeed more. This is especially true for firms that operate in legacy facilities and thus need to upgrade technology incrementally alongside regular manufacturing operations or during plant retooling.

Figure 4. Digital Technology Maturity Tiers for Advanced Manufacturing

Digital Transformation Stage	Maturity Tiers	Key Digital Technology	Firm Digital Transformation Maturity Level
Basic	Foundational Technologies	› Cloud computing/ cloud ERP › Cybersecurity	Foundation: establish prerequisite digital infrastructure.
Intermediate	Operational Optimization Technologies	› Sensors and IoT › Big data analytics	Integrate and optimize: build data collection and analytical processes from foundational digital infrastructure. Provide data platform for transformational technologies.
Advanced	Advanced Transformation Technologies	› AI/ML › Robotics and industrial automation › Digital twins	Transformation: adopt advanced digital technologies to transform enterprise manufacturing operations.

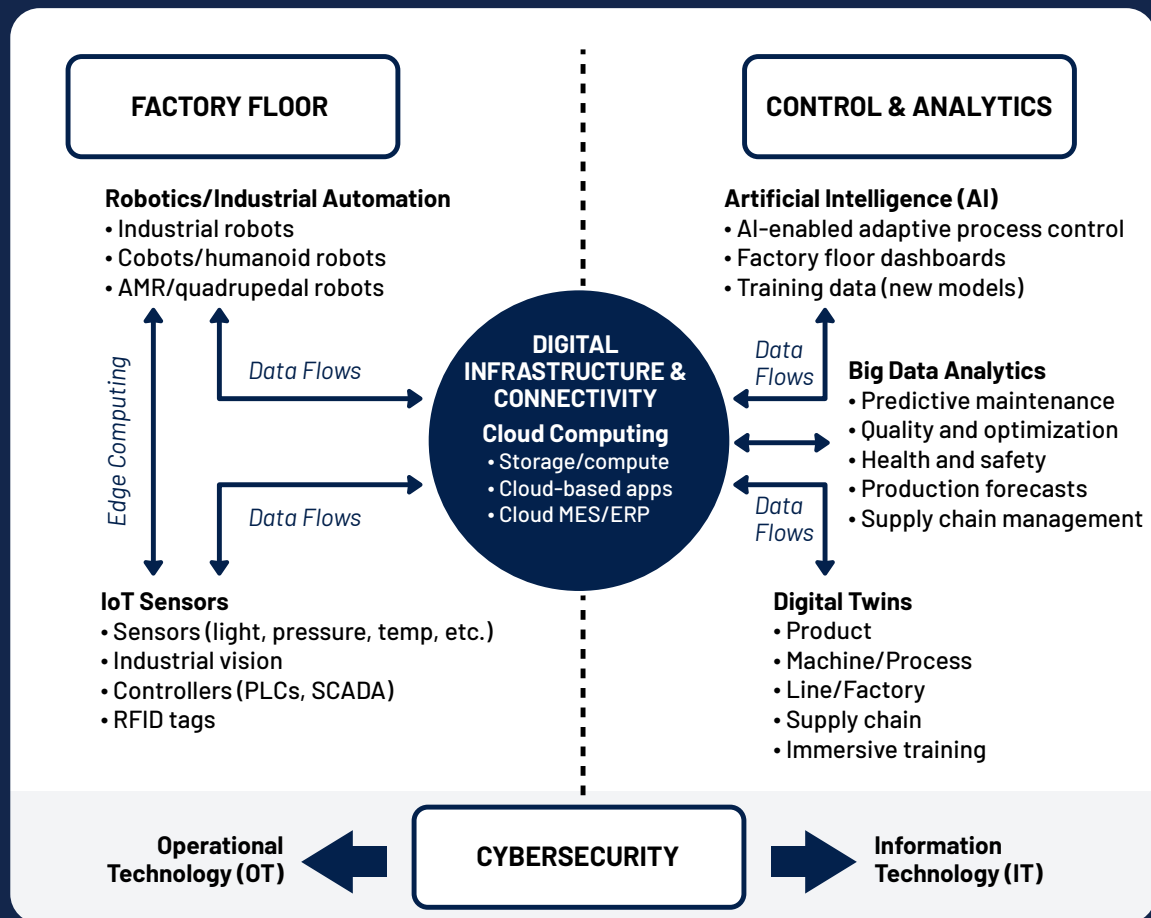
Source: ICTC analysis, 2026.

Advanced Manufacturing Digital Technology Integration Model

Figure 5 outlines, at a high level, how the seven digital technologies covered in this roadmap can be integrated together across a manufacturing enterprise. This includes integrating and connecting physical assets on the factory floor with control and analytics platforms in a cyber-secure manner, ensuring that both information technology (IT) and operational technology (OT) networks are secured against threats.

The model presented in Figure 5 is aspirational and intended to provide an overview of what is possible in the long term. Today, most Canadian manufacturers undergoing digital transformation of their operations have not yet achieved this level of total integration. Instead, Canadian manufacturers tend to adopt stacks of digital technologies incrementally over time.

Figure 5. Advanced Manufacturing Digital Technology Integration Model



Source: ICTC analysis, 2026.

How Were the Seven Key Digital Technologies Chosen?

To identify the seven key digital technologies covered in this study, ICTC and NGen conducted a desktop review of emerging digital technologies deemed most relevant to advanced manufacturing in Canada.

Table 6 outlines emerging digital technologies that leading industrial technology companies, including Eaton, Hitachi Solutions, IBM, Microsoft,

and SAP, have identified as key to driving digital transformation in advanced manufacturing. Lists of digital technologies driving advanced manufacturing, identified by these leading firms, are highly congruent with the seven digital technologies identified by ICTC and NGen for the study and for inclusion in the digital technology adoption manufacturing roadmaps.

Table 6. Digital Technologies Driving Advanced Manufacturing

Eaton	Hitachi Solutions	IBM	Microsoft	SAP
› Additive manufacturing › Augmented reality › Factory simulation › Robotics › Connected solutions	› Artificial Intelligence (AI) › Big Data & Analytics › Cloud Computing › Cybersecurity › Industrial Internet of Things › Simulations › Visualization	› AI and machine learning › Cloud computing › Cybersecurity › Edge computing › Digital twin › Internet of Things	› AI and machine learning › Big data and analytics › Cloud computing › Cybersecurity › Digital twins › Edge computing › Internet of Things	› Additive manufacturing/ 3D printing › Augmented reality › Autonomous robots › Big Data and AI analytics › Cloud computing › Cybersecurity › Horizontal and vertical integration › Industrial Internet of Things › Simulation/ digital twins

Source: Eaton, Hitachi Solutions, IBM, Microsoft, SAP.⁸

⁸ Eaton, "Industry 4.0: The factory of the future becomes the factory of today," accessed March 2, 2026, <https://www.eaton.com/us/en-us/digital/industry-4-0.html>; Hitachi Solutions, "Industry 4.0 & the Future of Manufacturing," accessed March 2, 2026, <https://global.hitachi-solutions.com/blog/industry-4-0-technologies-outcomes-and-the-future-of-manufacturing/>; IBM, "What is Industry 4.0?," accessed March 2, 2026, <https://www.ibm.com/think/topics/industry-4-0>; Microsoft, "What is Industry 4.0?," accessed March 2, 2026, <https://www.microsoft.com/en-us/industry/manufacturing/resources/industry-4-0-technologies>; SAP, "What is industry 4.0?," accessed March 2, 2026, <https://www.sap.com/canada/products/scm/industry-4-0/what-is-industry-4-0.html>.



Why Digital Technology Adoption Roadmaps are Needed in Canada's Manufacturing Sector

Key Takeaways



Like other sectors of the Canadian economy, manufacturing in Canada is suffering from lagging productivity, which is in decline relative to 2017.



Apart from the Canadian biomanufacturing industry, the other manufacturing industries covered in this study (i.e. automotive/parts manufacturing, aerospace manufacturing, fabricated metal products manufacturing, and food and beverage manufacturing) are facing slow or stagnant GDP growth since 2011.



ICTC's survey of Canadian manufacturers finds that 57% of manufacturing respondents were in the initial, least advanced stage of digital technology implementation.



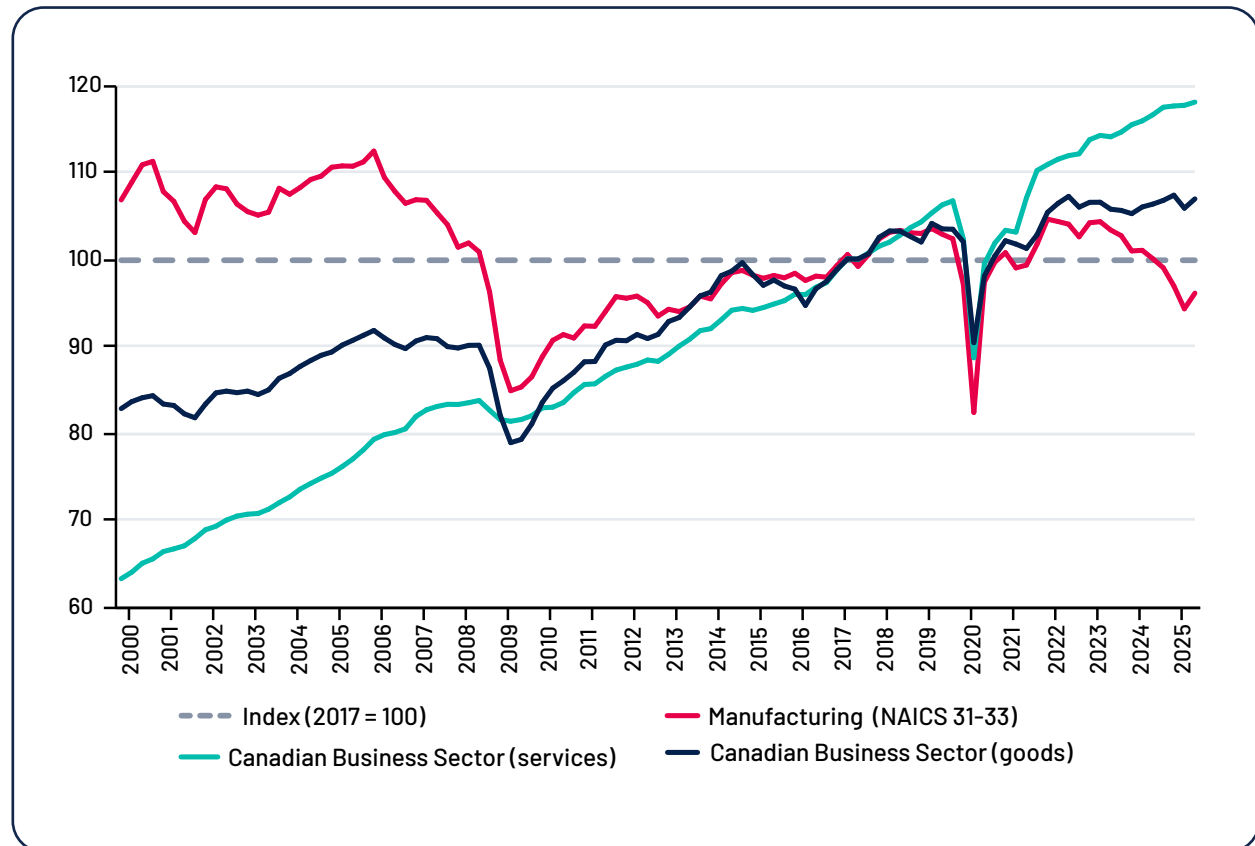
Significant numbers of Canadian manufacturers report no plans to adopt key digital technologies such as AI, digital twins, cloud computing, and IoT.

Economic and Technology Adoption Challenges the Canadian Manufacturing Sector Faces

Canada is facing ongoing productivity challenges across its economy.⁹ When compared with all goods- and services-producing sectors across the

Canadian economy, the manufacturing sector has been a relative laggard in productivity since 2020 (Figure 7).

Figure 7. Canadian Manufacturing Labour Productivity Index (2017 = 100)



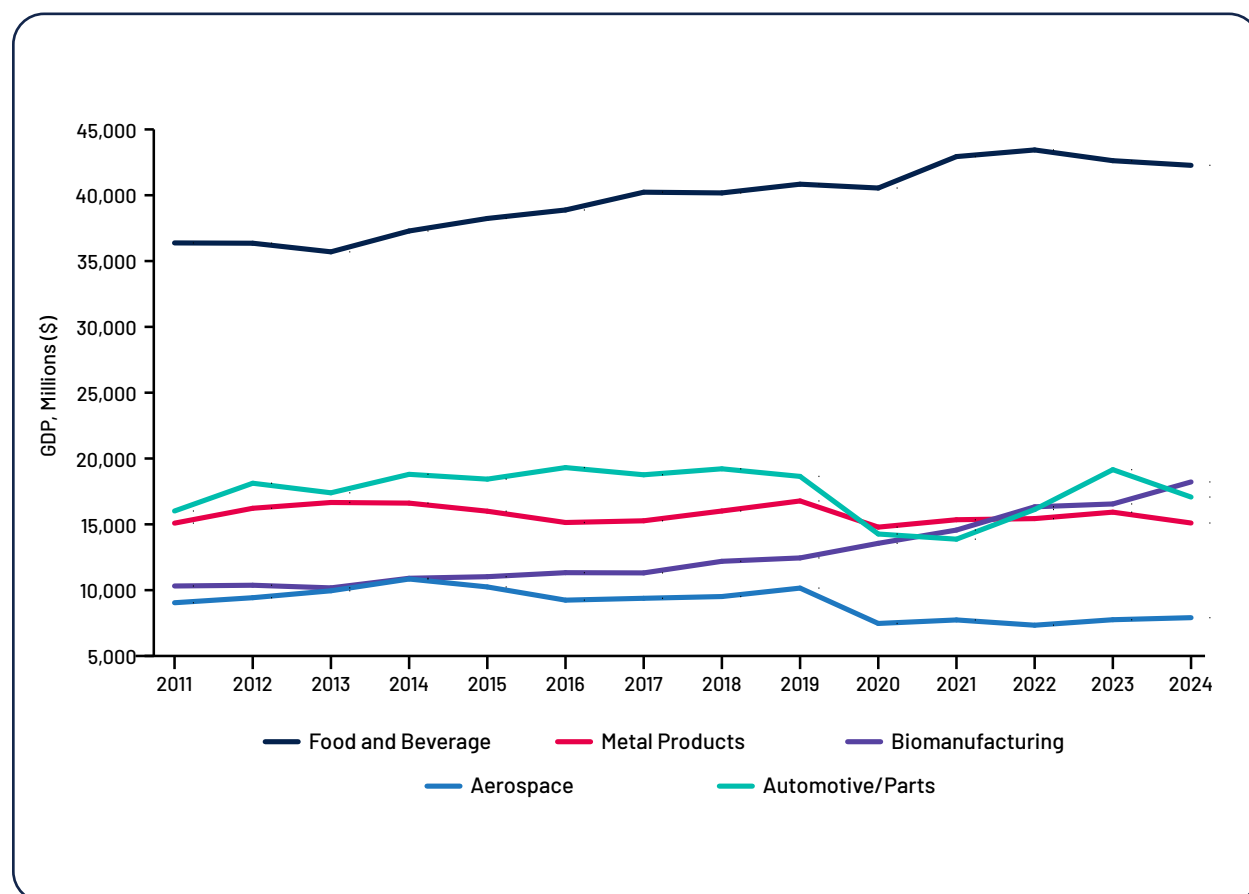
Source: Statistics Canada, Table: 36-10-0207-01.¹⁰ Note: Values are indexed to 2017 = 100.

⁹ See: Carolyn Rogers, "Time to break the glass: Fixing Canada's productivity problem," Bank of Canada, March 26, 2024, <https://www.bankofcanada.ca/2024/03/time-to-break-the-glass-fixing-canadas-productivity-problem/>.

¹⁰ Statistics Canada (Government of Canada), "Indexes of labour productivity and related measures, by business sector industry, seasonally adjusted," Table: 36-10-0207-01, last update April 13, 2026, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610020701>.



Figure 8. Canadian Automotive/Parts, Aerospace, Biomanufacturing, Metal Products, and Food and Beverage Manufacturing Industries GDP Value (2011-2024)



Source: Statistics Canada, Table: 36-10-0434-01.^{11,12}

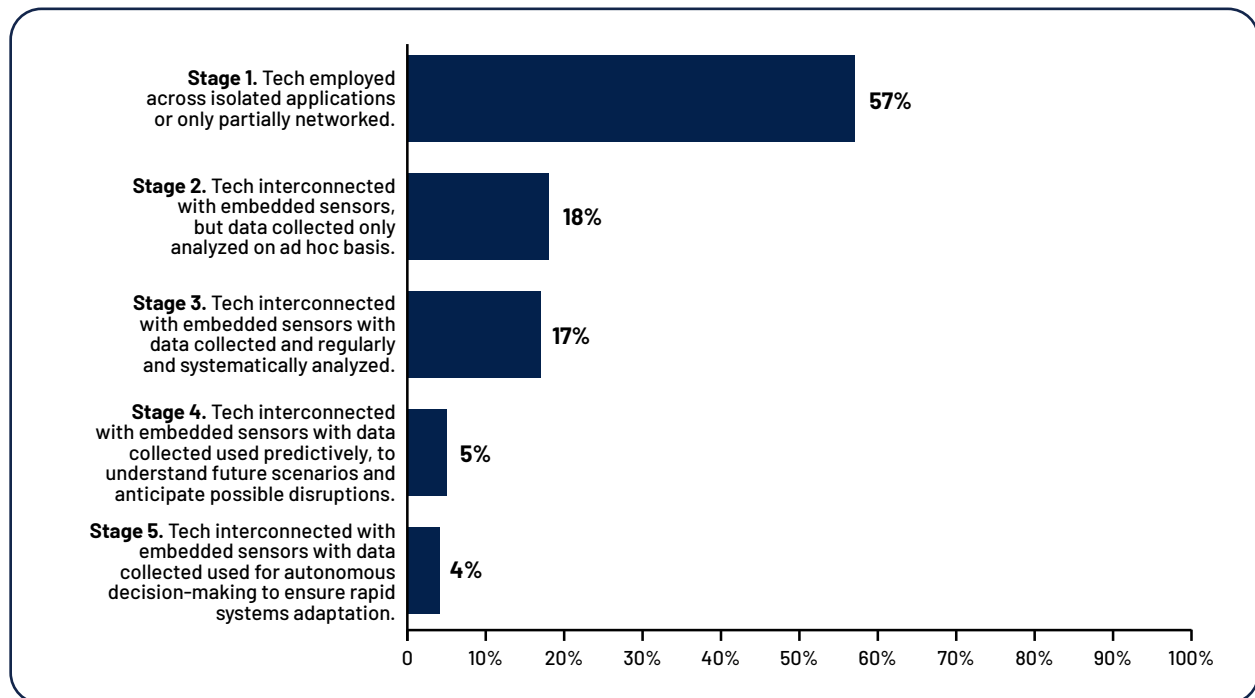
These productivity challenges across the Canadian manufacturing sector come at a time of economic stagnation for some individual manufacturing industries. According to data from Statistics Canada, since 2011, industries including automotive and fabricated metal products manufacturing have been stagnating, while aerospace manufacturing has suffered a decline and then a slow recovery, and food and beverage manufacturing has enjoyed a slow but steady increase over the years. Breaking this trend, biomanufacturing has seen strong growth over this time period.¹¹ Figure 8 outlines industry GDP value from 2011 to 2024 for the five manufacturing industries covered in this report.

When it comes to digital technology integration, across all five of the industries covered in this study, the majority of firms taking part in ICTC's Canadian manufacturing digital technology adoption survey for this study reported to be in initial stages, with 57% of firms employing technology in an isolated or partially networked manner (stage 1), 18% using interconnected embedded sensors but only analyzing data on ad hoc basis (stage 2), and 17% using interconnected and embedded sensors and regularly and systematically analyzing data (stage 3). Only 5% of firms reported using data collected from networked sensors for predictive analytics (stage 4) and 4% for supporting autonomous decision-making (stage 5), as shown in Figure 9.

¹¹ Statistics Canada (Government of Canada), "Gross domestic product (GDP) at basic prices, by industry, annual average, industry detail (x 1,000,000)," Table: 36-10-0434-06, release date January 26, 2026, <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610043406>.

¹² Ibid.

Figure 9. Canadian Manufacturing Digital Technology Implementation Stages



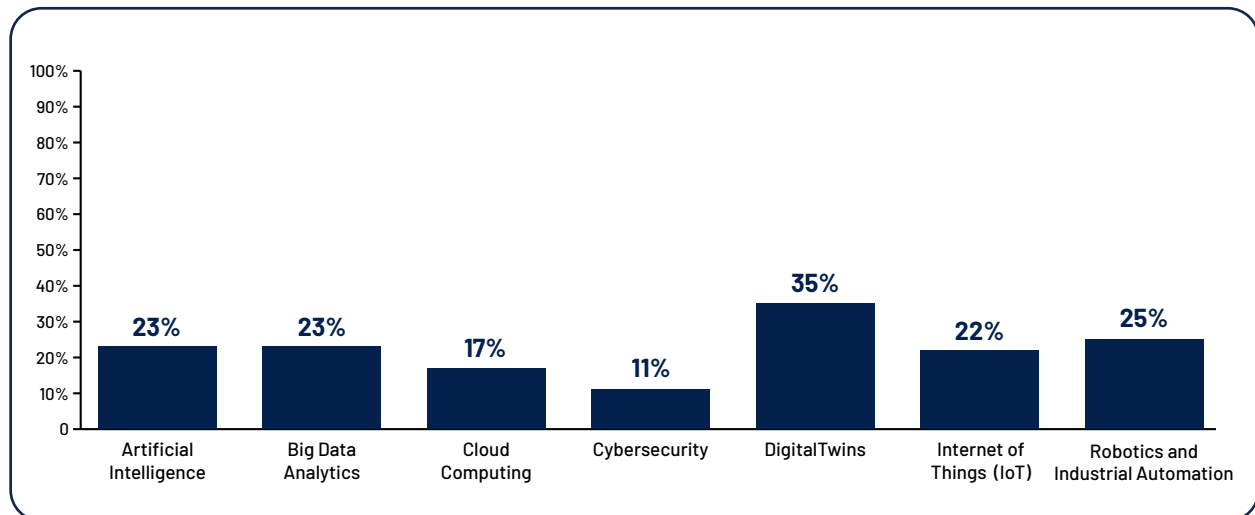
Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

The large numbers of Canadian manufacturers clustered in the more elementary stages of digital technology integration (stages 1 and 2), alongside the large portion of firms reporting no current plans to adopt key digital technologies, suggests that large numbers of Canadian manufacturers may lag in adopting digital technologies, and thus be unable to enjoy the full benefits of digital transformation of their manufacturing operations. This trend may

reduce global competitiveness for these industries over time as rival overseas firms accelerate their digital transformation.

Furthermore, significant numbers of Canadian manufacturers taking part in ICTC's survey reported having no current plans to adopt key digital technologies, such as AI (23%), cloud computing (17%), IoT (22%), and digital twins (35%)(Figure 10).

Figure 10. Key Digital Technologies Canadian Manufacturers Report Having No Current Plans to Adopt



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Digital Technology Drivers of Implementation and Usage in Canadian Manufacturing

Key Takeaways



ICTC's survey of Canadian manufacturers finds that major business drivers for digital technology adoption include a desire to improve profitability, meet customer expectations, and enhance product quality.



All seven of the key digital technologies identified by ICTC and NGen as crucial to advanced manufacturing are of significant interest to Canadian manufacturers, though manufacturing leaders do not view digital technology as a remedy for solving business problems.



All seven key digital technologies are being adopted to differing degrees across automotive/parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing.

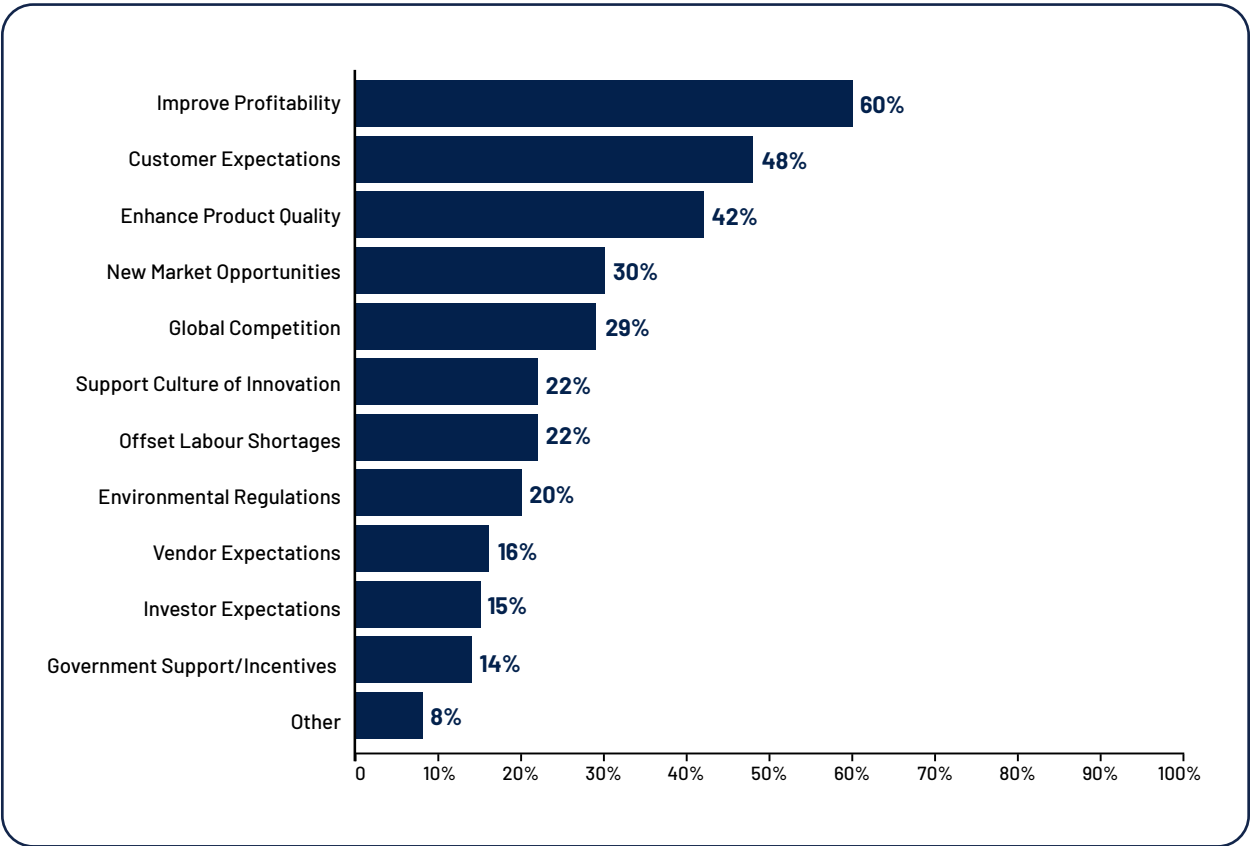


Business Drivers of Digital Technology Adoption

Across all five manufacturing industries covered in this study, manufacturers participating in ICTC’s survey noted that improving profitability (60%), meeting customer expectations (48%), and enhancing product quality (42%) were the most

important factors driving their adoption of digital technology. Other important factors, according to survey respondents, were finding new market opportunities (30%) and dealing with global competition (29%)(Figure 11).

Figure 11. Most Important Factors Driving Digital Technology Adoption for Canadian Manufacturers



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Canadian Manufacturers' Interest in Key Digital Technologies

Canadian manufacturers are turning to digital technologies to solve business challenges. Manufacturers participating in ICTC's survey reported high degrees of interest in the seven digital technologies covered in the study.

Across all five manufacturing industries covered in this study, most respondents rated technologies

such as AI, big data analytics, cloud computing, cybersecurity, digital twins, robotics and industrial automation, and sensors and IoT as moderately useful for addressing their current business challenges. Augmented and virtual reality (AR/VR), which has strong linkages with digital twins, was rated highly as the most useful digital technology (Figure 12).

Figure 12. Digital Technologies Perceived Usefulness in Solving Current Challenges – Combine Data from the Automotive/Parts, Aerospace, Biomanufacturing, Metal Products, and Food and Beverage Manufacturing Industries

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	11%	15%	37%	28%	9%	100%
Augmented & Virtual Reality (AR/VR)	29%	26%	26%	20%	0%	100%
Big Data and Analytics	10%	14%	33%	33%	11%	100%
Cloud Computing	8%	19%	31%	27%	16%	100%
Cybersecurity	7%	12%	27%	29%	24%	100%
Digital Twins	14%	17%	31%	31%	7%	100%
Robotics & Industrial Automation	11%	13%	32%	31%	13%	100%
Sensors & Internet of Things (IoT)	18%	12%	27%	30%	13%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Figure 13. Digital Technologies Perceived Usefulness in Solving Current Challenges – Automotive/ Parts Manufacturing

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	6%	23%	51%	14%	6%	100%
Augmented & Virtual Reality (AR/VR)	21%	21%	38%	21%	0%	100%
Big Data and Analytics	12%	9%	44%	26%	9%	100%
Cloud Computing	9%	14%	34%	29%	14%	100%
Cybersecurity	9%	11%	31%	23%	26%	100%
Digital Twins	12%	15%	47%	24%	3%	100%
Robotics & Industrial Automation	9%	9%	37%	29%	17%	100%
Sensors & Internet of Things (IoT)	21%	12%	35%	21%	12%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

This general trend was observed across the five industries, with the automotive and automotive parts manufacturing industry, where all digital technologies were rated by respondents as moderately useful. Though sensors and IoT, as well as AR/VR, were rated highly as the most useful technologies (Figure 13).

For aerospace manufacturing, digital technologies were rated lower-moderate by respondents, though cloud computing, robotics and industrial automation, and sensors and IoT were still rated as moderate. Few of the aerospace manufacturing respondents rated any of the digital technologies as most useful (Figure 14).

Figure 14. Digital Technologies Perceived Usefulness in Solving Current Challenges – Aerospace Manufacturing

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	0%	8%	33%	42%	17%	100%
Augmented & Virtual Reality (AR/VR)	8%	25%	17%	50%	0%	100%
Big Data and Analytics	9%	9%	27%	55%	0%	100%
Cloud Computing	0%	8%	50%	17%	25%	100%
Cybersecurity	0%	0%	33%	42%	25%	100%
Digital Twins	10%	20%	30%	40%	0%	100%
Robotics & Industrial Automation	0%	9%	45%	18%	27%	100%
Sensors & Internet of Things (IoT)	8%	17%	42%	33%	0%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Likewise, biomanufacturing respondents rated most digital technologies as low-moderate in usefulness, with the exception of AR/VR, which was rated most useful by 21% of respondents and high-moderate by 46% of respondents (Figure 15).

In both food and beverage manufacturing and fabricated metal products manufacturing, most

digital technologies were rated by respondents as moderately useful or low-moderate. Though for food and beverage manufacturing respondents, 58% rated AR/VR technology as most useful. For metal product manufacturers, 30% rated AR/VR technology as most useful, and 32% rated sensors and IoT technology as most useful (Figures 16 and 17).

Figure 15. Digital Technologies Perceived Usefulness in Solving Current Challenges – Biomanufacturing

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	8%	15%	19%	46%	12%	100%
Augmented & Virtual Reality (AR/VR)	21%	46%	17%	17%	0%	100%
Big Data and Analytics	0%	19%	23%	46%	12%	100%
Cloud Computing	4%	15%	19%	46%	15%	100%
Cybersecurity	4%	19%	11%	41%	26%	100%
Digital Twins	10%	10%	29%	33%	19%	100%
Robotics & Industrial Automation	8%	24%	24%	36%	8%	100%
Sensors & Internet of Things (IoT)	12%	15%	27%	35%	12%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 16. Digital Technologies Perceived Usefulness in Solving Current Challenges – Food and Beverage Manufacturing

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	24%	12%	28%	24%	12%	100%
Augmented & Virtual Reality (AR/VR)	58%	21%	17%	4%	0%	100%
Big Data and Analytics	17%	13%	33%	29%	8%	100%
Cloud Computing	12%	27%	35%	12%	15%	100%
Cybersecurity	7%	22%	26%	30%	15%	100%
Digital Twins	19%	19%	19%	43%	0%	100%
Robotics & Industrial Automation	16%	12%	36%	28%	8%	100%
Sensors & Internet of Things (IoT)	12%	15%	15%	38%	19%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 17. Digital Technologies Perceived Usefulness in Solving Current Challenges – Fabricated Metal Products Manufacturing

Digital Tech	Most Useful: 5	4	3	2	Least Useful: 1	Total
Artificial Intelligence (AI)	14%	11%	46%	25%	4%	100%
Augmented & Virtual Reality (AR/VR)	30%	19%	30%	22%	0%	100%
Big Data and Analytics	11%	18%	29%	21%	21%	100%
Cloud Computing	10%	24%	28%	24%	14%	100%
Cybersecurity	11%	4%	36%	21%	29%	100%
Digital Twins	17%	25%	21%	25%	13%	100%
Robotics & Industrial Automation	18%	11%	25%	36%	11%	100%
Sensors & Internet of Things (IoT)	32%	4%	20%	28%	16%	100%

Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Surveyed usefulness ratings of key digital technologies by Canadian manufacturers suggest that while there is a high degree of interest in digital technologies and their use in helping to solve business challenges, digital technology is not viewed as an ultimate solution in manufacturing. The vast majority of digital technologies covered in ICTC's survey were rated as moderately useful or less than moderately useful by respondents.

This muted response from manufacturers suggests that while business leaders in Canadian manufacturing see promise in digital technology, they are also aware of the challenges, barriers, and risks involved in adopting new technologies and undergoing digital transformations of their businesses. The responses may also highlight the hurdles Canadian manufacturers often face in effectively adopting novel digital technologies and integrating them into their manufacturing enterprises.

Digital Technology Usage in Canadian Manufacturing

Canadian manufacturers participating in ICTC's survey reported using all seven key digital technologies covered in the study, though adoption rates across the five manufacturing industries (i.e., automotive/parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing) reported different rates of adoption and planned future investments.

The variation in rates of digital technology usage and future planned investments reflects the different priorities and use cases each of the five industries has for digital technology adoption.

Artificial Intelligence

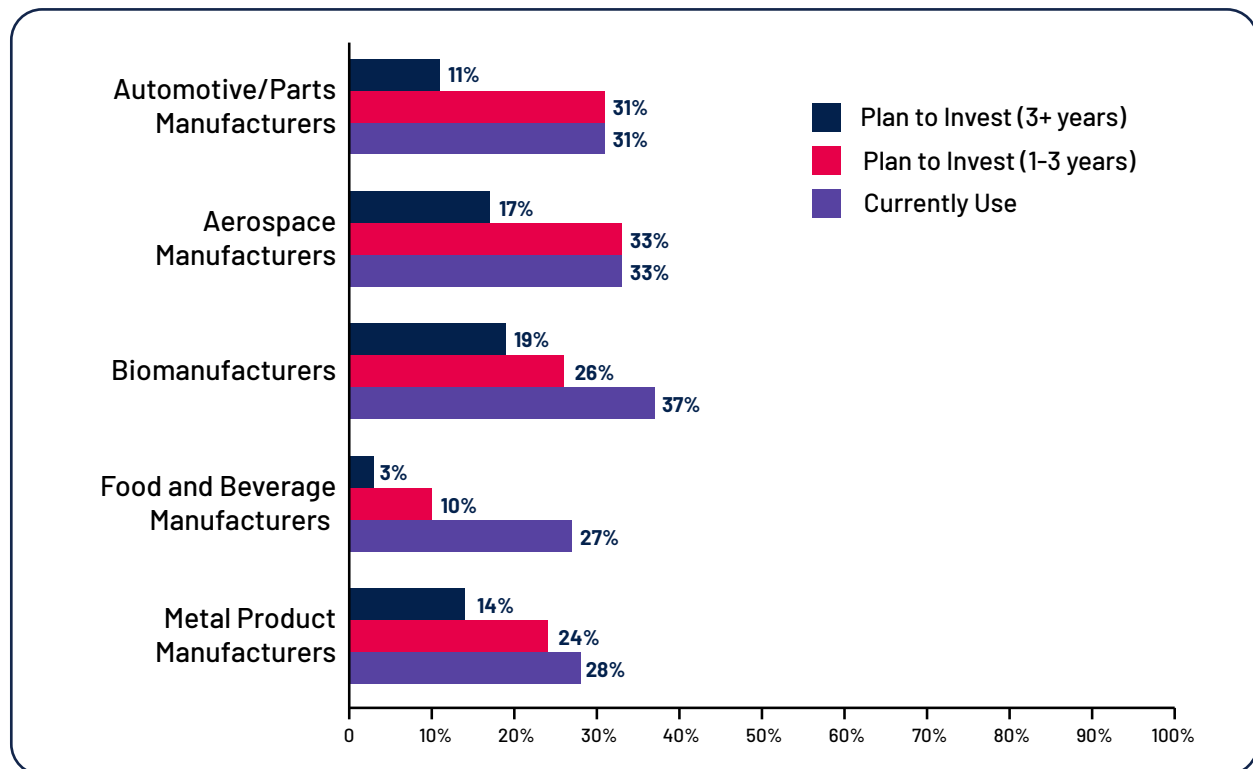
For the automotive/parts manufacturing industry, 31% of respondents reported currently using AI, while 31% planned to invest in AI in the next one to three years, and 11% planned to invest in AI in three or more years. For aerospace manufacturers, 33% of

respondents reported using AI, while 33% planned to invest in AI in the next one to three years and 17% planned to invest in AI in three or more years.

Biomanufacturers had the highest AI adoption rates among the five industries, with 37% of respondents reporting current use of AI. Among biomanufacturing respondents, 26% plan to invest in AI in the next one to three years, and 19% in three or more years.

Food and beverage manufacturers and metal products manufacturers had the lowest rates of AI adoption, with just 27% of food and beverage respondents and 28% of metal products respondents reporting to currently use AI, and just 10% of food and beverage respondents and 14% of metal products respondents planning to adopt AI in the next one to three years. Three percent of food and beverage respondents and 14% of metal products respondents plan to adopt AI in three or more years (Figure 18).

Figure 18. AI Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Big Data Analytics

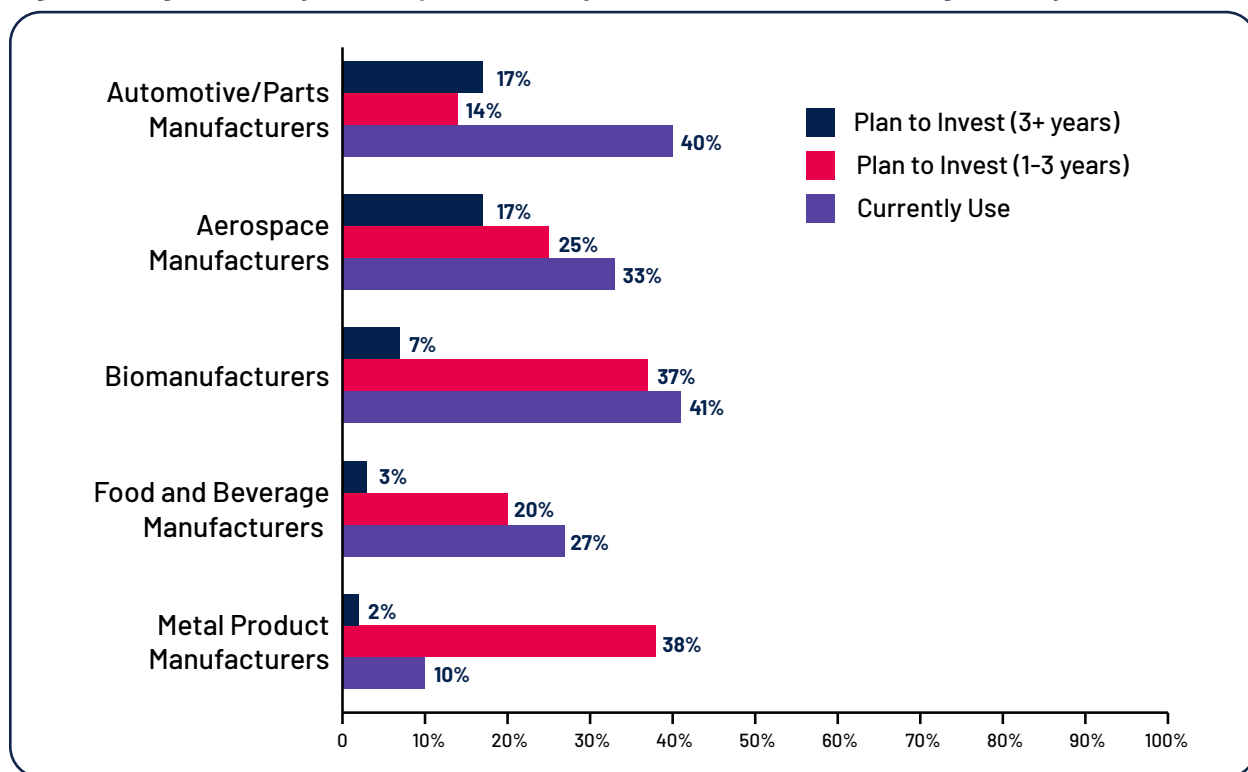
For the automotive/parts manufacturing industry, 40% of respondents reported to be currently using big data analytics, while 17% planned to invest in big data analytics in the next one to three years, and 17% planned to invest in big data analytics in three or more years. For Aerospace manufacturers, 33% of respondents reported using big data analytics, while 25% planned to invest in AI in the next one to three years and 17% planned to invest in big data analytics in three or more years.

Like AI, biomanufacturers had the strongest rates of big data analytics adoption out of the five industries, with 41% of respondents reporting to currently use big data analytics, while 37% of

biomanufacturing respondents plan to invest in big data analytics in the next one to three years and 17% in three or more years.

Food and beverage manufacturers and metal products manufacturers had the lowest rates of big data analytics adoption, with just 27% of food and beverage respondents and 10% of metal products respondents reporting to currently use big data analytics, and 20% of food and beverage respondents and 38% of metal products respondents planning to adopt big data analytics in the next one to three years. Three percent of food and beverage respondents and 2% of metal products respondents plan to adopt big data analytics in three or more years (Figure 19).

Figure 19. Big Data Analytics Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Cybersecurity

Of all the key digital technologies covered in this study, cybersecurity was the most widely adopted across all five manufacturing industries.

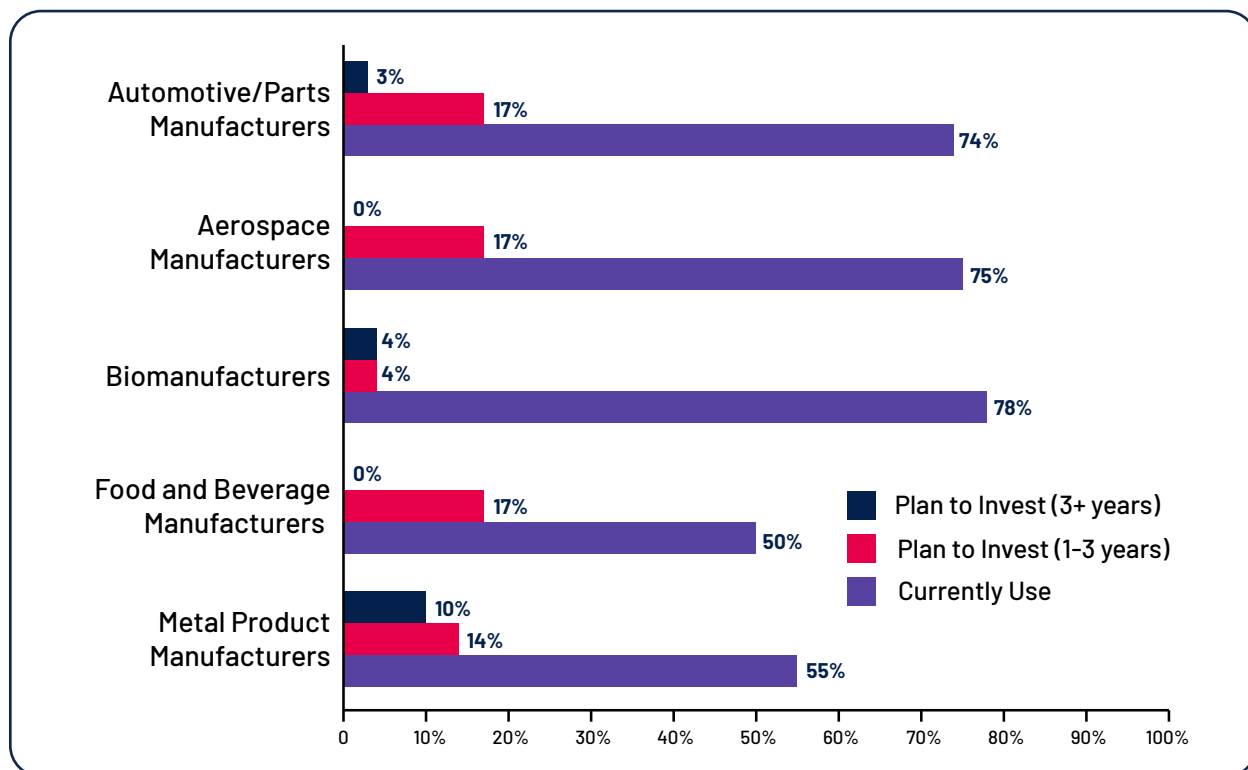
In the automotive/parts manufacturing industry, 74% of respondents reported having a cybersecurity program, while 17% planned to invest in cybersecurity in the next one to three years, and 3% planned to invest in cybersecurity in three or more years. For aerospace manufacturers, 75% of respondents reported having a cybersecurity program, while 17% planned to invest in cybersecurity in the next one to three years; no aerospace manufacturing firm reported planning to invest in cybersecurity in three or more years.

Biomanufacturers had the highest cybersecurity

adoption rates among the five industries, with 78% of respondents reporting a current cybersecurity program. 4% of biomanufacturing respondents plan to invest in cybersecurity in the next one to three years, and 4% in three or more years.

Food and beverage manufacturers and metal products manufacturers had the lowest rates of cybersecurity adoption, with 50% of food and beverage respondents and 55% of metal products respondents reporting to currently have a cybersecurity program, and 17% of food and beverage respondents and 14% of metal products respondents planning to invest in cybersecurity in the next one to three years. No food and beverage respondents, but 10% of metal products respondents plan to invest in cybersecurity in three or more years (Figure 20).

Figure 20. Cybersecurity Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Cloud Computing

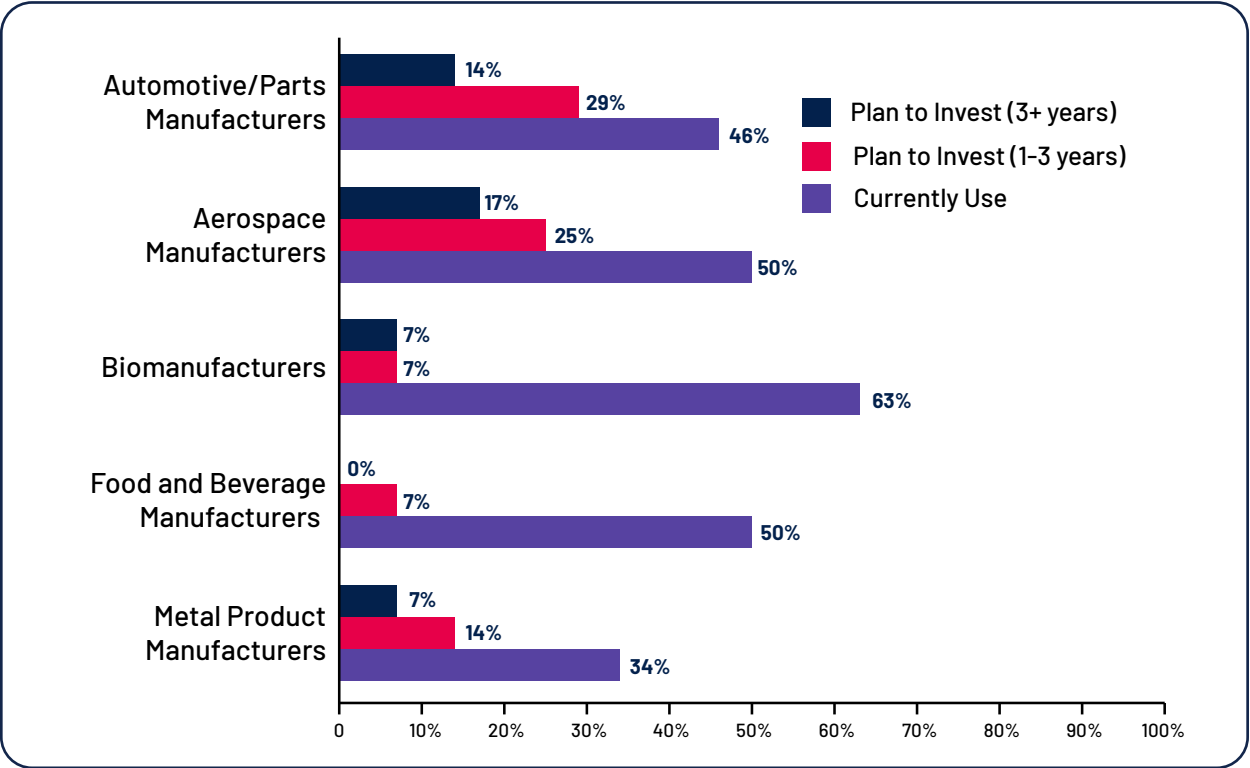
In the automotive/parts manufacturing industry, 46% of respondents reported currently using cloud computing infrastructure, while 29% planned to invest in cloud computing in the next one to three years, and 14% planned to invest in cloud computing in three or more years. For aerospace manufacturers, 50% of respondents reported using cloud computing infrastructure, while 25% planned to invest in cloud computing in the next one to three years and 17% planned to invest in big data analytics in three or more years.

Biomanufacturers had the highest cloud computing adoption rates among the five industries, with 63% of respondents reporting current use of cloud

computing infrastructure. Among biomanufacturing respondents, 7% plan to invest in cloud computing in the next one to three years, and a further 7% in three or more years.

Fifty percent of food and beverage manufacturing respondents and 34% of metal products manufacturing respondents reported currently using cloud computing infrastructure, while 7% of food and beverage respondents and 14% of metal products respondents plan to invest in cloud computing in the next one to three years. Seven percent of respondents in the metal products industry reported planning to invest in cloud computing within the next three years. No food and beverage respondents reported planning to invest in cloud computing in three or more years (Figure 21).

Figure 21. Cloud Computing Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Digital Twins

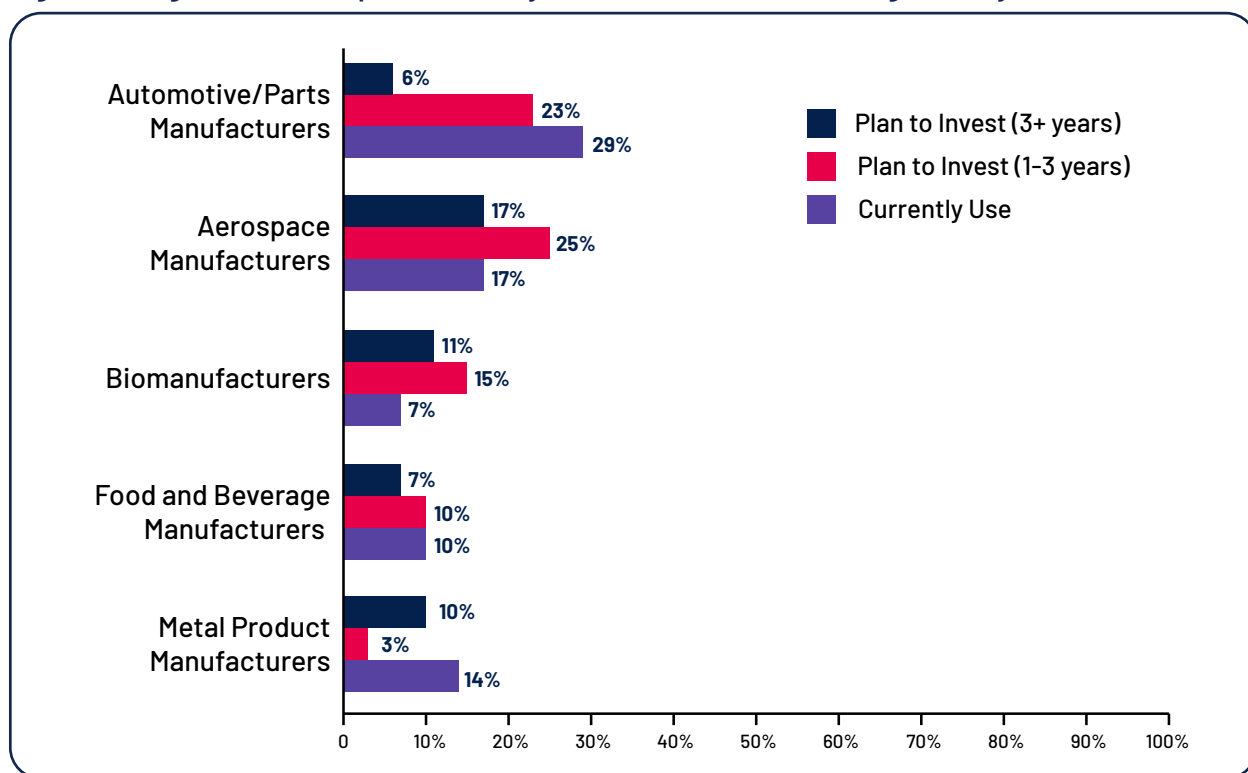
In the automotive/parts manufacturing industry, 29% of respondents reported currently using digital twins, 23% planned to invest in digital twins in the next one to three years, and 6% planned to invest in digital twins in three or more years. For aerospace manufacturers, 17% of respondents reported using big data analytics, but 25% planned to invest in digital twins in the next one to three years and 17% in three or more years.

Biomanufacturers responding to the survey reported having less enthusiasm for digital twins, when compared to the other digital technologies covered in this study, with just 7% of respondents

reporting to currently use digital twins, while 15% of biomanufacturing respondents plan to invest in digital twins in the next one to three years and 11% in three or more years.

Ten percent of food and beverage manufacturing respondents and 14% of metal products manufacturing respondents reported currently using digital twins, while 7% of food and beverage respondents and 3% of metal products respondents plan to invest in digital twins in the next one to three years. Seven percent of food and beverage respondents and 10% of metal products respondents plan to adopt digital twins in three or more years (Figure 22).

Figure 22. Digital Twins Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Sensors and Internet of Things (IoT)

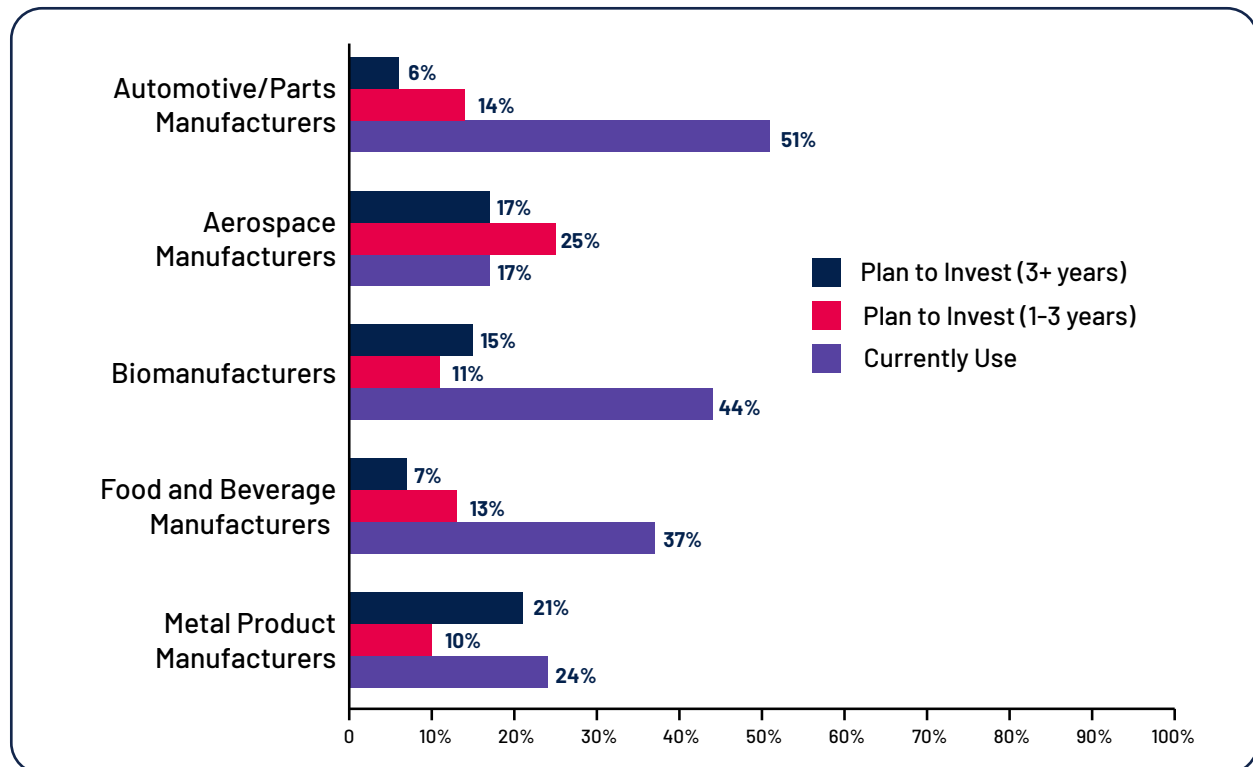
For the automotive/parts manufacturing industry, 51% of respondents reported currently using sensors and IoT technology, while 14% planned to invest in sensors and IoT in the next one to three years, and 6% planned to invest in three or more years. For aerospace manufacturers, 17% of respondents reported using sensors and IoT technology, while 25% planned to invest in sensors and IoT in the next one to three years and 17% planned to invest in AI in three or more years.

Forty-four percent of biomanufacturing respondents currently use sensors and IoT

technology, while 11% plan to invest in sensors and IoT in the next one to three years, and 15% in three or more years.

Thirty-seven percent of food and beverage manufacturing respondents and 24% of metal products manufacturing respondents reported currently using sensors and IoT, while 13% of food and beverage respondents and 10% of metal products respondents plan to invest in sensors and IoT technology in the next one to three years. Seven percent of food and beverage respondents and 21% of metal products respondents plan to adopt sensors and IoT in three or more years (Figure 23).

Figure 23. Sensors and IoT Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

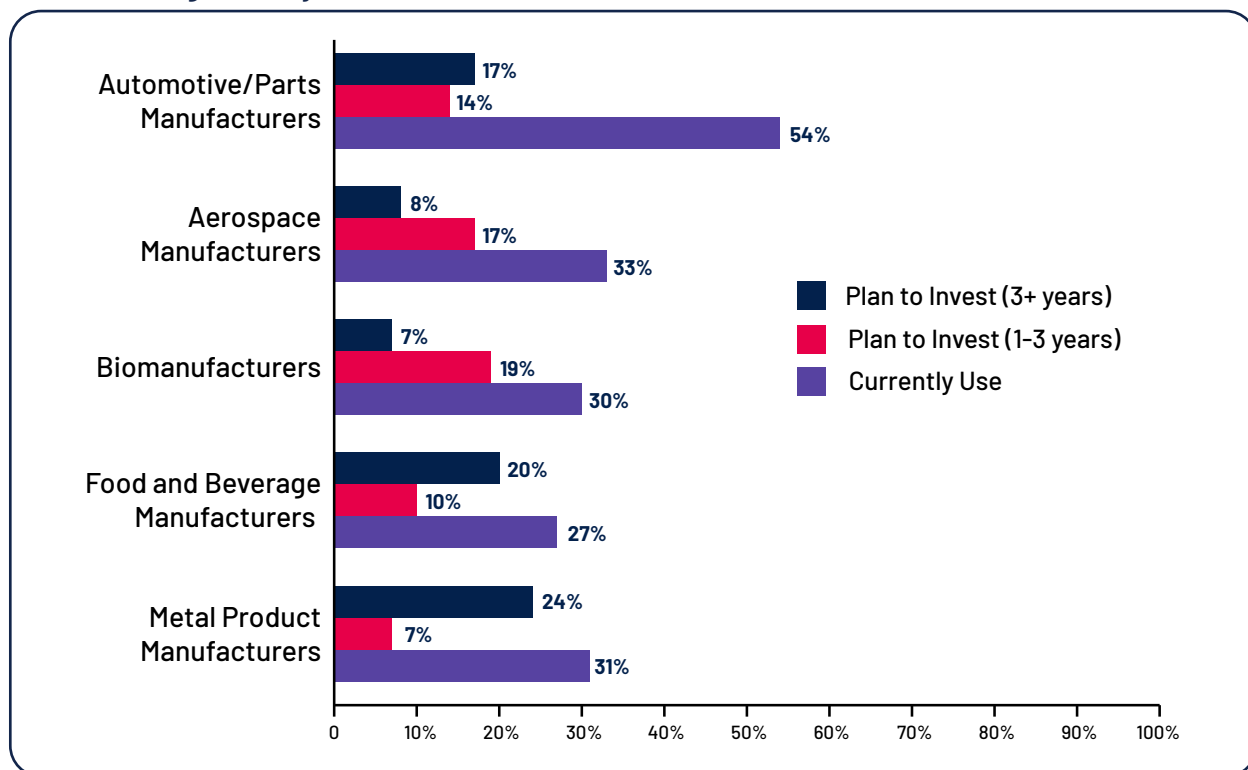
Robotics and Industrial Automation

The use of robotics was very common in the automotive and automotive parts manufacturing industry, with 54% of automotive/parts manufacturing respondents reporting to currently use robotics and industrial automation, while 14% were planning to invest in robotics and industrial automation in the next one to three years, and 17% planned to invest in three or more years. For aerospace manufacturers, 33% of respondents reported using robotics and industrial automation, while 17% plan to invest in robotics and industrial automation in the next one to three years and 8% plan to invest in AI in three or more years.

Nineteen percent of biomanufacturing respondents currently use robotics and industrial automation, while 19% plan to invest in robotics and industrial automation in the next one to three years, and 7% plan to invest in three or more years.

For food and beverage manufacturers, 27% of respondents currently use robotics and industrial automation, while 10% plan to invest in robotics and industrial automation in the next one to three years, and 20% plan to invest in three or more years. Likewise, 31% of respondents in metal products manufacturing reported currently using robotics and industrial automation, while 7% plan to invest in robotics and industrial automation in the next one to three years, and 24% in three or more years (Figure 24).

Figure 24. Robotics and Industrial Automation Adoption Rates by the Canadian Manufacturing Industry



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.



Challenges, Barriers, and Workforce Considerations for Digital Technology Adoption in Canadian Manufacturing

Key Takeaways



ICTC's survey of Canadian manufacturers finds that only 23% of digital technology implementations over the past five years have been fully successful.



The main obstacles Canadian manufacturers face when adopting new digital technologies include high purchase costs, market uncertainty, and uncertain economic return.



Canadian manufacturers allocate a low percentage of their workforce towards digital transformation initiatives.



Workforce development and training initiatives, change management strategies, and embracing a learning culture can help Canadian manufacturers overcome digital transformation challenges and barriers.



Challenges and Barriers

Adopting and integrating new digital technologies into a business is not always a straightforward endeavour. Indeed, across all five manufacturing industries covered in this study, manufacturers participating in ICTC's survey reported that, over the past five years, only 23% of their digital technology implementation initiatives were fully successful, while 47% were partially successful.

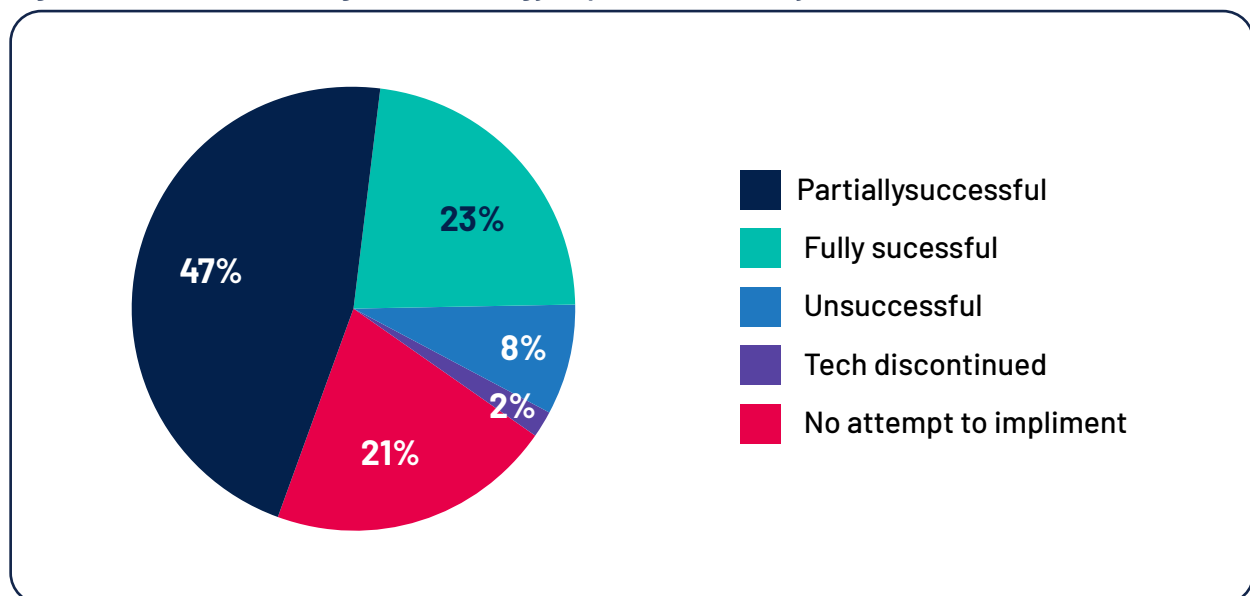
Eight percent of respondents had been unsuccessful in adopting digital technology, and 2% had experienced a vendor discontinuing the technology they had adopted. But perhaps most troubling, 21% of respondents reported to not have attempted to implement new digital technologies in the past five years.

These mixed results experienced by Canadian manufacturers in digital technology adoption point to the barriers, challenges, and risks inherent in adopting digital technology (Figure 25).

On the question of common obstacles that prevent Canadian manufacturers from investing in more digital technologies, manufacturers participating in ICTC's survey reported that high purchase costs of new digital technology (47%), ongoing market uncertainty (35%), and uncertain economic return (32%) were the most common concerns.

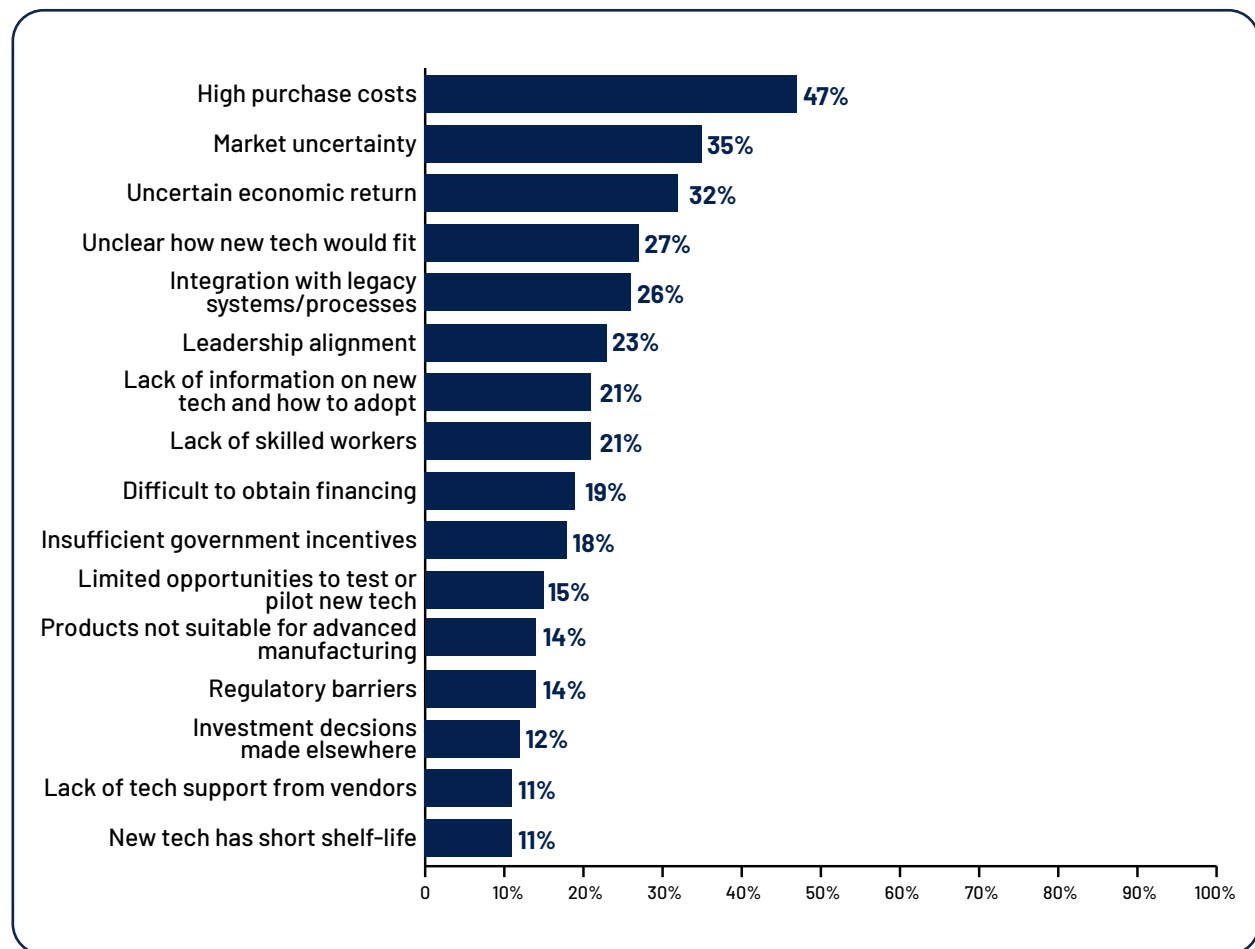
Other important concerns regarding digital technology integration include being unclear how new technology would fit into existing manufacturing operations (27%), difficulty integrating new digital technology with legacy systems and processes (26%), and a lack of information about newly available technology and how to integrate it into operations (21%). Concerns about leadership alignment and support for adopting new technologies (23%) and a lack of skilled workers (21%) were also common among respondents, as shown in Figure 26.

Figure 25. Outcomes of Digital Technology Implementations by Canadian Manufacturers



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 26. Main Obstacles to Adopting Digital Technologies in Canadian Manufacturing (2025)



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

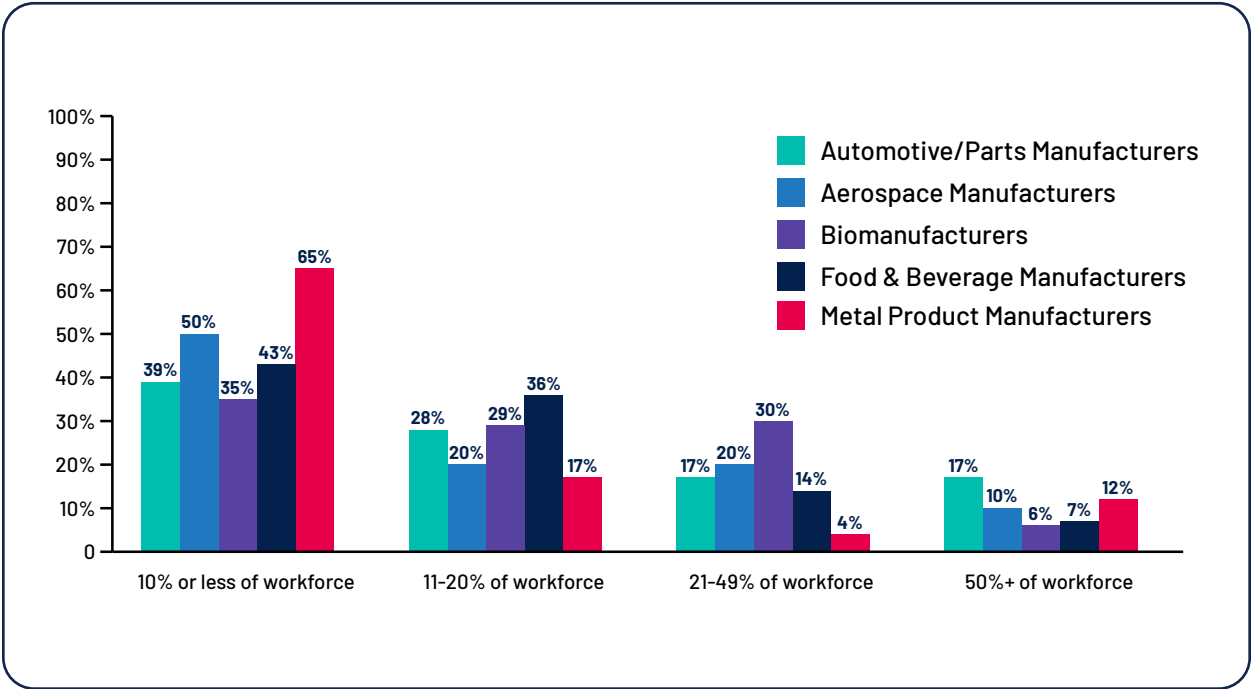
Workforce Development Considerations

Amongst Canadian manufacturers engaged for this study, developing and retaining a digital-ready manufacturing workforce was a crucial concern. Skilled workers are required to both implement and operate new digital technologies adopted by manufacturing firms, yet building a digitally skilled workforce can be challenging.

The majority of manufacturers participating in ICTC's survey had 10% or less of their workforce dedicated to digital transformation projects. This pattern held for the automotive and automotive parts manufacturing, aerospace manufacturing, biomanufacturing, food and beverage manufacturing, and fabricated metal products manufacturing industries (Figure 27).

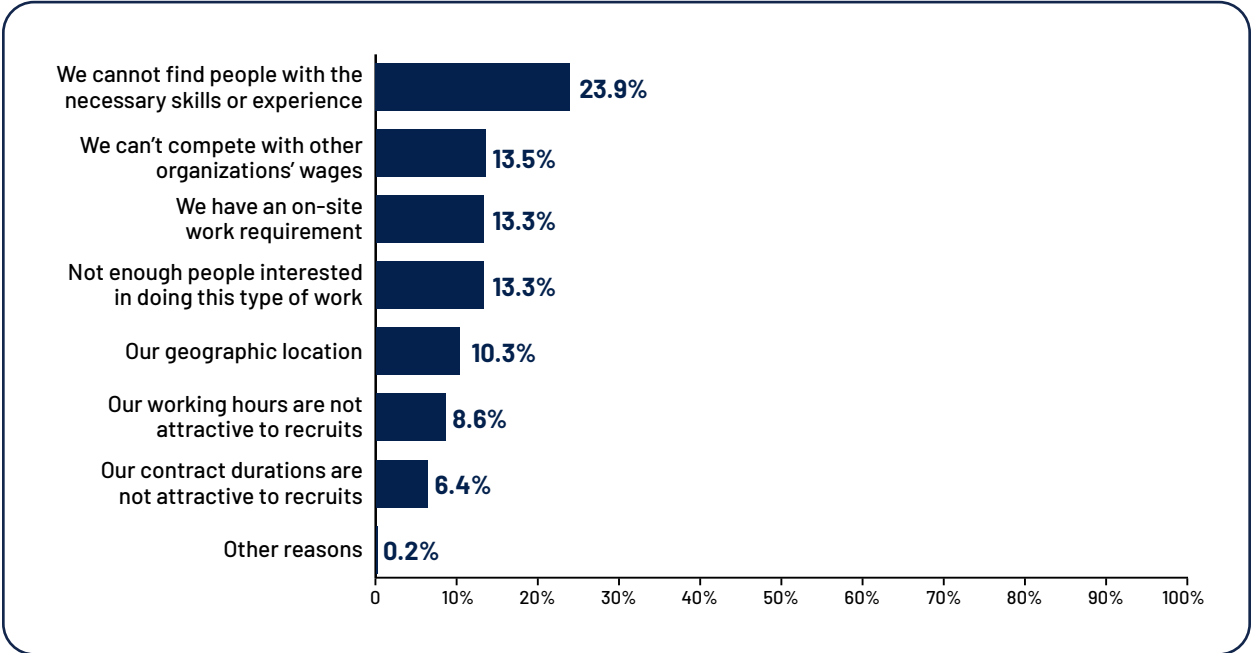
Recruiting technology employees can be challenging in Canada's contemporary labour market. According to a 2024 ICTC survey of Canadian employers on technology employee recruitment, the top challenge for recruiting was an inability to find candidates with the necessary skills and experience (24%), as well as being unable to meet candidate compensation expectations (14%), having on-site work (as opposed to remote work) requirements (13%), and finding candidates interested in the roles and type of work being offered (13%). These recruiting challenges cut across the Canadian labour market, including in the manufacturing sector (Figure 28).

Figure 27. Canadian Manufacturing Workforce Dedicated to Digital Transformation (2025)



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 28. Canadian Employers' Challenges in Recruiting Technology Employees in Past 12 Months

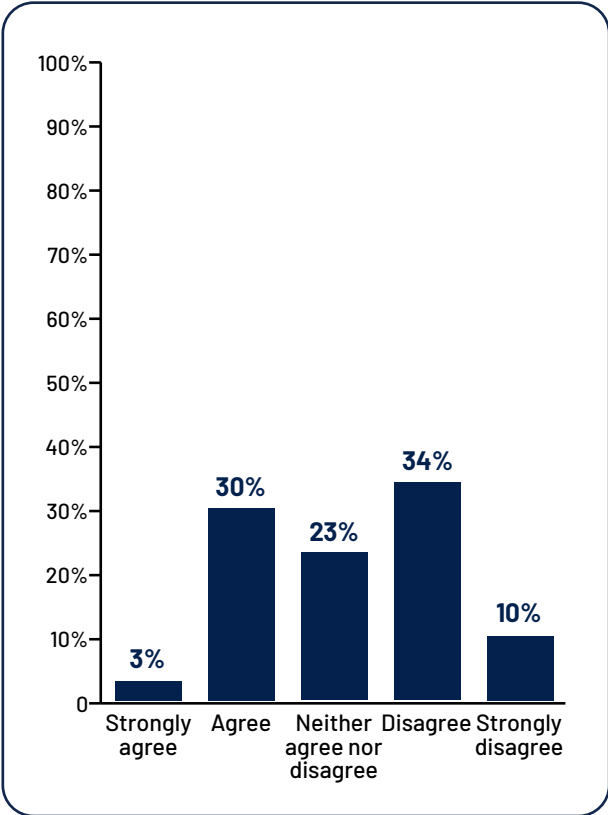


Source: ICTC's 2024 Digital Economy Employer Survey.

From the perspective of workforce development and training, only one-third (33%) of manufacturers participating in ICTC’s survey reported (i.e., agree/strongly agree) having a staff training plan for adopting and implementing new digital technologies (Figure 29). However, two-thirds of manufacturing respondents (66%) felt confident

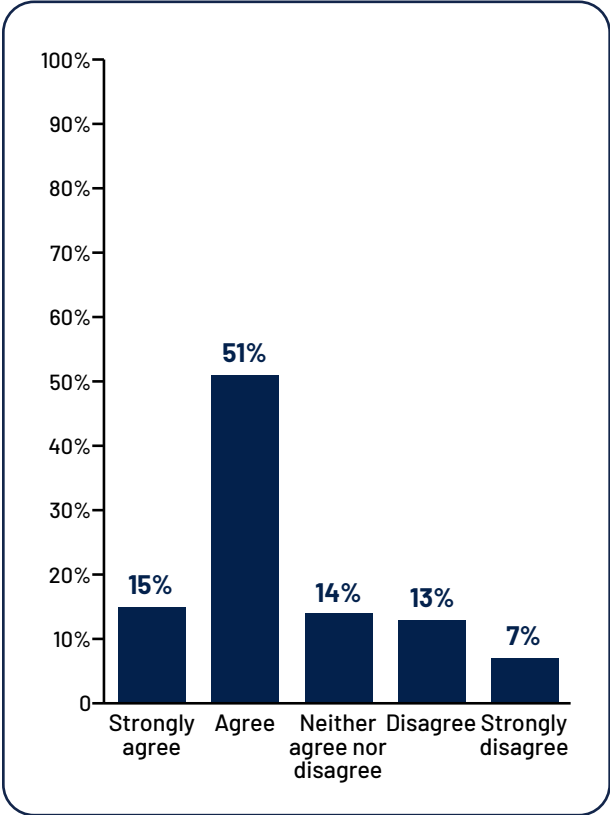
(i.e., agree/strongly agree) they had the staff with the necessary skills required for adopting and implementing new digital technology (Figure 30). It will be important for Canadian manufacturers to continue attracting, fostering, and retaining digitally skilled manufacturing talent as new digital technologies become common in manufacturing.

Figure 29. Agree/Disagree: My organization has a staff training plan required to implement and adopt new digital technologies



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 30. Agree/Disagree: My organization has staff with the digital technology skills required to implement and adopt new technologies



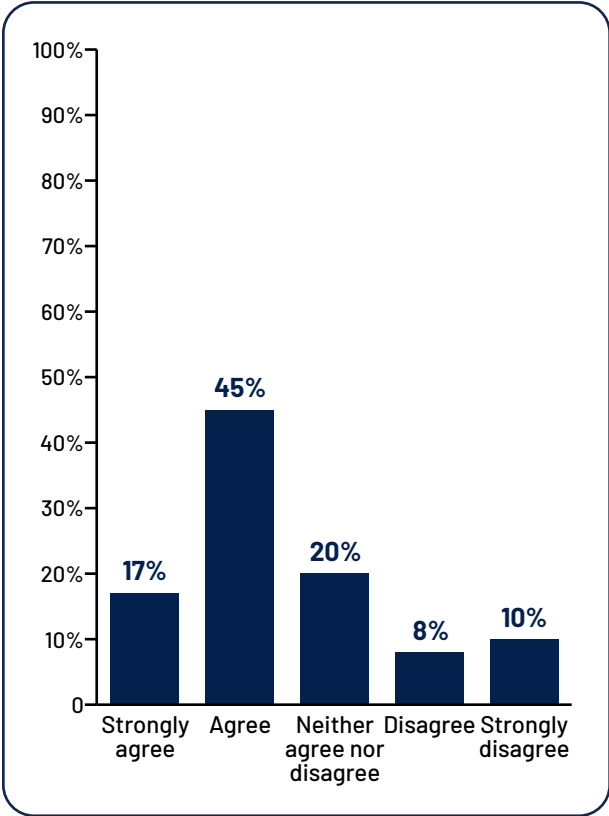
Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Considerations for Leadership, Organizational Culture, and Change Management

Manufacturers participating in ICTC’s survey reported keen interest in adopting novel digital technologies and a willingness to learn, but formalized change management planning is not widely adopted at Canadian manufacturing firms. Sixty-two percent of manufacturing respondents

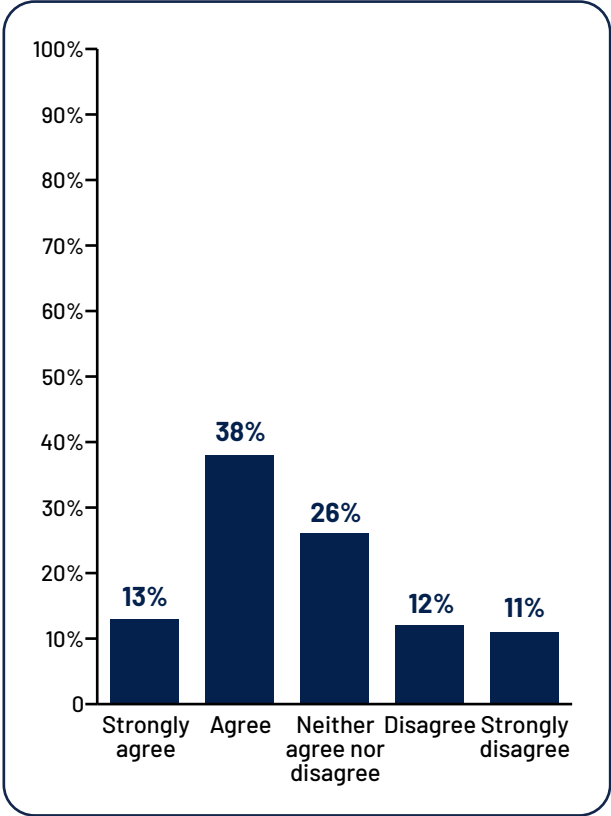
reported that their organizations were keen to (i.e., agree/strongly agree) adopt and learn new digital technologies (Figure 31), but only 51% of respondents held (i.e., agree/strongly agree) that executive leadership champions digital technology adoption at their firms (Figure 32).

Figure 31. Agree/Disagree: My organization is keen to adopt, learn, and embrace new digital technologies



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 32. Agree/Disagree: Executives lead and champion digital technology adoption initiatives at my organization



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

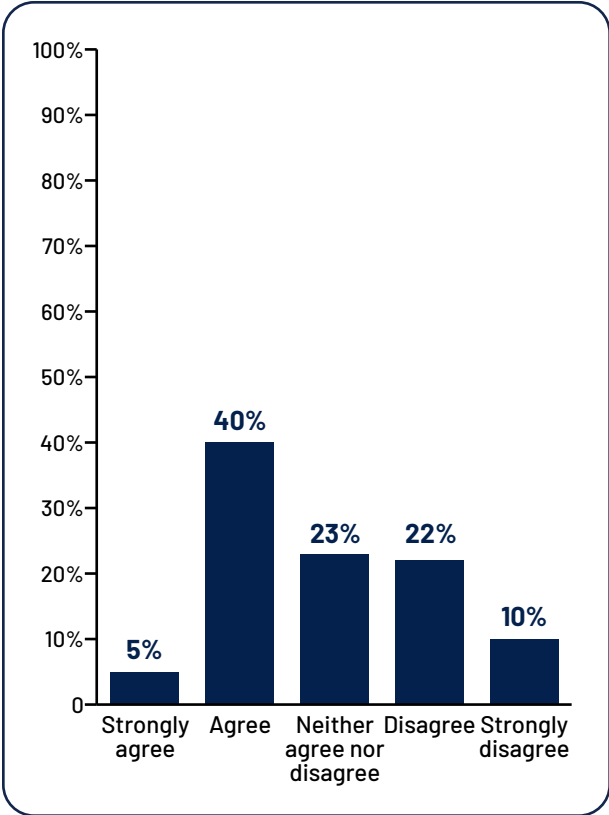
Only 45% of respondent manufacturing firms reported (i.e., agree/strongly agree) having a comprehensive change management strategy to support digital technology adoption (Figure 33), and only 46% of respondent manufacturing firms enjoyed (i.e., agree/strongly agree) a strong culture of change that aligned digital strategy with actions and structures across the manufacturing enterprise (Figure 34).

These survey data trends suggest that many Canadian manufacturers could benefit from formalized change-management and digital-transformation leadership practices to help them

overcome challenges and barriers to adopting novel digital technologies in their manufacturing operations. A focus on organizational change and leadership as they apply to digital transformation could only help increase the success rates of Canadian manufacturers’ digital technology implementations.

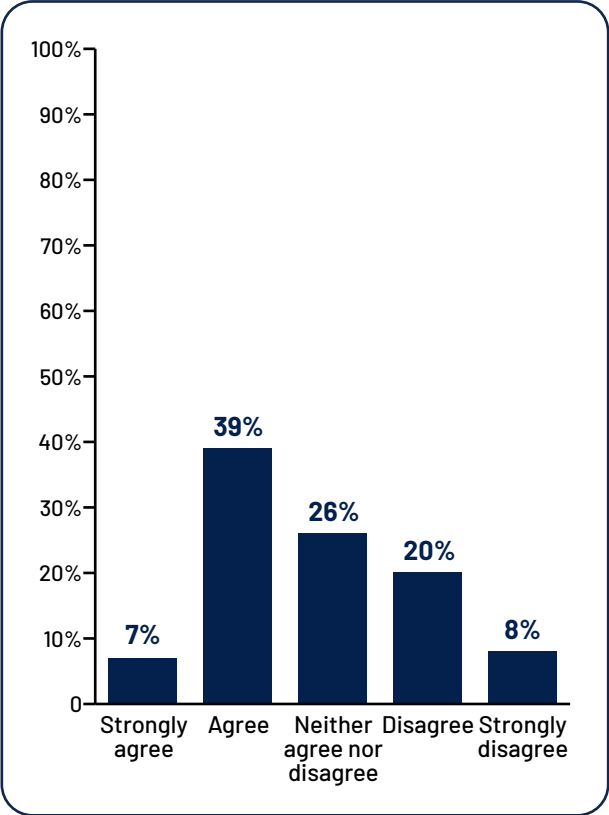
Likewise, aligning workforce development initiatives with recruiting and allocating more specialist technology workers for digital adoption initiatives will help Canadian manufacturing firms get the most out of digital transformation.

Figure 33. Agree/Disagree: My organization has a comprehensive strategy for digital technology adoption



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Figure 34. Agree/Disagree: There is a strong culture of change aligning digital strategy, actions, and structure across the organization



Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Conclusion

This study, including this summary report and the series of technology adoption roadmaps for Canada's manufacturing industries, underscores both the urgency and the opportunity for digital transformation in Canada's manufacturing sector. While emerging technologies such as AI, cloud computing, IoT, robotics and industrial automation offer clear pathways to improved productivity, innovation, and global competitiveness, their adoption across Canadian manufacturing remains uneven and too often limited in scope. A significant proportion of firms, particularly small- and medium-sized enterprises, continue to operate at early stages of digital maturity, with many either hesitant to invest or uncertain about the returns and integration challenges associated with new technologies.

The study highlights that digital transformation is not simply a technological shift, but represents a comprehensive organizational change requiring strategic alignment, workforce development, and sustained leadership commitment. Barriers such as high upfront costs, uncertain economic returns, integration with legacy systems, and skills shortages continue to impede progress. At the same time, the relatively low rate of fully successful digital technology implementation efforts suggests that many firms would benefit from more structured approaches, including phased adoption, pilot testing, and formal technology roadmaps.

Importantly, the study has demonstrated that the greatest value from digital technologies is realized not through isolated adoption, but through integrated technology stacks that connect data, systems, and processes across a manufacturing enterprise. This reinforces the need for long-term planning and cross-functional coordination

within firms. Moreover, as global competitors accelerate their own digital transformation efforts, delays in adoption risk further eroding Canada's manufacturing competitiveness and productivity.

It is ICTC and NGen's hope that this study and the series of roadmaps produced for the automotive/parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing industries can act as a helpful first step for Canadian manufacturers engaged in these industries, as well as inspiration for the development of roadmaps for other industries in Canada's manufacturing sector.

Ultimately, accelerating digital transformation in Canadian manufacturing is not optional—it is a critical step toward ensuring long-term economic resilience, innovation capacity, and global leadership in advanced manufacturing.



Appendix: Research Methods

ICTC employs a mixed-methods research approach to collect and analyze both primary and secondary research data. An overview of the methods used in this study is outlined below.

Literature Review and Secondary Data

Prior to carrying out primary data collection, ICTC conducted a comprehensive literature review on digital transformation, digital technology use cases in manufacturing, and the current state of advanced manufacturing in Canada. Insights collected during the literature review informed research participants in the industry survey, key informant interviews, and focus groups, as well as the design of the final roadmap documents and summary report.

Statistically Defining the Five Manufacturing Industries Included in this Study

ICTC statistically defined the five industries covered in this study by Statistics Canada’s 2022 North American Industry Classification System (NAICS) statistical classification codes. Figure 35 outlines all NAICS 2022 codes used to define the five industries covered in the study.

Figure 35. Five Manufacturing Industries Covered in Study and Their Corresponding NAICS 2022 Codes

Industry	NAICS 2022 Codes
Automotive and automotive parts manufacturing	3361-3363
Aerospace manufacturing	3364
Biomanufacturing	541710 & 325410
Fabricated metal products manufacturing	332
Food and beverage manufacturing	311 & 3121

Industry Survey

ICTC conducted an industry survey of Canadian manufacturers (n = 133) in June and July 2025. A breakdown of responses from each of the five manufacturing industries covered in this study are listed in Figure 36.

Figure 36. ICTC Canadian Manufacturing Digital Technology Adoption Survey Responses by Industry

Industry	Number of Survey Responses	% Total Responses
Automotive and automotive parts manufacturing	35	26%
Aerospace manufacturing	12	9%
Biomanufacturing	27	20%
Fabricated metal products manufacturing	29	22%
Food and beverage manufacturing	30	23%
TOTAL	133	100%

Key Informant Interviews

ICTC conducted 33 semi-structured key informant interviews with senior executives, technical leaders, consultants, and other experts in the Canadian manufacturing sector. These interviews were carried out between July 2025 and January 2026. Interviewees were drawn from all five of the manufacturing industries covered in the study and represented both large and small- and medium-sized enterprises from across Canada.

Industry Roundtables

ICTC carried out a series of five industry roundtables with industry leaders for each of the industries covered in the study, and represented both large, small, and medium-sized businesses from across Canada. A total of 31 participants attended the five sessions. These roundtables were hosted virtually and held in November 2025 and January 2026. Figure 37 outlines dates and participation.

Limitations of Research

Canada is home to a wide variety of manufacturers, both large and small, located throughout the country. These manufacturers produce numerous products, using a variety of manufacturing methodologies and processes.

Even by limiting ICTC's analysis to the five manufacturing industries included in this study (automotive and automotive parts manufacturing, aerospace manufacturing, biomanufacturing, fabricated metal products manufacturing, and food and beverage manufacturing), there are an almost limitless number of ways that the seven digital technologies included in this study could be used across a manufacturing enterprise. Thus, the data, analysis, and conclusions presented in this study may not fully reflect the individual digital transformation journeys of all Canadian manufacturers.

Figure 37. ICTC Canadian Manufacturing Digital Technology Adoption Industry Roundtables

Industry	Date	Number of Participants
Automotive and automotive parts manufacturing	November 13, 2026	5
Aerospace manufacturing	January 13, 2026	8
Biomanufacturing	January 15, 2026	3
Fabricated metal products manufacturing	January 14, 2026	5
Food and beverage manufacturing	November 20, 2026	10
TOTAL		31