Digital Techology Adoption Roadmap

Accelerating Digital Transformation in Canada's Food and Beverage Manufacturing Sector

ICTC CTIC

NGen

Roadmap 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 digital technology adoption roadmap covering the Canadian food and beverage manufacturing sector. The five-year roadmap details practical steps and considerations for Canadian food and beverage 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. The roadmap provides the food and beverage manufacturing sector with strategic level guidance on digital technology adoption. The roadmaps have been developed in consultation with industry and include real-world examples and use cases on how digital technologies are being used on factory floors across Canada and integrated into production processes.

Other digital technology adoption roadmaps available for Canadian manufacturers in this series:



Aerospace



Automotive



Biomanufacturing



Fabricated Metal Products

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

This five-year roadmap details practical steps and considerations for Canadian food and beverage manufacturers, particularly small- and medium-sized enterprises, interested in adopting advanced digital technologies and embarking on a digital transformation journey.

The roadmap provides a case study of real-word digital technology adoption in the Canadian food and beverage manufacturing sector, covering barriers, challenges, and solutions to digital transformation. It outlines how food and beverage firms are adopting novel digital technologies, including artificial intelligence (AI), big data analytics, cloud computing, cybersecurity, digital twins, sensors and Internet of Things (IoT), and advanced robotics and industrial automation.

The roadmap also provides examples of practical planning tools to help Canadian food and beverage manufacturing firms plan and execute their digital transformation journeys, including:

1. **Digital technology use case matrix:** highlighting practical uses of the seven digital technologies in the food and beverage manufacturing sector.
2. **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.
3. **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.
4. **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.
5. **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.
6. **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.

By providing these real-world case studies, insights, and practical tools, this roadmap seeks to accelerate the adoption of key digital technologies in Canada's food and beverage manufacturing sector and support ongoing digital transformation efforts. Adopting novel digital technologies is critical for continued sectoral success, addressing long-term stagnation in productivity in Canadian manufacturing, and maintaining the sector's continued global competitiveness.

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This roadmap was developed in consultation with digital transformation leaders from the Canadian food and beverage manufacturing industry, including five expert interviews and an industry roundtable. Representatives from food and beverage processors, digital technology vendors with expertise in the food and beverage industry, consultants, and other experts all contributed towards this roadmap.

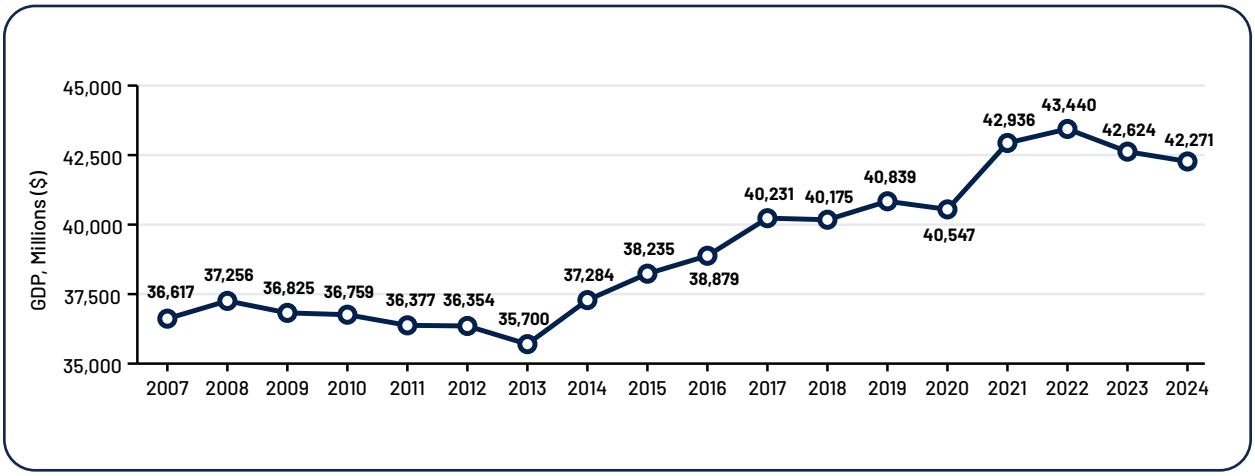
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Why this Roadmap is Needed

Canadian manufacturing is experiencing notable economic headwinds brought on by declining productivity, underinvestment, and economic uncertainty brought on by international trade disputes. For individual food and beverage firms, these headwinds translate into tighter margins, higher compliance costs, rising production downtime risk, and labour shortages. For the food and beverage manufacturing sector, these headwinds have amounted to a slow growth trajectory (Figure 1).

Figure 1. Canadian Food and Beverage Industry GDP Value (2007-2024)

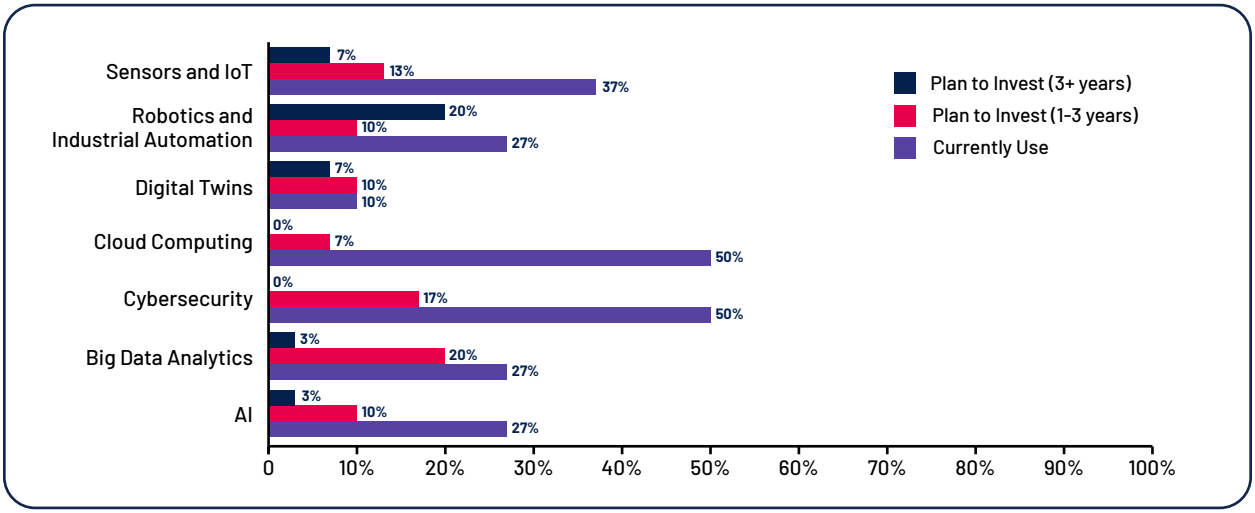


Source: Statistics Canada, Table: 36-10-0434-06 [NAICS 311 & 3121].[1]

These economic headwinds come at a time of technological disruption, brought on by rapid advances in digital technology, most notably in artificial intelligence (AI), but also in adjacent technologies such as advanced robotics, sensors and internet of things (IoT), and digital twins, alongside base digital infrastructure like cloud computing. Canadian food and beverage manufacturers have the opportunity to increase their productivity and accelerate growth by adopting greater amounts of digital technologies into their manufacturing operations. Yet an industry survey conducted by ICTC finds that numerous advanced digital technologies, like AI, IoT, and digital twins, have not yet been widely adopted in Canada's food and beverage manufacturing industry (Figure 2).

1 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.

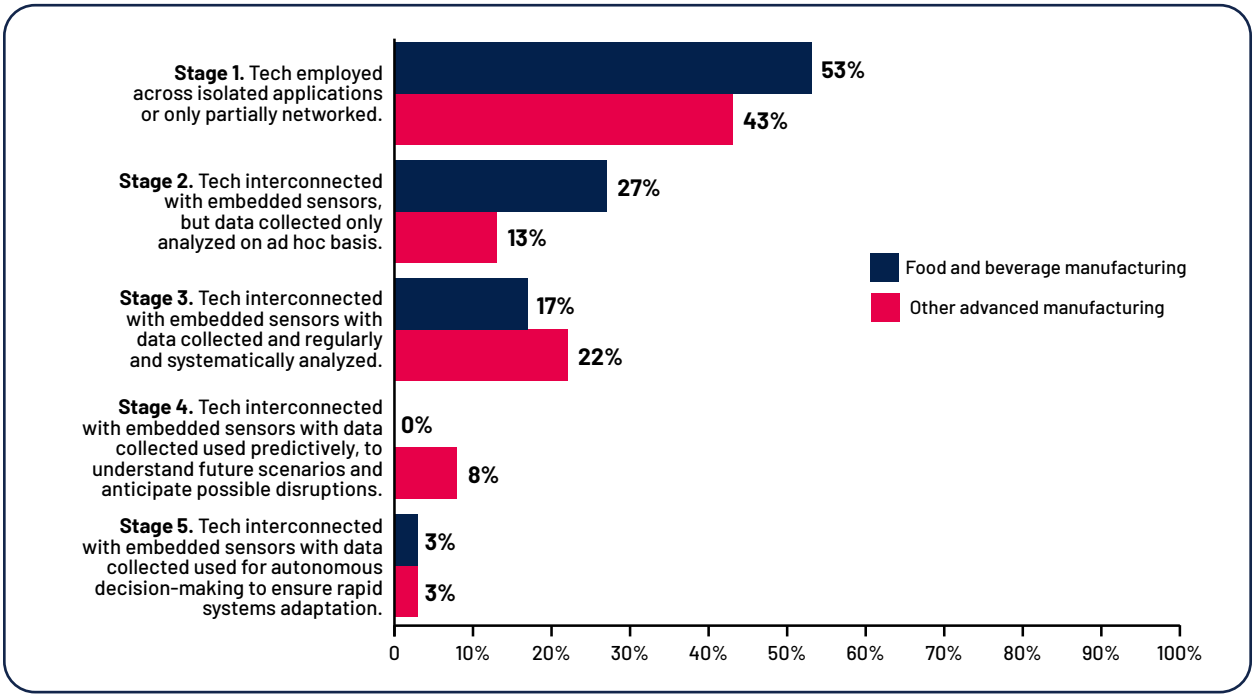
Figure 2. Canadian Food and Beverage Manufacturing Digital Technology Adoption (2025)



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

Canadian manufacturing technology adoption shows mixed progress across industries. Within the Canadian food and beverage manufacturing industry, ICTC's Canadian manufacturing digital technology adoption survey found that 53% of food and beverage manufacturers employed digital technology piecemeal, as isolated applications or only partially networked, 27% employed interconnected digital technology but only analyzed collected data on an ad hoc basis, and only 17% employed interconnected digital technology and analyzed collected data regularly and systematically. Furthermore, only 3% used data collected from networked sensors predictively or to support autonomous decision making (Figure 3).

Figure 3. Canadian Food and Beverage Manufacturing Advanced Digital Technology Implementation Stage (2025)



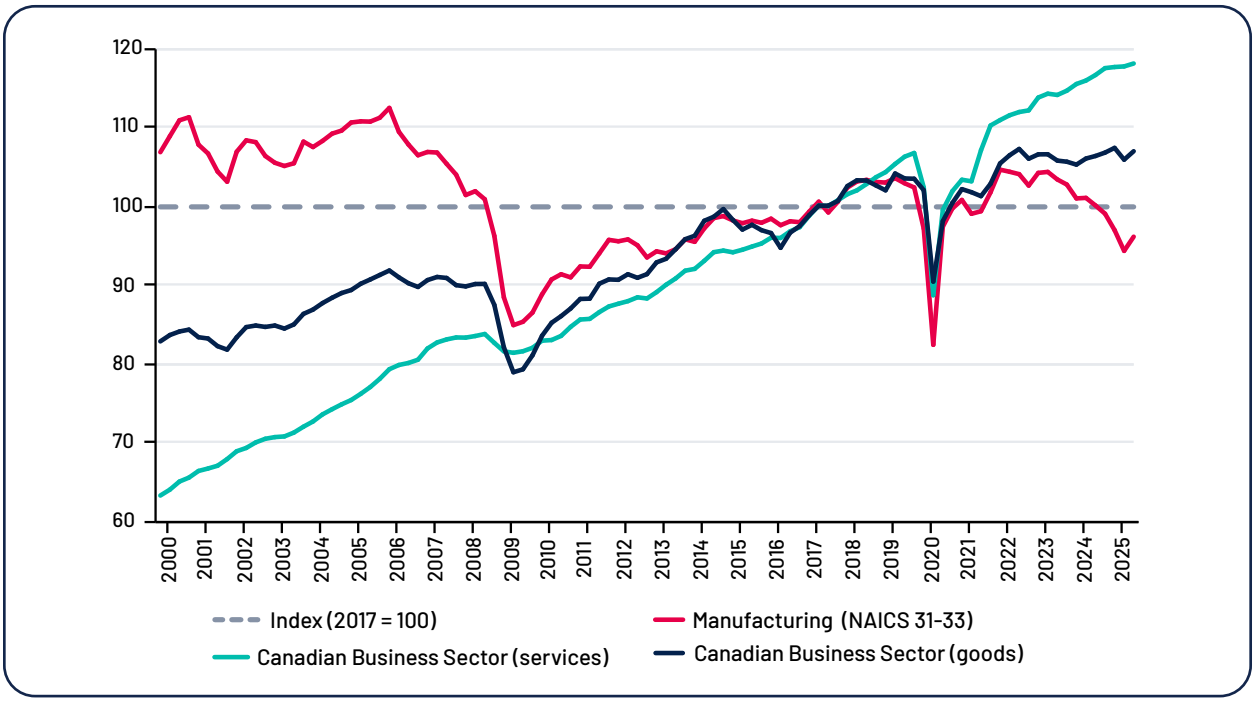
Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Leveraging networked digital technologies towards integrated, autonomous operations across a manufacturing process, or even an entire manufacturing enterprise, could have a positive effect on labour productivity in Canada's manufacturing sector (Figure 4). This would be a welcome development, as lagging productivity amounts to a persistent drag on the Canadian economy.[2]

Productivity challenges are often discussed in national economic terms, but they have very real implications for individual businesses. Canadian manufacturers continue to lag behind peers such as the United States, which puts pressure on costs, pricing, and margins. For a typical food and beverage SME with $20 million in annual revenue and a 15% EBITDA margin, even a modest 5–10% improvement in overall equipment effectiveness (OEE) can make a meaningful difference.

Improvements enabled by tools such as production monitoring, predictive maintenance, or better data use can increase throughput and reduce downtime without major new capital investment. For example, a 3% increase in output combined with small cost savings could translate into an additional $300,000–$600,000 in annual EBITDA—amounting to a 10-20% improvement in operating earnings. Seen this way, digital adoption is not just about upgrading technology; it is about strengthening profitability and long-term business value.

Figure 4. Index on Canadian Manufacturing Labour Productivity (2000 to Q3 2025)



Source: Statistics Canada, Table: 36-10-0207-01.[3]

2 Tim Sargent, "Productivity Growth in Canada: What is Going on?," University of Calgary, School of Public Policy Briefing Paper, October 2024, https://www.policyschool.ca/wp-content/uploads/2024/10/FP-9-ProductivityGrowth-Final.pdf.

3 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 September 3, 2025, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610020701.

Seven Key Digital Technologies for Food and Beverage Manufacturing

With an industry-wide need to adopt advanced digital technologies across Canadian manufacturing, including within Canada's food and beverage manufacturing sector, ICTC and NGen evaluate the seven digital technologies (Figure 5) as being essential to the future of Canadian manufacturing.

Figure 5. Seven Key Digital Technologies Essential for Canadian Manufacturing

Artificial Intelligence (AI) and Machine Learning (ML)	AI-enabled systems can quickly parse through large volumes of data, helping to optimize processes and predict outcomes, as well as 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, offsite 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 includes protecting both information technology (IT), such as networks and data, as well as 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 status and condition of the real-world asset.
Sensors and Internet of Things (IoT)	Networks of machinery, sensors, and other electronic devices can be networked together 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 food and beverage manufacturing, but advanced robotics, including cobots and humanoid robots, and can be used in manufacturing across a variety of applications and integrated using technologies such as AI and IoT networks.

Figure 6. 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.

No single digital technology delivers its full value in isolation—the true business value for all of these technologies is unlocked only when they are adopted in tech stacks. Food and beverage manufacturers can think of the seven key digital technologies as being in three maturity tiers (Figure 6):

1. foundational technologies (cloud computing/ cloud ERP, cybersecurity),
2. operational optimization technologies (sensors and IoT, big data analytics), and
3. advanced transformation technologies (AI/ML, robotics and industrial automation, and digital twins).

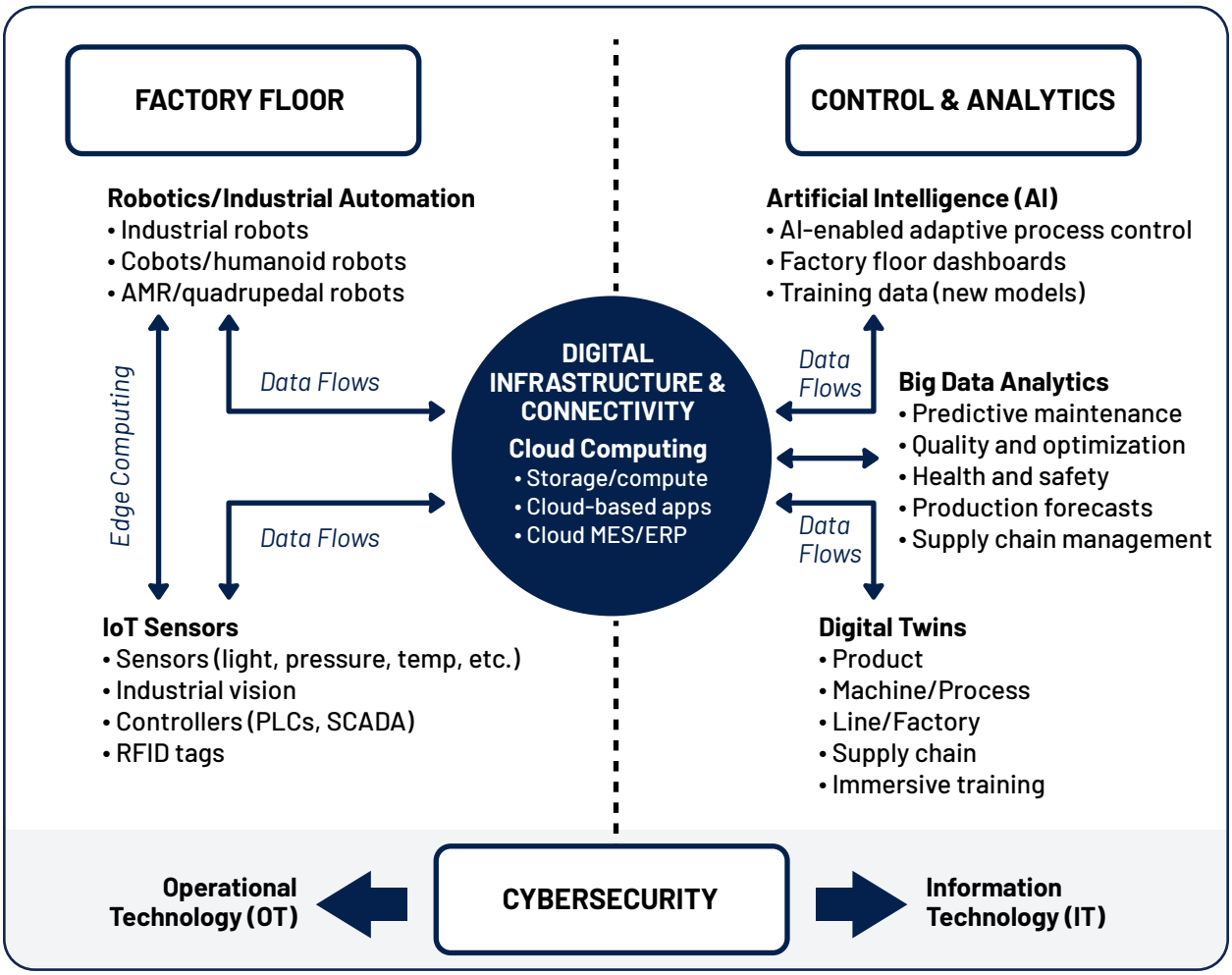
While any one of the seven digital technologies covered in this roadmap would be, on its own, consequential to advanced manufacturing in Canada, what makes these seven technologies truly impactful is how they interact with one another. These seven technologies can be digitally networked across a food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

For example, sensors deployed across a manufacturing operation, on industrial robots and other production equipment, can collect significant amounts of data in real time (i.e., big data), which can be stored and processed in a cloud environment. The data can be used to create digital twins of individual pieces of machinery and robots, manufacturing processes, products, and even the entire manufacturing enterprise.

The data can also be used to train AI models and run inference to help manage and optimize manufacturing operations. The digital infrastructure and valuable data, integrated across a manufacturing enterprise's information technology (IT) and operational technology (OT) assets must be secured against cyber threats, such as data breaches and cyberattacks, through a robust cybersecurity program. Figure 7 outlines, at a high level, how the seven digital technologies covered in this roadmap can be integrated together on the factory floor and across an enterprise in the food and beverage manufacturing sector.

The model presented in Figure 7 is intended to be aspirational, to provide an overview of what is possible in the long term. Today, most Canadian food and beverage manufacturers have not achieved this level of integration. Instead, Canadian food and beverage manufacturers interviewed for this roadmap tend to adopt stacks of digital technologies in an incremental manner, through strategic investments, pilot projects, and experimentation and organizational learning.

Figure 7. Advanced Digital Technology in Manufacturing Integration Model



Source: ICTC analysis, 2026.

Digital Transformation and Digital Technology Adoption Time Horizons

When discussing digital transformation and technology adoption in Canadian manufacturing, it is critical to develop achievable, realistic timelines. The complexities of digital technology adoption, both technical and organizational, are significant. For food and beverage manufacturers adopting novel digital technologies, such as AI, digital twins, or advanced robotics, for the first time, it can take years to derive the full value from the investment and get the most out of the new technology.

A phased, five-year timeline provides food and beverage manufacturers, including those undergoing a digital transformation project for the first time, with a realistic timeline for effectively adopting digital technologies. Firms should expect to spend the first one to two years piloting new technologies, gathering data, and developing a full business case, and then up to three years scaling successful pilots across their manufacturing operations and beginning digital integration with other manufacturing and enterprise systems.

Alongside piloting and adopting new digital technologies on the production floor, food and beverage manufacturers must also train their workforce, align HR policies and recruitment strategies towards digital transformation efforts, and provide training to the existing workforce. Furthermore, not all digital technology adoption initiatives will yield results. Manufacturers must also effectively manage risk when adopting new digital technologies into their manufacturing operations.

Case Study

Digital Technology Adoption in Canada's Food and Beverage Manufacturing Sector

This case study pulls together voices from across Canada's food and beverage manufacturing sector, including small and large food manufacturing firms, technology vendors, and researchers and innovators. Rather than focusing on a single company, it weaves multiple perspectives into a wider story about where the food and beverage manufacturing sector is headed. Along the way, we hear directly from those on the front lines of this digital shift: what's working, what's not, and how firms are tackling the challenges of digital adoption while adapting to a changing market.

Canada's food and beverage manufacturers are at the cusp of a digital transformation, one that is changing how products can be made. From design to production to delivery, new tools and technologies are reshaping every step of the food and beverage manufacturing process.

Industry Overview and Context

Canada's food and beverage manufacturing sector is the country's largest manufacturing industry by both sales and employment, making a substantial contribution to the national economy. In 2024, the industry recorded $173.4 billion in sales of goods manufactured, accounting for 20.3% of total manufacturing sales and approximately 1.6% of Canada's Gross Domestic Product (GDP). On a monthly basis, the sector contributed between $30.43 billion and $31.52 billion to Canada's GDP, underscoring its importance to economic stability and growth.

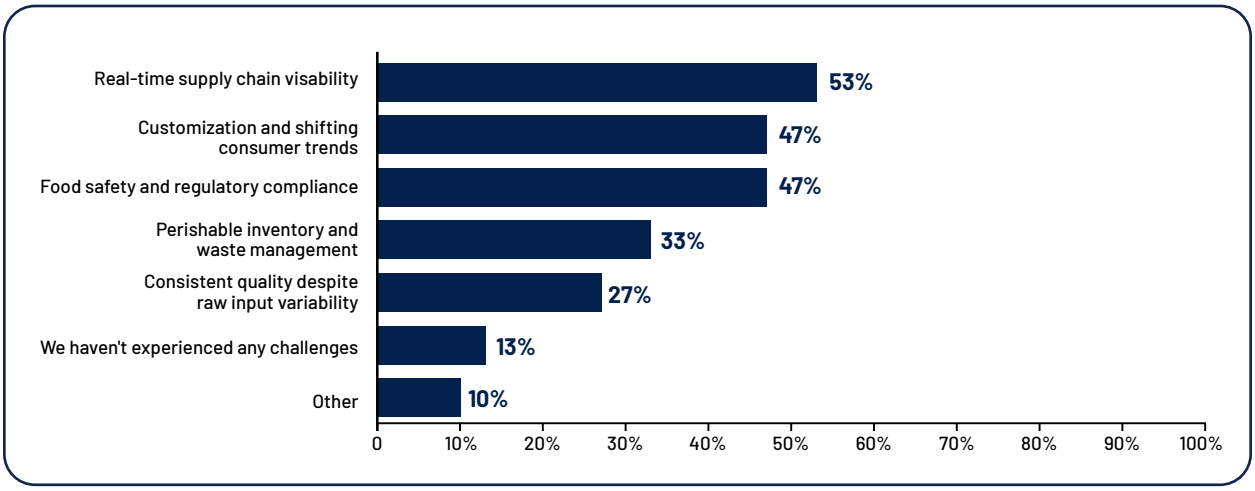
It is also the largest manufacturing employer, providing jobs for approximately 318,400 Canadians.[4] Beyond its direct economic contribution, the food and beverage manufacturing industry plays a critical role in Canada's food system. It supplies roughly 80% of all processed food and beverage products consumed domestically and is the single largest purchaser of agricultural output, buying more than half of all national agricultural production.[5]

Driving food and beverage manufacturers' digital transformation is the need to solve practical business problems, including real-time supply chain visibility, meeting customer demand for product customization, food safety and regulatory compliance, managing perishable inventories and waste management, and maintaining product quality despite variability in raw inputs (Figure 8).

4 Agriculture and Agri-Food Canada (Government of Canada), "Overview of the Food and Beverage Processing Industry," last modified 2024, accessed January 6, 2026, https://agriculture.canada.ca/en/sector/food-processing-industry/overview-food-beverage.

5 Ibid.

Figure 8. Most Pressing Business Challenges (Choose Top Three) – Food and Beverage Manufacturing Sector (2025)

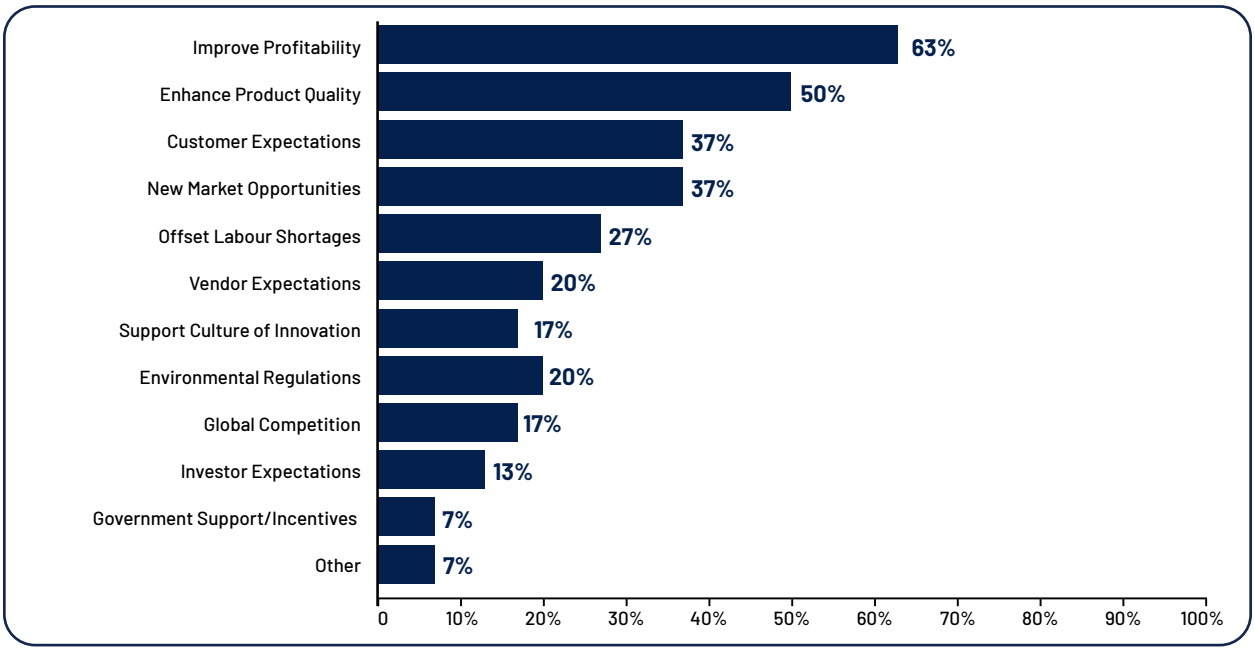


Source: ICTC Canadian Manufacturing Digital Technology Adoption Survey, 2025.

Strategic Approaches to Digital Technology Adoption

For Canada's food and beverage manufacturers, digital adoption is widely seen as an important element for remaining competitive. When deployed strategically, digital technologies can shift cost structures, streamline operations, and enable more automated, data-driven management. Food and beverage leaders ICTC interviewed for this roadmap emphasized the importance of framing digital transformation efforts along clearly defined business problems, rather than adopt new technologies for their own sake. What constitutes "strategic" adoption varies by context, but major strategic goals of digital technology adoption include improving profitability, enhancing product quality, meeting customer and vendor expectations, finding new market opportunities, and offsetting labour shortages (Figure 9).

Figure 9. Most Important Factors Driving Digital Technology Adoption – Food and Beverage Manufacturing Sector (2025)



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

Technology Applications in Practice

Across the five food and beverage manufacturing companies examined in this case study, advanced digital technologies are being applied at multiple points along the food and beverage value chain, reflecting both the diversity of operational contexts and the uneven pace of digital maturity within the sector.

Rather than pursuing large, organization-wide transformations, most firms adopted a phased strategy, starting with foundational technologies such as automation, sensors, and basic data collection, supported by a cloud ERP, to enhance operational visibility and provide baseline digital infrastructure. These initial investments into advanced digital technologies helped address immediate challenges including labour shortages, downtime, and quality variability, while at the same time creating the data infrastructure needed to adopt more advanced tools.

Collectively, these applications demonstrate how digital transformation in food and beverage manufacturing is less about adopting a single technology and more about layering interconnected systems to address persistent challenges related to productivity, quality, labour, risk, and competitiveness.

As digital maturity increased, firms reported gradually layering additional and complementary capabilities, including advanced analytics, AI, and machine vision through trials and pilots, which allowed firms to manage risk, control costs, and demonstrate value before scaling solutions more broadly.

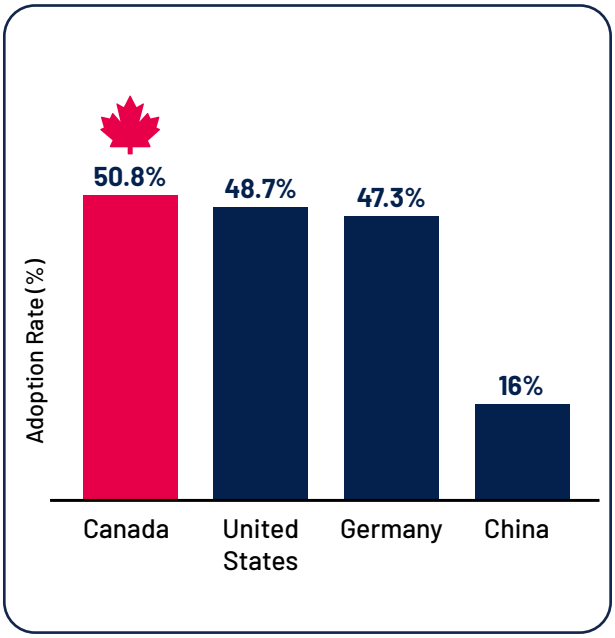
At the core of many implementations is the integration of industrial automation, sensors, and IoT technologies. Several companies operate highly automated production environments in which equipment-level sensors continuously capture data on temperature, vibration, motor performance, throughput, energy use, and product flow.

This sensor-generated data is aggregated through programmable logic controllers (PLCs) and manufacturing execution systems (MES), creating a real-time view of production processes across individual machines, entire lines, or even across multiple facilities. For smaller producers this enables improved visibility into previously manual or opaque processes, while for large, multi-site manufacturers, this can allow for centralized monitoring and benchmarking of performance across geographically distributed operations.

Sensors, IoT, Edge, and Cloud Computing

Cloud computing enables manufacturers to run software, store files, and process large amounts of data without the need for in-house servers. Cloud computing provides scalable storage and processing power, supporting everything from big data analytics platforms to storing product traceability data. Canadian manufacturers compare well with those in peer economies such as Germany and the United States when it comes to adopting cloud computing technology (Figure 10).

Figure 10. Manufacturing Sector Cloud Computing Adoption, Canada and Peer Economies (2022/23)



Source: Statistics Canada, 2024; Info Institute, 2023; National Center for Science and Engineering Statistics, 2022; McKinsey & Company, 2022.[6]

6 Statistics Canada (Government of Canada), "Information and communication technologies used by industry and size of enterprises," Table: 22-10-0117-01, September 2024, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2210011701; Info Institute, "Cloud Computing in Use at 46.5% of Companies in Germany," July 12, 2023, https://www.ifo.de/en/facts/2023-07-12/cloud-computing-use-companies-germany; Timothy R. Wojan, "Digitalization, Cloud Computing, and Innovation in U.S. Businesses," National Center for Science and Engineering Statistics, Working Paper NCSES 22-213, 2022, https://ncses.nsf.gov/pubs/ncses22213, Table 1; Kai Shen, et al., "Cloud in China: The outlook for 2025," McKinsey & Company, July 8, 2022, https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/cloud-in-china-the-outlook-for-2025.

In food and beverage manufacturing, some data processing also occurs locally at the "edge," such as within PLCs, industrial PCs, or machine vision systems on the factory floor. This enables low-latency control, continued operation during connectivity disruptions, and reduced data transmission costs, particularly important for real-time quality, safety, and high-speed packaging processes. In practice, most manufacturers adopt hybrid approaches, where edge-based processing supports immediate operational decisions while cloud platforms are used for aggregation, analysis, and optimization.

Cloud computing can be layered with IoT technologies and plays a critical enabling role in these systems. Cloud-based platforms allow companies to centralize operational data, reduce reliance on on-site IT infrastructure, and enable remote access for diagnostics, troubleshooting, and decision-making. In practice, this has allowed equipment manufacturers and software providers to remotely monitor customer equipment, identify issues in near real time, and provide faster technical support often preventing costly downtime in environments where even short interruptions can result in significant product loss.

For example, according to one technology vendor, active in the food and beverage manufacturing industry, reported to use cloud-based monitoring to oversee equipment and entire production lines across multiple global sites, this approach enables remote and near real-time issue diagnosis, "because we have machines all over the world and it's very hard to manage when a customer calls for help from Europe or China. This vendor noted that "by pulling data from individual sites into a cloud server, we can view information right away, diagnose issues remotely, and in some cases identify the root cause immediately." Speeding up diagnostics and troubleshooting through cloud-based access can yield significant savings through reducing production downtime and saving on wasted production feedstock.

AI and Big Data Analytics

Building on this digital foundation, several companies are actively deploying advanced analytics, artificial intelligence (AI), and machine learning technologies to move beyond descriptive monitoring toward predictive and prescriptive capabilities.

Across the companies, there was a strong sense of excitement about the potential of AI. As one food and beverage industry leader observed, "AI has two to three times more value in food and beverage than other sectors," while another described current developments as "really exciting," noting that for the food and beverage manufacturing sector "AI adoption is huge." Across all five companies interviewed for this roadmap, AI is consistently framed as a decision-support tool rather than a fully autonomous system. As one industry experts noted, "AI is not a light switch… it's a guide of 50 paths. All paths add value."

Predictive maintenance is one of the most common and mature use cases observed across firms ICTC engaged with for this roadmap. As one sectoral representative noted "because we collect so much data from all the equipment, we are trying to move towards the next step where we use that data in predicting, let's say, motor failure or equipment anomalies."

By training models on historical sensor data, companies are increasingly able to detect early warning signs of equipment degradation before failures occur and provides plants to adopt predictive maintenance processes, reducing unscheduled downtime. This is particularly valuable in food processing environments, where again unplanned downtime can lead to large volumes of spoiled or discarded product.

One medium-sized food manufacturer reported to have developed AI chatbots trained on existing repair manuals and maintenance guides, which was described as a relatively accessible way for food and beverage companies to begin experimenting with AI, allowing them to support maintenance

staff and capture institutional knowledge without first undertaking a complex or capital-intensive digital transformation to enable more advanced AI applications. AI is also being applied to quality control and process optimization, particularly through machine vision systems. In several cases, vision-based technologies are used to inspect products in real time.

Digital Twins

Digital twins and digital-twin-like simulation-based tools are being applied more selectively but offer growing potential across the sector. Rather than deploying full-scale digital replicas of entire facilities, most companies featured in this case study rely on partial or functional digital twins, such as process-level models, energy regression models, or simulations of production flows. Firms tend to employ digital twins, such as simulation and modelling tools, embedded in existing software tools, rather than adopting stand-alone digital twin platforms.

These tools allow companies to test scenarios virtually, including changes to equipment configurations, production schedules, energy usage, or facility layouts, before making capital-intensive investments. For sustainability-focused operations, digital twins are also being used to evaluate the impact of efficiency measures or decarbonization initiatives, supporting data-driven decision-making around energy and resource management.

Cybersecurity

Food and beverage manufacturers interviewed for this case study emphasized that cybersecurity concerns are closely tied to the risk of production disruption, arguing that "in the wake of a cybersecurity breach, the organization can really be ground to a halt." As one interviewee explained, a common source of worry is unauthorized access, specifically, "can they change equipment parameters? Can they start or stop equipment?" Because even brief interruptions can have serious consequences in food and beverage production environments. As a result, some firms reported being cautious about connecting equipment to cloud-based or external networks.

One industry expert engaged by ICTC for an interview observed how food and beverage manufacturers' cybersecurity posture "affects insurability, customer qualification, and compliance audits in food manufacturing," reflecting global trends in the industry.

Several firms also highlighted information security risks related to intellectual property as an important consideration in their digital adoption journey. For smaller producers in particular, protecting proprietary knowledge, such as recipes, formulations, and process know-how, was a central concern. As one craft brewery explained, data security and sovereignty were top of mind when considering digital tools, noting "where I get concerned about automation is really data storage, security, and data sovereignty."

Understanding ROI and Measuring Digital Transformation Results

Across all five companies that participated in interviews with ICTC, measuring the impact of digital transformation varied by firm size, digital maturity, and the type of technology adopted. Rather than relying on a single metric, companies assess outcomes through a mix of operational, financial, quality, and risk-based indicators. Firms used a variety of ROI metrics adapted to individual firms' business contexts, operational realities, and strategic goals.

For industrial automation and equipment-level digitization, results are most often measured through changes in throughput, downtime, labour requirements, and line efficiency. Even modest improvements in these areas can generate significant value in high-volume production environments, making automation an easy technology to justify from an ROI perspective. Success using these ROI anchors can help food and beverage manufacturers build a path to further digital technology investment.

Where sensors, cloud platforms, and predictive maintenance tools are used, success is frequently defined by avoided disruptions rather than visible gains. Companies track reductions in unplanned downtime, fewer emergency repairs, and faster troubleshooting, with the absence of major failures viewed as a key indicator of impact. For data integration and analytics initiatives, firms focus on improved data accessibility, faster decision-making, and greater operational visibility across equipment, lines, or sites.

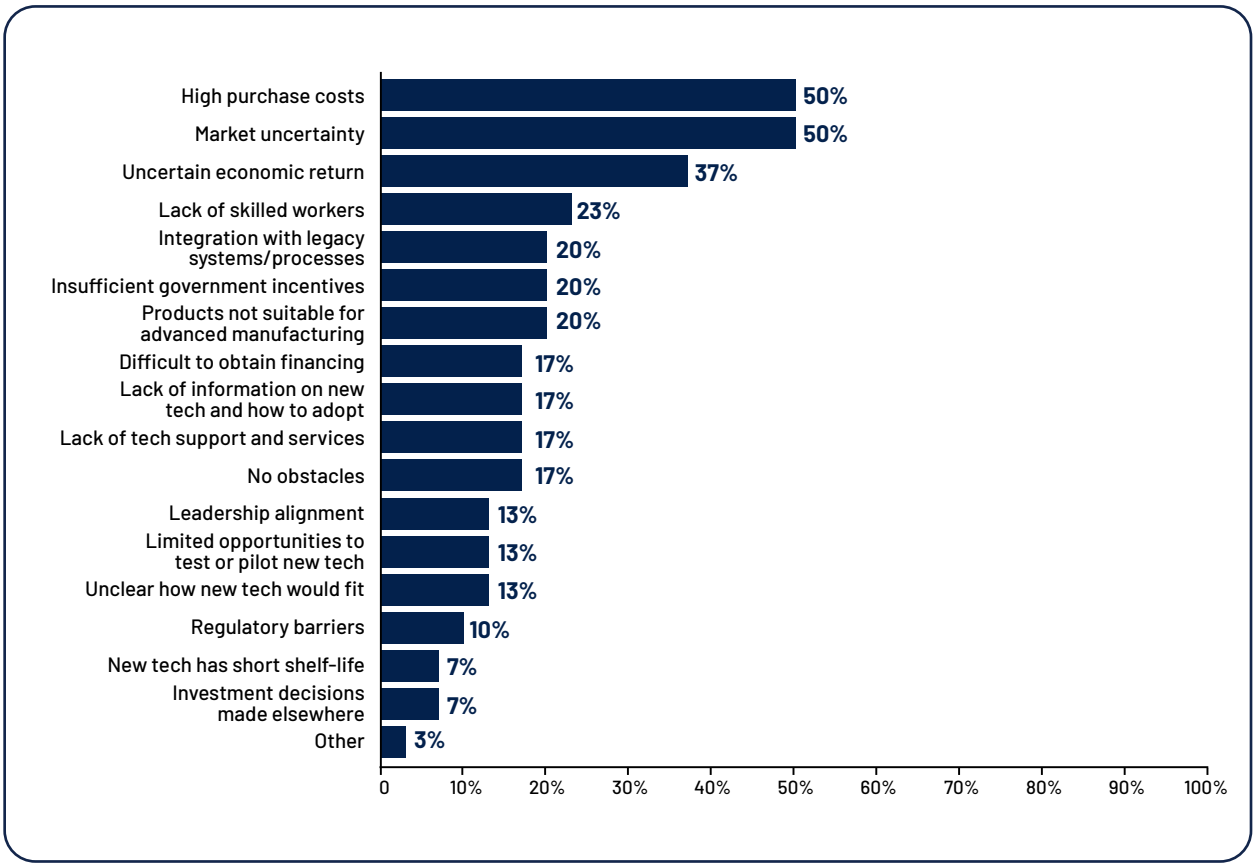
AI, advanced analytics, and digital twin–based tools are typically evaluated on their ability to enhance existing processes rather than deliver perfect outcomes. Incremental improvements in quality control, earlier detection of anomalies, and reduced process variability are commonly cited measures of success, particularly when dealing with food and beverage products.

Overall, smaller firms tend to rely on pragmatic and experience-based assessments, such as improved consistency, smoother operations, or reduced manual effort, while larger manufacturers increasingly incorporate longer-term indicators related to sustainability, compliance, and operational resilience. Pilots can play a crucial role in bridging this gap. By testing technologies on a smaller scale, companies can see how they perform in real-world conditions, build familiarity across their teams, and generate practical data from their own facilities—evidence that strengthens the business case for future large-scale adoption.

Barriers to Adoption

Despite clear interest in and demonstrated benefits from advanced digital technologies, research interviews with food and beverage manufacturers reveals a range of persistent barriers that slows or complicates digital technology adoption across the food and beverage manufacturing sector. Canadian food and beverage manufacturers report high purchase costs, market uncertainty, and uncertain economic returns, as major barriers to adopting digital technologies into their operations, alongside a lack of skilled workers needed to make the most out of digital technologies, and integrating legacy systems and infrastructure with new technologies (Figure 11).

Figure 11. Main Obstacles to Adopting in Digital Technologies – Food and Beverage Manufacturing Sector (2025)



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

Cost Barriers, Uncertain Economic Returns, and Market Volatility

Limited budgets and a culture of cautious risk tolerance can also be a barrier to digital adoption, especially for small and medium-sized businesses. Food and beverage manufacturers repeatedly emphasized that their industry is "a low-margin business," with one leader noting that food and beverage companies "can't make large risky bets in an industry like ours," emphasizing the need to "maintain profitability quarter to quarter."

As a result, many firms are hesitant to invest in technologies with uncertain or long-term returns, especially when benefits like improved data quality or predictive insights can be indirect or difficult to quantify upfront. As one interviewee observed, "companies are a little risk averse and have limited funds," and, as a result, "most food and beverage companies don't want to be that first guinea pig" which often forces them to prioritize immediate operational needs, including equipment replacement, regulatory compliance, and facility maintenance, over longer-term digital investments. Developing defined and measurable ROI metrics up front can help control uncertainties when adopting new digital technologies.

Closely related is the challenge of showing a clear return on investment. Business leaders explained that some technologies, like industrial automation, are easier to justify because the savings are more obvious, often coming from reduced labour costs or increased throughput. As one interviewee put it, these projects have a "dead simple ROI calculation," where companies can clearly see gains from "increased throughput, reduced downtime, or headcount reduction."

By contrast, the value of more data-heavy tools, such as AI, advanced analytics, or digital twins, can be harder to see upfront. Several companies noted that these technologies often deliver indirect or longer-term benefits, making them more difficult to justify financially. One company leader explained that projects like IoT or analytics are "much more complicated" to make the business case for, especially when the cost savings are not immediate or represent only a small share of overall costs.

Some firms indicated that they often rely on small pilots or proofs of concept before committing to larger investments. However, even when pilots are successful, they do not always lead to broader rollout, as one interviewee noted, if a project was expected to save "$5" but only saved "$4," so firms could decide "it doesn't really work," even if meaningful value was created. This strong focus on short-term, narrowly defined ROI can limit experimentation and slow the adoption of enabling technologies whose benefits tend to build gradually over time.

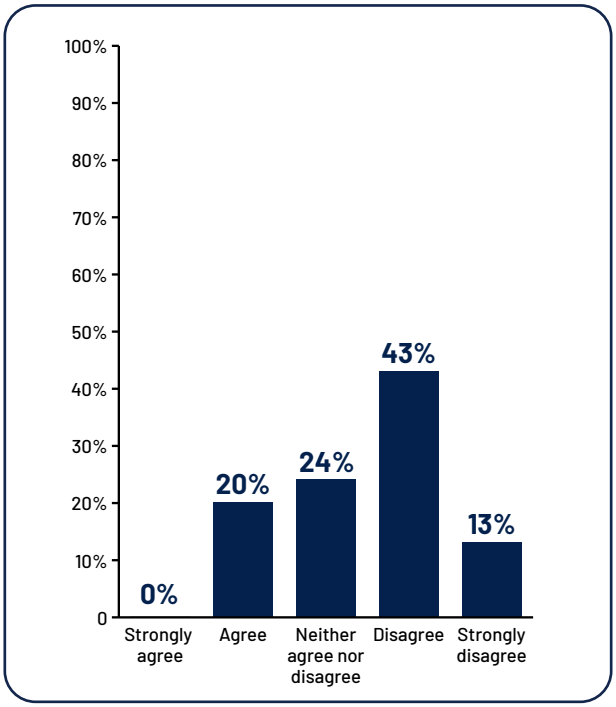
Workforce and Skills Barriers

Workforce capacity and skills gaps were also regarded as a major barrier, with one industry leader noting that "the lack of skill sets in some of these tech adopters does limit the adoption of the technology." Many Canadian food and beverage manufacturers lack internal teams with the expertise required to champion, implement, and sustain digital transformation initiatives. Skills gaps can constrain the pace of digital transformation for food and beverage manufacturers.

In some cases, operational teams are already stretched thin, leaving little capacity to engage with new systems or interpret increasingly complex data outputs. The departure or retirement of experienced maintenance staff further compounds this challenge, as tacit knowledge is often lost before it can be captured digitally. As one interviewee explained, when a senior maintenance worker leaves, the worker "kind of takes away all that maintenance knowledge with them," leaving teams without the expertise or capacity needed to fully integrate and sustain digital systems with legacy equipment. Without dedicated internal champions or sufficient training, even well-designed technologies risk underutilization or abandonment.

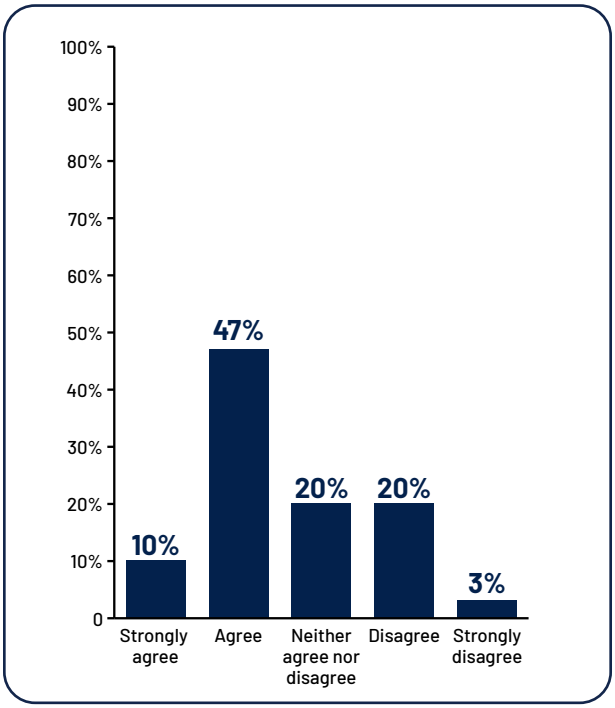
When it comes to supporting staff training and workforce development to support digital transformation efforts in food and beverage manufacturing, the situation could be improved. While 57% of food and beverage manufacturers responding to ICTC's digital transformation survey of Canadian manufacturers reported to have staff with the digital technology skills needed to adopt to technologies, only 20% of food and beverage manufacturers reported to have a staff training plan to support digital technology adoption, (Figures 12 and 13).

Figure 12. Agree/Disagree: My organization has a staff training plan required to implement and adopt new digital technologies – Food and Beverage (2025)



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

Figure 13. Agree/Disagree: My organization has staff with the digital technology skills required to implement and adopt new technologies – Food and Beverage (2025)



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

Legacy Equipment and Systems Integration Barriers

Another barrier to digital adoption noted across the firms that participated in the research interviews is the need challenge of integrating legacy equipment and facilities with new digital technologies. With many of the firms indicating that their facilities operate machinery that is decades old and still in working order, firms often decide to "run that line until it stops working" thinking "if it works right now, then why change it," as one industry leader observed.

Beyond a hesitancy to replace older but still working equipment and infrastructure, digital adoption can also be stalled because this legacy equipment was not designed for digital connectivity. As one industry expert noted "It's impossible to connect those devices to a more modern digital system," as these systems often lack modern interfaces, standardized communication protocols, or sufficient sensor coverage. This can make integration with cloud platforms, IoT sensors, data analytics tools, and AI applications technically challenging and costly. Yet, retrofitting legacy production equipment is often the preferred pathway for integrating digital technologies into food and beverage manufacturing operations.

While newer facilities can be designed with digital readiness in mind, retrofitting existing plants is frequently constrained by both physical limitations and the risk of disrupting ongoing production. As a result, companies often pursue incremental upgrades, "taking on one project at a time," rather than comprehensive transformation, slowing the pace at which advanced technologies can be deployed at scale. Though taking a piecemeal approach can provide immediate benefits and allow room for experimentation as digital technologies are rolled out across a food manufacturing enterprise.

The complexity of data integration was also noted by food and beverage companies interviewed as a significant obstacle. Food and beverage manufacturing operations frequently rely on a patchwork of systems, including multiple PLC vendors, proprietary equipment software, ERP platforms, and manual data collection processes, that are not necessarily designed to work together.

As one industry representative explained, food and beverage plants often rely on "different controllers" and legacy systems that require "a lot of work integrating all of those sensors into one location," and without this foundational integration, companies "don't have enough digital data ready" to fully benefit from analytics or AI. Harmonizing these systems requires substantial effort to normalize data, establish common standards, and ensure interoperability. As one industry expert interviewed for this roadmap observed, "data integration challenges often need to be addressed before advanced analytics or AI can deliver value."

Risk Management

Managing risk in digital transformation means addressing people and culture, and strategic concerns alongside technology risks. Firms emphasized that shifting the ROI lens beyond cost savings—toward readiness, flexibility, and workforce capability—is essential to build buy-in. Managing risk is not a downstream activity. Risk management considerations should be built into any digital technology adoption plan from the start. Without this, even well-funded digital technology adoption initiatives risk stalling.

Technology and Data Risks

Adopting advanced technologies brings risks of system failures, integration errors, or unscheduled downtime. Some manufacturing technology leaders shared that AI models they were experimenting with were still not reliable enough to introduce into the main manufacturing environment and remained experimental projects for the time being. Approaches such as sandboxing, parallel operations, and staged rollouts of new technologies on the production floor can help reduce risks.

At the same time, unprecedented volumes of operational data produced by IoT technology raise cybersecurity risk concerns. Cybersecurity breaches threaten intellectual property, disrupt production operations, and break customer trust, while also risking costly downtime.

Beyond these issues, manufacturers also flag challenges with interoperability and data transformation. Different digital platforms are not always compatible, making it difficult to move data seamlessly across systems for analytics, industrial automation, and other applications. These frictions can slow digital transformation and complicate integration across technologies. Interoperability challenges are a common issue in most digital transformation initiatives and affect companies of all sizes.

Moreover, questions about data ownership and control are becoming more prominent. Several companies expressed uncertainty about where their data is stored, who controls it, and how it might be used in the future. For firms operating in regulated environments or across different jurisdictions, these concerns make decisions about cloud adoption and partnerships with large technology providers more complicated. The lack of clear, widely understood rules around data ownership and sovereignty adds another layer of caution to digital investment decisions. Data ownership issues are particularly salient for food and beverage firms operating across borders.

Considerations for Organizational Change Management

For many food and beverage manufacturing firms, the hardest part is not the technology but managing changes brought on by digital transformation throughout a manufacturing enterprise. Across firms, organizational change management emerged as a practical challenge rather than an official or formalized process. As one industry leader, with significant experience in digital transformation shared, "change management challenges are often more significant than technical challenges, particularly for SMEs."

Many food and beverage manufacturers, particularly small- and medium-sized firms, described a limited capacity to lead or sustain change while maintaining day-to-day operations and meeting food safety requirements. As one industry representative noted, many firms are "still on the basic digital infrastructure challenge" and are "operating with little to no digital tools," which shapes both the pace and scope of digital adoption.

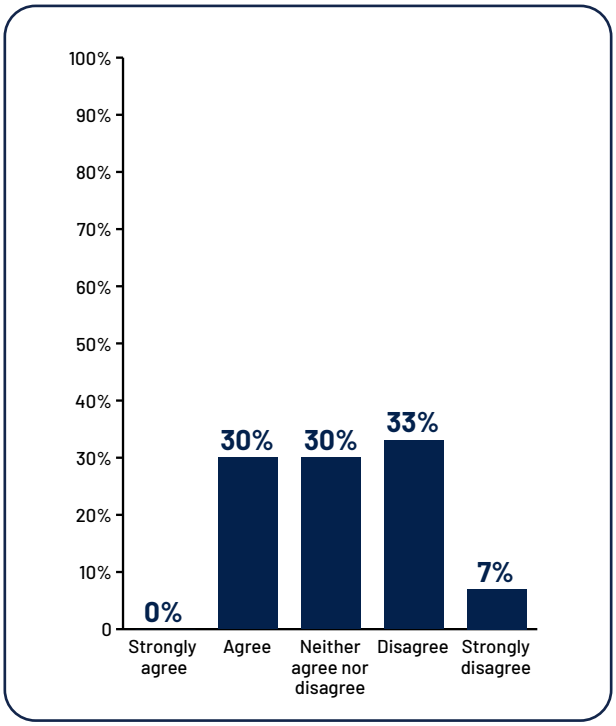
Industry experts emphasized the need for realistic technology sequencing and measurable early wins. One industry expert compared their digital transformation to "climbing Mount Everest," arguing that organizations need a "base camp" approach, building foundational capabilities before attempting more ambitious applications. This perspective aligns with the view that change is more sustainable when firms "think big, start small," then "nail it, then scale it" across similar processes and assets. Pilots and prototyping help build trust and gather valuable data and experience, while training and clear communication reduce workforce fears of technologies such as AI and advanced robotics.

Those who have had the most success tend to work in a collaborative manner, bringing in specialized technology vendors, working with suppliers and customers, and developing strategic partnerships with post-secondary institutions, industry associations, and other ecosystem actors such as technology accelerators and startup incubators. These collaborations can start informally through tactics like peer learning, participation in industry user groups, and build towards more formalized relationships like joint pilot projects and vendor support programs.

Several representatives from the food and beverage manufacturing industry noted that many companies begin the digital adoption process feeling "lost," with little understanding of where to start or which technologies are appropriate to start with. In response, ecosystem actors can act as "connectors," helping to "shorten that learning curve" by providing guidance, sharing examples of "simple systems that have already worked for others," and reducing uncertainty around adoption. By offering practical entry points and trusted support, these organizations help make digital change feel more achievable for firms with limited capacity and risk tolerance.

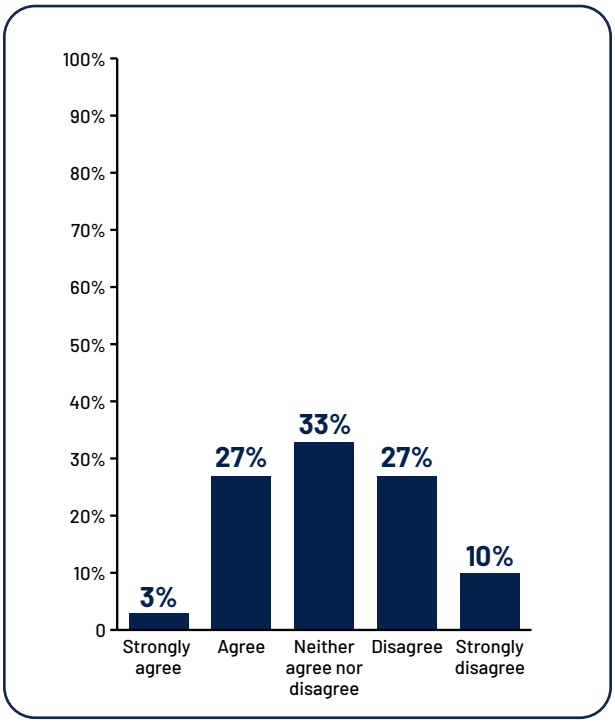
Only one third of food and beverage manufacturers surveyed for ICTC's digital transformation survey of Canadian manufacturers reported to engage in both strategic planning and fostering cultures of change across their organizations, with 30% reporting having a comprehensive digital technology adoption strategy and 30% enjoying a culture of change aligned to digital transformation (Figures 14 and 15).

Figure 14. Agree/Disagree: My organization has a comprehensive strategy for digital technology adoption – Food and Beverage (2025)



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

Figure 15. Agree/Disagree: There is a strong culture of change aligning digital strategy, actions, and structure across the organization – Food and Beverage (2025)



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

Digital Technology Adoption Horizon

As outlined in this case study, the technical and organizational complexities involved in adopting digital technologies and engaging in digital transformation are immense, yet not overwhelming. Food and beverage manufacturers should plan digital technology adoptions on a five-year time horizon. Figure 16 outlines digital technology adoption time horizons for food and beverage manufacturing.

Figure 16. Digital Technology Adoption Horizon

Adoption Phase	Time Horizon	Illustrative Examples
I. Pilots	Years 1-2	Initial small-scale production automation experimentation, adopt AI production scheduling tools, cloud-based dashboards, predictive maintenance pilots.
II. Scaling	Years 3-5	Expand successful pilots across production lines/plants, broaden workforce training programs, increased use of IoT sensors for real-time monitoring.
III. Integration	Years 5+	Integrate digital ecosystems (e.g., AI, IoT, cloud, digital twins) fully, implement enterprise-wide data platforms, share data across supply chain.

Note: This timeline reflects how firms in the case study see their own readiness and adoption pace. Actual timelines will vary by company size, resources, and market conditions.

Digital Technology in Food and Beverage Manufacturing Use Case Matrix

Use cases specify how different digital technologies can be adopted into a manufacturing operation. Figure 17 provides a matrix outlining five example use cases for each of the seven digital technologies covered in this roadmap alongside benefits that can be derived for each use case. As there are likely dozens of different use cases for each of these advanced digital technologies, with specific use cases relevant for specific types of food and beverage manufacturing operations, the use cases presented are intended to be illustrative, rather than exhaustive.

Figure 17. Digital Technology Use Case Matrix – Food and Beverage Manufacturing

Technology	Example Use Case	Benefit
AI/ML	Predictive maintenance	Decrease risk of unscheduled downtime, reduce incidents of equipment catastrophic failure.
	Production equipment maintenance and repair chatbot	Reduce troubleshooting time, compile and systematize repair knowledge on legacy production machinery, capture and codify repair processes.
	AI-enabled machine vision inspection, sorting, and defect detection systems	Increase speed and accuracy of defect detection processes.
	AI-enabled production floor dashboard	Add predictive capabilities to dashboard, automate routine decision-making.
	AI-enabled adaptive process control	Improve quality, increase throughput, reduce downtime, increase energy efficiency, enhance production flexibility.

Technology	Example Use Case	Benefit
Big Data Analytics	Process optimization/root cause analysis	Increase throughput, identify root causes of variance, improve quality, reduce feedstock wastage.
	Demand forecasting and inventory optimization	Increase market responsiveness, decrease wastage, optimize production scheduling.
	Supplier performance dashboards/monitoring	Real-time monitoring of supplier performance, predict supplier performance variance, predict supplier shorts.
	AI/ML training data collection for future AI model building	Collect large volumes of real-world data from production operations to train ML models for future AI implementation.
	Energy/water consumption monitoring and analysis	Reduce energy and water consumption/costs, help meet ESG performance targets.
Cloud Computing	Food safety and product traceability	Digital records of food safety and product traceability
	Centralized data sharing across facilities/ production sites	Seamless data-sharing across facilities and production sites, more efficient information flow.
	Scalable cloud-based/hybrid MES/ERP systems	Increase MES/ERP flexibility, reduced risk of digital infrastructure/IT resource bottlenecks, cost savings.
	Digital twins hosting and scalable iteration	Host product, equipment, production line, or facility digital twins in cloud environment.
	Cloud-based digital product traceability	Enhanced access to digital records and traceability of products and feedstock inputs.
Cybersecurity (IT/OT)	Intrusion detection and Security Information and Event Management (SIEM)	Real-time detection, analysis, and response to incidents across networks and applications.
	Pen-testing and red team exercises	Stress-test critical IT/OT networks, identify vulnerabilities in networks and business processes.
	Cybersecurity standards and best practices (e.g., ISO 27001)	Enhance cybersecurity governance and compliance, reduce cyber risk, adhere to insurance requirements.
	Digital forensics	Capture and collect OT/IT network data for forensic analysis after incident, aid law enforcement.
	Secure backups and disaster recovery testing	Reduce risk of catastrophic data loss, enhance business continuity.

Technology	Example Use Case	Benefit
Digital Twins	Process and quality digital twins	Link production process parameters, ingredients, environmental conditions to quality and safety outcomes.
	Virtual (VR/XR) equipment operator training	Shortened training time for new hires, reduced time required to train workers on real equipment.
	Production line/facilities layout design/optimization	Shortened retooling time, lower hours needed by skilled trades to relocate equipment.
	Warehouse material flow digital twins	Optimize flow of supplies and materials inputs from warehouse storage to factory floor
	Supply chain scenario planning	Enhanced supply chain resilience, reduced risk of bottlenecks. Requires robust real-time production, inventory, and supply chain data.
Robotics & Industrial Automation	Automated raw material handling and primary processing	Reduce manual contact, consistent feedstock handling, improved ergonomics.
	Sanitation and hygiene automation	Less operator exposure to chemical cleaners, reduced use of cleaning agents and water.
	Packaging process automation/ cobots	Free production workers from repetitive packaging tasks.
	Quadrupedal robots (i.e., "robot dogs") for automated facilities/ machinery inspection	Identify variance in plant/equipment conditions, decrease risk of unscheduled downtime. An advanced robotics use case.
	Autonomous mobile robots (AMRs) for facility intralogistics	Reduce need for human material handling, real-time monitoring of materials flows, agile material flows.
Sensors & IoT	Sensors for cold chain monitoring	Reduce spoilage risk, allow temperature and humidity monitoring during transport.
	IoT sensors for machine vibration/temperature monitoring	Reduce variance in machinery operations, capture and feed data into operational dashboards.
	RFID tags for tool/asset tracking and facility geolocation monitoring	Track tools and production assets around production environment, reduce chance of asset loss.
	Machine vision cameras for allergen cross-contact and contamination detection.	Detect instances of allergen cross-contamination in food/beverage production line. Reduce risk of contaminated batches being shipped.
	IoT sensors and worker wearables for real-time hazard monitoring and detection	Increase worker safety, reduced safety incidents, shorten hazard resolution time.

ROI Measurement Framework

Like other business decisions, investing in digital transformation and the adoption of novel digital technologies should be assessed from a financial lens and should be aligned with strategic objectives, such as cost reduction, revenue growth, risk management, and alignment with high-level corporate strategy (Figure 18).

Figure 18. Digital Transformation Strategic Objectives

I. Reduce Costs	Leveraging advanced digital technologies and undergoing digital transformation to reduce costs, both from an operational perspective, by increasing output efficiencies, and an enterprise perspective, by reducing overheads and inputs.
II. Grow Revenue	Leveraging advanced digital technologies and undergoing digital transformation to support revenue growth, by expanding market access, increasing process and product innovation, per-unit improving output capacity.
III. Manage Risk	Leveraging advanced digital technologies and undergoing digital transformation to better manage operational, enterprise, and market risk, including reducing error and improving quality, retaining customers, and improving workplace safety.
IV. Strategic Alignment	Leveraging advanced digital technologies and undergoing digital transformation in pursuit of long-term corporate vision and enterprise strategic planning, particularly regarding factors such as market access, innovation, workforce development and human resources, and profitability.

Figure 19. Digital Transformation Investment Inputs

Category	Investments/Spend	Illustrative Examples
Digital Technology & Equipment	Robotics (cobots, humanoid/mobile)	ABB IRB 360 "FlexPicker", Vention UR3e
	IoT/sensors	Sensors, controllers, RFID tags, machine vision cameras
Digital Infrastructure	Networking and connectivity	Industrial ethernet, 4G/5G, ISED NCLL spectrum[7]
	Cybersecurity program (IT/OT)	Firewall, SIEM, endpoint protection, pen-testing
	Cloud services subscriptions	AWS, Microsoft Azure, Google Cloud
Software Licensing	IoT/IIoT plaforms	GE Predix, SAP Digital Manufacturing Cloud
	AI platforms	Seebo, Falkonry, IBM Watson
	Cloud/hybrid ERP platforms	JustFood ERP, Odoo, Aptean Food & Beverage ERP
	Cybersecurity (IT/OT) platforms	Fortinet OT Security, Microsoft Defender, Splunk
	Digital Twins platforms	Siemens Xcelerator, IBM Maximo, PTC ThingWorx
Human Resources & Workforce Development	Workforce training/development	Employee training, tech. mentorship/coaching
	Digital talent recruitment	Campus recruiting, co-op program participation
	Change management	Internal communications, consultants
	HR management	Union negotiations, job description changes

Note: The software applications and hardware platforms mentioned in this table are intended to be illustrative examples and should not be construed as endorsements nor as procurement recommendations.

Required investments will include hard costs, such as new technology and equipment, underlying digital infrastructure, and software licensing, as well as soft costs, such as training and workforce development, change management, and HR issues (Figure 19).

Figure 20 outlines an ROI framework for adopting digital technologies for a manufacturing enterprise. This ROI framework is categorized into different classes of benefits, including operational efficiencies, workforce and capital productivity, market access, innovation, health and safety, and ESG (environmental, social, and governance), and is cross referenced by digital transformation strategic objectives discussed above.

Detailed ROI calculations will be unique to individual manufacturers, including the specific mixes of digital technologies and their associated use-cases, with the ROI framework presented being intended to help manufacturers navigate ROI assessments and business case development. Like the use case matrix, the ROI framework is intended to be illustrative rather than exhaustive.

7 Innovation, Science and Economic Development Canada (Government of Canada), "Non-competitive local licensing (NCLL)," last update February 19, 2026, https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/licences-and-certificates/non-competitive-local-licensing-ncll.

Figure 20. Advanced Manufacturing Digital Technology Adoption ROI Framework

	Benefits	ROI Metrics	Objective Alignment			
Benefit Types	Potential Benefits	Example Metrics	Reduce Costs	Grow Revenue	Manage Risk	Strategic Alignment
Operational Efficiencies	Increased production	% increase in finished goods/hour		X		X
	Scheduling adherence	% decreased in scheduling variance	X		X	
	Reduced materials wastage	% reduction in material scrap	X			
	Reduced error	% reduction in error rate	X		X	
Workforce Productivity	Task automation	# labour hours saved	X			
	Workforce redeployment	% role revised for higher value tasks	X	X		X
	Enhance employee engagement	% increase in employee engagement				
	Reduce absenteeism	% decrease in absentee hours	X		X	
Capital Productivity	Equipment utilization	% increase in equipment utilization	X			
	Production line flexibility	% reduction in line retool time	X			X
	Reduced equipment downtime	% reduction in equipment downtime	X			
	Efficiency of capital investment	% increase in EBITDA per dollar PP&E	X			X
Market Access	New OEM customers	# new contacts		X		X
	Efficient business development	% bid-to-win rate for new contacts	X	X		
	Customer retention	% of existing customers retained	X	X	X	X
	Digital capability tie-ins	% of RFPs requiring digital capabilities		X		X
Innovation	Reduced product iteration time	% reduction in time to iterate design	X	X		X
	Digital pilot projects launched	# of new digital tech adoption pilots			X	X
	Prototype development time	% reduction in prototype dev. Time	X			X
	Reduce time-to-market	# week reduction time-to-market	X	X		
Health & Safety	Reduced lost-time incidents	% reduction in lost time incidents	X		X	
	Reduced repetitive strain injuries	% reduction in repetitive strain injuries	X		X	
	Fine particulate matter illnesses	% reduction in workplace FPM illness	X		X	
	Reduced WCB premiums	% reduction in WCB premiums	X		X	
ESG Measures	Reduced carbon footprint	% reduction in carbon footprint	X		X	X
	Increased energy efficiency	% reduction in plant electricity use	X		X	X
	Reduced material inputs	% reduction in material input per part	X		X	X
	Reduced water use	% reduction in plant water use	X		X	X

Change Management Checklist

Adopting digital technologies into existing manufacturing operations necessitates careful change management planning. Investing time and resources in a change management strategy in support of digital transformation can improve the likelihood that a project will meet its objectives by seven times, while producing a 3:1 to 7:1 ROI, according to a 2025 whitepaper by Culture Partners.[8] Likewise, early engagement in change management can increase project ROI by 40-60%.[9]

Change management plans supporting digital technology adoption initiatives should include a project sponsor, outline roles and responsibilities, identify a champion to lead the change, and include internal and external communications planning, as well as a staff training plan. Plans should also include predesigned feedback loops, such as feedback portals, surveys, and staff townhalls.

Lastly, they should include measurable goals to and timelines to monitor progress and provisions to celebrate success when achieved, as well as options to scale successful pilots into larger digital transformation projects. Figure 21 below outlines a change management checklist for use in digital technology adoption initiatives.

Figure 21. Digital Technology Adoption Change Management Checklist

I. Pre-Implementation Phase:

- Secure executive leadership commitment and clear digital transformation vision.
- Conduct comprehensive skills assessment and identify training needs.
- Establish dedicated project team with representatives from all affected departments.
- Create communication plan addressing concerns and benefits for all stakeholders.
- Define success metrics and establish baseline measurements for ROI tracking.

II. Implementation Phase:

- Pilot technology with small, manageable scope before full deployment.
- Provide hands-on training for all users, with special attention to production workers.
- Establish feedback mechanisms and regular check-ins with implementation team.
- Address resistance proactively through transparent communication and involvement.
- Document lessons learned and adjust approach based on pilot results.

III. Post-Implementation Phase:

- Measure outcomes against established success metrics and ROI framework.
- Celebrate early wins and recognize team contributions to build momentum.
- Establish continuous improvement processes for ongoing optimization.
- Plan for scaling successful implementations across additional facilities or processes.
- Update training programs based on real-world experience and user feedback.

8 Culture Partners, "Change Management ROI: Measuring Financial Returns and Business Impact," June 10, 2025, https://culturepartners.com/insights/change-management-roi-measuring-financial-returns-and-business-impact/.

9 Ibid.

Digital Transformation Phase Gates

When undertaking digital transformation of manufacturing enterprises, a change management plan can be supported by structuring change through phase gates, which are aligned with the digital transformation timeline outlined earlier in this document.

For example, if a brewery were interested in placing IoT sensors on an existing fermentation vessel, Gate 1 could be checking to see if the vessels were compatible with the new sensors and that connectivity in that area of the brewery floor had the needed connectivity for sensors to send data back to a cloud database.

Gate 2 would be to validate if the new IoT sensors were able to capture the data reliably over a period of time and if the data were able to provide management with useful insights into the state of the fermentation process. After Gate 2 is cleared, manufacturers should financially validate the pilot to measure ROI and adherence to strategic objectives (i.e., cost reduction, revenue growth, risk management, and long-term strategic alignment). Intermediate financial validation helps firms reduce the chance of falling for sunk costs.

Gate 3 would include staff training for all cellar operators and brewers, while Phase 4 would include expanding the technology adoption initiative and adding IoT sensos to all fermentation operations. Figure 22 outlines such a phased gate approach to digital transformation in manufacturing, including illustrative examples for each of the seven digital technologies covered in this roadmap.

Figure 22. Digital Transformation Phase Gates

Digital Technology	Gate 1: Tech Readiness Check	Gate 2: Pilot Validated	Intermediate Financial Validation Step	Gate 3: Workforce Trained	Gate 4: Integration Approved
AI/ML	Identify use case (e.g., predictive maintenance)	Pilot AI model on one production line	Predefined ROI metrics mapped to strategic objectives.	Train engineers to interpret outputs	Deploy across facilities
Big Data Analytics	Ensure data capture infrastructure in place	Pilot dashboards for root cause analysis	Predefined ROI metrics mapped to strategic objectives.	Train data analysts and production staff	Scale to enterprise-level decision-making
Cloud Computing	Assess cloud vendor solutions/ options	Pilot cloud-based MES/ERP on trial basis	Predefined ROI metrics mapped to strategic objectives.	Train IT and plant managers on new system	Fully migrate workflows to cloud MES/ERP
Cybersecurity (IT/OT)	Baseline security assessment	Pilot intrusion detection system	Predefined ROI metrics mapped to strategic objectives.	Train production staff on cyber protocols	Certify enterprise-wide compliance
Digital Twins	Develop digital twin for one piece of machinery	Validate twin against real performance	Predefined ROI metrics mapped to strategic objectives.	Train operators with simulations	Expand to line or facility-wide twins
Sensors / IoT	Install sensors on one production cell	Validate output improvement/ downtime savings	Predefined ROI metrics mapped to strategic objectives.	Train operators to use new technology	Expand across production line
Robotics	Assess cobot robot readiness for simple task	Pilot robotic food packaging cobot cell	Predefined ROI metrics mapped to strategic objectives.	Train operators on safety and co-working	Integrate robotics into multiple food packaging lines

Managing Risk

As with any new initiative, risk and uncertainty are inherent part of change and should be accounted for in project plans. Figure 23 below provides an example risk register. Such tools can be used to document and specify risks brought on by technology adoption and digital transformation.

Figure 23. Canadian Food and Beverage Manufacturing Example Digital Transformation Risk Register

Risk Category	Specific Risk	Impact	Probability	Possible Mitigation Strategies
Technical	Integration failures	High	Medium	Pilots/testing, vendor partnerships
	Cybersecurity vulnerabilities	High	Medium	Security framework, audits, response
	Legacy compatibility	Medium	High	Assessment, middleware, migration
Financial	Cost overruns	High	Medium	Phased implementation, ROI metrics
	Negative ROI	Medium	Medium	Track ROI metrics
Human Resources	Digital skills gaps	High	High	Training, recruit for digital skills
	Workforce resistance	Medium	Medium	Employee ownership
Operational	Production disruptions	High	Medium	Parallel ops, scheduled downtime
	Supply chain disruptions	High	High	Multi-region sourcing, stockpiling
Vendor Risk	Tech vendor reliability issues	Medium	Medium	Multi-vendor, SLAs, backup plans
	Vendor lock-in	High	Medium	Open standards, portability, and exit strategy
Market/ External	Regulatory/policy changes	Medium	Medium	Monitoring, flexible compliance
	Competitive pressure	High	Medium	Market monitoring, agile strategy
	IP theft/cyberattack/data breach	High	Medium	Cybersecurity, IP protection, pentesting

Risk Management Trigger Scenarios

In addition to establishing a risk roster to support enterprise digital transformation, trigger scenarios can be adopted as a risk management tool. Trigger scenarios are indications that a risk is either occurring or is at a heightened probability to occur in the future. Figure 24 below provides illustrative trigger scenarios with early warning indicators and suggested actions, showing SMEs how to spot when a risk is rising and take timely steps to mitigate it.

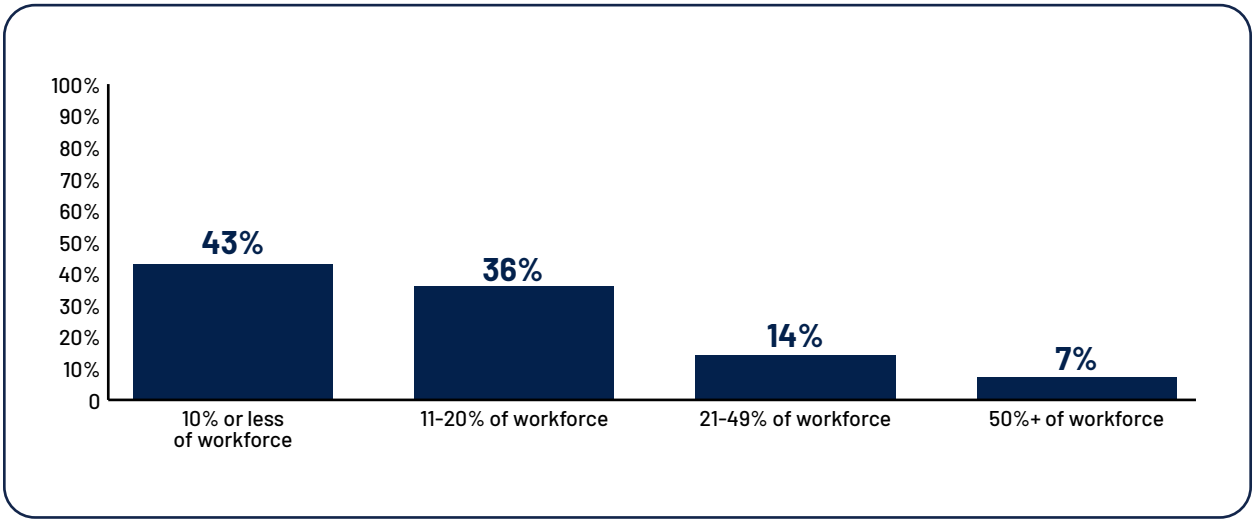
Figure 24. Example Food and Beverage Manufacturing Trigger Scenarios

Trigger Scenario	Early Warning Indicator	Potential Action
I. CFIA introduces new digital traceability compliance requirement	Updated traceability clauses in RFQs or supplier contracts.	Review food traceability policies and digital readiness; engage vendor for gap assessment.
II. Key supplier shows signs of financial distress	Late deliveries, quality slippage, credit rating downgrades.	Identify alternate suppliers; build buffer stock; engage in contingency planning.
III. Workforce turnover spikes in skilled trades	Increase in overtime reliance, exit interviews citing job dissatisfaction.	Launch retention measures; accelerate cross-training; adjust hiring plans.
IV. Equipment reliability declines	Rising unplanned downtime or repeated maintenance calls.	Initiate predictive maintenance pilot; prioritize Capex replacement schedule.
V. Customer demand shifts suddenly	Drop in firm orders or requests for new product configurations.	Reassess production plan; explore using product digital twins; increase use of flexible automation.

Talent, Workforce Development, and Training

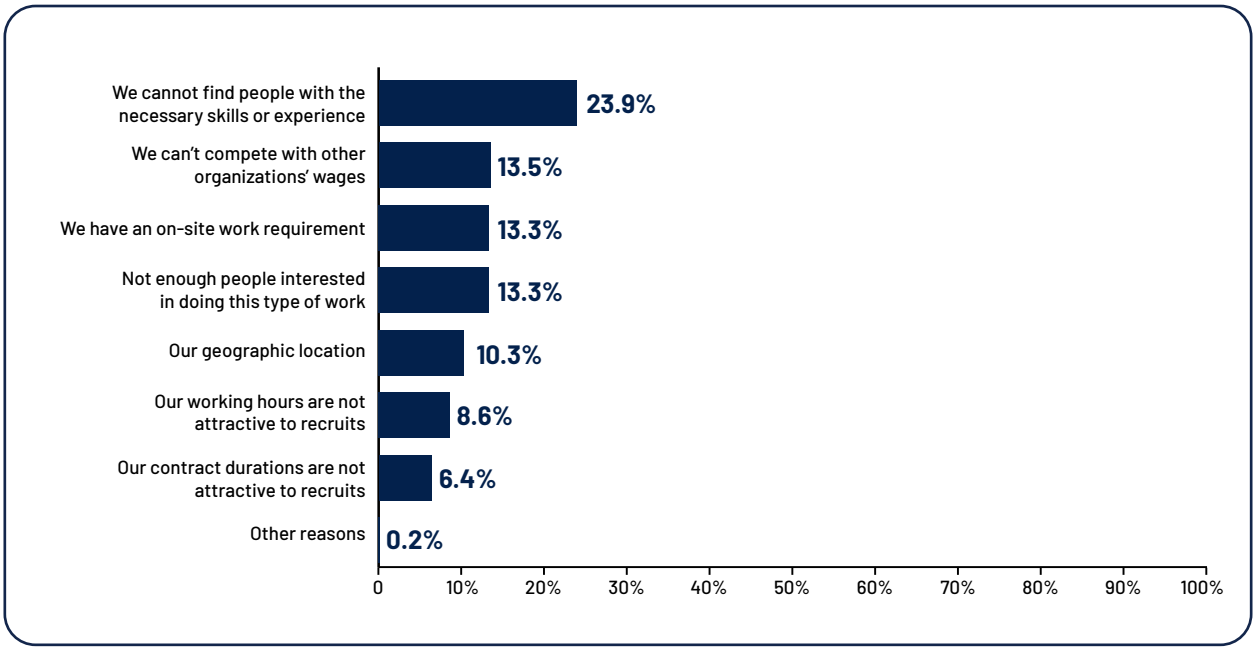
Developing a digitally skilled manufacturing workforce is essential to realize the full potential of digital transformation in Canada's food and beverage manufacturing sector. The need to accelerate the proportion of the workforce driving digital transformation in food and beverage manufacturing is acute. ICTC's 2025 survey on digital technology adoption in Canadian manufacturing found that the vast majority of food and beverage manufacturers had 20% or less of their workforce dedicated to digital transformation (Figure 25).

Figure 25. Workforce Dedicated to Digital Transformation at Canadian Food and Beverage Manufacturers (2025)



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

Figure 26. Canadian Employers' Challenges in Recruiting Technology Employees in Past 12 Months



Source: ICTC's 2024 Digital Economy Employer Survey.

Competition for digital talent in adjacent sectors to manufacturing—such as infrastructure, energy and natural resources, and technology—are immense. Indeed, recruiting technology workers with the needed mix of skills and experience was the top recruiting challenge faced by employers across Canada, according to ICTC's 2024 digital economy employer survey (Figure 26).[10]

On top of recruiting and retaining skilled digital talent to drive digital adoption in Canada's food and beverage manufacturing sector, there are significant opportunities to invest in upskilling and retraining programs for the existing workforce.

Manufacturers adopting digital technologies into their operations as they undergo digital transformation need to establish baseline, essential digital competencies across their workforces This includes the following essential advanced manufacturing digital competencies outlined in Figure 27.

10 Maryna Ivus, Todd Legere, Christopher Lindstrom, Sheldon Lopez, and Faun Rice, "Digital Economy Pulse: Productivity and Employment Trends in Canada," Information and Communications Technology Council (ICTC), 2025, https://ictc-ctic.ca/reports/digital-economy-pulse-productivity-and-employment-trends-canada-august-2025, 22, Figure 9.

Figure 27. Baseline Digital Competencies for Advanced Manufacturing

Advanced Robotics Interaction	Safely and productivity interacting with advanced robotics in food production environments, including interactions with cobots, autonomous mobile robots, and human-centric robots.
AI and ML Basics	Understanding capabilities and limitations of AI/ML systems and how autonomous systems are being adopted into advanced manufacturing applications.
Cloud Computing Applications	Working with cloud-based manufacturing and enterprise systems such as MES and ERP applications.
Cybersecurity Fundamentals	Basic IT/OT security awareness for manufacturing environments.
Digital Twin Operation	Managing and interpreting virtual representations of physical systems.
Data Analytics and Interretation	Understanding how to collect, curate, analyze, and act on large volumes of operational data

Most critically, food and beverage manufacturers engaging in digital transformation need to create a culture of continuous learning amongst their workforces through deliberate organizational strategies and embracing innovative training models to foster digital talent.[11] Learning should be structured in a practical manner that conveys hands-on knowledge and digital skill development. Figures 28 and 29 outline organizational strategies and training delivery models for fostering digital talent in food and beverage manufacturing.

11 The Conference Board of Canada, "Building a Digitally Skilled Workforce: Insights from Canadian Employers and Skills Leaders," The Conference Board of Canada and Future Skills Centre, March 2022, https://fsc-ccf.ca/research/building-a-digitally-skilled-workforce/

Figure 28. Organizational Strategies for Fostering Digital Competencies in Advanced Manufacturing

Integrate Digital Skills into Existing Roles	Integration of digital competencies into existing job roles rather than creating separate digital positions.
Provide Recognition and Incentives	Recognition and incentive systems that reward digital skill development and knowledge sharing.
Develop Internal Digital Skills Training Capabilities	Invest in internal training capabilities to reduce dependence on external providers.
Include Workforce in Pilot Projects	Create cross-functional teams made up of employees throughout manufacturing enterprise to launch technology adoption pilots, document learnings.
Pursue Digital Talent Development Partnerships	Partnerships with post-secondary institutions, technology vendors, and other ecosystem actors for ongoing skills development.

Figure 29. Training Delivery Models for Fostering Digital Competencies in Advanced Manufacturing

Cross-generational Mentoring	Pairing digitally skilled employees with experienced technicians and scientists.
Simulation-Based Learning	Using digital twin environments, coupled with VR/XR for safe, realistic training experiences.
Micro-Learning Modules	Short, focused training sessions that accommodate shifts and production schedules.
Vendor-Supported Training	Leveraging technology supplier expertise for specific system training.
Micro-credentials	Short, skill-focused, and flexible educational programs, often delivered online.

Developing Strategic Partnerships

Canadian food and beverage manufacturers do not need to undertake their digital transformation journeys alone. Indeed, there are plenty of outside organizations within the manufacturing industry and the public sector that food and beverage manufacturers can develop strategic partnerships with. These include industry associations, as well as other ecosystem actors, such as industry working groups, industry-led training initiatives, and tech incubators. Post-secondary institutions can also be leveraged to provide workforce training, a pipeline of new talent, through work-integrated learning (WIL) initiatives, such as co-op programs, campus recruiting, and joint research activities.

Likewise, relationships with stakeholders such as customers, suppliers, and technology vendors should be taken into account when undergoing digital transformation. Figure 30 below outlines key strategic partnership and stakeholder management verticals, which should be accounted for when undergoing digital transformation.

Figure 30. Strategic Partnership Verticals

Customers	Vendors and Suppliers	Industry Associations and Ecosystem Groups	Post-Secondary Institutions
› Digital transformation co-investment and cost-sharing programs › Open digital platforms and interoperable data standards › Joint cyber/ information security protocols › Joint digital transformation pilot programs	› Digital transformation co-investment and cost-sharing programs › Open digital platforms and interoperable data standards › Vendor training and technical mentorship/ coaching programs › Joint cyber/ information security protocols	› Industry working groups (e.g., joint digital trans-formation working group) › Technology/ start-up incubator programs › Industry-led training and workforce development initiatives › Sectoral public affairs and governmental relations initiatives	› Workforce training and talent development › WIL programs (e.g., internships, co-ops practicums) › Campus recruiting (e.g., job fairs, industry nights) › Joint industry-academic research › Industry curriculum advisory councils › Research security cooperation/ safeguards

Information and Data-sharing for Food and Beverage Manufacturing Strategic Partnerships

In addition to the key partnership verticals listed above, food and beverage manufacturers should be ready to jointly develop predefined partnership frameworks and agreements upfront between new partners. Co-developing a common understanding of partnership objectives, scope, and timelines is critical to foster successful partnerships. Manufacturers should also understand the types of potentially sensitive non-personal data, such as production, financial, supply chain data, that may be needed to share with partners (Figure 31).

Figure 31. Strategic Partnership Information and Data-sharing Considerations

Strategic Alignment

- Objectives, scope, and partnership timeline
- Business case and ROI expectations (e.g., financial/performance metrics)
- Governance model and decision-making processes (e.g. IP ownership, dispute resolution)
- Knowledge sharing frameworks (e.g., publication agreements, joint workshops, user groups, technology demonstrators, pilots)

Technical Data Requirements

- Manufacturing systems and process (e.g., enterprise systems and control systems (MES/ERP), machinery/ equipment inventory)
- Facilities connectivity (e.g., 5G, ethernet)
- Non-personal data sharing (e.g., production and process, IP/trade secrets, quality, financial, safety/incident, supply chain)
- Interoperability standards and data formats
- Cybersecurity standards/data protection, Tri-council research security compliance

Safety, Regulation, and Compliance Requirements

- Quality standards
- Health and Safety standards
- Therapeutic safety and traceability regulations
- Environmental/ESG standards
- IP and confidentiality agreements

Digital Technology Adoption: A Call to Action

Canada's food and beverage manufacturing sector stands to greatly benefit from increasing digital technology adoption throughout the manufacturing enterprise. Over decades, Canada's food and beverage manufacturing industry has played an important role in Canada's economy, as a significant economic actor, major employer, and consumer of Canada's agricultural sector.

Canada's food and beverage manufacturers—including small- and medium-sized enterprises—have over the decades introduced innovative products to market to the delight of customers. Yet the sector has been slower to adopt novel digital technologies when compared to other industries in Canada's manufacturing sector. Over time, this may reduce the competitiveness of the food and beverage industry.

Over the next five to ten years, there are significant opportunities in emerging digital technologies such as advanced robotics, AI, IoT, and digital twins, but digital infrastructure must be continuously upgraded, while the food and beverage manufacturing workforce needs to be continuously trained and upskilled to get the most out of novel digital technologies on the factory floor.

Likewise, to get the most out of digital transformation, manufacturing businesses need to understand and rigorously assess opportunities brought about by novel digital technologies and incorporating them into their business plans and long-term corporate strategies, developing business cases, measuring ROI, evaluating risk, managing organizational change, and mapping stakeholders and strategic partners.

Action Steps

Assess	Map your current processes and technological capabilities and identify digital gaps.
Pilot	Start with a small project (e.g., a lab automation, predictive maintenance, or AI production scheduling tool).
Train	Involve staff early, build digital change champions on the lab floor, recruit digital technology talent.
Partner	Engage with vendors and suppliers, post-secondaries, industry associations and ecosystem groups, and customers for expertise and shared resources.
Scale	Expand proven pilots across lines, labs, or product families.
Integrate	Network successfully scaled technology adoption initiatives into a cohesive technology stack to drive profitability, cost savings, and productivity.
Iterate	Repeat technology adoption cycle as new technologies emerge and markets evolve.

Research Methods

This roadmap for the Canadian food and beverage manufacturing sector is informed by mixed methods research, including an industry survey of Canadian advanced manufacturers, a series of key informant interviews, an industry roundtable, and a comprehensive literature review. .

ICTC carried out an industry survey of Canadian manufacturers (n = 133) from June and July 2025, which included responses from 30 firms from Canada's food and beverage manufacturing sector. Due to the wide variety of firm types involved in food and beverage manufacturing and a relatively small sample size, survey data may not fully reflect the state of all Canadian food and beverage manufacturers. ICTC also carried out five semi-structured key informant interviews with senior executives, technical leaders, and other experts from the Canadian food and beverage manufacturing sector. ICTC also hosted a food and beverage manufacturing sectoral roundtable with industry leaders in November 2026.

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 helped to inform questions asked to research participants during the industry survey, key informant interviews, and focus groups, as well as design the final roadmap document.