

# Engineering Growth

Trends, Challenges & Investment Opportunities in  
Canada's Manufacturing Sector



MARCH 2024



deepcentre



## About the Report

As one of Canada's foundational industries, manufacturing is a vital driver of economic prosperity, employment, and R&D investment. Despite its importance in driving innovation and economic activity, the Canadian manufacturing sector has experienced significant headwinds, including stagnating productivity and flatlining sales. Reversing these trends is critical to the sector's long-term competitiveness and contribution to economic growth in Canada.



In September 2023, the Government of Canada commissioned the DEEP Centre to undertake a qualitative study of R&D performance in Canada's manufacturing sector. The study identifies barriers to R&D investment in the manufacturing sector and documents insights and strategies for helping Canadian manufacturers strengthen their growth and competitiveness. The findings and observations presented in this report reflect the views and concerns of forty traditional and advanced manufacturing executives across Canada and a select number of technology leaders and investment professionals. The DEEP Centre conducted interviews for the report between October 2023 and January 2024.

## About the Author



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Anthony is co-author (with Don Tapscott) of the groundbreaking international bestseller *Wikinomics: How Mass Collaboration Changes Everything*. The Economist called his latest work *Macrowikinomics: New Solutions for a Connected Planet*, a "Schumpeterian story of creative destruction," and the Huffington Post said the book is "nothing less than a game plan to fix a broken world."

In addition to his work with the DEEP Centre, Anthony is a research director with the Blockchain Research Institute, an expert advisor to the Markle Foundation's Initiative for America's Economic Future, a senior fellow for innovation with the Lisbon Council in Brussels, and chief advisor to Brazil's Free Education Project, a national strategy to equip 2 million young Brazilians with the skills required for a 21st Century workforce.

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# Engineering Growth: Trends, Challenges & Investment Opportunities in Canada's Manufacturing Sector

Despite the inexorable rise of the digital economy, manufacturing physical goods remains fundamental to economic prosperity and growth among the world's advanced economies. Indeed, as one of Canada's foundational industries, manufacturing accounts for the second highest share of Canada's gross domestic product (GDP) and provides high quality employment opportunities across the country.<sup>1</sup>

Canada's manufacturing industry encompasses a diverse range of sub-sectors, including automotive, aerospace, food and beverage, pharmaceuticals, machinery, and advanced manufacturing technologies. These sub-sectors feed economic growth by generating substantial revenue, foreign exchange earnings, and export opportunities. They also play a vital role in supporting other domestic industries by supplying intermediate goods and services.

The manufacturing sector is also essential to Canada's broader business research and development (R&D) ecosystem. In 2021, manufacturing firms contributed 25% of total business expenditure on R&D and represented 29% of R&D-performing firms.<sup>2</sup> New or improved products and production processes developed through R&D in Canada have enhanced the efficiency of resource extraction, lowered production costs in auto parts and aerospace manufacturing, and generated exciting growth opportunities in new frontiers such as bio-manufacturing, nanomaterials, and quantum computing.

Despite its importance in driving innovation and economic activity, the Canadian manufacturing sector has experienced significant headwinds. Real manufacturing sales have remained essentially flat over the last two decades. In addition, Canada had 1,789 fewer manufacturing firms performing R&D in 2021 compared to 2014, and there has been little real growth in R&D spending within the sector.<sup>3</sup> Expressed as a share of GDP, business expenditures on R&D in Canada are now roughly half the U.S. level and declining.<sup>4</sup>

In an uncertain global environment and amid ongoing processes of technological change, Canada's manufacturing sector faces significant challenges and opportunities. On the one hand, stagnation in Canadian business expenditure on R&D has weakened productivity growth and undermined the global competitiveness of Canadian manufacturers. A failure to reverse these trends will have far-reaching implications for the sector's long-term competitiveness, productivity, and contribution to economic growth. Without continuous innovation and investment, Canadian manufacturers will be less able to capitalize on emerging technologies and market opportunities, which will limit their ability to adapt to changing consumer preferences and industry dynamics, further eroding their growth and competitiveness over time.

On the other hand, waves of technological change present immense opportunities for manufacturing firms to streamline operations, enhance productivity, improve product quality, and reduce costs. For example, automation technologies can increase the efficiency of repetitive manufacturing processes, leading to higher precision and faster production cycles. IoT devices paired with AI algorithms can enable

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<sup>1</sup> <https://www150.statcan.gc.ca/n1/daily-quotidien/230214/dq230214a-eng.htm>

<sup>2</sup> <https://www150.statcan.gc.ca/n1/daily-quotidien/230802/dq230802a-eng.htm>

<sup>3</sup> Internal quantitative research conducted by the Government of Canada.

<sup>4</sup> <https://cca-reports.ca/wp-content/uploads/2022/11/State-of-Industrial-RD-Full-Report-EN.pdf>

predictive maintenance, optimize production processes, and reduce downtime. Embracing technological advances like these will allow Canadian manufacturers to unlock new avenues for growth, competitiveness, and sustainability in a rapidly evolving global marketplace.

In recent years, the Government of Canada has recognized the importance of increasing the competitiveness of Canada's established industries (including the manufacturing sector) with numerous commitments and initiatives to promote innovation-driven economic growth. This report contributes to that effort by exploring options to help firms in the manufacturing sector address barriers to increasing R&D investments and achieving innovation-driven sales growth.

## Study objectives and key findings

In September 2023, the Government of Canada commissioned the DEEP Centre to undertake a qualitative study of R&D performance in Canada's manufacturing sector. The study aimed to identify barriers to R&D investment in the manufacturing sector and document tools and strategies for helping Canadian manufacturers bolster their growth and competitiveness. Specifically, the investigation was designed to:

- **Undertake qualitative, interview-based research with manufacturing firms across Canada** to better understand their R&D models, their challenges in performing R&D, and their interaction with the current ecosystem of innovation support programs in Canada.
- **Identify specific sector-based barriers** preventing manufacturing firms from performing R&D at their optimal level and achieving innovation-driven sales growth.
- **Document insights into the specific R&D-related supports** that manufacturing firms have found helpful and would take advantage of to improve their R&D performance.
- **Provide context** to the government's efforts to develop new R&D-related support programming.

Semi-structured interviews with forty manufacturing executives, technology leaders, and investment professionals yielded the following key findings.

**Canadian manufacturers have diverse motivations for performing R&D.** Traditional manufacturers emphasized the need to increase productivity, differentiate their products from competitors, and compete with lower-cost jurisdictions. Advanced manufacturing executives said continuous investments in innovation enabled their companies to evolve and diversify their current product offerings, ramp up manufacturing operations, expand into adjacent verticals, and enter new markets.

**ROI expectations shape the scope and ambition of R&D investments by Canadian manufacturers.** When defining ROI expectations for R&D investments, advanced manufacturing companies operate with a high-risk, high-reward mentality, while traditional manufacturers emphasize the importance of stability and profitability. These different orientations are rooted in the nature, goals, and life stages of the two types of enterprises. Traditional manufacturers are typically mature businesses with bottom-line focused management teams that favour conservative and incremental investments in innovation with a proven, short-term ROI. By contrast, the founder-led management teams at deep tech and advanced manufacturing companies prioritize bold and continuous investments in market-leading innovation and see disruptive innovation and risk-taking as the price of entry into lucrative markets.

**Executives offered a mixed assessment of their capabilities to perform an optimal level of R&D.** Advanced manufacturing companies generally felt confident in their ability to conduct world-class research and innovation. Still, they often cited a lack of financial resources as a barrier to further investment. On the other hand, traditional manufacturers pointed to learning curves on new technologies, organizational culture, and risk appetites as crucial determinants of their capacity to perform R&D optimally. Additionally, manufacturing executives have experienced difficulties in partnering with post-secondary institutions and claimed that the tendency of universities to reap disproportionate benefits from R&D partnerships could significantly diminish access to critical resources for innovation.

**A challenging business environment for manufacturing is constraining growth and limiting R&D investments.** Traditional manufacturers said regulation, carbon pricing and the cost of capital have significantly impacted operational expenses, eroded profit margins, undermined competitiveness, and reduced the resources available for R&D. Advanced manufacturing firms said Canada’s comparatively immature ecosystem for scaling deep tech innovation has made it challenging to access the specialized capital, talent, infrastructure, and advisory services required to facilitate their growth and success.

**Labour market conditions, management skills, and industry structure are critical factors shaping the rate of technology adoption in Canadian manufacturing.** Executives understand that recent advances in automation technologies, robotics, machine learning, and the Internet of Things present opportunities to modernize legacy manufacturing operations. However, traditional manufacturers claimed that high rates of immigration and less acute labour shortages compared to the U.S. have dampened investments in productivity-enhancing technologies. Executives also cited a need for additional knowledge and capacity to evaluate and implement new technologies. Meanwhile, companies selling automation and robotics solutions into the manufacturing sector are frustrated with Canada’s inhospitable environment for technology adoption and believe new incentives and demonstration facilities could encourage domestic investment. Executives also pointed to industry structure in Canada as an obstacle to technology adoption, given the prevalence of SMEs and high-mix manufacturing operations.

**Traditional and advanced manufacturing firms differ significantly in how they finance investments in R&D and innovation.** Traditional manufacturers with established revenue streams and consistent profitability tend to invest conservatively from their balance sheets. Executives are reluctant to take on debt or dilute shareholder equity to fund “risky” investments in new technology or innovation, especially in a high-interest-rate environment. On the other hand, deep tech and advanced manufacturing companies broadly rely on external sources of private capital to fuel further investments in growth and innovation. Executives pointed to challenges in accessing sufficient late-stage capital for commercialization in Canada, citing the small deep tech investor pool and the CAPEX-intensive nature of their businesses as obstacles. Several executives believe the absence of further investment could trigger a sale to a foreign competitor.

**Deep tech and advanced manufacturing companies are concerned about their capacity to finance the commercialization and operating costs that complement their core R&D efforts.** Executives report receiving generous support for R&D activities but claim that innovation programs provide inadequate funding for various go-to-market activities critical to their company’s success. Executives said these costs include investments in scaling manufacturing capacity, pursuing international business development and sales, setting up distribution channels, and managing regulatory compliance and product certifications in international markets. Several executives fear their inability to invest boldly and move quickly will inhibit their ability to compete with deep-pocketed incumbents and well-financed foreign competitors. However, deep tech investors suggest the problem is not capital availability but rather a general lack of preparedness to scale among growth-stage companies.

**Canadian manufacturers deploy a broad mix of production models and face difficult location decisions when building additional manufacturing capacity to support growth.** The production mix ranges from fully outsourced manufacturing to contract manufacturing paired with in-house final assembly to full-scale production and assembly in Canada. Executives said they determine the choice of production models based on factors such as material and labour cost considerations, expertise, supply chain efficiency, and strategic partnerships. Many would like to expand their manufacturing operations in Canada but see richer federal, state, and local incentives to build capacity south of the border. Several interviewees also noted that federal and provincial governments have provided billions to help foreign multinationals build manufacturing capacity in Canada but have yet to match those investments with an equal readiness to help Canadian manufacturing scale-ups do the same.

**Manufacturing executives believe Canada provides generous support and incentives for R&D but see opportunities to make innovation funding more relevant and impactful for the manufacturing sector.**

Nearly all firms in the interview sample have received support from at least one significant federal innovation program or agency, including SDTC, IRAP, SR&ED, SIF, and the RDAs. Many executives singled out IRAP for praise, with its ITA-led model widely appreciated by manufacturing firms. However, executives did flag several concerns, including problems identifying the right programs, frustrations with administrative processes, and what several executives described as a perceived bias against traditional industries. Executives want funding programs to provide more support for the capital investments required to modernize legacy operations and scale up manufacturing. They also desire greater customization and flexibility in how funding is packaged and delivered to Canadian firms.

**The growth and international success of Canadian manufacturing require a broad menu of supports that go beyond traditional R&D funding.** Manufacturing executives want existing R&D programming to continue but warn that an exclusive focus on R&D funding is too narrow to meet the needs of Canadian manufacturers. Traditional and advanced manufacturing executives identified priorities such as support for market access and international business development, technology adoption, demonstration facilities and innovation partnerships, and support for scaling manufacturing capacity, including significant capital investments in equipment. Executives also said that the discretion to leverage government funding to invest broadly in various company functions—including marketing, sales, and other go-to-market activities—is critical to their ability to achieve innovation-led sales growth. Moreover, executives believe the government could help address gaps in private market financing for deep tech and advanced manufacturing ventures by providing a flexible combination of non-dilutive grants, debt, and equity investments.

## Project approach and methodology

The findings and observations presented in this report reflect the views and concerns of traditional and advanced manufacturing executives across Canada and a select number of technology leaders and investment professionals. To arrive at our conclusions, the DEEP Centre conducted 40 one-hour semi-structured interviews between October 2023 and January 2024. The interview questions fell under three categories:

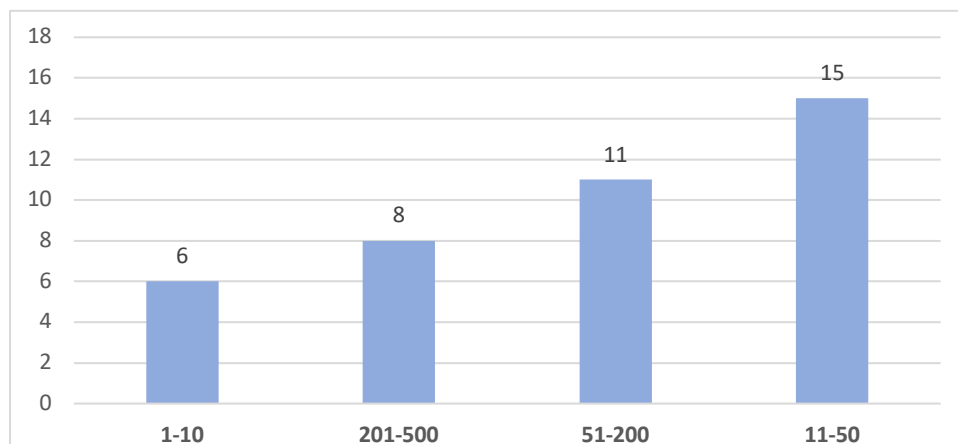
- Questions about the current R&D capacity of Canadian manufacturers, including the strategic drivers of their investments and their challenges in adopting new technologies.
- Questions exploring the barriers to increasing R&D investments, including access to financing and other critical resources to support growth and innovation.



- Questions examining the interaction between manufacturing firms and the ecosystem of government support programs in Canada.

The sample of Canadian manufacturing companies includes a diverse range of manufacturing sub-sectors, provinces, and company sizes and maturity levels. On a company size basis, the sample includes fifteen small manufacturers with 11 to 50 employees, eleven mid-size manufacturers with 51 to 200 employees, eight large manufacturing SMEs with 201 to 500 employees. The venture capital firms consulted by the DEEP Centre account for most of the micro-firms in the study.

**Figure 1: Sample distribution by company size.**



The interview sample also features a balance between the eight manufacturing sub-sectors targeted for the analysis. It includes representation ranging from heavy industrial sectors such as agricultural equipment, automotive, metal, and machinery manufacturing to deep tech and advanced manufacturing companies in robotics, semiconductors, photonics, bio-manufacturing, and medical devices.

**Figure 2: Sample distribution by manufacturing sub-sector.**

Manufacturing sub-sector	Count of Participants
Food manufacturing	1
Metal manufacturing	3
Machinery manufacturing	4
Medical equipment manufacturing	4
Electrical equipment manufacturing	4
Chemical manufacturing	5
Venture capital	5
Transportation equipment manufacturing	6
Computer and electronic product manufacturing	8
<b>Total</b>	<b>40</b>



## Observations and Findings from the Executive Interviews

The DEEP Centre’s executive interviews provided insight into R&D-related trends, challenges, and investment opportunities in Canada’s manufacturing sector. Following a systematic review of the transcripts, we distilled the key observations from Canadian manufacturing executives, technology leaders and investment professionals into ten themes.

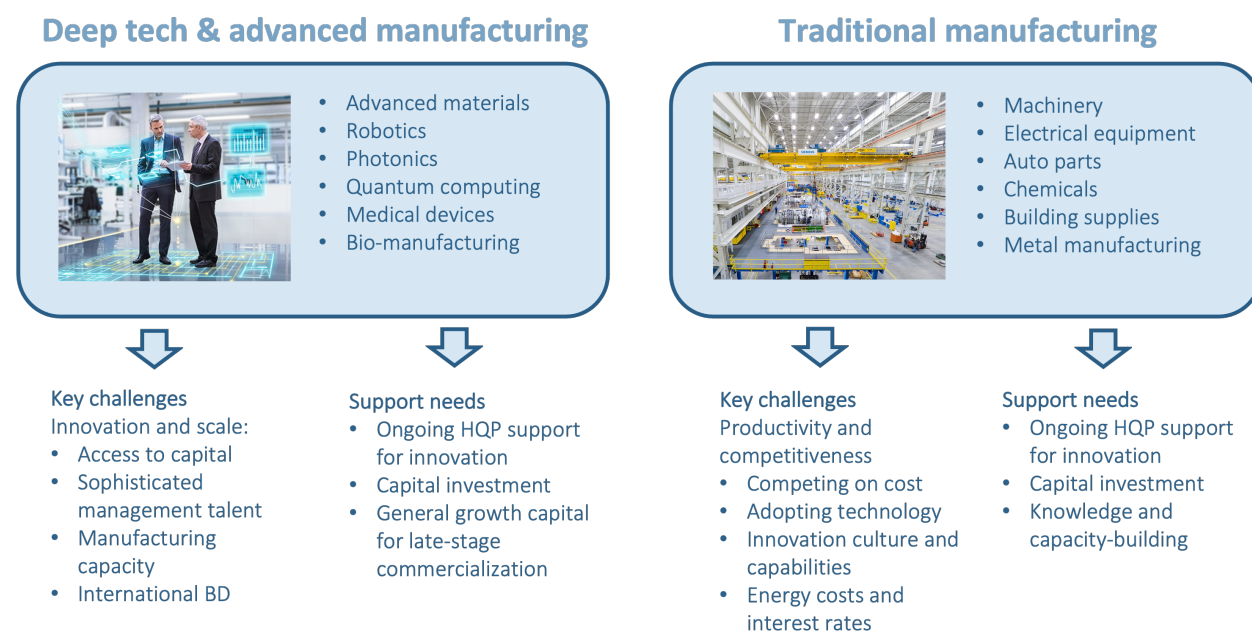
1. **Understanding the strategic drivers of R&D** including the motivations executives identified for investing in R&D and innovation.
2. **Differentiating ROI expectations from investments in innovation**, which highlights key differences in how manufacturing companies expect to benefit from R&D activities.
3. **Assessing R&D capacity**, with observations on skills, organizational culture, university partnerships and other critical ingredients for enabling innovation.
4. **Documenting challenges in the business environment** including access to talent, interest rates, energy costs and other factors that are shaping the current investment climate.
5. **Promoting technology adoption**, including reflections on the challenges of modernizing legacy manufacturing operations.
6. **Financing R&D and innovation**, with insights into how companies finance their R&D activities.
7. **Scaling deep tech and advanced manufacturing companies**, with observations on growing engineering-driven manufacturing firms in robotics, semiconductors, photonics, and other high-tech fields.
8. **Building manufacturing capacity in Canada**, which highlights challenges in scaling domestic manufacturing operations.
9. **Evaluating government support for R&D**, which documents company experiences with funding programs and agencies such as IRAP, SDTC, SIF and SR&ED.
10. **Identifying priorities for investment**, with insights into the activities for which manufacturing companies are seeking support.

Although the interview sample consisted of executives from firms of varying sizes and different sectors, we found the most salient and meaningful way to parse the input on the themes above was to distinguish between the views and concerns of traditional manufacturing companies and an emerging generation of engineering-driven deep tech and advanced manufacturing firms.

The traditional manufacturers included companies operating in the automotive, metal, machinery, chemical, and agricultural equipment manufacturing sectors. These mature companies were typically privately owned or family-operated businesses. Most were decades old and ranged in size from as few as twenty employees to roughly five hundred.

The deep tech and advanced manufacturing firms in the sample included companies working on cutting-edge technology and engineering challenges. Their specialities include advanced materials, robotics, photonics, quantum computing, clean technologies, medical devices, and bio-manufacturing solutions. Most deep tech companies in the sample are less than ten years old and in the startup or scale-up phase of maturity. Several of the mature deep tech firms employ between two hundred and five hundred

people. The sample includes deep tech firms that manufacture a physical product. We did not include deep tech firms whose primary business is software-based, such as artificial intelligence, blockchain or virtual reality companies.



As detailed in our analysis below, deep tech and traditional manufacturing executives identified significantly different drivers for their R&D programs. They also experienced differing challenges when translating R&D into innovation-led sales growth. For example, traditional manufacturers emphasized the importance of increasing productivity by modernizing legacy operations and investing in technology-enabled efficiency. By contrast, deep tech and advanced manufacturing companies prioritized the need for growth capital to fuel investments in rapid product innovation, talent acquisition, and global market expansion. In the remainder of the report, we examine these themes and challenges in more detail.

## 1. Understanding the strategic drivers of R&D

The DEEP Centre asked executives to reflect on the strategic drivers of their recent or ongoing R&D investments. In other words, we wanted to understand whether manufacturing companies align their innovation efforts with business objectives such as enhancing competitiveness, adapting to market changes, or ensuring long-term sustainability in a dynamic and evolving business environment. Here, we saw differences in how executives with traditional manufacturing companies and deep tech firms described the strategic intent of their investments in innovation.

**Traditional manufacturers emphasized the need to increase productivity, differentiate their products from competitors, and compete with lower-cost jurisdictions.** For example, automotive, machinery, and metal manufacturing companies face tough competition from manufacturers in China, India, Vietnam, and other countries with lower cost structures. Canadian executives claimed that investments in process optimization, automation and productivity-enhancing technologies were necessary to keep their costs as low as possible and, in some instances, to distinguish their offerings from companies that compete primarily on price.

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*“We feel the only way to not compete on margin is product differentiation. We want to be a technology leader, and I think we have succeeded in taking that on. Our product is considered best in class, and it allows us to separate ourselves from our competitors. If we were just in a commodity market, we wouldn't be very successful, and it would be hard to justify keeping the company in Canada. You have to put in the engineering time and differentiate. That's what's made us successful.”*

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**Deep tech firms described R&D activities as integral to the growth and evolution of their companies.** Key R&D drivers for these companies included the desire to enter new verticals, scale their operations, and compete with incumbents in their industry. Executives said continuous investments in innovation enabled their companies to evolve and diversify their current product offerings, ramp up manufacturing operations, expand into adjacent verticals, and enter new markets.

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*“Our biggest challenge is scale. The parent company of our largest US competitor is a three-and-a-half billion dollar publicly listed company. They don't even sneeze at spending money on the engineering problems we are working on now. When they move, they move so swiftly. Their dispersed access to scale in the form of distribution, logistics, personnel, and capital provides an enormous advantage. The thing that keeps me up at night is that in four years, we'll have been overtaken by a company that is behind us in the race right now.”*

*“If you look at our investment profile, it's really two buckets. One bucket is product development and product evolution. The other bucket is scalability. As products go to market and become successful, we need to fund the scaling of those products. Everybody would love to snap a chalk line to what that profile looks like. It never happens that way. And so, you invariably get production and scale issues that you need to address and deal with until you get to a mature state, which is where you become the incumbent in the market.”*

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## 2. Differentiating ROI expectations from investments in innovation

When asked about their return on investment expectations from investments in R&D, executives with deep tech firms and traditional manufacturing companies offered differing perspectives. Whereas deep tech companies operate with a high-risk, high-reward mentality, mature manufacturing companies emphasize the importance of stability and profitability. These different orientations are rooted in the nature, goals, and life stages of the two types of enterprises.

**Traditional manufacturers are typically mature businesses with private ownership structures and management teams that are bottom-line focused.** Executives with these firms tend to favour conservative and incremental investments in innovation with a proven, short-term ROI. By extension, they prefer to avoid risky, longer-term investments that they can't finance with positive cash flows. This ROI orientation is consistent with the strategic objectives identified above, including the emphasis on

improving efficiency, reducing costs, and maintaining market share rather than pursuing radical, high-risk innovations.

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*“There are cultural issues in private companies and family-owned businesses. The bottom line is really important. They're not looking to build generational wealth; they're looking to build profit for 10, 15, 20 years. Having more capital available does not mean they will invest in R&D because it's never going to be 100% leverage on the R&D spend. At best, you are getting 70% leverage which means they're losing 30%. They would rather invest in people that are going to squeeze more out of the bottom line.”*

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**Deep tech firms are typically young businesses with founder-led management teams focused on increasing enterprise value.** These executives are motivated to make bold and continuous investments in market-leading innovation. They see risk-taking as the price of entry into lucrative markets. As with growth-focused firms in other sectors, executives said sales growth and competitiveness take precedence over short-term profits. Underpinning this strategic orientation is the belief that investing in disruptive innovation and market leadership will yield long-term benefits and sustainable profitability.

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*“We have 100 people in R&D, and the team is divided in half. Half are focused on mechatronics. The other half is pure software. That's where I would say we have a very strong autonomy team, definitely the best in Canada and probably competing with the world's best. Our focus is on getting to the first 100 million dollars in ARR (annual recurring revenue) by scaling our existing offering. But our longer-term vision is to expand into a number of new use cases. We will be doing a lot of R&D and product development to get there.”*

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### 3. Assessing R&D capacity

R&D capacity refers to an organization's ability to conduct and manage research and development activities effectively. The capacity for world-class R&D can significantly enhance the ability of Canadian manufacturers to foster innovation, stay competitive, and drive long-term growth. Factors that influence R&D capacity include:

- Adequate financial resources for personnel, equipment, state-of-the-art facilities, and the acquisition of intellectual property.
- Human capital, including the skills, knowledge, and expertise of a company's workforce.
- Organizational culture, especially the risk tolerance of senior executives.
- Collaborations that provide access to additional expertise, resources, and diverse perspectives through external partnerships with research institutions, universities, and government agencies.



In assessing their current level of R&D capacity, executives with Canadian manufacturers offered a mixed assessment of their capabilities to perform an optimal level of R&D.

**Traditional manufacturers pointed to learning curves on new technologies, organizational culture, and risk appetites as crucial determinants of their capacity to perform R&D optimally.** Companies that were content with their R&D capacity emphasized the role of company owners and senior executives in creating an innovation-focused culture and sanctioning the requisite investments in people, technologies, and infrastructure. Executives who saw room for improvement in their company's R&D capacity identified risk as a significant impediment to investment or said they lacked the right skills and capabilities to evaluate and implement new technologies. In some instances, executives claimed that a high degree of risk aversion among their customer base limited the scope for R&D collaborations.

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*"Our customers are extremely risk averse. They are natural gas utilities, where bad things can't happen. So that means that all of that development of new technologies and solutions, all of the maturing of new approaches, has to happen outside of the customer's walls. If you can't innovate with your customer, you have to do it before your customer. That puts all the risk on our plate. We have to be hitting the market fully ready to go because your customer can't tolerate risk."*

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**Most executives with deep tech companies felt confident in their capability to conduct world-class research and innovation.** Many of the companies we consulted were undertaking extensive product development or had recently brought innovative products to market. Executives at these companies praised the depth and quality of their R&D teams, and most were not concerned about their ability to find high-quality scientific and engineering talent. However, many felt insufficient financial resources presented a significant barrier to making additional R&D investments at the pace required to keep up with competitors. In other words, of the essential ingredients of R&D capacity, access to capital ranked highest.

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*"R&D is a huge part of what we invest in. Certainly, hardware products require longer and perhaps more intensive R&D cycles but finding engineers and software developers has not been a problem. Generating the capital to hire those people is an ongoing challenge. The main issue for us is we could move faster if we had more access to resources, in particular financial resources. We're constrained by the number of people that we can afford to keep on payroll, which means we're not moving as quickly as we could."*

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**University-industry partnerships have traditionally been a vital engine for innovation in Canada, but executives said recent difficulties in building effective partnerships are a significant concern.** Several executives noted that the burden of managing the overhead associated with relatively small grants outweighs the benefits. However, the most significant point of contention is the perception that universities often reap disproportionate benefits from R&D partnerships. Executives claimed that grants to facilitate partnerships are usually structured so that universities receive all of the funding, equipment, and opportunities to engage their graduate students in cutting-edge research projects. Increasingly,

universities have also insisted on owning the IP generated from research partnerships. Numerous executives said this distribution of benefits is untenable when they are committing significant human, financial and intellectual property resources to the partnership.

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*“There are lots of universities that are interested in working with us and we're flattered by that. But we just don't have the manpower to manage four or five different smaller programs. Three years ago, we would have been happy with a \$30 to \$50,000 grant to work on something with a university partner. Now it's just too much overhead to start up, maintain a relationship and get results. The university programs are rewarding, but we're incurring costs to support a program when I could hire two engineers. The university partner gets more out of the relationship. They upskill their graduate students, they get all the funding, and they get all the equipment. Increasingly, they want to keep all of the IP generated from collaborations as well, which is a deterrent to working with them when we are contributing our time, people, expertise, and financial resources to the partnership.”*

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## 4. Documenting challenges in the business environment

The DEEP Centre asked executives to identify challenges in the broader business environment inhibiting growth or investments in R&D and innovation. Here again, we see significant differences between deep tech and traditional manufacturing firms. Executives with traditional manufacturing companies pointed to factors inflating their operating costs and impacting profitability and competitiveness. By contrast, executives with scaling companies referred to the relative scarcity of essential resources for facilitating growth, including access to domain-specific capital, talent, and infrastructure.

**Executives in traditional manufacturing companies identified regulation, carbon pricing and the cost of capital as challenges.** More specifically, firms in heavy industrial sectors and rural locations said rising energy prices have significantly impacted operational expenses, eroded profit margins, and undermined competitiveness. Numerous executives also noted that today's high-interest rate environment is a significant obstacle to further investment in R&D and innovation, especially capital-intensive projects requiring purchases of expensive equipment and technologies.

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*“Our challenges are significant when it comes to the cost of energy. Heavy industrial processes like welding and melting paint at 400 degrees all day long consume a lot of electricity and cost a lot of money. The unrecoverable cost of transforming that into another form of energy supply is non-viable and can be a major obstacle to the sustainability of industry in rural Canada. 90% of the farm machinery manufacturing business lives in rural Canada, adjacent to farms in small communities. We're dependent on a whole bunch of satellite industries, like maybe five guys in Swift Current who do laser cutting of steel and CNC bending and forming. If we go away, those three or four companies in Swift Current go away. Farmers and rural manufacturers are being asked to get to zero carbon emissions, without additional investments in significant infrastructure for alternative fuels and energy sources.”*

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**Early-stage companies point to the relative immaturity of the domestic ecosystem for scaling deep tech innovation as a constraint on growth in Canada.** Critical features of mature innovation ecosystems include the presence and quality of physical and digital infrastructure required for the adoption and advancement of new technologies, the availability of skilled labour and sophisticated management talent to drive innovation and sustain growth, and the density of entities operating within the ecosystem, including companies, research institutions, investors, anchor customers, and support organizations such as incubators, accelerators, and technology demonstration labs.

In Canada, domains such as photonics, EV batteries, hydrogen, quantum computing, and bio-manufacturing represent exciting opportunities for innovation and growth but generally lack one or more of these vital ecosystem features. By contrast, US-based companies in these high-growth sectors typically operate in a more mature ecosystem, making it easier to access the specialized capital, talent, infrastructure, and advisory services required to facilitate their growth and success. In addition to needing more growth capital (discussed below), Canadian executives said it is challenging to find sophisticated management talent with the domain-specific knowledge and experience required to commercialize and scale their innovations successfully. A less mature ecosystem also presents fewer opportunities for collaboration, networking, and knowledge exchange among startups, established companies, research institutions, and investors.

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*“Talent acquisition is probably my biggest growth hurdle. In the future, the small talent pool in Canada could very well be a driver for us relocating to Boston. I think we could build here, but it would be a lot harder to fill our key positions, especially the upper management talent. If the flywheels really start to turn and you're growing quickly, filling in those middle to upper management positions with innovative people with experience in innovative companies would be really tough.”*

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## 5. Promoting technology adoption in Canadian manufacturing

Globally, manufacturing is undergoing significant technological transformation. Leading global manufacturers have invested significantly in AI and machine learning to optimize production processes. Robotics and automation solutions are increasing precision and productivity. Investments in IoT and sensors are providing manufacturers with real-time insights into machine performance, product quality, and supply chain logistics. The DEEP Centre asked executives to reflect on the challenges associated with modernizing legacy manufacturing operations in light of these recent advances. Executives in traditional manufacturing focused on perceived obstacles to investments in automation. In contrast, executives with companies selling automation solutions into the manufacturing sectors voiced their frustrations with what several interviewees described as Canada’s inhospitable environment for technology adoption.

**Traditional manufacturers pointed to skills and capabilities as limiting factors and cited a need for additional knowledge and capacity to evaluate and implement new technologies.** Perspectives on technology, innovation, risk, and workforce development can significantly impact the rate at which traditional manufacturing businesses invest in automation. Successful adoption of automation often requires a forward-thinking leadership team that recognizes the potential benefits and navigates the challenges associated with technological advancements. Several executives noted that their management teams needed stronger technical backgrounds to appreciate the benefits and limitations of advanced

technologies. Conversations with executives also highlighted the need for higher comfort levels with the risks associated with automation investments and the organizational changes such investments entail.

**Labour market conditions in Canada also figured prominently in discussions about technology adoption**, with executives claiming that high rates of immigration and less acute labour shortages compared to the U.S. have dampened investments in productivity-enhancing technologies. For example, several executives noted that competitors in the United States have responded to the extreme scarcity of skilled labour in the manufacturing sector by turning to automation to fill the gaps in workforce availability. Canadian executives conceded that increased investment in automation could reduce their dependence on high-cost labour and improve their flexibility to respond to ups and downs in the business cycle. However, given the high costs associated with automating a legacy production line, many have struggled to make a compelling business case.

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*“It’s true that Canadian manufacturing companies have under-invested in technology. We don’t have anywhere near the labor shortages that our US counterparts face. From talking with some of the US counterparts, sometimes automation is their only option because they just can’t find staff. The labour market is not limiting our business. We always seem to be able to hire staff. I do think we do have a more flexible immigration policy, which insulates us from having to invest in automation technologies as heavily as the Americans and Europeans.”*

*“It’s always hard to make a business case around automating this piece of a process when it’s a choice between putting in a person or having a robot. On the longer term, investments in robotics will pay off because you have the reliability that you know that robot is going to operate at 99% uptime, and you won’t shut the line down just because of human constraints. But for smaller scale operators, it’s like, ‘Okay, it’d be nice to automate this,’ but what’s your payback and how much more competitive will you be by replacing a person with a robot? When you are building a new plant from scratch you can sink that extra \$10 million dollars into robotics to make it a full blown automated production line and you’re going to have a better competitive advantage out of the gate. But most manufacturers in Canada are making incremental improvements. It’s the same amount of money, but it just gets stretched out over time, and you may lose that competitive advantage because others catch up.”*

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**Deep tech companies, including those selling automation and robotics solutions into the manufacturing sector, pointed to industry structure as an obstacle to technology adoption.** One factor is the prevalence of SMEs in the manufacturing sector, which typically have fewer resources to invest in new technologies. Another factor is the concentration of high-mix manufacturing operations, which are more challenging to automate than high-volume manufacturing. For example, automotive and consumer electronics manufacturing typically features repeatable production processes that are amenable to automation. Shipyards, heavy industry, and industrial equipment, on the other hand, require frequent retooling to meet changing demands, making automation more complicated.



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*“A very significant percentage of the manufacturers in Canada are smaller companies with 10 to 20 employees. They have a small shop, doing a lot of high-mix manufacturing. They're not doing millions of units a minute. The nature and scale of the operations is not very conducive to automation. The midsize and smaller manufacturers don't have the resources for extensive R&D teams. The owners are also not really educated about the advances in robotics. Canadians are also a more conservative. They're not the first to adopt new technologies.”*

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**Technology suppliers would like Canada to strengthen the domestic adoption environment for new technologies with new incentives and facilities.** For example, scaling companies pointed to a need for demonstration facilities for piloting advanced manufacturing technologies and practices that could increase the productivity of the Canadian manufacturing sector. Executives have also experienced difficulties finding early adoption partners, with several suggesting that increased incentives might motivate large companies in Canada to test or adopt new technologies. Several interviewees noted a perceived bias against “Made-in-Canada” innovations, with many executives complaining that Canadian incumbents will only look at their solutions once they have proven themselves outside of Canada.

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*“Getting new technology adopted in Canada is just a pain in the ass. In as much as everybody talks about how technology is important, it just doesn't fly. No matter how many studies you do, and we have done lots of studies that have been published on how our stuff works, the first thing that happens in Canada is they say we're going to have to look at it for a couple of years before we can do something. We're finding Australia is much more interested in trying to do that stuff then Canada. Everybody says, ‘Well, why aren't you selling it in Canada?’ Well, if our product came from Europe, Canada would probably have adopted it much quicker. But it's kind of a Canadian thing to assume that nobody in Canada can do something great. So, we don't even really try. I just I lost complete interest in trying to sell in Canada.”*

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## 6. Financing R&D and innovation

The DEEP Centre asked executives to describe their company’s approach to financing R&D and innovation. Whereas traditional manufacturers tend to draw from current cashflows, scaling companies seek financing for R&D from private capital markets. Most of the companies consulted generally pursue additional financial support for R&D and innovation from IRAP, SR&ED and other innovation programs in Canada, a point we return to in section 8. Meanwhile, investment professionals claimed that Canada’s relatively small venture capital funds make financing advanced manufacturing and deep tech companies impractical.

**When financing investments in R&D and innovation, mature companies generally invest conservatively from their balance sheets.** Mature companies typically have a stable financial position with established revenue streams and consistent profitability. Executives said this financial stability allows them to allocate funds from their own resources without relying extensively on external financing. Indeed, we found a general aversion to taking on debt or diluting shareholder equity to fund “risky” investments in new

technology or innovation. Several executives with traditional manufacturers said debt financing for investments in new equipment or R&D projects was even less likely in a high-interest-rate environment.

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*“We finance most of our investments in R&D and technology out of cash flow and most of the time it's driven by customer needs. We are fortunate to have large customers like Suncor that who don't want to do anything that doesn't involve making oil. They want to have other people do the stuff that supports making it, but their focus is making oil. They know our capabilities and we've got a lot of projects on the go with them right now and they really champion some of the stuff that we do because of our capabilities. So that continues to enable our growth.”*

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### **Deep tech companies broadly rely on private capital to fuel further investments in growth and innovation.**

However, most growth-stage firms in the sample pointed to challenges in accessing sufficient late-stage capital for commercialization in Canada, citing the small deep tech investor pool and the CAPEX-intensive nature of their businesses as obstacles. More specifically, executives said private market investors in Canada are uncomfortable with the return/risk profile and the long timelines to liquidity associated with deep tech investments. As a result, most of the scaling companies consulted by the DEEP Centre have relied on angel funding or received capital from investors outside of Canada. Several executives suggested that their companies require additional growth capital rounds to stay the course as independent companies. The same executives feared the absence of further investment could trigger a sale to a foreign competitor.

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*“Most of our private sector funding has come from outside Canada. We received a lot of funding from the UK and Germany. Generally, there is an aversion to investing in the harder tech sectors in Canada. The harder assets don't have the same exit opportunities for VCs. The returns are on longer time scales and sometimes there is incongruency on valuations.”*

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**Investment professionals concede that Canada can be a difficult environment for commercializing advanced manufacturing and deep tech innovation.** Investors agree that Canada has been producing significant thought leadership and innovation but has yet to develop the commensurate investment constructs to finance deep tech companies through to maturity. Interviewees with venture capital funds said larger fund sizes are required to support capex-intensive companies while maintaining a sufficiently diversified investment portfolio. They also emphasized the importance of deep tech investors having return expectations and a degree of patience consistent with the realities of deep tech commercialization. As one VC put it, “We have a competitive differentiator in our academic institutions, and the level of science coming out of Canada is very powerful. But we don't protect it either from an IP perspective, and we're not yet sophisticated enough in that investment category. Deep tech is a very, very different construct of risk and return.”

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*“Deep tech and industrial transformation deals, including very capital-intensive domains like carbon capture, hydrogen and fusion energy are difficult to do given the*

*fund sizes in Canada. Our first fund was \$36 million, our second fund was \$63 million, and our current fund is \$145 million. And for those types of capex heavy scale-ups, you really need to be a fund of \$500 million or more, because your initial investment to actually get the company anywhere has to be significant if you're going own a decent chunk of the cap table, which is what we have to do as early-stage VC investors. At a minimum, you have to have \$10 to 15 million to invest, and then you have to reserve at least that amount for follow-on investments, outside of an extremely concentrated portfolio strategy, which in the grand scheme of VC hasn't really worked out historically. It's very hard to build a deep tech portfolio like that without more than \$500 million. So, Breakthrough Energy Ventures, for instance, is much better suited to funding those types of plays.”*

*“There's a massive, massive, massive hole right now in deep tech. Right now, advanced manufacturing companies are being financed by angels, or their capital is coming from the US. There is not much appetite or incentive to bring more capital towards deep tech. There is also a general lack of capital for longer R&D projects that come out of academia and need capital to commercialize and scale. The companies don't grow as quickly, and the margins are not quite there. BDC is trying to cover this space with its \$200 million deep tech envelope. Our fund is also active here. But across Canada, it's an underfunded domain. We need some out-of-the-box thinking from the federal government to attract more capital and make it more enticing to invest in Canada's future because deep tech is the backbone of the future.”*

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## 7. Scaling deep tech and advanced manufacturing companies

As a follow-up to our conversations about financing R&D, we asked executives leading deep tech companies about the challenges they have encountered in scaling their firms in Canada. While executives said their companies have received generous support for R&D activities, they are concerned about their capacity to finance the commercialization and operating costs that complement their core R&D efforts.

**Scaling companies claim that innovation programs could provide more robust support for various commercialization costs.** Numerous executives stressed that their R&D efforts mark the beginning of their company's commercialization journey. To ramp up sales, many say they are confronting significant and sometimes unexpected expenses for go-to-market activities that are critical to their company's success. Executives said these costs include investments in scaling manufacturing capacity, pursuing international business development and sales, setting up distribution channels, and managing regulatory compliance and product certifications in foreign markets. To manage the above activities, companies need skilled professionals whose work has little to do with the company's R&D and product engineering efforts. As a result, executives claim these go-to-market costs mostly fall outside of the purview of innovation programs in Canada.

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*“Either I'm going to license my technology or I'm going to make my product. The federal government can help me make my product. We have first-of-a-kind engineering costs to build a plant and other costs very specific to hydrogen, including supply chain validation. We have to run feasibility studies for new market applications.*

*Helping cover those types of costs will be important. I have \$10 million in backlog, and I am nervous and excited that to win the next \$30 million contract. But I have no idea how I'm going to execute."*

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**Founders are apprehensive about their competitiveness and long-term survival.** Although most aspire to replicate the successes of companies like Shopify, conversations revealed a sense of trepidation about the arduous path to becoming bona fide global champions. Several executives fear their inability to invest boldly and move quickly will inhibit their ability to compete with deep-pocketed incumbents and well-financed competitors in foreign markets. As one company founder said, "The entrepreneurs that get [to the late stage of commercialization] are so beat up, they're operating on fumes. And instead of seeing an opportunistic path forward to commercialization, you hit this brick wall of obstacles. Like, where's my engineering team? Where's my marketing and business development team? Where do I get the capital? It becomes so onerous that it's easier to sell out to a multinational company that understands those challenges of capital, patience, and tenacity to scale."

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*"Our industry is maturing to the point where we either need to raise billions to compete or we need to sell the company to a larger competitor that is willing to invest to expand their market share. I hope we will be a \$10 billion company, but I can understand a lot of founders wanting to sell between \$100 million and \$ 1 billion because when you get to those later stages if you're not all in, you're going to get crushed. And I don't think Canadians are as good at raising money at those later stages as many US companies."*

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**Investors believe many early-stage companies in Canada are insufficiently prepared to scale.** While company founders point to problems with capital availability, investors claim the underlying issue is that early-stage companies need to do more to prepare themselves to receive late-stage capital. Deep tech investors say early-stage companies often focus on the initial stages of product development and market entry without having a clear and comprehensive strategy for international expansion. For example, an early-stage company may find an initial product-market fit with a few local early adopters but fail to adapt their product to evolving customer needs or sufficiently differentiate it from those of international competitors. Additionally, founders may have strong expertise in product development but lack experience navigating challenges such as scaling operations, expanding the management team, and leading international marketing efforts.

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*My biggest comment on the Canadian ecosystem is that we often see early-stage companies that have not been adequately positioned to compete on a global stage. They may have support from SDTC and IRAP, which are great. And they may have a Canadian company as their first demonstration of their product, and they've got some initial capital behind it. So, everything makes sense from an entrepreneur's perspective. I have de-risked product development, and I've got a customer, I've got a government partner, everything is perfect. But from our perspective as investors, the technology needs to not just find product market fit with small utilities in Canada, but also be category leading and defining globally. Canadian companies are not the best*



*place to start. You need to be finding US customers that are at a completely different scale and demonstrating from the very earliest stages of your company that this is a product that's not only going to find product-market fit with six small Canadian utilities, but applies globally, whether it's energy and transportation, you name it. I think sometimes we see some of that earlier, development capital tricking entrepreneurs into thinking that they've found product market fit, which will allow them to scale globally and win the race. Unfortunately, that's not always the case. I think it's incumbent on us as later stage investors to be communicating these realities to some of these earlier stage companies.*

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## 8. Building manufacturing capacity in Canada

The DEEP Centre asked manufacturing executives to describe their company's approach to manufacturing and note any specific challenges inherent in scaling their manufacturing capacity, domestically or internationally. Here, we found that each company's unique circumstances and priorities had a significant bearing on its approach to production and its strategic decisions about where to build additional manufacturing capacity to support growth.

**Canadian manufacturers are deploying a broad mix of production models.** The production mix ranges from fully outsourced manufacturing to contract manufacturing paired with in-house final assembly to full-scale production and assembly in Canada. Executives said they determine the choice of production models based on factors such as material and labour cost considerations, expertise, supply chain efficiency, and strategic partnerships. Outsourcing is common among firms seeking to leverage the specialized capabilities of external partners, reduce manufacturing costs, and focus on core competencies such as product design and marketing. On the other hand, companies deploy in-house production when their products require a high degree of customization, confidentiality, and tight quality control.

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*"All of our manufacturing is offshore today. We are mainly manufacturing in China and India and Thailand is coming up to speed. In fact, we'll be shifting some product manufacturing to Thailand over the next two to three years. The labor is more cost effective. Many of our parts are pretty steel oriented. The Asian market for steel is still much lower cost than the European and the North American markets. So, there's definitely a distinct advantage in material costs in Asia, especially in China."*

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**Companies building additional manufacturing capacity to support growth face difficult location decisions.** Many would like to stay in Canada but see richer incentives to build capacity south of the border. For example, several executives noted that the U.S. provides richer incentives, tax breaks, and federal, state, and local subsidies. These financial incentives can substantially reduce the overall cost of building and operating a facility. Others prefer the United States because of the proximity to their largest customer markets. Executives claim that building manufacturing capacity in the U.S. can enhance supply chain efficiency and reduce logistical complexities. As one executive explains, "We would like to expand in Canada, but we're having a hard time doing the business case... We have to consider that 75% of our business is in the U.S. It would be nice if it was more economically viable to be here and expand our facilities here. But the U.S. is pretty tempting."

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*“We have big decisions to make about where we scale up manufacturing. The delays by the Canadian government on passing our version of the IRA is making the US a much more attractive place to scale up. If we do robot manufacturing in the US, we could get 70% of costs on a project for like \$140 million and very low interest loans covered by US Department of Energy. That solves one of our biggest challenges, which is equipment. It's a very capital intensive upfront investment to build a new plant. How do you cover that and not pay 18% interest because I can tell you that Canada doesn't have anything like what the DoE is offering.”*

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**Executives say risk-aversion is leading to lopsided support for multinationals.** Several interviewees noted that federal and provincial governments have provided billions to help foreign multinationals build manufacturing capacity in Canada but have yet to match those investments with an equal readiness to help Canadian manufacturing scale-ups do the same. Many executives consulted by the DEEP Centre lamented that the Strategic Innovation Fund reserved most of its firepower for enabling foreign direct investment. Some claimed that SIF's mandate should be to help scale made-in-Canada innovations.

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*“Every nickel we have right now is going into building a new manufacturing site. We need the government to get behind the domestic scale-ups that are trying to stay ahead of the competition and build their capacity. But what I find is every part of government is afraid to touch us. If SIF doesn't come through, our next expansion will probably be in Philadelphia where you can get access to American know-how and American money. We need another \$100 million to take the next step and do it at a scale that's feasible and competitive.”*

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## 9. Evaluating government support for innovation and R&D

The DEEP Centre asked executives to reflect on their experiences with government support programs for R&D and innovation in Canada. Here, executives generally appreciate the government's support for innovation in Canada, especially the non-dilutive funding that assists companies with the early stages of product development and commercialization. However, we also find evidence of considerable frustration with some elements of the federal funding apparatus, along with many suggestions for making innovation funding more relevant and impactful for the manufacturing sector.

**Nearly all interviewees in the sample have taken advantage of at least one of Canada's major innovation programs and agencies.** The most commonly cited programs included SDTC, IRAP, SR&ED, SIF, and the RDAs. Many executives singled out IRAP for praise, with its ITA-led model widely appreciated by manufacturing firms. Overall, there is a consensus that Canada provides generous funding and incentives for R&D. Executives want that support to continue but see opportunities for improvement, which we discuss below.

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*“From my experience, IRAP has done a great job. They're the only government funding agency that understands what manufacturers need and are willing to invest money into stuff that's not sexy, like the grimy R&D. They are willing to get involved in those*

*very early stages and the fact that they're all former business people is a massive bonus. Yes, they're trying to check the normal government boxes. But they can be flexible if your project changes. The reporting requirements are there, but they're not burdensome."*

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**Executives flagged several concerns about existing innovation support programs.** We have organized these challenges and concerns into five domains.

- **Identifying the right programs.** Most executives consulted by the DEEP Centre seemed well-versed in the array of federal funding programs. However, mature SMEs in traditional manufacturing sectors were more likely to need clarification about which programs best fit their needs. As one executive said, "The smaller companies don't know how to leverage the diversity of provincial and federal programs. They don't know how to stack funding because you can stack things so that we've got research programs with almost three-to-one leverage. You don't learn that in university. So, how do you learn it, and how do you create the access for SMEs to be able to do it?"
- **Navigating administrative processes.** The most common complaint from executives concerns the speed of application processing and decision-making from federal programs. As one executive explains, "If you can close funding from government within 12 to 18 months, you're doing well. That's in a world where time is everything. We are in a space that is so competitive. If it takes 18 months to determine if you're funding 25% of a \$20 to 25 million program, stay home, you're not adding any value." Additionally, executives would like greater transparency and active communication when applications are under review, noting that the absence of updates creates considerable uncertainty.
- **Overcoming perceived biases against traditional industries.** Several executives noted what they described as a bias against funding the kinds of R&D projects that are consequential for manufacturing companies in traditional sectors. For example, executives see plentiful funding for AI and electric vehicles but less support for advances in agricultural machinery manufacturing or redesigning automotive parts to increase production efficiency. "We feel like outsiders from the main sectors that seem to get funded," said one executive. "If we were doing AI, maybe I would feel differently. Because we're not a blockchain company, or an AI company or something else that feels new and shiny, we seem to have a hard time justifying why we need support. There are real businesses making real products employing lots of people who are fairly successful but can't get the attention they merit."
- **Accessing support for CAPEX investments.** Executives would like to see more support for the capital investments required to conduct R&D (such as lab equipment) or support commercialization and growth (such as building a manufacturing plant). As one executive explains, "IRAP is very strong on salaries for HQPs. It's not the best program on CAPEX. To be honest, all of these programs are really bad for capex. One of the key challenges in doing R&D in-house is buying the materials and lab equipment you use daily. Most of these programs only cover a portion of the depreciation of your asset, which is a 20-year depreciation. You have to put up the big bucks at the beginning. So, that forces companies to opt not to do R&D in-house. Instead, they rely on universities who get all of the funding, all of the IP and are very slow."
- **Customizing support to meet each company's unique circumstances.** Several executives also voiced their desire for greater customization and flexibility in how funding is packaged and delivered to Canadian firms. "The funding from the government has been awesome," said one executive. "35% of

our funding has been government leveraged. But the rigidity of the programs can hamper the commercialization process. We would like to see better options for customization. The programs need flexible funding instruments. We also need better messaging from the agencies. Make it clearer what the envelopes of funding are for so that we don't waste time. It took us a long time to understand the expectations."

## 10. Identifying priorities for investment

Executives interviewed by the DEEP Centre were asked to identify gaps in the current funding landscape. They also offered suggestions for making federal innovation programming relevant to the needs of traditional manufacturing firms and a new generation of engineering-driven, deep tech companies. While firms want existing R&D programming to continue, most interviewees believe federal programs need to provide a broader menu of supports to facilitate company growth. Priorities included support for market access and international business development, technology adoption, demonstration facilities and innovation partnerships, and support for scaling manufacturing capacity, including significant capital investments in equipment.

### Strengthen the public funding landscape

**Canada's ample support for R&D has primed the pipeline of early-stage deep tech and advanced manufacturing companies.** Executives consulted by the DEEP Centre want the federal government to focus its efforts on scale-ups and mature companies. They pointed to a gap in the public funding landscape for companies with projects or products between technology readiness levels 7 and 9. As one executive explains, "It's great that we have a support structure appropriate for early-stage companies, but it takes ten years to get these companies ready to go to market. We have next-generation biofuel companies, solar companies capable of generating gigawatts-levels of energy, and energy storage companies bidding on billion-dollar commercial projects. Those are the companies that we need to continue to support."

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*"The Americans and the Europeans seem to understand the huge gap to get from tier seven to nine which is so capital intensive, and so HQP intensive. The message to the government is look, commercialization in advanced manufacturing is a long road. If you don't have the stomach, the fortitude, to get to TRL 9, stay home, get out of the way. Don't waste time priming the pipeline with small opportunities, but then don't convert any of them to wealth generation at TRL 9. I think that's our greatest weakness and so any change to a federal program has to address these gaps in a material way."*

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**From a programmatic lens, interviewees said there are limited options between where IRAP and SDTC typically stop providing support and where SIF begins.** Some executives suggested that insufficient public funding for late-stage commercialization in deep tech and advanced manufacturing could partly explain Canada's lack of homegrown champions. However, contrarians countered that too many Canadian companies are insufficiently prepared to receive growth capital from the private market.



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*“We have tremendous funding for TRL 1 to 4. SDTC and IRAP are really good for lab scale and pilot scale where you're looking for somewhere close to \$5 to \$10 million. When you get to market demonstrations (TRL 8 & 9) and you need \$50 million or more, you have excellent coverage with Strategic Innovation Fund. Where you're really lacking is TRL 6 to 8. There's a big gap in Canada. I think the mandate should be somewhere between where SDTC stops, and SIF begins. We are looking for nothing more than \$50 million nothing less than \$10 million.”*

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## Close the growth equity gap for deep tech and advanced manufacturing

Executives claim that an aversion to funding deep tech and advanced manufacturing companies in Canada has left a gap in private market financing. Venture capital funds driven by the pressure to show returns to their limited partners typically prioritize investments in highly scalable ventures operating in sectors with quicker paths to market and profitability. By contrast, deep tech and advanced manufacturing ventures often involve longer development cycles, substantial R&D expenditures, and inherent technological risks. In some cases, the addressable market may be adequate to achieve significant revenue growth but too small to reach a VC's valuation objective. In other instances, comparatively high costs and long timelines for getting a solution to market can make VCs reticent to tie up a significant proportion of their capital in an illiquid position. Given the obstacles to obtaining private market financing, executives believe that a federal agency could position itself to provide the specialized finance and programming required to energize the development of robust advanced manufacturing clusters in Canada.

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*“The problem with VCs is their timelines, ROI expectations and their focus on a quick exit are not aligned with what many business owners want. And they are reluctant to invest in capital intensive manufacturing business. So, there is definitely a gap in growth equity. BDC has a VC arm, but there was not a good relationship there. We felt like BDC should have been much more supportive of the broader mandate of growing the Canadian economy rather than earning the highest returns.”*

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Investment professionals and business owners believe the Government of Canada overlooked the lower middle market of the growth equity space in its efforts to strengthen domestic venture capital. Several interviewees claimed there is a financing gap for mid-sized SMEs, including traditional manufacturers, that contribute significantly to prosperity and employment in Canada. The observed gap in lower middle market financings is corroborated by research from BDC and the CVCA. For example, research by Remilliard and Scholz identified a gap for mid-size SMEs looking for financing options in the \$2 - 5 million range.<sup>5</sup> Remilliard and Scholz described mid-size firms seeking capital in this range as “too small to attract the interest of the US majors, too low growth to attract venture capitalists, and too small for traditional private equity funds and banks....” As a result, Remilliard and Scholz conclude that domestic capital providers underserve companies seeking financing in this segment because the deals combine smaller capital requirements with more significant risks.

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<sup>5</sup> [https://www.ic.gc.ca/eic/site/061.nsf/eng/h\\_03133.html](https://www.ic.gc.ca/eic/site/061.nsf/eng/h_03133.html)

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*“The private equity in Canada to finance late-stage scaling in advanced manufacturing just isn't there. Just look at Carbon Engineering. After four years they got acquired by Occidental, so they're now an American company. The frustration is that we lost another unicorn. Why not step up, take a modest risk, and do what is required to functionally shackle these companies to Canada. That means you have got to have a cash component. Grants are great. Reasonable debt is good. And equity investments, if that's what it takes, we should be open to it. We have to put reasonable shackles to keep these firms in Canada meaning, at the very least, that we should do everything possible to facilitate the commercialization in Canada because the Americans and the Germans take no prisoners. We invest so much at the front end of innovation and then we do nothing, and the Americans just walk in and take it and bring it back.”*

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**A strategic and patient investor could use a combination of grants, debt, and equity to support growth in deep tech and advanced manufacturing.** In essence, executives are looking for a growth equity investor that operates without the expectations of private equity and VC-like returns. Nevertheless, executives believe they could leverage government funding to attract additional private capital. Most executives are also open to the government using “reasonable shackles” to incentivize firms to scale up in Canada as long as the funding is material. Such covenants could include clawbacks if, for example, recipients fail to meet domestic employment provisions.

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*“I think they should be making big bold bets, and they should be open to doing equity investments. The government talks so much about wanting to keep companies in Canada, but if you need to raise hundreds of millions, everyone knows that the investors aren't here in Canada. So, you're going to end up being foreign owned for these really expensive companies that are making chips or making new drugs. That's the missing link. I hope a federal agency could lead rounds or provide a secured source of investment that helps to bring in the other private investors.”*

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**Canadian manufacturers want the government to provide a flexible menu of supports to facilitate company growth.** Executives say the discretion to invest broadly in various company functions is critical to their ability to achieve innovation-led sales growth. “We don’t have the same access to the VC market as companies in other high-tech sectors,” said one executive. “We need equity investments or other types of funding that aren’t specifically tied to an R&D project. We need the flexibility to grow our business and to invest in the activities that support growth. So, if our current focus is on international expansion, we need more business development resources to help us penetrate China, as opposed to more engineering support for new product development.” Another executive agreed, noting that “Smart companies can determine how best to allocate the funds to move forward. They will do some R&D. They will develop the products, hire the salespeople they need, and do the marketing things required to support the general growth of the company.”

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*“I hope the government will provide broad funding to enable us to grow. If you narrow the funding too much, it may not be the best fit for the growth. Because if you say,*

*well, you can have \$5 million but you can only use it for R&D, you can choke the company up with R&D and not get all the other pieces done to make the company grow. If you don't have enough marketing and salespeople, enough regulatory people, or enough design people, you may have a fantastic manufacturing facility but lack all the other essential components to support the growth of the company."*

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## Provide market access and business development assistance

Like most growth-oriented firms in Canada, deep tech firms and traditional manufacturers need global reach to achieve high growth. However, physical products and solutions are typically more complex and costly to export than software and knowledge-based services. For example, moving physical products across borders involves complex supply chain logistics, including transportation, customs clearance, and distribution. Firms must take steps to safeguard their intellectual property and, in many cases, obtain and maintain various certifications. Exporting physical products also entails navigating complex international regulatory frameworks, including product standards, safety requirements, and compliance with trade agreements.

*"We're trying to deal with a global market. We have no choice but to go outside of Canada and because of the nature of our product and the markets, it's very expensive for us to do that. We've gotten support from government on the technology side. But our biggest challenge is trying to get in front of more potential customers and do more trials with them... We have trials underway right now in Spain, Argentina, and the US. We expect we'll be starting in Turkey in January and one in Switzerland in January. Now imagine the costs of doing this because the initial trip at least has got to be in person with nowhere near a guarantee of a payback."*

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Executives point to significant outlays for various international business development activities. These costs include international salespeople, travel, customer trials, product testing and certifications, and regulatory compliance. Once companies have completed a product development cycle, the cost and complexity of conducting these various international business development activities represent their most significant obstacle to expanding global reach and achieving high growth.

*"Most of the markets we go to require product testing and certification. There doesn't seem to be any government help with the testing and certification, and yet it can be an impediment to actually getting into the marketplace. Some of the tests to certify a product for the United States cost hundreds of thousands of dollars. We're not big enough to be able to do that for every state. It's too much risk. IRAP can help us develop a product for a new market. But when it comes to the testing the product, they can't for some strange reason."*

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Federal programs only cover a few of the costs associated with international market access and business development. Executives acknowledged that Global Affairs Canada's Trade Commissioner Service can

provide on-the-ground connectivity to support sales activities in foreign markets. Some firms have also received financial support to attend tradeshows. However, executives claimed that the Government of Canada should accompany its robust support for product development with more fulsome support for bringing those products to international markets.

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*“You need to look at the lifecycle of a company. IRAP fits at a certain sweet spot within that lifecycle. There are other lifecycle periods in which IRAP doesn't play at all right now. And certainly, once you get past the technical stuff, most of the commercialization and business development related activities just aren't funded by the federal programs. At that stage, you need the people and the processes and the engagements to commercialize your technology. Funding the whole lifecycle is important.”*

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## Fund capital investments and technology adoption

**Many federal funding programs provide support for HQPs but not for equipment and other capital investments.** Several executives said the significant financial commitments required to modernize production processes and adopt new technologies far outstrip the people costs. These costs include the upfront capital investment for acquiring and integrating advanced technologies such as automation, robotics, artificial intelligence, and data analytics. Other examples include capital-intensive investments to upgrade manufacturing facilities to meet modern standards, enhance energy efficiency, and comply with environmental regulations.

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*“We have got terrific growth potential in the company, but we need to make big capital investments and that's the roadblock. The technology investments help enable that because it puts us at the cutting edge, and we can do stuff that other companies can't. We've had a lot of successful projects with IRAP, but we have outgrown the program. We don't need to hire another engineer right now. We need to get the toys in the sandbox before we can build the right sandcastle. And those are expensive investments. There needs to be a balance between capital expenditure and support for the HQPs.”*

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**Manufacturing executives want a funding partner that provides a “one-stop shop” for CapEx and human capital investments.** Executives suggested that an integrated approach makes sense since increasing growth and competitiveness in the manufacturing sector often entails simultaneous investments in people, equipment, and facilities. Many suggested low-cost loans to support capital investments would be attractive in today's high-interest rate environment. As one executive explains, “Historically, we haven't pursued those bigger investments because much of the funding we're using is retained earnings. Low-interest loans for capital expenditures could be interesting. I think that kind of financing would become more attractive as we get into some of the higher dollar value investments and capital-intensive projects.”

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*“We are looking at building next generation manufacturing facilities in Canada, but the capital costs are enormous and far outstrip the people costs. The construction and the fit out of the plant and the equipment is actually a higher proportion of the risk. The people you can scale up as your business grows. You have a bit more control over how and when you scale that up. On the capex side you have to plunk down a whole bunch of money up front. Looking at the problem in front of us holistically, it would be great to have a funding partner within the government that is a one stop shop to cover the CAPEX and the human capital element rather than having to go to many different governmental organizations to try and meet those needs.”*

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**Support for capital investments and tech adoption could have a synergistic impact on Canadian suppliers of automation solutions and other productivity-enhancing technologies.** For example, programs to incent first movers and foster early adoption partnerships could support growth and productivity at both ends of the maturity spectrum. “Sometimes mature companies need incentives to try something new,” said one executive. “There are things you’ve been doing for decades, and sometimes you can’t see the forest for the trees when you’ve been in manufacturing for so long. You’ll always find reasons not to spend money and focus on getting through the next three months instead of thinking, ‘If we make this investment in automation, then we can go out and get more contracts or make our process flexible to do the same thing for another market that we haven’t discovered yet.”

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*“R&D tax credits and IRAP are fantastic for commercialization. I think the gap is more about the adoption of technology. It's very hard to push something new in the manufacturing sector when you're working with SMEs. Most companies don't want to be the first to try new technology. If you want innovative startups to push more technology and productivity into the manufacturing sector you need a mechanism to support the first movers.”*

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## Conclusions for the Government of Canada

Canadian manufacturers are well aware that adapting to evolving technological dynamics and global competition in the manufacturing sector requires them to address long-standing issues with productivity and competitiveness. Based on our consultation, the nature of this profound adjustment looks different for traditional and advanced manufacturing firms.

Traditional manufacturers must embrace advanced technologies—including automation, robotics, artificial intelligence, and data analytics—to optimize production processes, reduce costs, and enhance overall efficiency. Manufacturing executives understand that vital investments in innovation and technological transformation are necessary to compete with firms in lower-cost jurisdictions and sustain participation in global value chains. At the same time, executives concede that modernizing legacy manufacturing operations is a complex and challenging endeavour.



Challenges in retooling manufacturing operations include risk-averse organizational cultures, a lack of technology-related managerial competencies, and difficulties integrating digital solutions into decades-old equipment. Many manufacturers have also experienced margin compression due to rising wages, interest rates, and energy costs, which means less free cash flow to invest. Thus, when traditional manufacturers invest in R&D, they prioritize conservative and incremental projects that deliver short-term ROIs. Over 60% of manufacturing SMEs in Canada are family-owned businesses where stability and profitability take precedence over building generational wealth through disruptive innovation.<sup>6</sup> Some traditional manufacturers also claim that Canada's high immigration rates have expanded the low-wage labour pool, undermining the business case for making costly investments in AI, robotics, automation solutions, and other game-changing technologies.

Advanced manufacturing and deep tech companies face different opportunities and challenges. This emerging generation of engineering-driven companies operates at the bleeding edge of technological innovation. Executives understand that their companies must prioritize rapid innovation, talent acquisition, and global market expansion to keep pace with world-class competitors. Quantum computing, bio-manufacturing, robotics, and other deep tech domains are high-risk, high-reward fields characterized by revolutionary technological advances and aggressive global competition. The winners in these high-tech arenas need exceptional talent, deep financing, sophisticated go-to-market strategies, and world-class execution.

Canadian deep tech and advanced manufacturing executives are excited about the prospect of becoming homegrown global champions. At the same time, founders say the path to maturity has become more challenging in the post-pandemic environment. Above all, these challenges include what many describe as Canada's critical shortage of essential ingredients for scaling: growth capital, experienced management talent, and a robust environment for commercialization. As a result, some founders claim the unique combination of larger market opportunities, access to capital, strong industry ecosystems, favourable regulatory environments, and a deep talent pool makes the United States a more compelling destination for scaling deep tech and advanced manufacturing ventures. Other founders conceded that their inability to raise sufficient growth capital made a sale to a foreign competitor the most likely outcome.

In summary, traditional manufacturers need help with technology-enabled efficiency and productivity. Advanced manufacturing and deep tech firms need assistance with growth and scale. Both constituencies believe the federal government can help them address these challenges. Traditional manufacturers envision a funding agency with the resources and know-how to help firms modernize legacy operations with combined support for people and capital investments. Deep tech and advanced manufacturing companies see the potential for a modern, patient investment partner with a broad menu of supports to facilitate growth and innovation and the disposition and processes of a sophisticated private sector investment team.

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*"The government has got to move fast and take some risks. I've been through the emergence of advanced materials. Canada failed that miserably and is on the sidelines. Clean tech, nanotech, and AI are going the same way. And that's because of this aversion to risk and lacking the fortitude to disrupt and not just be a follower but a leader. BASF is 150 years old and spends \$2.3b a year on R&D. Of that, \$300 million of investment a year must fail. That is the ultimate measure of whether you are doing*

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<sup>6</sup> <https://www.conferenceboard.ca/product/the-economic-impact-of-family-owned-enterprises-in-canada/>

*anything disruptive. If we can get a little bit of that into our DNA, I think it'll be better for the country."*

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Although funding for R&D remains critical, executives want a holistic approach that provides business leaders with some discretion to deploy resources to the activities that are most likely to unlock growth and innovation. In some instances, hiring more engineers for product development will take precedence. In other cases, the most urgent priorities will include bolstering international business development resources or making capital investments in robotics and automation. "Flexibility is a key success factor," said one executive. "We need a combination of capital investment and people to grow and would like some flexibility to pick and choose a funding approach based on our current state. What's your technology readiness level, and what's your balance sheet look like? If we're making money, tax credits are gold. On the other hand, a low-interest loan could make sense for capital-intensive projects with a big upfront investment. We're a small company, we're a private company, we can be nimble and make quick decisions. We want to work with a funding agency that can offer a more tailored approach."

Above all, Canadian executives believe Canada needs big, bold investments in innovation to ensure the manufacturing sector fulfills its potential to deliver economic prosperity and high-quality employment opportunities across the country. That could mean setting aside the customary caution and political considerations that lead funding agencies to make many small investments spread evenly across jurisdictions. Instead, executives want transformative investments that will position a cohort of exceptional companies to succeed on the world stage. As one executive said, "If Canada wants to compete in key sectors, we have to make bets, and some of them will fail. But you can't win the lottery if you don't buy a ticket."