PROTEIN INDUSTRIES CANADA FIVE-YEAR SUPERCLUSTER STRATEGY

PROTEIN
INDUSTRIES
CANADA

Our Vision *is to position Canada as a leading global source of sustainable, high-quality plant protein and plant-based co-products, while substantially contributing to Canada's economic growth and international trade.*

Our Mission *is to inspire innovation and support collaboration to transform Canada's agriculture and food processing sectors.*

THIS IS CANADA'S OPPORTUNITY

The global demand for food is growing, with a specific need for more protein. Canada is uniquely positioned to meet this need. We are a leader in agriculture research with technologically advanced farmers. Western Canada is home to more than 28 million hectares of arable land, with annual production of 60 million metric tonnes of crops that results in 12 million metric tonnes of protein. Canada is a trusted supplier of food and feed.

It is our time

By creating more value-added processing opportunities in Canada, we will generate new companies, products, processes and services. We will create jobs. We will generate opportunities for our small and medium enterprises to scale, integrate into global value chains, transition to high-value activities and become global market leaders. We will build a shared competitive advantage for Canada.

A BOLD VISION FOR CANADA'S AGRI-FOOD SECTOR

The Advisory Council on Economic Growth and Canada's Agri-Food Economic Strategy Table set bold growth targets for the agri-food sector. The Dominic Barton chaired Advisory Council challenged Canada "to double its global market share in agri-food products by 2027."[1] The Economic Strategy Table set goals including $140 B in domestic sales by 2025 (an increase from $110 B in 2017) and $85 B in exports by 2025 (an increase from $65 B in 2017).[2]

Protein Industries Canada (PIC) is well-positioned to support these ambitious goals.

PIC will work to grow small and medium-sized enterprises and leverage the market power of large anchor multinational firms by:

- Creating connections between companies, customers and our world-leading scientific capacity;
- Investing in technological priorities;
- Addressing constraints to growth;
- Creating a strong, globally-recognized, Canadian plant protein value-chain; and
- Improving Canada's global brand.

1. Unleashing the growth potential of key sectors, The ADVISORY COUNCIL ON ECONOMIC GROWTH February 6, 2017.
2. The Innovation and Competitive Imperative: Seizing Opportunities for Growth. Report of Canada's Economic Strategy Tables: Agri-Food.

THE GROWING GLOBAL DEMAND FOR PLANT-BASED PROTEIN

The global plant-based protein market is estimated at more than $8 B USD and is expected to reach $14.8 B USD by 2023 with an expected compound annual growth rate of 5.9 per cent.[3] Over the next five years, human consumption of plant-based protein is projected to nearly double.[4]

This growth trajectory is supported by an increasing global population, a growing middle class, changes in western diets and increased requirements for livestock and aquaculture feed and companion animal food. According to the Canada West Foundation, as this global demand for plant ingredients escalates, international firms have assessed the Canadian Prairies as the place best suited to meet this demand. Getting in on the ground floor will position Western Canada to dominate the global plant ingredient industry.[5]

Canada has an advantage in the fact that we produce unique, high-protein crops, specifically canola and pulses. Our sustained advantage comes when we have continued access to the global market with novel products that come from these crops.

This space, primed for economic growth, is characterized by technology driven start ups, SMEs ready to scale and large anchor companies that have access to capital and global markets.

Targeted investments through the Innovation Supercluster Initiative (ISI) will contribute to this growth and create a sustaining ecosystem that will help meet the ever-growing market demand for plant proteins.

THE WESTERN CANADIAN PLANT PROTEIN ADVANTAGE

With approximately 85 per cent of Canada's farmland, innovative producers, globally-recognized research infrastructure and a low carbon agricultural production system, the Canadian Prairies are uniquely positioned to capitalize on global growth in demand for plant protein.

Few places can reproduce this competitive advantage that has evolved over a century of agricultural production in Western Canada. Canada's agriculture system is backed by a unique set of crops that are sustainably produced by innovative farmers. This system is supported by a research and development community that links the entire value chain from genetic researchers and breeders through the producer to ingredient processors and food manufacturers. The entire system is responsive to consumer needs and trends, as they are communicated back to researchers at the start of the value chain, allowing for innovation to be scaled and commercialized quickly.

3. Mordor Intelligence, "Global Plant Protein Market," https://www.mordorintelligence. com/industry-reports/plant-protein-market, November 2017.
4. Mordor Intelligence, "Plant Protein Market (2017 - 2022) | Size | Share | Forecasts". Web excerpt.
5. Canada West Foundation, "Sprouted: the plant ingredient opportunity taking root on the Prairies", December 2017.

STRATEGIC INVESTMENTS IN TECHNOLOGY

PIC's value chain approach to innovation, leading to increased production and processing, new and expanded export markets, and scaling of agriculture business, will occur through investment across four main technology priorities:

CREATE:

Will focus on advanced breeding technologies and germplasm development. Investments will focus on improvements to protein content, quality and functionality with an aim to improve processing efficiency and the development of novel food ingredients.

GROW:

Concentrates efforts on primary production and sustainability objectives using technologies related to data and predictive analytics, artificial intelligence, automation and sensor technology to increase production efficiency, including nutrient and water use, as well as soil carbon sequestration and enhanced photosynthesis. These efforts will reduce cost, improve sustainability and increase understanding of the effects of production practices on protein quality and quantity.

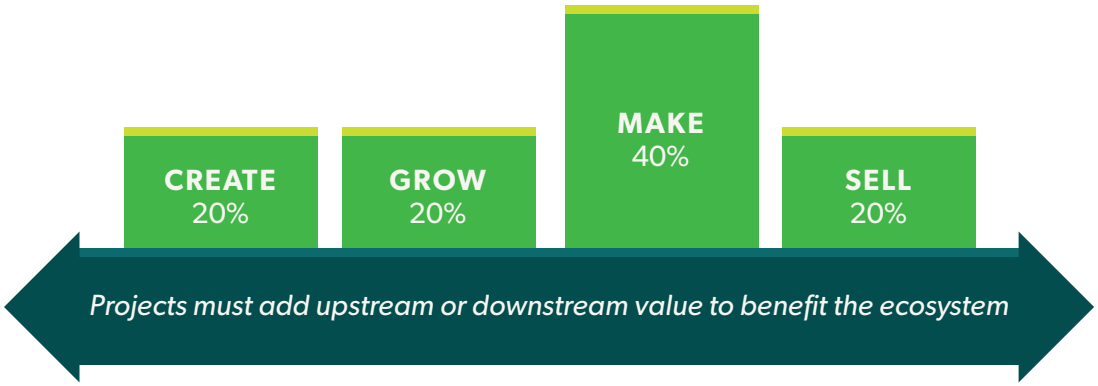
MAKE:

Is centred on improving processing by enhancing current processes or developing new technologies to increase efficiency, decrease energy consumption or to develop entirely new products from existing commodities. Improvements in this area will allow companies to scale, attract investment into the sector and help meet the need for product consistency in both supply and quality.

SELL:

Focuses on the development of new markets, in the human, livestock, aquaculture and pet food markets and serving those markets more effectively with improved logistics and traceability. This pillar builds on Canada's brand advantage as a food and ingredient supplier to be better position SMEs to take advantage of the increased demand for plant proteins. This includes pre-competitive research, prototyping and testing, improved trade relationships and trade literacy. Investments will connect small and medium-sized enterprises with multinational food and ingredient manufacturers and branded food companies through improved supply chains.

PIC's investment will be distributed in each of the four pillars that makeup the ecosystem.



OPPORTUNITIES FOR INVESTMENT

PIC will focus its investment in priority areas as identified by industry. These areas represent the most significant opportunities for growth and will have the greatest impact on the success of the ecosystem. These have been identified through industry consultation, the work of the Federal/Provincial/Territorial Agriculture Ministers' Table, and the Advisory Council Economic Growth and Agri-Food Economic Strategy Table Report.

Investments made in collaboration with the private sector will accelerate opportunities, while addressing areas of constraints. Together, this approach will grow the value added and food processing sector and establish Western Canada as a leader in the plant-protein sector. PIC will also help to build and strengthen the ecosystem, with the goal of ensuring that businesses have the supports and tools necessary to be successful, sustainable and to take advantage of opportunities. Examples of this include, improving IP literacy and assisting with access to capital and other support programs. PIC will invest into both Technology Priorities and Ecosystem Development.

Year	Technology Priorities	Ecosystem Development
2019	90%	10%
2020	88%	12%
2021	86%	14%
2022	85%	15%

The areas of investment can be classified within the broad categories of technology, global branding and recognition, infrastructure, access to labour, skills and talent, regulation, intellectual property management and access to capital.

Technological Opportunities

Agriculture and food processing are technology driven and innovative industries. Together, technology and innovation keep the sector globally competitive, allows the value chain to respond to shifting consumer demands and ensure industry remains adaptable to factors such as climate change. Innovation in technology is a major area of opportunity for the agriculture and food processing sectors, however, there is decreasing public sector investment in this area.[6] Increased and targeted investment will focus on advanced plant breeding technologies, data management and processing technology.

CREATE:

PIC will invest in advanced breeding technologies to overcome challenges related to speed of traditional breeding. Genomics and gene editing technologies will be employed to advance breeding objectives faster than could be achieved through traditional breeding methodology. In plant breeding, data and information derived from genomic screening and digital imagery will drive algorithms to predict field performance reducing the time from initial crosses to commercial production.

GROW:

Will focus efforts on data and predictive analytics to improve agronomic practices and to drive production decisions at the farm level which can have positive effects on yield as well as protein content, quality, consistency and overall production sustainability and Carbon emissions and sequestration.

MAKE:

Work in this area will ensure processors are more efficient, profitable and will help to reduce the environmental footprint of value added processing. Investment will address processing efficiency, including research into energy and input reduction, as well as support the development of new products and processes.

SELL:

Includes technology, such as employ block chain technology, to improve data capture and digitization to support supply chain efficiency and traceability.

Investing in our Global Brand and Recognition

Western Canada is home to more than 28 M hectares of farmland, that supports an average of 60 MMT of high-protein crops; an accomplishment not produced in any other jurisdiction. Add to this, Canada's current reputation as an environmentally sustainable source of agricultural commodities, with world-class innovative producers, and a strong competitive advantage begins to emerge.

However, the industry faces three main challenges in this area: reliability of supply, authenticating our global reputation and a lack of global recognition as a supplier of protein-rich food ingredients. Investment into these areas is necessary to improve Canada's global brand as a food and ingredient supplier.

6. AIC (2017), An Overview of the Canadian Agricultural Innovation System. Ottawa, ON: Agricultural Institute of Canada.

Canada's global brand as a reliable supplier is increasingly questioned due to issues with our rail and port infrastructure. PIC investments will lead to higher value, higher bulk density ingredients and food products, while opening alternative avenues of transportation; alleviating the dependency on rail infrastructure. PIC will also support the development of enhanced supply chain logistics to meet end use customer demands for reliability and traceability.

Canada, with the support of PIC, also has an opportunity to keep enhancing our brand around data trust and integrity. With the continued focus on field to plate, the ability to identify ingredients and their source with a transparent, traceable, reliable and trusted data tool is important in building our Canadian Brand. PIC will engage in partnerships to better understand expectations of customers and the proof points, metrics and data necessary to substantiate the claims.

The increasing demand for sustainability measures by both food manufactures and consumers, such as a full life cycle analysis of a product's carbon footprint, is a new factor influencing ingredient and food purchasing. PIC will work with industry to better understand how food companies are making ingredient purchasing decisions beyond the traditional criteria of volume, price, consistency and functionality. Targeted investments will explore purchase decisions related to sustainability, total carbon foot print, nutritional composition and food safety and develop a process and strong science to validate those claims.

Finally, PIC will work with industry leaders to tell the story of Western Canada's plant protein advantage – of novel crops that lead to novel products – to the global marketplace. Our goal is to ensure that domestic and international food and feed companies recognize our global advantage and that the entire value chain receives full benefit for our innovative and sustainable production and processing practices.

Infrastructure

The agriculture and food processing sectors have complex and substantial infrastructure needs. To secure the Prairies as an agriculture production and processing powerhouse, focused investment into infrastructure along the value chain – from the lab to end market – is necessary.

As a sector required to move high volumes of low-bulk density product to market, the agriculture and food processing sector is particularly attuned to transportation infrastructure challenges. While PIC is not investing in rail transportation, PIC will focus on the creation of new, higher value products that allow for additional modes of transportation in addition to rail – helping to improve reliability of western Canadian products

Beyond transportation challenges, infrastructure deficits exist in research capacity and data management.

RESEARCH CAPACITY:

Research needs for the agriculture sector in Western Canada are well serviced at the front end of the value chain, or the Grow pillar. A strong network of private and public plant breeders and facilities exist to meet most needs in this area. However, research infrastructure is lacking in the processing, product development and product testing areas. PIC will work with private sector partners, contract research facilities, post secondary research institutions, regional food industry development centres and regional colleges to catalogue the research infrastructure, identify critical gaps and then co-ordinate with funding partners to create a sustainable research and development community and infrastructure. Potential research infrastructure funding partners include producer organizations, federal and provincial government departments and agencies, private sector contract research institutions and philanthropic investors.

DATA MANAGEMENT:

We are currently witnessing a digital transformation of all industries across the global economy. The rate and pace of digital transformation is increasing, and the agriculture and food industries must adapt to survive and thrive in this transforming economy. This is critical to meet the increased demand for food, sustainable production goals and to attract much needed capital investment to the sector. PIC will help foster a foundational data platform for innovation across all four PIC pillars and for all members to meet the goals of the Supercluster.

The need for improved data infrastructure in the agri-food space was recently highlighted by Dominic Barton who urged the industry to "develop a data strategy for the agfood sector in Canada to securely collect agronomic and economic data from farmers and food processors, provide them with enhanced decision-making tools to enhance yield, crop quality, and competitiveness, foster system-wide transparency and traceability, and furnish researchers with data for their work–all through partnerships with analytical platform providers and scientists."[7]

Improved Data and IT Management can be employed across all four PIC strategic pillars;

- **Create:** Utilize bioinformatic data and digital plant imagery to improve the speed and accuracy of plant genetic improvement and creating tighter linkages between genotype and nutritional quality;
- **Grow:** Improve the intersection of sensor technology, satellite imagery, weather data and farm record management (both inputs and outputs) to improve production efficiency;
- **Make:** Through enhanced seed quality information (protein content and seed constituent characterization) to improve processing efficiency; and
- **Sell:** Employ industry chain of custody technology to improve both supply chain efficiency and traceability.

PIC will work with members in the Data and IT space and across all four strategic pillars to address principles related to data management for data creators, aggregators and user, work to address data governance issues and increase collaboration with existing data and new data that will be created within the ecosystem.

Increasing Access to Labour, Skills and Talent

The value added, food processing and feed sectors require a diverse and specialized labour force that spans plant breeders and geneticists to agronomists and production agriculture specialists. Food processing – creating new products and processes, requires an array of skills – from process engineers, plant operators, food scientist and product development specialists. In addition, the increased focus on digitization will require more programmers, AI specialists and data analysts than are currently working in the field.

The Agri-Food Strategy table characterized the problem, "primary agriculture, food processing companies and related input and service providers employ approximately 3.5 per cent of Canadians, yet the sector continues to report critical and ongoing labour shortages across all skill levels. The cause of this is complex, but top reasons cited by industry include a lack of skilled talent both in STEM and other high-skilled occupations (e.g., machine technicians), lack of awareness about career opportunities in the agri-food sector for general occupations (e.g., electricians, plumbers) and perceptions about working in the sector."[8]

7. Unleashing the growth potential of key sectors, The ADVISORY COUNCIL ON ECONOMIC GROWTH February 6, 2017.
8. The Innovation and Competitive Imperative: Seizing Opportunities for Growth. Report of Canada's Economic Strategy Tables: Agri-Food.

The challenge is that no single academic institution can provide the full capacity in programming required to match industry needs. Given the pace of intelligent technology disruption and the opportunities associated with these new technologies, the need for iterative collaboration between industry and academia is critically important. Western Canada can be a leader in industry and academia working together to design curriculum that considers industry demanded skills to produce highly skilled graduates.

In support of this, PIC is working with industry and academia to establish the Pan Prairie Academic and Training Working Group (PPAT-WG). This group will ensure that there are the necessary skills and training tools to meet the future demands of the sector. The PPAT-WG is composed of representatives from industry and academia from businesses, universities, colleges and polytechnics across the Prairie Provinces. In addition to industry and academic stakeholders, the PPAT-WG engages with the National Research Council (NRC), the National Sciences and Engineering Research Council (NSERC), the Social Science and Humanities Research Council (SSHRC), Mitacs and Technology Transfer Offices across the Prairies.

Specifically, the PPAT-WG will develop a labour force skills strategy, provide an online, searchable database of academia skills and training expertise across the Prairies, create programming for skills and talent development for students at all levels and act as a technology and training sandbox to provide work-integrated learning opportunities for students at all levels.

Addressing Regulatory Barriers to Innovation

Canadian commodities, ingredients and food products enjoy a strong domestic and international reputation for food safety, due in part to a science based regulatory framework, anchored by *The Safe Food for Canadians Act* and several other Acts and Regulations that strengthen our reputation.

However, the state of the regulatory environment in Canada and the impact of regulation is impacting companies' willingness to invest and their ability to innovate. Dominic Barton called for "modernizing regulations to streamline approvals and remove barriers to bringing new solutions to market."[9]

The Agri-Food Economic Strategy Table was more direct stating that, "Overly prescriptive and process-driven regulations are preventing companies from adopting innovative products and production systems, responding to shifting market opportunities and accessing the latest technologies used by competitors. Regulators need to work with industry…to identify opportunities to achieve our strict health and safety outcomes at the lowest cost to the economy."[10]

PIC has engaged in a series of industry consultations regarding the challenges our member face in the regulatory space. These span the value chain from Plants with Novel Trait Regulations, Novel Food Regulations, Novel Feed Regulations and Food Labelling requirements. Industry concerns include uncertainty with how regulatory decisions will be made and enforced, uncertainty about how new technologies will be regulated, the length of time required for regulatory approval and asymmetrical regulations with our major trading partners.

9. Unleashing the growth potential of key sectors, The ADVISORY COUNCIL ON ECONOMIC GROWTH February 6, 2017.
10. The Innovation and Competitive Imperative: Seizing Opportunities for Growth. Report of Canada's Economic Strategy Tables: Agri-Food.

This uncertainty impacts a company's willingness to invest in the agriculture and food processing sector. Plant breeding firms, for example, have greater certainty about the regulation of gene editing technology in other jurisdictions, such as the United States. Therefore, these companies are much more willing to invest in the U.S. compared to Canada. This is compounded when both SMEs and MNEs potential investment is considered. Canola and pulses are large and important crops in Western Canada, but relatively small globally. The uncertainty of Canada's regulatory space for novel traits further cements a business' decision to invest in larger crops, such as corn and soybean, in more certain regulatory environments such as the U.S.

From a food processing perspective, the asymmetrical regulatory requirement for plant protein labelling with the U.S. requires food companies to create and run separate packaging lines for both markets. This prevents investment in Canada, as the U.S. market is considerably larger and more profitable. This leads to Canadian developed food products, made with Canadian ingredients, being produced in the U.S. for the U.S. market.

PIC will work with industry to determine the most significant regulatory barriers to innovation, while maintaining food, feed and environmental safety. The Supercluster will work with federal and provincial regulatory agencies to create the scientific knowledge required to implement regulatory changes in support of innovation.

Increasing the Value of Intellectual Property

Canada is a country of inventors. We have strong scientific capacity that leads to the creation of new knowledge and technologies, however we lag other industrialized nations in our ability to realize the value of IP. There are many reasons for this identified in the recent Federal Government report, Building a Nation of Innovators, including weak IP literacy, the fact that only 10 per cent of SMEs hold IP and less than half of those have a formal IP strategy. This is despite our understanding of the value of IP in today's economy. "SMEs that hold formal IP are four times more likely to export and 64 per cent more likely to be high-growth firms. Businesses using IP in patent-intensive industries have about eight to 10 times more revenues than those not using IP. IP-intensive businesses pay 16 per cent higher wages, on average, than businesses with little or no IP. SMEs that hold formal IP are three times more likely to engage in product innovation than those without IP and two times more likely to engage in other types of innovation."[11]

Support in managing, and access to, IP is a benefit of Membership with PIC. PIC's approach to IP management is based on three guiding principles:

- Building trust among Supercluster members;
- Protecting the value of background IP; and
- Maximizing the value of foreground or arising IP.

Using these principles, PIC will work with industry to increase the value extracted from Supercluster co-funded research.

PIC will work with SMEs to improve their IP literacy with a focus on awareness, education and advice with an aim to create better knowledge and understanding of how IP can help companies compete in a global marketplace. PIC will provide services through a dedicated IP Manager and create opportunities for information exchange on industry best practices for IP management.

11. Building a Nation of Innovators, Innovation, Science and Economic Development. www.canada.ca/innovation.

To assist members in maximizing the value of IP, PIC will create an IP registry for all Foreground IP developed with investment from the Supercluster. In addition, at the start of each project, PIC will, through the role of the IP Manager, help consortia develop their IP rationale, anticipate the Foreground IP that will be developed and help identify Supercluster members that may benefit from a formal licencing of the Foreground IP.

PIC will help SMEs better protect their IP through improved IP literacy, creating connections between members and legal expertise and ensuring that project consortia define at the start of a project, both the IP ownership structure and plans for the licensing of IP to other members of the Supercluster. In addition, PIC will work with industry to explore a prior art library in the agriculture and food processing sector to help defend against patent challenges against member developed IP.

Access to Capital

In recent years, agriculture and food processing has been an area of emphasis for venture capital investors. Most notably, high profile projects such as the development of the Impossible Burger have garnered attention. It is encouraging to see the investment in the agriculture and food space, however, the Canadian reality is that less than three per cent of venture capital investment flows into the Prairie region, and only a fraction of that is targeted to the agriculture and food processing sector.

Western Canada has seen both start up and established companies looking to scale, move out of the Prairie region and establish operations closer to venture capital sources. This separation between the research community that generates new technology and those with the skills to develop and commercialize it, has slowed the pace of innovation and commercialization.

As PIC works with industry to develop new crop processing technologies and novel food ingredients, it only makes sense to commercialize and scale those processes in Western Canada, near the supply of raw material. This requires talent and capital. To achieve the convergence of technology, talent and capital, PIC will work in close concert with a series of Venture Capital firms that have a line of sight to the PIC research portfolio. The mutual exchange between the technology companies and the venture capital firms will help ensure that technology is commercialized faster. Venture Capital firms are best positioned to provide an environment for technology incubation and mentorship to PIC funded SMEs.

KEY PERFORMANCE INDICATORS

PIC is seeking to increase Canada's global economic strength in the creation, development and commercialization of plant proteins and co-products to help position firms to achieve scale, become integrated into global value chains, transition to greater production of high-value activities and become global market leaders.

PIC has identified seven top line metrics on which to measure success;

Opportunities for Growth	Outcome
Overcoming Technological Challenges	• The development of new plant-based food ingredient, feed, pet food, aquaculture and industrial products • Increase in the research and development investments in the private sector • The creation of 4,500 jobs over the next 10 years as a result of PIC investments and the development of new technologies
Improving our Global Brand and Recognition	• Increase the economic value of Canada's Agri-Food industry by $4.5 B over the next 10 years • Establishing Canada as a globally recognized centre for plant proteins and related co-products
Addressing the Infrastructure Deficit	• The creation of lasting research infrastructure for the value added processing sector • Enhanced industry collaboration in data management and data analysis leading to improved production and processing decisions
Increasing Access to Labour, Skills and Talent	• Increase in the number of students trained in fields related to the value added processing sector in Western Canada • Increase in the number of new graduates employed in the values added processing sector in Western Canada • Increase to the number of research and development employees and world-class scientists present in the cluster
Addressing Regulatory Barriers to Innovation	• A regulatory system that supports and encourages innovation across the value chain while ensuring food, feed and environmental safety
Increasing the Value from Intellectual Property	• Increase in the number of SME firms that hold IP • Increase in the number of firms with a formal IP strategy • Increase the number of license agreements for IP in the agriculture and good processing sector
Improving Access to Capital	• Increase the total percentage of venture capital funds invested in Western Canada • Increase in the total percentage of venture capital funds invested in the agriculture, value added and food processing space • Increase the number of new firms, spin-offs and their survival rate, as well as the number of local firms involved in the cluster

ONGOING STRATEGY EVALUATION

The Board of Directors and Management of Protein Industries Canada are committed to organizational and operational excellence, responsive to the needs of our members and industry, delivering on the objectives and expected results of the Innovation Supercluster Initiative and above all, growing the value-added processing sector in Canada.

The concept of the Supercluster, the Innovation Supercluster Initiative and the work that Protein Industries Canada is about to undertake is new to Canada. As this sector is rapidly growing and subject to changing market demands, new trends and the adoption of new technologies, this strategy will continue to evolve.

An indication of the success of the strategy, is PIC's sustainability beyond the initial five-year agreement. Therefore, in addition to the work necessary to operationalize and implement this strategy, PIC will explore strategic partnership and alternate revenue sources to ensure relevance and continued growth beyond 2022.

As such, Protein Industries Canada is committed to ongoing review, evaluation and adjustment of this five-year strategy and will update and amend as required.