# ALBERTA INNOVATES

# ALBERTA INNOVATES BUSINESS PLAN 2018-21

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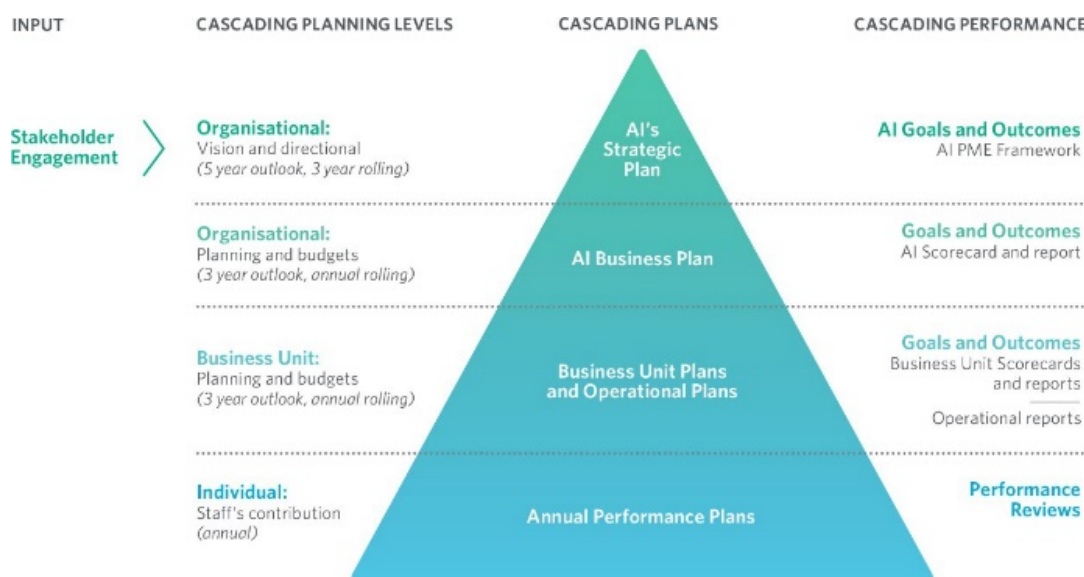
**ALBERTA INNOVATES**

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# EXECUTIVE SUMMARY

Alberta Innovates (AI) became a single entity on November 1, 2016. Our path to this business plan was preceded by a period of transition, during which we focused primarily on key integration activities and operational goals in our transitional business plan. We continued to deliver on the intended outcomes of our primary stakeholder, the Government of Alberta, during this period of consolidation.

AI undertook an in-depth strategic planning process that set the foundation for a business plan framework and provided the focus for this plan. Our process also included the following cascading plans and performance methodology. These led to the creation of the goals and outcomes presented in this business plan.

**Figure 1. AI's Cascading Levels and Performance Development**



During the coming years, we will work toward our **vision** – to be indisputably recognized provincially, nationally and internationally as a leader in catalyzing research and innovation (R&I) in Alberta. Our **mandate** is to be outcomes-oriented; user-driven and responsive; collaborative; strategic; and transparent and accountable. Our **goals** are to:

- Be a trusted R&I system convener.
- Strengthen capacity and ecosystem supports to enhance Alberta's knowledge workforce and talent pool.
- Foster system linkages to advance knowledge and cultivate a high-performing R&I ecosystem.
- Adopt better ways to accelerate innovation.
- Make a difference for our clients, Albertans and society by contributing to a diversified economy, cleaner environment, and a healthier and more prosperous Alberta.

As AI accomplishes its goals, the Corporation will contribute to the creation of new industries in Alberta and strengthen existing ones, help diversify the provincial economy, and help expand economic activity by driving the growth of jobs and exports. AI will also help Alberta move to a lower-carbon future and improve the health and well-being of Albertans.

In the near term, AI will provide continued support through the full R&I continuum, from discovery to use, in the areas of: health; energy and greenhouse gas (GHG) mitigation; environment and climate adaptation; food and agriculture; and development of bioindustrial products and technologies. Many existing post-secondary, business and industry research programs will be unchanged. AI will also continue its contributions to building an integrated R&I system in Alberta. With our partners and other stakeholders, we will identify and define pathways between our inputs and activities and downstream economic, environmental, health and social impacts. Additionally, to achieve the greatest diversified economic impact, we will begin to align integrated R&I investments that reflect market demand and focus on **our three R&I strategic priorities**:

- Embracing the digital future
- Enhancing Alberta's knowledge workforce
- Developing emerging technologies

At the same time, AI will begin to shift its investment portfolios away from sector-specific initiatives and issues. The Corporation will move toward investments in emerging technologies that can be applied across multiple sectors. This shift will capitalize on Alberta's current strengths while leveraging technologies with the greatest promise to address interconnections, needs, and future opportunities and applications. This includes a focus on **four core emerging technology areas** that have demonstrated sufficient momentum for cross-sector utilization in areas of high potential return and lower risk, namely: data-enabled innovation; digital tech for business transformation; clean technology; and innovative production and distribution.

This business plan charts a course for AI over the next three years. It will guide us in aligning our investments and business and concentrate more of our work across the Corporation on advancing emerging technologies. In addition, we will work to integrate our internal business line strategies, so we invest in high-potential opportunities to better achieve our goals and priorities. These approaches not only will enable AI to adjust and balance its investment portfolio to ecosystem needs, it will also position AI as an R&I system convener focused on priority outcomes.

During the next three years, AI will *keep doing* what it has been doing – supporting the initiatives and programs of its various lines of business to contribute toward the intended outcomes of the government, as outlined in the Alberta Research and Innovation Framework. The Corporation will *start* focusing on the emerging technologies and integrating its business line activities to achieve desired outcomes.

During the coming business year, AI will also *start* improving the cascading alignment of its plans and performance. As AI continues to fulfill its commitments, the Corporation will (re)evaluate its initiatives for impact. At the same time, AI will *stop* doing those things that are not producing desired outcomes and redirect to optimize impacts.

# INTRODUCTION

Alberta Innovates is a publicly funded, board-governed provincial R&I corporation that reports to the Minister of Economic Development and Trade via the ministry. We were created on November 1, 2016, when four former, sector-specific AI corporations were consolidated into a single entity.

## VISION AND MANDATE

The vision for AI is to be indisputably recognized provincially, nationally and internationally as a leader in catalyzing R&I in Alberta.

The mandate of our Corporation is to be:

- **Outcomes-Oriented**: AI will accelerate progress in R&I with a focus on commercialization aligned with Alberta's world-class strengths and will contribute to tangible outcomes that offer value to Albertans – including a more diversified economy, enhanced environmental performance and a healthier population.
- **User-Driven and Responsive**: AI will take a responsive, market/user-driven approach that enables Alberta's innovators across current and emerging sectors by providing a single-entry point to meet a range of needs. AI will:
    - Foster networks/partnerships across the R&I continuum;
    - Act as funders;
    - Supply business/technical expertise and applied research services to de-risk and accelerate R&I to the next level for impactful application; and
    - Build capacity of Alberta's next generation of innovators.
- **Collaborative**: AI will catalyze co-ordinated approaches to drive outcomes through partnerships across all orders of government, the private sector (particularly entrepreneurs), academia and other R&I stakeholders.
- **Strategic**: AI will advise the Government of Alberta on its policy development – bringing innovation leadership, foresight and expertise to the Government of Alberta's overarching system strategy for R&I and programs, and AI will leverage its strategic partnerships across stakeholders and multiple Government of Alberta ministries.
- **Transparent and Accountable**: AI will demonstrate and communicate to Albertans the tangible value of public investment in innovation via success stories, will be transparent in its investments, and accountable in its reporting and performance.

## GOALS

The inclusion of corporate goals in the business plan provides guidance and direction that inform operational planning in our business lines. The goals are in alignment with our strategic plan, to help employees and our stakeholders not only understand where the Corporation is going but how it intends to get there. This insight  can help employees contribute in relevant ways to our Corporation, so that our activities and achievements are targeted to the same overarching goals and strategic priorities.  Established corporate goals also help AI monitor and management its performance. The five AI corporate goals are to:

- Be a trusted R&I system convener.
- Strengthen capacity and ecosystem supports to enhance Alberta's knowledge workforce and talent pool.
- Foster system linkages to advance knowledge and cultivate a high-performing R&I ecosystem.
- Adopt better ways to accelerate innovation.
- Make a difference for our clients, Albertans and society by contributing to a diversified economy, cleaner environment, and a healthier and more prosperous Alberta.

Throughout this business plan, AI's actions and investments for achieving these goals and  associated outcomes will align to the Alberta Research and Innovation Framework (ARIF)[1] and the Alberta Innovates Five-Year Strategy. A summary of our strategy is provided in the section called Elements of the Business Planning Framework (see p. 11).

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[1] https://www.alberta.ca/alberta-research-innovation-framework.aspx

# BUSINESS PLANNING CONTEXT

## BUSINESS ENVIRONMENT

Alberta Innovates is the largest research and innovation agency in the province. It acts as a main catalyst for R&I activities through the administration of public investments in these areas. Government priorities and provincial finances determine the overall direction and scale of R&I in Alberta. Within these, AI charts the course – carefully navigating among available choices to ensure its investments in the R&I ecosystem, knowledge advancement, technology development and commercialization bring the greatest benefits to Albertans.

The good news is that Alberta is emerging from the worst economic downturn in a generation. According to the 2018 Alberta budget, the provincial economy was forecasted to grow by 2.7 per cent this year. However, after several years of reduced provincial revenues due to lower world oil prices, Alberta remains in the red. At the time the 2018 Alberta budget was released, the province was expected to finish the current fiscal year with a deficit of $9.1 billion.

AI will continue to keep discretionary spending in check as it manages within the limits of the 2018 provincial budget, which provided no new funding to the Corporation. This makes AI's focus on performance measurement of its R&I results (i.e., outputs, outcomes and impacts) even more critical in the coming year.

The Government of Alberta's (GoA) stated priorities in Budget 2018 included moving the province off the resource revenue roller-coaster by building a more resilient and diversified economy and getting the most value out of provincial resources. Government also said it will continue to identify opportunities to help drive innovation and create jobs, especially in the areas of clean technology, health innovation and value-added agriculture. Our programming remains in alignment with these provincial priorities.

This business plan outlines AI's ongoing work in all the above areas and the path forward until 2021.  Through a cascaded approach, the business plan was informed by and aligns with the Alberta Innovates Five-Year Strategy.

## STRATEGIC PARTNERS

Collaboration with strategic partners increases both the speed and likelihood of successfully achieving our intended outcomes. As such, effective strategic partnerships are viewed as a method to improve the effectiveness of the R&I system. Partnering with industry, non-profits, government and post-secondary institutions is critical to maximizing economic and social benefits that accrue when knowledge and technologies are adopted at scale. Where appropriate, AI co-ordinates with partners to leverage dollars, resources and expertise. AI's administration of funds from the GoA's Climate Change Innovation and Technology Framework (CCITF) stands as a current example of how AI is leveraging external dollars and co-ordinating its internal programming and investments.

## TRENDS & OPPORTUNITIES

Feedback obtained from internal and external R&I stakeholders during consultations for the five-year AI strategic plan was very consistent about Alberta's challenges, but also about the opportunities to leverage innovation for more diversified economic growth. Most believed the greatest impact will be derived from innovation that reflects

market demand and capitalizes on the application of new technologies to Alberta's traditional industries. There also was a recognition that Alberta must help grow employment in sectors outside of traditional oil and gas extraction, production and distribution.
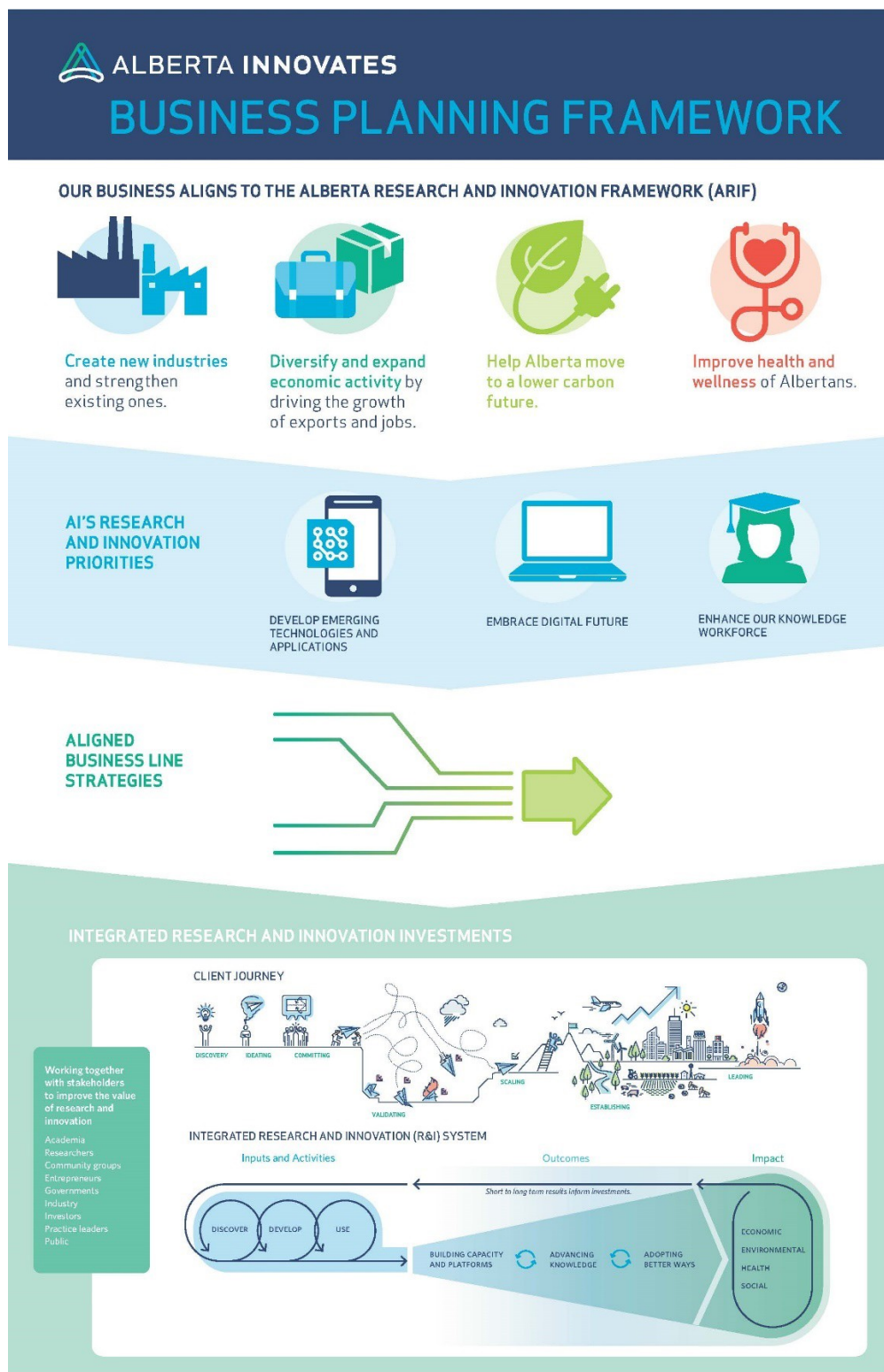
AI also learned through its strategic planning process that it must make some adjustments if it is to maximize positive results for Alberta. This includes adjusting our focus and investment portfolios to **emerging technologies** that can be applied in multiple sectors, to help Alberta become future-ready. The strategic planning process also showed that AI needed to focus more on those investments that produce outcomes aligned with our goals. Stakeholder engagement further suggested that when we consider emerging technologies, AI should also consider existing processes or procedures that may require review. The topic of emerging technologies is discussed in greater detail later in this document.

## BUSINESS PLANNING FRAMEWORK

AI developed a business planning framework based on six interconnected elements (see Figure 2, p. 10); more detail about these elements is provided in the next section.  In brief, it highlights that our business aligns to ARIF and reflects our corporate goals, which are summarized at a high level at the top of framework. Within these broad goals, AI will be progressively shifting its focus to our three strategic R&I priorities as identified through our strategic planning process. Optimal achievement of AI's goals in the priority areas will be realized through the collective efforts of our business lines. It is therefore essential for the business units to align their strategies and goals to those of the Corporation.

Stronger integration of the business lines will further augment our  achievements through improved internal efficiencies, better leveraging of our resources and a smoother transition for clients during their journey through the R&I ecosystem. AI's array of supports and services helps clients progress in their journeys through discovery, development and scale-up, to establishing and leading in  their field. The last element illustrates how AI's investments in an integrated R&I ecosystem will result in  outcomes ranging from building capacity and platforms, to advancing knowledge and adopting better ways, to  achieving more downstream economic, environmental, health and social impacts in Alberta.

**Figure 2. Alberta Innovates Business Planning Framework**

# ELEMENTS OF THE BUSINESS PLANNING FRAMEWORK

## OUR R&I PRIORITIES

Strategies in today's hyperconnected world are not developed in isolation, nor are they executed in a vacuum. Alberta Innovates is mandated to serve as the convener and catalyst of R&I for Alberta, and its five-year strategic plan reflects insights gathered through extensive provincewide consultations with stakeholders across the R&I continuum. The strategic plan is also based on research into global best practices with applicability to Alberta. The strategic planning process included a target sector economic analysis and scan of Alberta's competitive standing in key technology areas to gather insights into the greatest opportunities for economic diversification.

The AI strategic roadmap charts a course to align investments and business lines with three R&I priorities:

- **Embrace the Digital Future**: We will streamline and automate our internal processes and operations to ensure target clients are aware of and have seamless access to our programs and services.
- **Enhance Our Knowledge Workforce**: Working with our post-secondary partners and others, Alberta Innovates can play a key role in enhancing our knowledge workforce.
- **Develop Emerging Technologies:** AI will facilitate the growth and development of *emerging technologies* in Alberta that have demonstrated momentum for high potential return and lower risk.

In the near term, AI will continue to support the full R&I continuum, from discovery to use, in the areas of: health; energy and greenhouse gas (GHG) mitigation; environment and climate adaptation; food and agriculture; and development of bioindustrial products and technologies. Many existing post-secondary, business and industry research programs will be unchanged. At the same time, AI will begin to shift its investment portfolios away from sector-specific initiatives and issues toward emerging technologies that can be applied across multiple sectors. This is intended to capitalize on Alberta's current strengths while leveraging technologies with the highest promise to address interconnections, needs and future opportunities.

### Embrace the Digital Future

AI currently labours under legacy IT systems from the predecessor AI corporations. This negatively affects our ability to be nimble and responsive to our clients, partners and stakeholders. In the coming year, we will continue to review legacy systems and processes to transform our internal operations our interactions with partners. We will be proactive, efficient and cost-effective by embracing digitization in our tools and systems. Data visualization/dashboarding, for example, will enable us to improve our decision-making speed and ability to course-correct. Collaboration tools will allow us to co-ordinate client activities between our lines of business and have visibility into data and knowledge management. This will help us in: supporting our business lines better, performance evaluation, investment decisions and agreements, and reporting. We also will embrace the digital future in our internal communications and how we communicate with stakeholders and the public.

**Enhance Our Knowledge Workforce**

Building new industries in Alberta requires a trained workforce with hands-on experience in emerging areas. Working with our partners, we can play a key role in enhancing the province's knowledge workforce. This may include retraining skilled workers to use new technologies. We can also collaborate with our post-secondary partners to help build and accelerate new training experiences that will enable Albertans to adapt to emerging technologies and the digital future. AI will encourage uptake of trained personnel into new industries.

AI's strategic planning process[2] revealed that Alberta currently has a deficiency in the talent and workforce capacity needed for large-scale commercialization and expansion; talent capacity in key technology occupations is well below peer levels in other jurisdictions. This can be partially addressed by strengthening higher education programs in computer science, mathematics and statistics relative to global peers.

Additionally, with a concentration of civil, mechanical, electrical and chemical engineers 40 per cent higher compared to average Canadian communities, Alberta has a tremendous potential to leverage these existing talent pools to build greater capacity in data-enabled innovation. This could be achieved through career transition programs and by furnishing these workers with upskilling in computer science and data analytics.

An analysis commissioned by Alberta Innovates[3] shows that Alberta has competitive workforce pools that can assist existing energy companies and rising startups as they commercialize clean technologies. This workforce – a byproduct of Alberta's specialized oil and gas extraction sector – includes very high concentrations of chemical and petroleum  engineering talent relative to other jurisdictions in Canada. Specifically, chemical engineers and petroleum engineers are two and seven times, respectively, more concentrated in Alberta than is expected for an economy of the province's size.  It is also anticipated that career transitions among oil and gas workers may increase as energy companies pursue emission reduction technologies. Petroleum engineers will likely require minimal upskilling, job retraining or career transition support to use their skills in clean tech, due a high degree of skill and knowledge compatibility with a variety of clean-tech occupations.

Alberta's existing workforce capacities strongly align with innovative production and distribution, especially in advanced materials and machinery. These capacities have workforce concentrations well above the national average in several occupations, including contractors and supervisors of mechanical trades, welders and related machine operators, and transport and heavy equipment operators and maintenance. In 2016, manufacturing and logistics companies in Alberta employed 269,889 Albertans and represented a 10.9 per cent increase in employment since 2011; this was 2.8 times more than the national average during the same time. Alberta also has a key asset in its post-secondary institutions – such as the Northern Alberta Institute of Technology (NAIT), the Southern Alberta Institute of Technology (SAIT), as well as several community colleges – to develop talent for innovative production and distribution. Given the existing workforce concentrations and higher education capacity, Alberta is an attractive destination for innovative production and  distribution companies.

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[2] Stone-Olafson & Market St. (2018). Draft Economic Growth Through Innovation Strategy, Alberta, Canada.

[3] Stone-Olafson & Market St. (2018). Draft Target Sector Economic Analysis, Alberta, Canada. Employment figures and degree completion data provided by Economic Modeling Specialists International.

The Ministry of Advanced Education and post-secondary institutions are vital partners in enhancing our province's knowledge workforce, through development and delivery of advanced training in undergraduate and graduate degree programs. AI will continue to support training at these levels. While advancements in knowledge and technology are largely led and influenced by a cohort of researchers and innovators, industry ultimately will also need greater numbers of trained and skilled employees who do not require advanced degrees, such as software technologists and data analysts. As well, given the identified near-term demand in emerging technology areas such as data analytics and artificial intelligence, educational programs that deliver skilled personnel in weeks or months rather than years are also required.

Finally, there is an opportunity to promote cross-training in science and technology at the same time as building skills in entrepreneurship and business by co-locating training and development opportunities with business incubators or accelerators, so that Albertans can learn technical skills they might need while also gaining hands-on business experience in a growing SME. AI will play a role in developing and delivering on programs that meet these requirements in partnership with Alberta Advanced Education, educational institutions, non-profit organizations and industry.

**Develop Emerging Technologies**

Information communications technology (ICT) was identified during AI's strategic planning process as a key emerging opportunity where Alberta can accelerate sustainable growth. During AI's consultations with R&I stakeholders, 80 per cent working in technology fields identified better utilization of technology as the "best opportunity" for growth. But there also was a recognition that Alberta has lost ground in its ability to compete in a technology-driven economy. Traditional industries and emerging sectors also identified technology gains as an important need. This stakeholder feedback is supported by international data – the impact of rapid technological change on growth is a significant concern for 38 per cent of global CEOs.[4] It is forecasted that technology platforms will enable two-thirds of digital technology value creation – an area that could generate $100 trillion in value to industry and society globally by 2025.[5,6] Within Canada, 42 per cent of our workforce over the next 20 years could be impacted by technologies such as digitization and automation.[7]

AI recognizes no single technology will transform our economy – instead, a convergence of emerging technologies and applications must be applied to solving problems. We further recognize that the collision of research discoveries and emerging technologies is how new industries are discovered, built and grown. Developing new industries, combined with our existing strengths, will diversify our economy and insulate Albertans from resource sector economic swings. During its strategic planning process, the Corporation identified four core areas within emerging technologies that are strategically important to the province, as highlighted in Figure 3 on p. 14. This business plan charts a course for AI over the next three years to align our lines of business with these emerging technologies.

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[4] PwC. (2018). 21st CEO Survey: The Anxious Optimist in the Corner Office.

[5] World Economic Forum. "Digital Transformation Initiative: Unlocking $100 Trillion for Business and Society from Digital Transformation" January 2017.

[6] IBID.

[7] Creig Lamb. (June 2016). *The Talented Mr. Robot: The impact of automation on Canada's workforce*. Brookfield Institute for Innovation and Entrepreneurship.

These areas represent technology use trends in early commercial adoption that have demonstrated sufficient momentum for cross-sector utilization in  areas of high potential return and lower risk. See Appendix A (p. 52) for detailed discussion about these technologies, and their potential benefits for Alberta.

**Figure 3. Four Core Emerging Technology Areas**



1 Data-Enabled Innovation

Transforming data into actionable information enables digital transformation.

2 Digital Technology for Business Transformation

How we leverage technology to sense and measure information across enterprise is changing the way we live and conduct business.

3 Clean Technology

The sustainability of our planet necessitates innovation for a low carbon future.

4 Innovative Production and Distribution

In a globalized economy, product innovation and access to market is critical to competitiveness and continued prosperity.

AI's unique position in the R&I ecosystem, with its existing cross-sectoral R&I partnerships and collaborations, will be leveraged and new ones fostered to accelerate the development, uptake and spread of emerging technologies. Rather than focusing on individual sectors, the strategic planning process has made it clear AI must also focus on technologies that serve multiple sectors.

The addition of these relevant, cross-sectoral, emerging technologies to AI's portfolio of investments will help Alberta to become future-ready. These broad technologies break down silos between industry and  institutional sectors, and foster cross-sectoral collaborations with public, private and post-secondary  stakeholders. Moreover, applying emerging technologies across sectors optimizes impact by connecting Alberta's R&I ecosystem to the market. This will help to better position Alberta to compete in a digitally transformed, globalized economy.

## ALIGNED BUSINESS LINES AND INTEGRATED INVESTMENTS

During the next three years, AI will function as a single entity with integrated R&I investments. Investments will include resources such as projects, programs, expertise and direct funding. We will be purposeful in finding or developing linkages between our business and operational areas, so that our investments are co-ordinated and the client hand-off through the R&I cycle becomes seamless. Our integrated entity will be able to recognize opportunities and act quickly to leverage our internal and partner strengths.

As part of its fiduciary responsibility, AI will implement a comprehensive performance management system that will be used to inform its decision-making, to ensure innovation investments are directed toward areas of high potential. Over the longer term, we will continuously assess our investment portfolio and resource allocation to ensure they remain relevant in light of current conditions. We will review programs and projects and align them where it makes sense and stop them where outcomes are not being achieved or where they no longer serve our priorities.

As we continue to implement our five-year strategy, we will support promising discoveries and developments that solve problems and can be tested via early adoption. We will continually scan the ecosystem and adapt to emerging science and technologies with an applied-research and market-driven focus. We expect to operate in a field of uncertainty where we might not envision the technology intersections that could create new industries.

We will use globally contextualized, accurate data and analytical skills to guide our investment decisions. We will create a compendium of shared knowledge and gather, analyze and share insights across our business lines. We will use a cross-sectoral investment and market intelligence team to help inform:

- Strategy development
- Deal-making activities
- Investment decisions
- Program development
- Sharing of an Alberta-wide R&I system map
- List of alternative funding sources

We will look at potential investments for a fit with our goals and consider multiple lenses, including scientific, technical and business feasibility. We will consider risk, rewards and sector needs, and invest our resources with transparent, accountable and fair processes. We will apply knowledge and expertise from all our business lines by deploying multidisciplinary, cross-functional teams within AI.

## CLIENT JOURNEY WITHIN AN INTEGRATED R&I SYSTEM

The client journey in our business planning framework illustrates the progression from research to development to commercialization and export growth, from a client perspective. This occurs within an integrated R&I system and its pathways to impact. In this system, we will provide supports along the R&I continuum of **discover, develop and use,** as described in Table 1 below.

**TABLE 1: RESEARCH AND INNOVATION CONTINUUM**

**DISCOVER** aims to create new knowledge or understanding that does not have specific applications in mind from the outset. This type of research is usually performed at universities. It includes basic and applied research.

**DEVELOP** involves developing knowledge from the discovery stage towards a particular use. This applied research or development work typically occurs in applied research areas within universities, colleges and polytechnics as well as industrial research laboratories and company laboratories.

**USE** is about translating and applying developed research to address needs in the 'real world'. This innovation activity focuses on processes for the uptake, spread and scale of application ready research. Examples include technology adaptation, technology commercialization, product and market innovation, and translational research in health care.

Our clients are those who use our funding and services. They include researchers, entrepreneurs, small and medium-sized enterprises (SMEs) and large companies. We will keep the client journey in mind as we streamline how they access AI programs and services, and how we serve them across our integrated R&I system. Our service will be co-ordinated using collaboration tools to manage our interactions with clients and share knowledge across business lines. We will draw upon our internal scientific and technical capabilities, business and commercial know-how, and perspectives on emerging technologies, as well as those of our partners, to provide clients with the tools they need to be successful, from discovery to use.

Furthermore, we will foster a healthy R&I ecosystem that relies on collaboration and co-ordinated efforts among its members. An integrated R&I system is particularly powerful for recognizing when a scientific breakthrough, technology or suite of intersecting technologies can be applied to complex problems.

Alberta Innovates investments help to support building human, infrastructure and platform capacity. They advance knowledge and help Alberta adopt better ways through innovation. AI's achievements in these areas ultimately contribute to ARIF outcomes. To maximize these impacts, we will make evidence-based and market-informed decisions about which research, technologies and companies to support.

# ALBERTA INNOVATES BUSINESS LINES

The shift in Alberta Innovates to an overarching focus on our three priorities (Embrace the Digital Future, Enhance Our Knowledge Workforce, Develop Emerging Technologies) is in the early stages and will be progressively operationalized over time as per our strategic plan. In the year ahead, our business lines will begin to identify and develop programs with defined outcomes in alignment with these priority areas. During this time, legacy programs and those developed following consolidation will be operated by the Corporation with a continued view to increasing cross-sectoral integration.

An internal, operational focus on embracing the digital future will include the development of several initiatives that will be systematically implemented across the Corporation. These internal initiatives will focus on streamlining our systems and processes to better co-ordinate client activities between business lines, improve our decision-making speed, and our ability to course-correct at the business line and organizational levels. These initiatives will optimize the use of our resources. Other areas of focus will include enhanced internal and external communications with stakeholders and the public.

The following sections describe the business lines in Alberta Innovates. The descriptions provide a summary of:

- The current state (i.e., business context, strategic partnerships, contributions to an integrated R&I system and integrating investments).
- Current and/or future alignment to AI's strategic priorities.
- Insights into the sector outlook and associated opportunities for the business line.

## CLEAN ENERGY

**Business Context**

Clean Energy develops and invests in programs to create a new clean-tech industry, enhance the competitiveness of the resource industry, and protect the environment in Alberta. These R&I programs aim to diversify and expand Alberta's economy and lead Alberta into a lower-carbon future and responsible, sustainable development of our natural resources.

Clean Energy invests in three portfolios: Advanced Hydrocarbons, Clean Technology, and Water and Land.  It also leads the delivery of Climate Change Innovation and Technology Framework (CCITF) programs at Alberta Innovates. This business line provides expertise to the Government of Alberta (GOA) on climate leadership, energy diversification, and water and land policies. Clean Energy provides technical due diligence and project management services to Emissions Reduction Alberta (ERA), and supports researchers, entrepreneurs and industry in clean innovation. Clean Energy is identifying opportunities and creating the partnerships necessary to achieve the ARIF 2030 targets in Energy and GHG Mitigation, Environment and Climate Adaptation, and Emerging Technologies.

**Strategic Partnerships**

Clean Energy has strong external partners that provide exceptional value propositions. Clean Energy brings value by leveraging key partnerships through judicious R&I investments and advocating for a balanced clean energy portfolio. Moving forward, Clean Energy will continue to build and strengthen key partnerships with municipal, provincial and federal governments, post-secondary institutions, and industry:

- **Municipal and provincial partnerships:** Partnerships are used to help inform the government for the development of technically feasible policies. AI co-funds projects and conducts techno-economic feasibility studies. We work with our partners to maximize our impact on projects and ensure smooth hand-offs between partners.
- **Federal partnerships:** AI leverages federal funds and works to increase efficiency through sharing application forms and due diligence, also ensuring co-ordination that bring value to Albertans and Canadians.
- **Industry partnerships:** Value propositions include AI investment in innovative solutions that will elevate environmental and economic performances. We reduce risk in projects by pooling resources where possible. We help companies move to the next 10 to 20 years of productivity. We assist SMEs prove innovative technologies.
- **Post-secondary partnerships:** We provide funding for research that will lead to innovations, and leverage industry investments in shared research priorities. We support development of highly qualified personnel through project funding.

In addition to external partnerships, Clean Energy has made significant efforts to collaborate internally with the other AI business lines.

**Contributing to an Integrated R&I System**

Clean Energy is collaborating with strategic external partners and other AI business units to contribute to the achievement of an integrated R&I system. The CCITF programs present a significant opportunity for such integration, as exemplified by Clean Energy working with AI business units including Entrepreneurial Investments, the Post-Secondary Investments Team (PSIT) and Bio. Clean Energy played a significant role in shaping the CCITF and is leading the delivery, with participation from the other business lines. The development of co-ordinated funding calls, shared applications forms and a co-ordinated approach to due diligence is helping to create a more integrated system that will provide our clients with more streamlined and consistent processes. Clean Energy has also been supporting and engaging AI's applied research subsidiary, InnoTech Alberta, in novel solvent recovery process development, AI's Solvent Leadership Series, AI's Bitumen Beyond Combustion program, and shale gas development.

**Integrating Our Investments**

Clean Energy will actively identify opportunities to assist AI in establishing integrated investments with desired outcomes. The CCITF programs are an example of one opportunity. Clean Energy and Entrepreneurial Investments have established a mutual referral system, co-ordinating our market intelligence and investment.

Clean Energy also collaborated with AI's Post-Secondary Investments Team in an investment in the Institute of Oil Sands Innovation (IOSI) and will seek further collaboration in AI investments in industry research chairs. The greatest opportunity is perhaps in the resource and emerging industries, where Clean Energy, Bio, InnoTech Alberta, C-FER, Entrepreneurial  Investments and PSIT can co-ordinate their investments to achieve the ARIF 2030 targets in Energy and GHG Mitigation, Environment and Climate Mitigation, and Emerging Technologies.

**Alignment to AI's Strategic Priorities**

To contribute to AI's strategic priorities, Clean Energy will increasingly focus on developing emerging  technologies such as clean tech (water technologies, emission reduction technologies, smart grid, cleaner fuel  production) and innovative production (advanced materials, value-added processing, etc.). Clean Energy will also  contribute to an enhanced knowledge workforce in Alberta.

- **Develop Emerging Technologies:** Clean Energy is working on smart grid technologies and energy efficient systems for residential and commercial buildings. We will accelerate innovation in bioenergy and waste-to-value-added (W2VA) technology development. In the Water and Land portfolio, more water treatment and land reclamation technologies are being developed for commercial deployment. Our Bitumen Beyond Combustion (BBC) program invests in clean innovation to convert Alberta's vast oil sands resources into non-combustion materials and products – such as carbon fibres, composites, and vanadium flow batteries. Further development of the knowledge and efficiencies around bitumen partial upgrading (BPU) continues to be a priority, in alignment with the Economic Diversification Advisory Committee report.
- **Embrace the Digital Future:** Clean Energy is working on the digital oilfield concept, which is about improving efficiencies and reducing costs for the resource and clean-tech industries. We will continue our work in smart grids and smart homes that help homeowners understand their electricity usage and how to minimize their costs. This work includes micro-generation from a variety of sources and creating the  digital technology to manage electricity at the local level. Applications of artificial intelligence and reinforced learning are being considered in the water and land portfolio, currently in the areas of remote sensing and water treatment system operations. In the resource sector, Clean Energy is considering forging a strategic partnership with a venture fund or incubator(s) in the digital space. AI could play a role as a trusted interface between entrepreneurs and end users, increasing efficiency and reducing redundancy. We will stimulate innovative approaches, attract solution developers and help identify promising young talent in the industry.
- **Enhance Our Knowledge Workforce:** Clean Energy invests in post-secondary applied research and development through targeted project and research chair investments which create significant training opportunities for undergraduate and graduate students, post-doctoral fellows and research associates. These and other investments have a direct line of sight to the 2030 ARIF targets.

**Outlook and Opportunities**

The world is transitioning to a low-carbon economy. Renewable energy is on the rise and becoming increasingly cost-competitive; electrification in the transportation sector is gaining momentum; and clean tech is

experiencing a rapid growth worldwide. However, most experts agree that demand for oil will continue to rise, with peak demand still decades away. Global demand for natural gas is even stronger and the growth is  expected to last well beyond mid-century. At the same time, climate change and global population growth will put increased strain on water, land and biodiversity. Alberta is uniquely challenged because of its reliance on natural resource revenues and restrictions on pipeline expansion, which makes it difficult to diversify its oil and gas markets.

There are clear threats for Alberta's land-locked resource industry. On one hand, lack of market access lowers the value of hydrocarbon resources and undermines the competitiveness of the industry. On the other hand, smaller resource revenues reduce Alberta's ability to invest in economic diversification, and transition to a lower-carbon economy.

Amid such challenges, the opportunities for AI are abundant. R&I related to Recovery Technologies (a Clean Energy program) has the potential to significantly reduce GHG emissions intensity and cost of production. Bitumen Partial Upgrading (another Clean Energy program) could add value to bitumen and enhance its market access. Value-added materials with minimal or no GHG emissions could be created through Bitumen Beyond Combustion R&I (a third Clean Energy program). Digital technologies could improve efficiency of the entire industry, while leveraging existing oil & gas assets to generate skills and products that are transferable to other industries. These innovations will make our resource industry cost- and carbon-competitive, diversify energy products, and help create new multibillion-dollar industries and thousands of high-paying jobs in Alberta.

Opportunities in the clean-tech space are equally significant.  Research in the Water and Land program is essential to sustainable development in Alberta and can lead to innovative technologies for domestic and export markets. Smart grid technologies would enable renewable energy deployment and improve energy efficiency in buildings. Bioenergy innovation would turn wastes and biomass into renewable energy and chemicals. Enhanced geothermal technologies have the potential to create export opportunities around the world. Clean Energy will continue to build balanced portfolios with much stronger clean technology and value-add components. Within three years, Clean Energy-supported technologies and companies will have started to generate significant and measurable economic and environmental impacts. All Clean Energy programs will be continuously monitored and evaluated, based on these impacts.

## HEALTH INNOVATION

**Business Context**

Catalyzing the development, growth and sustainability of an impact-focused health innovation ecosystem in Alberta is the central tenet by which AI operates in the health innovation space. AI leverages Alberta's excellence in health research and the growing health technology sector to contribute to increased economic development, enhanced patient care and a resilient health-care system. Health Innovation also fosters strategic partnerships with like-minded organizations to better achieve these impacts.

The investments of Health Innovation span the spectrum of discover, develop and use. These investments include:

- Project investments that are designed to rapidly launch partnerships or to prototype the potential for a program.
- Program investments that aim to scale and spread support in areas of strategic interest.
- Platform investments that intend to enable and accelerate health R&I.
- People investments that are designed to develop competencies in key health innovation areas in alignment with our strategic interests.

**Strategic Partnerships**

To realize its vision of transforming health and wellness through R&I and achieve its desired outcomes, Health Innovation works closely with a variety of partners in the health system, academia and industry to design, deliver and evaluate programs and services that help achieve excellence.

- **Provincial partnerships:** Working closely with our provincial partners, we collaborate to launch innovation opportunities that are Alberta-specific, extract market needs and expertise to inform our investment strategy, and to advise on policies developed by the government.
- **Federal partnerships:** As broad funders of innovation across the nation, federal partnerships provide opportunities to leverage investments in Alberta. These partnerships provide opportunities for collaboration and co-investment, including the development, adoption and effective use of technologies such as digital health solutions and artificial intelligence.
- **Industry partnerships:** AI actively seeks industry partnerships that work toward the development of new commercial products, programs, services and treatments. Health Innovation has collaborative funding agreements for translational research with various industry partners.
- **Post-secondary partnerships:** As a whole, post-secondary institutions provide the expertise and infrastructure to create and develop cutting-edge ideas. Health Innovation collaborates with post-secondary to understand the world of the possible.

**Contributing to an Integrated R&I System**

An integrated R&I system is critical for optimizing the economic, environmental, health and social impacts of AI's investments. This includes development of a partnership engagement map to identify the gaps and opportunities for engagement provincially and nationally in accordance with our strategy. This map would clearly define interests and capabilities of partners. Health Innovation key messages and marketing materials, as well as operational delivery mechanisms, can be co-developed with existing and potential partners. Health Innovation is also working with other AI business lines to identify areas of collaboration on existing and future programs. The approaches, frameworks and tools used by Health Innovation to catalyze change and enhance the R&I ecosystem are often sector-agnostic and hence can be generalized to the broader R&I ecosystem.

**Integrating Our Investments**

Health Innovation will lead the creation of an asset map of Alberta's current strengths and capacity for emerging technologies in health, including workforce, SMEs and groups that are leading-edge and ready for scale and spread. It will also identify the critical success factors and enablers for the investments to achieve the desired outcomes. Health Innovation will be working closely with AI's business lines to map existing portfolios, co-develop cross-functional investments, and review and reallocate future resources in a manner that reduces redundancies and provides pragmatic movement of investments across business lines and along the "discovery, development, use" pathway.

**Alignment to AI's Strategic Priorities**

- **Develop Emerging Technologies:** The Health Innovation business line continues to invest in data-enabled innovation programs to achieve outcomes in visualization, identification of trends and predictive analytics; high-performance computing to assist the collection and critical analysis of literature to support evidence-informed decision-making; and utilizing large datasets to support clinical trials and health outcomes. Investments in digital tech for business transformation also includes supporting open data platforms.
- **Embrace the Digital Future:** Investments are targeting the development and implementation of mechanisms to monitor and display ecosystem linkages at an individual, project, program and organizational level. Health Innovation will collaborate with AI business lines to create an integrated investment dashboard on business intelligence for effective and efficient decision-making. Health Innovation will also continue implementation of a collaboration tool with Alberta Health Services, Covenant Health and post-secondary institutions. The collaboration tool supports the seamless exchange of project information with partner organizations for real-time reporting, dashboard and process improvement.
- **Enhance Our Knowledge Workforce:** To inform the development of market-focused training programs, Health Innovation collaborates with the local, national and international health industry to better understand their needs for competency and skill development in the workforce. Health Innovation will also continue supporting the integration of digital technology competencies in existing and future health initiatives.

**Outlook and Opportunities**

The health sector in Alberta is being driven by increasing health-care costs, population changes and evidence supporting person- and community-centred care. The Government of Alberta's vision is to improve Albertans' health and well-being through an integrated health system in which health facilities and services remain very important, and there is stronger emphasis on supporting people and communities to achieve and maintain better health outcomes. The challenges in establishing an integrated health-care system require innovative solutions driven by an integrated R&I system. AI will co-ordinate and collaborate with Alberta's R&I ecosystem partners to overcome challenges and achieve desired outcomes. An integrated investment portfolio will complement these efforts, enabling AI to identify, evaluate, invest in and manage health innovation opportunities capable of

providing solutions to the various challenges.

The health ecosystem in Alberta collects an immense amount of clinical and corporate data and information. A focus on emerging technologies and applications will be pivotal if this tremendous asset is to be used to identify issues and improve health outcomes for Albertans. The opportunity to apply artificial intelligence and machine learning to analyze and action data at both an individual and population level also cannot be ignored.

According to Rock Health, there were 345 digital health deals in 2017 worth $5.8 billion dollars, and the Digital Health Public Index exceeded the return provided by the S&P 500 by 31 per cent.[8]

The world of medical research is complex and the approach to discovering and developing critical medical knowledge and technologies must include collaborations across multiple disciplines. With world-class institutions right here in Alberta in areas of medicine, virology, pharmacology, artificial intelligence, nanotechnology, engineering and computing science, AI has the opportunity to leverage its cross-functional technical and business expertise to develop and commercialize medical research and innovations.

Other emerging trends and opportunities in the health sector include:

- Artificial intelligence to enhance health technology assessments, drug development and clinical trials.
- Augmented reality for training and development of health-care professionals.
- Behavioural health technologies.
- 3D printing of medical devices and drugs.
- Novel immunotherapy and gene-therapy technologies.
- Point-of-care diagnostics.
- Internet of Things supporting remote monitoring.
- Personalized medicine.

To realize these opportunities, AI's Health Innovation business line must overcome several existing risks and threats. These include a lack of investment capital available in Alberta for health innovation, a lack of business expertise in leveraging follow-on funding and investment attraction in the health system, and a lack of resources for the pragmatic trialing and adoption of novel technologies.

## BIO

### Business Context

The Bio business line in AI meets the government's R&I priorities by providing leadership and co-ordination for activities that support the growth and diversification of Alberta's agriculture, forestry and food sectors. Bio focuses its investment in support of smart science and technologies that accelerate sustainable agriculture productivity, mitigate climate change and advance development of market-oriented, value-added food products.

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[8] *Year in Review:* Digital Health Venture Funding, Rock Health. January 2017.

Bio's investment strategies are also targeted to the creation of markets for biodiversity and ecosystem services, and to developing uses for biomass from forest and agriculture that will leading to bioindustrial growth in Alberta. Bio's responsibilities and operational functions are two-fold in the agriculture, forestry and food sectors:

- Knowledge development along the R&I continuum that includes long-term, early research; mid- and short-term applied research; and short-term, market-ready research. This includes investing in science that informs policy.
- Supporting the sustainable growth and diversification of the agriculture, food and forest industries through direct investment in promising company ideas. One of the key criteria considered for investments is the need to demonstrate the strong possibility of high economic benefit and impact.

**Strategic Partnerships**

Strategic collaboration is a cornerstone of Bio's operations. The business line brings energy to projects that can meet AI goals by being a leader, an influencer, an initiator, a persuader and a collaborator.

- **Provincial and federal partnerships:** Bio aligns with federal programs to reduce duplication and maximize impacts of Bio's investments. Bio also aligns its programs and priorities with those of the GoA (e.g., ARIF and CCITF).
- **Industry partnerships:** Bio plays a significant role in linking Alberta's academic and research institutions with industry. This helps researchers to better understand industry issues and assists bio-based industries to discover new science and technology opportunities.
- **Post-secondary partnerships:** Bio enables researchers, SMEs, post-secondary institutions and industry partners to collaborate and turn challenges into opportunities by:
  o Assessing AI's innovation investment portfolio and resource allocation decisions to ensure they remain relevant, by considering current market conditions and the contributions of other stakeholders.
  o Performing regular global environmental scans for new knowledge and/or technology that could be adapted to Alberta.
  o Holding stakeholder engagement sessions to better understand opportunities and challenges. An already established model of key stakeholders and experts for the Bio sector is the Ecosystem Services and Biodiversity Network.
  o Participating and contributing to creating corporate processes that ensure we can meet the expectations of external partners.

**Contributing to an Integrated R&I System**

The Bio business line anticipates continuing to participate and contribute to processes and events across AI that will facilitate greater engagement and collaboration between and across business lines and operational enablers. Bio is already sharing with Health RFPs related to medicinal properties of CNC and lignin antimicrobial properties, food for health project applications, and discussing research opportunities related to prion-like behaviour in human dementias. Bio is an active participant in the Agriculture Funding Consortium and obtains feedback from

other AI units for project evaluations. Bio collaborates with Clean Energy regarding shared involvement in two NSERC-funded Industrial Research Chairs.

InnoTech Alberta is a partner with Bio in the creation of a new ecosystem services partnership with NAIT for the creation of an ecosystem services clearinghouse and exchange. Bio is also working with Innotech Alberta on hemp decortication requirements in Alberta and refinement of the Vegreville hemp processing facility. Bio, along with other AI business lines, is part of the delivery team providing technical due diligence and project management services to ERA and CCITF for many of their related projects. Bio engages Technology Development Advisors from AI's Entrepreneurial Investments business unit in the commercialization of novel technology for the detection of food pathogens, and in the co-ordination of smart agriculture applications by Alberta colleges, multinational enterprises (MNEs) and other businesses.

**Integrating Our Investments**

Bio will continue to co-ordinate, share and align programs with Clean Energy that are directed at sustainable land and water management. Joint planning will also be pursued to identify areas of interest that exist in the intersection of the Bio and Health business lines. Bio will contribute to the creation of an integrated R&I system by exploring opportunities for commercialization of products, evaluating expanded post-secondary investments that support accelerated achievement of collaborative Bio outcomes, and better co-ordinate with AI's applied research subsidiaries to achieve desired outcomes on programs and projects.

**Alignment to AI's Strategic Priorities**

- **Develop Emerging Technologies/Embrace the Digital Future:** The Bio business line will develop emerging technologies and embrace the digital future by:
  - Supporting further development and application of platform technologies such as genomics and nanotechnology.
  - Pursuing advancements in smart agriculture by supporting crop and livestock production sensors, and other autonomous and precise production technologies.
  - Supporting and adopting software for crop, forest and livestock micro-analytics.
  - Supporting the development and use of geomatics, geospatial data management and analytics such as data management for bio resources (BRIMS), agricultural operations and livestock genetics.
  - Developing metrics to demonstrate economic, environmental and social sustainability.
  - Advancing biomaterials development.
  - Modernizing IT resources in relation to AI's internal operating system.

- **Enhance Our Knowledge Workforce:** Bio will align to AI's strategic priority of enhancing the knowledge workforce within the Corporation and with external stakeholders. Internally, this includes supporting capacity-building across the Corporation in analytical mathematics, data science skills to analyze the effectiveness of new technologies, coding, modeling experience, and skills in interdisciplinary approaches. Bio will also support staff development programs. Externally, Bio will support training and development, short-term work assignments and exchanges (e.g., networking with digital companies).

**Outlook and Opportunities**

The province's agriculture, food and forest industries currently generate significant revenue and constitute important contributors to Alberta's economy. In 2016, these sectors had approximately $34 billion in sales, with agriculture exports rising by 64 per cent since 2006.[9] With more than 55 million hectares of arable and forested land base, a competitive climate for producing crops and forests, and plentiful grazing lands for livestock, Alberta has an opportunity to further diversify its economy and reduce its dependency on oil royalties.

There is a growing trend in consumer expectations for verifiably safe, healthy and nutritious food produced in a socially responsible fashion. Continuous improvements in environmentally friendly production, food processing technologies and product quality by Alberta's crop, livestock and value-added industries is driving industry in relation to these expectations. The opportunity to leverage naturally sourced materials for different value-added outcomes is one this sector cannot ignore. Alberta has a wealth of renewable biomass feedstock in the forestry and agriculture sectors that will, for example, drive considerable production of low-carbon transportation fuels and power generation.

Better integration of biomass products and services to complement the energy sector is also a growing trend within the industry.

Other broad trends include a focus on nature's contribution to people through ecosystem services and biodiversity, natural capital and green infrastructure, and a desire to move to a green economy. Crop and livestock productivity will need to increase by 30 per cent from 2013 levels to meet global population growth demands.

Several opportunities exist for Alberta and AI's Bio stakeholders in agriculture, food and forestry, despite issues such as market access, international trade and competition, rising production costs and supply chain logistics. Adding value to Alberta's abundant primary agricultural commodities by supporting further processing and integrating the emerging technologies (i.e., identified within AI's strategic priority of Develop Emerging Technologies) to decrease production costs represents a significant opportunity. With the launch of the provincial government's Climate Leadership Plan, a greater focus on expanding the availability of renewable energy and biomass-based products is also required.

As the demand for agriculture and forest products evolves, there are increased expectations for open, transparent management and mitigation of environmental effects from resource use and extraction. The Bio business line can provide leadership to capture the opportunity to implement market-based approaches for environmental ecosystem services that diversify the rural economy, demonstrate environmental integrity and stimulate innovation in resource-based sectors.

AI's opportunity is to be the "go-to" destination for governments, institutions and industry for the identification of opportunities for high-priority research and business growth in the agriculture, forestry and food sectors. Bio

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[9] Highlights of the Alberta Economy Presentation 2014. Government of Alberta.  http://www.albertacanada.com/files/albertacanada/SP-EH_highlightsABEconomyPresentation.pdf.

will use prescriptive, predictive, diagnostic and descriptive analytics in performing this role, and will leverage existing, extensive internal data, and its expertise and strong working relationships and partnerships. Further, Bio will implement these strategies in collaboration with its innovation ecosystem partners.
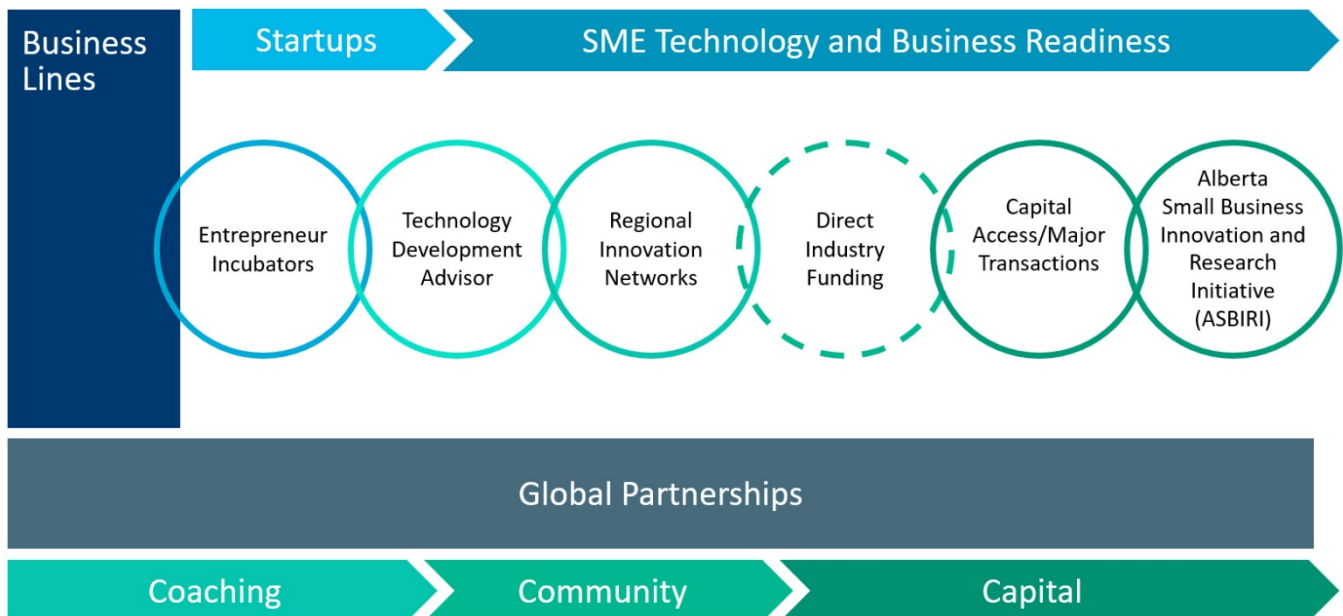
## ENTREPRENEURIAL INVESTMENTS

**Business Context**

Entrepreneurial Investments (EI) supports an integrated innovation system to deliver accelerated commercialization of high-growth, high-potential, knowledge-based technologies and companies to diversify the provincial economy, support new industries, create jobs and support exports. Its target clients are entrepreneurs with promising, novel, job-building companies, and SMEs that wish to scale using innovation as a growth strategy. EI's innovation support system is an inter-dependent network that includes coaching, community and capital. It spans the journey from early-stage entrepreneur programs to support for scaling established firms.

**Figure 4. Entrepreneurial Investments Business Framework**



Fundamentally, AI considers investment based on two distinct principles. Collaborative funding is intended to create networks and partnerships to establish and develop a R&I ecosystem. Competitive funding is intended to incite competition by incentivizing innovation. This enables EI to target high-potential, high-growth companies that can help achieve our goals.

**Figure 5. AI Funding Principle**



**ALBERTA INNOVATES RESEARCH AND INNOVATION INITIATIVES**

| Collaborative | Competitive |
|---|---|
| R&I Ecosystem Development: Networks and Partnerships | Direct Investments |

EI's partners in the Alberta Entrepreneurial Incubator pilot program and Regional Innovation Networks (RINs) deliver "one-to-many" entrepreneur and business training to clients in the early stages of entrepreneurial development. Their job is to continually scan the entrepreneur and innovation system supports in their regions and adapt to gaps and trends.

EI's Technology Development Advisors (TDAs) provide direct, one-to-one, confidential, front-line business and technology development advice and system connections to promising SMEs in technology or knowledge-based industries.

In addition to training and system access supports, EI delivers a suite of competitive direct funding programs to accelerate technology development and commercialization for high-growth, high-potential firms leading to market leadership and export. These competitive programs include direct funding vouchers for a variety of purposes including prototyping, research and development, commercial associates, product demonstration and partnering with large firms. EI also provides access to scale-up and capital advice via Executive Business Advisors. Underpinning all these programs is access to global partnerships.

EI collates data on the system supports and gathers qualitative client satisfaction surveys. The business line measures competitive direct funding results through surveying clients and communicates results via the Technology Commercialization Scorecard.

**Strategic Partnerships**

Development of a network-based system of partners and service providers, in which the entrepreneur is the central focus and driving force for all activities, requires collaboration rather than competition between internal and external partners. Both internal and external R&I partners need to see themselves as a system and act like a network, which requires an aligned understanding of the overarching goals and purpose.

- **Provincial partnerships:** EI partners with provincial partners to build capacity to serve early-stage entrepreneurs, to develop and support SMEs and industry, and explore opportunities in international markets.
- **Federal partnerships:** EI takes a collaborative approach with federal partners to support SMEs and to

leverage competitive direct investment funds on all direct funding programs where possible. EI has established global partnerships with Mexican and Chinese provinces to deliver programs with leveraged funding.

- **Industry partnerships:** EI partners with industry to solve the Government of Alberta's Grand Challenges by leveraging funds and expertise to develop opportunities for both industry and SMEs.
- **Post-secondary partnerships:** EI supports Regional Innovation Networks (RIN) which include 11 post-secondary institutions providing prototyping, product design and development services, plus entrepreneur and business supports in partnership with other RIN members.

**Contributing to an Integrated R&I System**

EI's programs collectively create an innovation system that, over time, will be expanded to work with AI's other business lines, to include support for researchers and create a more integrated R&I system. Working with the other business lines, EI will be better able to support AI's corporate goals and partners with collaborative and integrated client management.

**Integrating Our Investments**

Investments will be balanced across the life cycle of innovation to support high-potential research, innovation and commercialization or utilization. EI will collaborate with AI's various lines of business to optimize support for commercialization of R&I opportunities arising throughout AI's investment portfolio. Integral to this will be developing a process to ensure that EI's investment philosophy and current investment targets are consistently communicated. EI will also work closely with these other business lines to determine how best to share information, share investment opportunities and build due diligence process throughout the Corporation.

**Alignment to AI's Strategic Priorities**

- **Develop Emerging Technologies**: As a systems convener, EI will bring together partners to collaborate on developing emerging technologies such as virtual reality/augmented reality. EI will also continue to search for new opportunities that may arise in the ecosystem with the potential for commercial success.
- **Embrace the Digital Future:** EI will be proactive, efficient and cost-effective by embracing digitization in our tools and systems. Data visualization/dashboarding, for example, will enable us to improve our decision-making speed and ability to course-correct. Collaboration tools will allow us to co-ordinate client activities between our lines of business, and to have visibility into data and knowledge management to better support our business lines, performance evaluation, investment decisions and agreements, and reporting.
- **Enhance Our Knowledge Workforce**: Working with our partners, EI will play a key role in expanding our knowledge workforce. This may include retraining skilled workers to use new technologies. We can also collaborate with our post-secondary partners to help build and accelerate new training experiences that will enable Albertans to adapt to emerging technologies and the digital future. Alberta Innovates will encourage uptake of trained personnel into new industries.

**Outlook and Opportunities**

EI can foster a healthy ecosystem by encouraging collaboration with a wider range of stakeholders, focused on ecosystem needs. An Alberta-wide Innovation System Map is under development and will inform system partners, funders and users of program inventory and access points. It will also assist in the entrepreneur's journey through to commercialization. EI can also assist in catalyzing networks that utilize the emerging technologies outlined in our strategic priorities.

EI must focus TDA time on its suite of AI investments and those high-potential researchers and SMEs that are most likely to contribute to our corporate goals. EI has found that 58 per cent of TDA intake is with very early-stage software and web application companies. To better serve this group, the EI business line needs to continue to collaborate with partners to develop one-to-many training programs rather than individual consultation. Early-stage entrepreneurs can be supported through diverse, leading-edge training systems delivered by EI partners. EI can focus on high-potential, high-growth SMEs and work to scale companies using innovation as a growth strategy.

## POST-SECONDARY INVESTMENTS TEAM

**Business Context**

The Post-Secondary Investments Team (PSIT) oversees the sustained delivery of value to Alberta through investment in Alberta's post-secondary  institutions (PSIs). It works to strategically develop capacity in people, key infrastructure, collaborations and projects necessary to create innovative solutions within priority areas of Alberta's knowledge-based economy. Our programs support graduate students, research chairs and strategic research projects. We also support student entrepreneurship and networking. As well, PSIT supports industry-partnered projects at PSIs and in the greater R&I ecosystem.

R&I activities in Alberta's PSIs are essential elements of a well-functioning, innovation-based economy. We will actively engage the PSIs to identify existing strengths and emerging opportunities to enable capacity building, knowledge creation and transformative technology development. Through the continuous improvement and enhancement of program offerings, PSIT will mobilize people, technologies and collaborations that will diversify the provincial economy and solve intractable challenges facing Alberta and beyond.
Activities at the core of PSIT include:

- **People**: PSIT builds Alberta's knowledge workforce through enhanced educational offerings in key technology areas to maximize the intellectual talent available to support Alberta's economy. Talent is subsequently deployed through industry, academia, government and not-for-profit organizations.
- **Knowledge**: PSIT enables the local creation of knowledge in science, engineering and business directed to strategic areas of importance for Alberta. The strategic context is guided by ARIF, Alberta's Platform Technologies Strategy and AI's Five-Year Strategy document.
- **Technologies**: PSIT facilitates the creation of new technologies in areas aligned to the four emerging technologies identified by AI. These areas currently include artificial intelligence and data science,

quantum technologies, advanced materials and manufacturing, synthetic biology, and others at the cutting edge of science and technology.

**Strategic Partnerships**

- **Provincial partnerships**: PSIT collaborates with EDT on strategic planning, co-development, co-funding, policy and the alignment of the R&I ecosystem. PSIT also collaborates with various ministries and on the development and delivery of key programs such as CCITF as they pertain to Alberta's PSIs.
- **Federal partnerships:** Federal agencies are important partners whose funds and networks can be leveraged by AI to develop national and international R&D collaborations and industry partnerships. Opportunities exist to develop collaborations on the broader impacts of emerging technologies, including ethical, environmental, economic, legal and social issues. Awareness and management of these issues can be important to reduce the barriers to social acceptance and translation to society.
- **Industry partnerships:** PSIT partners with Alberta's SME community as a conduit for knowledge, people and technology into the economy. Alberta industry provides direction and intelligence of market demand and directionality.
- **Post-secondary partnerships:** AI funding supports Campus Alberta research institutions and researchers with well-established programs and mechanisms to fund projects. PSIs are the delivery agents of people, knowledge and technologies to the broader economy. New or expanded funding programs to support colleges and polytechnics are under development. In general, PSIs are leaders in building and sustaining global networks and are conduits to a global pool of knowledge and talent at the forefront of science and technology around the world. In partnership with AI, these assets can provide greater understanding of emerging technology trends at the global scale, and they can be used to bring the best and brightest personnel to Alberta to address our existing challenges.

**Contributing to an Integrated R&I System**

Effective supports for an integrated R&I system depends upon the seamless integration of activities and capabilities within AI, along with collaboration with system partners to help achieve desired outcomes. PSIT will collaborate with government to align system activities to ARIF and Alberta's key economic sectors. We will act as a system convener and enabler. Additionally, EI will serve as the co-developer of the Emerging Technology framework through the Government of Alberta's Emerging Technology Collaboratory. Throughout our activities, EI will seek partnerships within Alberta's R&I ecosystem representing various sectors to target high-value initiatives.

**Integrating Our Investments**

PSIT focuses investments across a spectrum of activities linked to PSIs with programs that support individual training, skills development and research, all the way to supporting collaborations with industry and other researchers in centres of excellence. In advance of new investment and/or adjustments to AI's investment portfolio, PSIT will partner with AI's other business lines to identify shared priorities, processes and activities to maximize efficiency, ensure alignment and avoid duplication. Where opportunities exist, we will partner with funders provincially, nationally and beyond to develop integrated funding programs. In all cases, PSIT will

consider the wider innovation system when developing new AI funding calls and we will align our programs with partners' programs where relevant and feasible.

**Alignment to AI's Strategic Priorities**

- **Develop Emerging Technologies:** PSIT will leverage its existing portfolio of Chairs by offering funding competitions targeted to recently PSI-funded researchers, focusing their highly qualified personnel on defined outcomes in emerging technologies. Where possible, PSIT will also adjust its portfolio to fund strategic research projects and/or the development of highly qualified personnel in emerging technologies.
- **Embrace the Digital Future:** PSIT will implement and use enterprise content management tools such as Open Text to optimize operations and knowledge management. Pursuit of a client management tool  across the Corporation will be critical to achieving a client-centric service model.
- **Enhance Our Knowledge Workforce:** PSIT will continue to develop HQSP to work in Alberta's  knowledge-based economy and attract, engage and enable top-tier researchers in Alberta. There is an  opportunity to promote cross training in science and technology at the same time as building skills in  entrepreneurship and business by co-locating training and development opportunities with business  incubators or accelerators. This will enable Albertans to gain the technical skills they might need while gaining hands-on business experience within a growing SME. In partnership with Alberta Advanced  Education, PSIs, non-profit organizations, and industry, AI will play a role in developing and delivering on  programs that meet all these requirements.

**Outlook and Opportunities**

PSIT deploys a broad suite of programs to enable the stepwise development and support of individual trainees, researchers, research teams and of technologies from early-stage ideation through product development. These programs can be readily tuned, as needed, to align to our strategic priorities and those of the province. This includes aligning to our current strategic priority of emerging technologies and working with the government's Emerging Technology Collaboratory.

An increased focus on the development of Alberta's workforce to be more technology-ready will open opportunities for the strategic creation of advanced training programs and short courses to enhance skills in areas where there is demonstrated need.

A specific goal of PSIT moving forward is to enable the creation of additional value and impact by connecting 'alumni' to opportunities and demand in the economy. Another is to develop a system to systematically measure the longitudinal impact of trainees, researchers and technologies supported by AI.

## APPLIED RESEARCH: INNOTECH ALBERTA & C-FER TECHNOLOGIES

**Business Context**

InnoTech Alberta Inc. (InnoTech Alberta) and C-FER Technologies (C-FER) provide applied research services to government and industry clients in the energy, agriculture and forestry sectors. These clients rely upon AI's applied research subsidiaries to provide contract research to de-risk  innovation, accelerate outcomes such as

technology adoption and pursue new market opportunities. For the public sector, InnoTech Alberta provides technical expertise and assets to help achieve priorities such as biodiversity monitoring and environmental due diligence.

## InnoTech Alberta

InnoTech Alberta offers a diversified range of scientific, engineering and technological research and testing capabilities and facilities to support technology scale-up. Our focus is to accelerate technology development and application, and provide expert advice, technical information and scientific infrastructure to meet the immediate and long-term technical needs of the private and public sectors.

InnoTech Alberta's principal R&I role is to help develop new products, processes and commercial opportunities for clients in a fee-for-service model. Contract research provides InnoTech Alberta with unique, strategic knowledge of existing industrial opportunities. This knowledge enables:

- High-risk, high-return investment opportunity: Investment in high-risk innovation has the potential to yield significant benefits and returns for the province.
- Uptake of emerging technologies: Contract research provides insight into which emerging technology can provide a potential solution to an industry need.
- Receptor potential: Partnering with more than 600 industry clients provides a unique opportunity for us to provide industry partners for both AI-developed innovation and technical expertise developed in Alberta's workforce.

## C-FER

C-FER works closely with industry and client subject matter experts to develop solutions to unique engineering challenges in the oil and gas industry. Our expertise is focused on serving upstream drilling and production operations as well as midstream and downstream pipeline operations.

C-FER continues to play a role in positioning Alberta as a responsive and progressive energy producer. Its applied research capacity supports the accelerated development and adoption of innovative technology into the energy sector. It will continue to link innovators, industry and government to collectively resolve their common issues. Apart from demonstrating innovative discoveries to the energy sector, C-FER will also continue to assist in setting worldwide safety standards and explore the frontiers of new energy development.

**Strategic Partnerships**

InnoTech Alberta represents a critical part of AI's due diligence process by providing AI's business lines with technical expertise. In partnership with PSIT, InnoTech Alberta will enable AI to leverage expertise within PSIs. As part of a cross-functional, multidisciplinary team, InnoTech Alberta will partner with AI's other business lines where appropriate in the execution of critical priorities and programs such as the Climate Leadership Plan.

**Outlook and Opportunities**

InnoTech Alberta clients vary by industrial sector and location and range from multinational enterprises to not-for-profit organizations. As such, the needs of our clients vary significantly and continue to evolve. With an increasing emphasis on competing in international markets, InnoTech Alberta clients will continue to examine cost savings through the optimization of operations or the adoption of new technology. In terms of its operations with AI, InnoTech Alberta connects its technical expertise and industry knowledge to AI's various business lines. Alignment to AI's R&I system and long-term strategy will enable greater utilization of the talent and facilities of InnoTech Alberta, both within AI and the provincial R&I ecosystem. An opportunity also exists for InnoTech Alberta to export its knowledge and industry expertise beyond provincial boundaries to the global marketplace.

C-FER Technologies focuses on facilitating the use of leading-edge technology by the oil and gas sector, and pipeline operators involved in the development of very challenging resources. The Alberta economy contracted by 3.7 per cent in 2016 due to oil and gas price declines, which led to sharply lower capital investment by oil and gas companies.[10] However, investment in innovation is crucial for the industry to be the preferred supplier of oil and gas products, transported in the safest manner with lower-carbon intensity.

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[10] Highlights of the Alberta Economy Presentation 2014. Government of Alberta.  http://www.albertacanada.com/files/albertacanada/SP-EH_highlightsABEconomyPresentation.pdf.

# PERFORMANCE MANAGEMENT

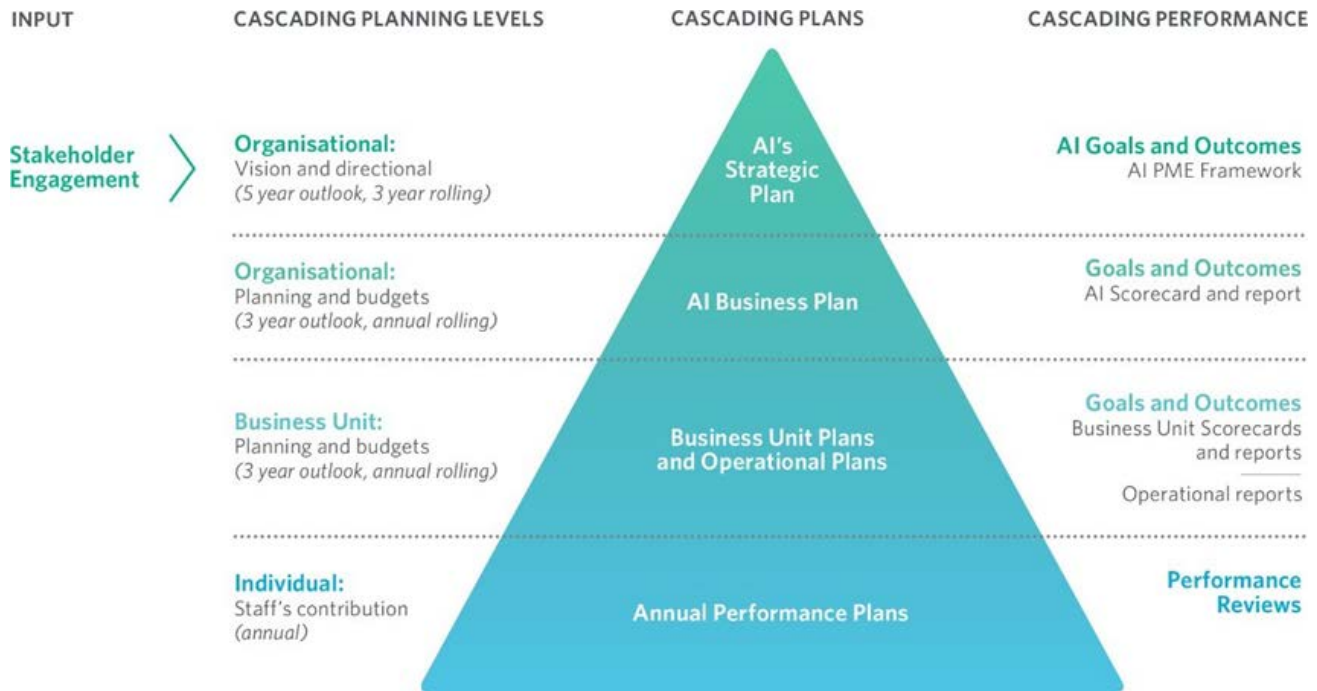## AI's APPROACH TO PERFORMANCE MANAGEMENT & EVALUATION

Investments in R&I are substantial, and organizations face increasing pressure to measure the impact of their investments and demonstrate value for money. Consequently, there is increasing demand for R&I to be systematic and results-focused, with the objective of improving the frequency and impact of positive results. At AI, we strive to work toward results and understand how our investments make a difference to a more prosperous economy, cleaner environment and healthier Albertans. Working with others, we aim to improve "what we do and how we do it" through measuring and evaluating our performance and communicating our results and impact to Albertans.

In keeping with our mandate to be outcomes-focused, our new business plan is (re)aligning our investments (which includes dollars, knowledge, time and de-risking capabilities) with our desired outcomes, as well as aligning to the Alberta Research and Innovation Framework (ARIF).[11] We are also embedding an outcomes-focused culture across the organization. At the outset of designing a program or an initiative, we are working with our stakeholders to define the overall results we intend to achieve and identify the data needed to measure those results.

AI holds the view that it is essential to integrate the performance process into the planning process. As illustrated in Figure 6 below (p. 36), cascaded and interconnected relationships exist between AI's strategic and business plans, plans at the business unit level and staff annual performance plans. Cascaded performance management and reporting accompany planning at each level. This integrated approach helps ensure that performance at each level ultimately contributes back to AI's strategic plan.

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[11] https://www.alberta.ca/alberta-research-innovation-framework.aspx.

**Figure 6. AI's Cascading Planning Levels and Performance Management**



| INPUT | CASCADING PLANNING LEVELS | CASCADING PLANS | CASCADING PERFORMANCE |
|---|---|---|---|
| Stakeholder Engagement | **Organisational:** Vision and directional (5 year outlook, 3 year rolling) | AI's Strategic Plan | **AI Goals and Outcomes** AI PME Framework |
| | **Organisational:** Planning and budgets (3 year outlook, annual rolling) | AI Business Plan | **Goals and Outcomes** AI Scorecard and report |
| | **Business Unit:** Planning and budgets (3 year outlook, annual rolling) | Business Unit Plans and Operational Plans | **Goals and Outcomes** Business Unit Scorecards and reports — Operational reports |
| | **Individual:** Staff's contribution (annual) | Annual Performance Plans | **Performance Reviews** |

## REPORTING ON RESULTS

Reflecting international best practices, performance management and evaluation in AI is guided by a framework that will help us track and evaluate our progress across the pathway to impact. To this end, we are actively working with the Ministry of Economic Development and Trade (EDT) to co-develop a sector-agnostic Research and Innovation Impact Framework (see Figure 7, p. 37) that complements the ARIF innovation targets. This R&I framework is one element in the Business Planning Framework (see Figure 2, p. 10), and represents an integrated R&I system. A six-block protocol is being used that provides a "fit for purpose" approach to the development and implementation of the performance management and evaluation framework, tools and processes.

**Figure 7. Research and Innovation Impact Framework[12]**
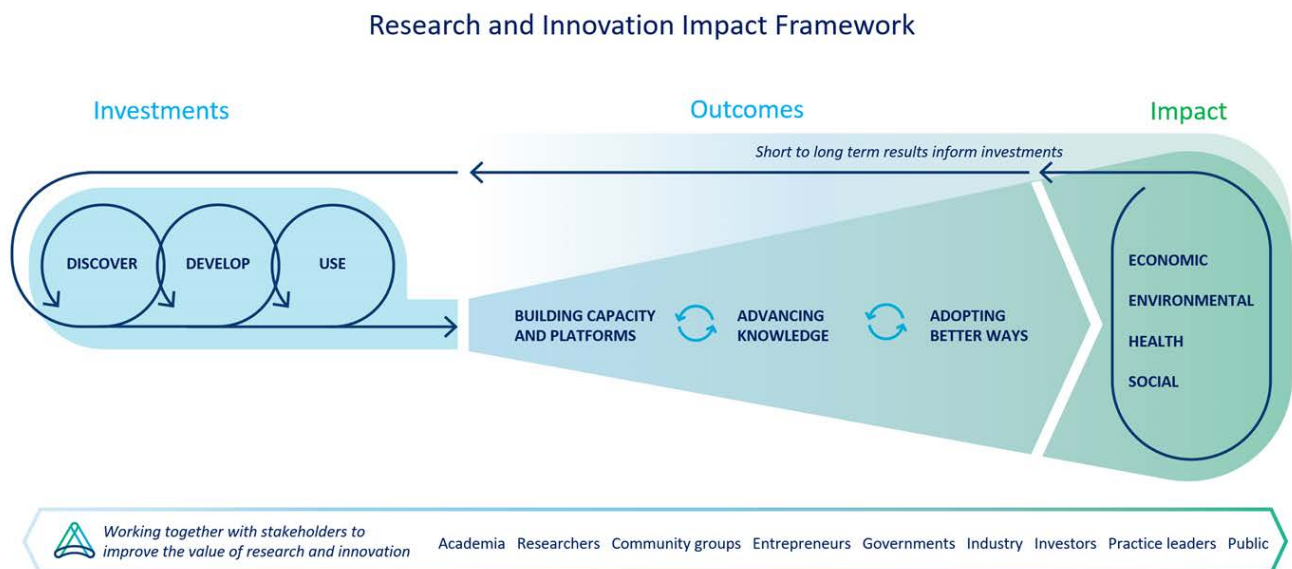


Research and Innovation Impact Framework

Figure 7 reads from left to right, starting with a venture investment view across the R&I continuum of  discover, develop and use (Table 1, p. 16).  These supports strengthen the R&I ecosystem through three  enabling outcomes: Building Capacity and Platforms, Advancing Knowledge and Adopting Better Ways. The  "pull" from end users helps inform the adoption of better ways in terms of pathways to better policies,  practices, processes, technologies, products and services. The new, innovative approaches and technologies can  lead to solutions to societal challenges and, depending on the pathway, result in economic, environmental,  health and social benefits for Albertans. **These benefits (i.e., impacts) are how we make a difference and  represent the "so what" of what we do for Albertans.**

The Research and Innovation Impact Framework depicts the feedback loops necessary within a complex R&I ecosystem and illustrates how R&I investments, outcomes and impacts inform future R&I activities (e.g., planning, investment strategies, policy, etc.).
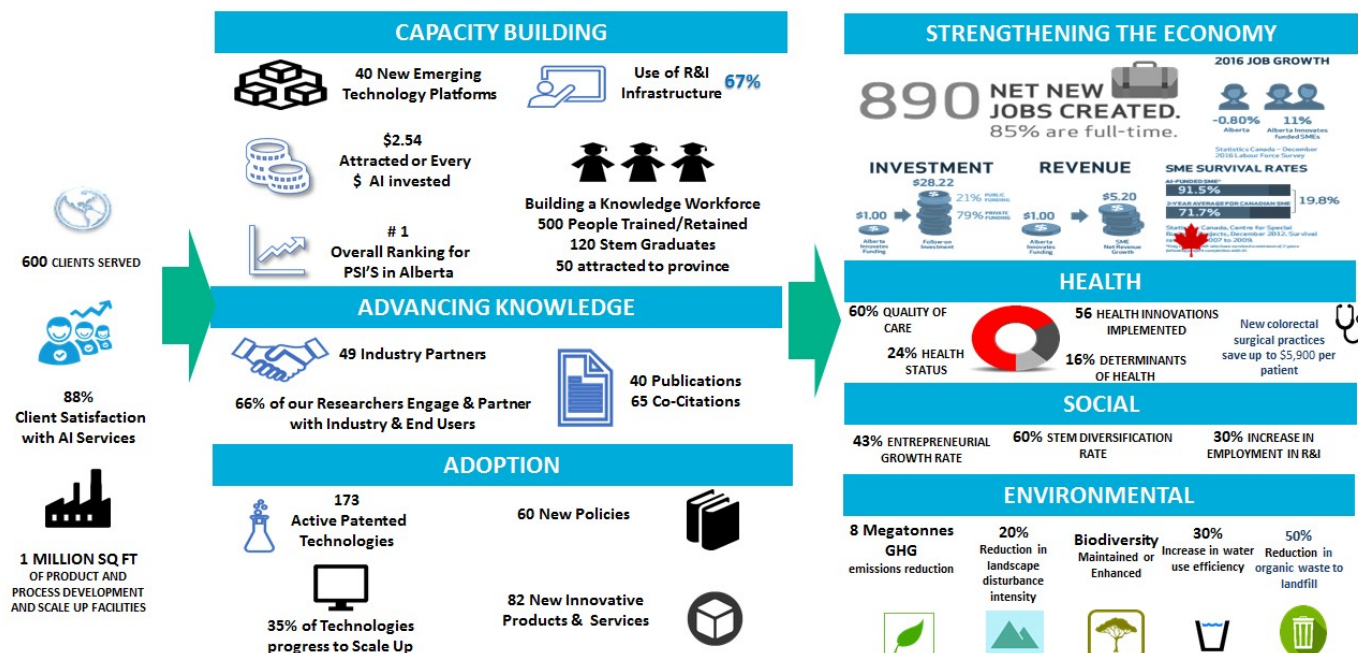
On a go-forward basis, the Research and Innovation Impact Framework will be used to monitor and evaluate the extent to which AI's new strategic plan, investment strategies and operational plans contribute to achieving our goals and intended outcomes. That is, it will be used to measure and report the value of our investment programs and operations in contributing to economic, environmental, health and social benefits to Albertans, by  showing whether intended changes occurred (or not) and why. Cascading scorecards and scheduled evaluations   will be used to systematically implement the framework in AI and provide evidence for purposes of accountability, transparency to the public and reviewing programs to inform allocation decisions. The evidence  will also be used to inform continued alignment, learning and adjustment initiatives in AI to ensure ongoing   performance improvement.

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[12] DRAFT Research and Innovation Impact Framework, Jan. 07, 2019

Of note is that the framework guides the identification of appropriate key performance indicators (KPIs) along the pathways to impact to evidence, progress and results. As well as co-developing the Research and Innovation Impact Framework, EDT and AI are also working together to co-identify KPIs and co-develop a consolidated scorecard. As this work is in progress, KPIs and associated measures are yet to be finalized, systematically implemented and integrated into our performance management and evaluation activities (e.g., cascading scorecards from the organizational to program level). Consequently, we are unable to provide specific performance measures for our goals and intended outcomes at this time. It is also not possible to set realistic targets until a baseline is established. It is anticipated that the KPIs and associated measures and scorecard will be implemented in early 2019 based on progress to date, with results reported in the 2018-19 Annual Report. The results will also serve as the baseline from which future targets can be established.

Figure 8 shows a sample of possible performance measures on a mock-up consolidated scorecard. The actual KPIs are still being determined and will be finalized with EDT and internal and external stakeholders to ensure our partners and clients have the capacity and support to generate and report quality evidence.

**Figure 8. Sample Consolidated Scorecard**



Over time, an enterprise business solution will be developed and implemented to capture data and report systematically across all levels in the organization.

## GOALS, OUTCOMES AND CORE LINES OF BUSINESS

As per the above, KPIs and performance measures are currently being co-identified and co-developed with EDT and internally with AI staff.  The performance measures provided below are therefore sample measures that may or may not be the measures that are implemented and reflected in the scorecard.

Because of the cross-sectoral reach of AI investments, the intended outcomes of each corporate goal in some way contribute to all the ARIF outcomes (economic diversification and job creation, environmental stewardship and climate leadership, effective resource management, and engaged individuals and communities for a healthy Alberta).

For example, AI's goal of enhancing Alberta's knowledge workforce and talent pool (i.e., Corporate Goal 2, below) can contribute to the ARIF outcome of economic diversification and job creation through the development and creation of new entrepreneurs and SMEs in Alberta.  Further, the enhanced knowledge workforce could reasonably produce new knowledge and novel technologies, products, services and practices that, when adopted and applied in the province, could mitigate environmental impacts, lead to more effective resource management and/or improve the health and well-being of our citizens.

Additional insight into the contributions that AI can make to ARIF is provided in Appendix B. It highlights the various strategies being used by AI's sector-specific business lines in relation to innovation target taglines in ARIF.

Several AI programs have objectives that span across more than one corporate goal. In the tables that follow, programs were identified within a goal if the main objective(s) of the program aligned to the goal. As a result, some programs are listed for more than one goal. Further, the absence of a program does not mean that it does not contribute to a goal but rather that the main objective(s) of the program do not correlate with goal.  For example, many programs that have the main objective of supporting research also enable trainees to be supported as part of the research project. But because the main objective(s) of such programs are not trainee development, the programs are not listed for the goal of enhancing the knowledge workforce.

**Goal 1.  Facilitate AI's role as a trusted R&I system convener**

| | |
|---|---|
| Goal Statement: | AI functions as a trusted convener by bringing together representatives from industry, government, academia and the community to deliver 21$^{st}$ solutions for the most compelling challenges facing Albertans. We do this by building on the province's strengths and investing across the R&I continuum (discover, develop, use). As a convener, AI works closely with our partners towards diversifying Alberta's economy, improving our environmental performance, and enhancing the health and well-being of Albertans. |
| Intended Outcomes: | • Co-ordinated and aligned investments along the R&I continuum to achieve outcomes-based objectives<br>• Investments in new strategic priority areas<br>• AI stimulates cross-sector collaboration with industry, governments, academia and the community<br>• AI recognized by stakeholders as a trusted convener/catalyst within Alberta's R&I system<br>• Client satisfaction with AI |

| Potential Performance Measures: | • $ invested across the R&I continuum<br>• $/% invested in new strategic priority areas<br>• # of participants attending INVENTURE$, broken down by sector<br>• Partnership $ attracted by AI<br>• % of stakeholders recognizing AI's role as a convener/catalyst<br>• % of clients willing to recommend AI (e.g., net promoter score) |
|---|---|
| Core Line of Business: | • Clean Energy, Health Innovation, Bio, Entrepreneurial Investments, Post-Secondary Investments Team and Applied Research contribute to this goal, supported by AI's administrative corporate services (e.g., Finance, Communications, etc.).<br>• AI is co-ordinating its investments across the business lines of Clean Energy, Health Innovation, Bio, Entrepreneurial Investments, Post-Secondary Investments Team, Applied Research. An investment framework that identifies common criteria across the Corporation was developed and is being implemented to ensure a line of sight between the *AI Five-Year Strategy* and our business lines. Please refer to dollars invested by business line and ARIF outcomes in the Consolidated Budget section.<br>• The AI *Five-Year Strategy* with supporting data outlines Alberta Innovates' key strategic focus areas, Alberta's areas of strength and how AI needs to start investing a proportion of its investments to achieve intended outcomes. The process for developing the plan used wide stakeholder engagement. The data provided is a starting point for measuring our success in terms of how stakeholders see us and our role in the research and innovation ecosystem.<br>• AI is working closely with industry and government to partner on specific initiatives and attract leveraged (partner) dollars to strengthen R&I investment in the province (e.g., clean technology).<br>• AI is focusing on putting the client first and ensuring a seamless client journey as they navigate through the system. Client navigation tools and processes are under development by Entrepreneurial Investments. |

## Goal 2. Strengthen capacity & ecosystem supports to enhance our knowledge workforce and talent pool

| Goal Statement: | Develop, attract and retain a highly qualified and skilled talent pool in Alberta. Enable, enhance and accelerate the ability of the province's R&I workforce to address Alberta's needs of today and tomorrow through the building of infrastructure and innovation platforms, improved access to research, technology infrastructure (e.g., centres, laboratories, technology development and testing facilities, etc.), technical expertise and better systems connectivity. |
|---|---|
| Intended Outcomes: | • Strengthen Alberta's knowledge workforce through R&I<br>• Support (re)skilling of highly qualified personnel (HQP) workforce to a knowledge and technology-based market<br>• Strengthen Alberta's R&I infrastructure<br>• Enhance access to R&I platforms<br>• Enhance community access to technical expertise and system connectivity |
| Potential Performance Measures: | • # of HSP/workforce supported directly and indirectly through AI investments<br>• # of HQP in (training) programs for knowledge and technology-based markets<br>• Usage rates of AI infrastructure programs (e.g., centres)<br>• Usage rates of R&I platforms supported by AI<br>• # of clients accessing technical expertise |
| Core Line of Business: | **Health:** People investments are designed to develop competencies in key health innovation areas in alignment with AI's strategic interests. Investments in platforms enable and accelerate R&I in the province.<br>   • Programs: Chairs; Education/Career Development; ACRC; ARECCI; Secondary Use Data; Health Research Ethics (HREH & HREBA); SPOR Platforms |

| | **Entrepreneurial Investments:** Investments contribute to the entrepreneurial ecosystem via the regional innovation networks, (RINs) which provides supports to individuals in the knowledge workforce who wish to develop their entrepreneurial skills and businesses.<br><br>• Programs: RINs; TDAs; Alberta Entrepreneurial Incubator Programs; Capital Access Major Transactions<br><br>**Post-Secondary Investments Team (PSIT):** Builds Alberta's knowledge workforce through enhanced educational offerings in key technology areas to maximize the intellectual talent available to support Alberta's economy.  Talent is subsequently deployed through industry, academia, government and not-for-profit organizations. Student entrepreneurship and networking is also supported.<br><br>• Programs: Research Chairs/Strategic Investments; Graduate Studentships; Student and Recent Graduate Entrepreneur; Strategic Networking and Development; MindFuel; Mitacs; ACAMP<br><br>**Applied Research:** InnoTech Alberta offers a diverse range of scientific, engineering and technological testing capabilities and facilities to accelerate technology development and scale-up for government and industry clients. Support also includes expert advice and technical information and scientific infrastructure to meet the immediate and long-term technical needs of the private and public sectors. C-FER provides technical expertise and technology infrastructure for the development and testing of solutions to unique engineering challenges in the oil and gas industry. |
|---|---|

## Goal 3.  Foster system linkages to advance knowledge to cultivate a high performing R&I ecosystem

| | |
|---|---|
| Goal Statement: | The generation of knowledge and new discoveries, developments and breakthroughs produced by researchers and innovators. This requires that knowledge, new discoveries, developments and breakthroughs are shared and reach the people and organizations who can put it into practical use. |
| Intended Outcomes: | • Foster cross-sector system linkages to advance knowledge<br>• Knowledge and innovations are shared across sectors<br>• Support clients (e.g. companies, innovators) along their stage of development/readiness |
| Potential Performance Measures: | • # of collaborations and engagements, and % including industry and end users<br>• % of collaborations and engagements at a local, provincial, national and international level<br>• # of publications produced by AI-supported researchers<br>• # of patents<br>• # of clients (companies, etc.) that are supported according to their stage of development/readiness during or following AI support |
| Core Line of Business: | **Clean Energy:** Invests in programs that enable that discovery and development of innovative technologies to maximize the value of the Alberta's natural and renewable resources. Provides technical due diligence and project management services to ERA. Identifies opportunities and creates partnerships, including working with EDT and ERA as delivery agents to administer a suite of programs under CCITF.<br><br>• Programs: Recovery Technologies; Partial Upgrading; Methane Reduction; Bitumen Beyond Combustion; Renewable and Alternate Energy Program; Bio-Energy; Carbon Capture and Utilization; Energy Storage; Land and Biodiversity; Tailings Management; Water Innovation; Climate Adaption<br><br>**Health:** Project investments are designed to rapidly launch partnerships or to prototype the potential for a program. Programs are designed to scale and spread support in areas of strategic interest. Fosters strategic partnerships to achieve increased economic development, enhanced patient care and a resilient health-care system.<br><br>• Programs: Investigator Awards, Chairs, ACPLF; CRIO Portfolio; CIHR Teams/Networks; Brain Canada; CRA Wildfires; Genome Alberta; CLPNA; CIHR-PHSI & PCN; PRIHS; Alberta Translational Funds (Pfizer & Novartis); AICE; Li Ka Shing Applied Virology Institute; CIHR EHealth IPP; Health System Innovation |

| | |
|---|---|
| | **Bio:** Investments are focused on supporting smart science and technologies that accelerate sustainable agriculture productivity, mitigate climate change and advance the development of market-oriented, value-added food products. Supports knowledge development along the R&I continuum in the agriculture, food and forest industries.<br>    • Programs: Prion; Sustainable Production, Food Innovation; Alberta Bio Future, Bioindustrial Innovation; Biological GHG Management; Ecosystem and Biodiversity<br>**Entrepreneurial Investments:** Provides funding support to accelerate technology development for high-growth, high-potential firms leading to market leadership and export. Contributes to developing a network-based system of partners and service providers to assist entrepreneurs and SMEs in accelerating commercialization.<br>    • Programs: AEI Vouchers, Vouchers; Industry Associates Program; Product Demonstration Program (PDP); ASBIRI; Alberta-Ontario, Alberta-Zhejiang, Alberta-Jalisco; Centre of Excellence: Tecterra<br>**Post-Secondary Investments Team (PSIT):** Supports the creation of knowledge in science, engineering and business directed to strategic areas in Alberta as guided by ARIF, Alberta's Platform Technologies Strategy and AI's Strategic Plan. Also facilitates creation of new technologies in emerging technology application areas including artificial intelligence and data science, quantum technologies, advanced materials and manufacturing, synthetic biology and other cutting-edge science and technology areas.<br>    • Programs: Research Chairs/Strategic Investments; Alberta Glycomics Centre; Alberta Machine Intelligence Institute (Amii); ACAMP; Nanotechnology Programming, Nanotechnology Accelerator<br>**Applied Research:** InnoTech Alberta offers a diverse range of scientific, engineering and technological research to accelerate technology development and scale-up for government and industry clients. C-FER works with industry and client subject matter experts to develop solutions to unique engineering challenges in the oil and gas industry (i.e., focus is upstream drilling and production operations as well as midstream and downstream pipeline operations). |

## Goal 4. Adopt better ways to accelerate innovation

| | |
|---|---|
| Goal Statement: | Shared knowledge and real-time evidence is used to address the province's needs through new and/or improved policies, processes, technologies and products, practices and services. It is through the adoption of these better ways that investments in R&I make positive changes in the way that Albertans think and do things. It is also the cornerstone to achieving wider impact. |
| Intended Outcomes: | • Innovations (i.e., new or improved products and services, practices and policies) produced with the support of AI<br>• Innovations (i.e., new or improved products and services, practices and policies) are adopted (i.e., taken up and applied/used) |
| Potential Performance Measures: | • # of innovations created with support of AI<br>• # of innovations licensed<br>• # of influences on policy, practice and the public<br>• Description of companies and interventions that have scaled and spread with the support of AI |
| Core Line of Business: | **Clean Energy:** Develops and invests in programs that enable the use of innovative technologies to maximize the value of the Alberta's natural and renewable resources. Expertise is provided to the Government of Alberta on climate leadership, energy diversification and water and land policies. Supports entrepreneurs and industry in clean innovation.<br>    • Programs: Recovery Technologies; Partial Upgrading; Methane Reduction; Bitumen Beyond Combustion; Renewable and Alternate Energy Program; Bio-Energy; Carbon Capture and Utilization; Tailings Management<br>**Health:** Supports the progression and delivery of solutions generated through research into the health system |

- Programs: CIHR-PHSI and PCN; PRIHS; Alberta Translational Funds (Pfizer); AICE; Li Ka Shing Applied Virology Institute; CIHR EHealth IPP; Health System Innovation

**Bio:** Invests in science that informs policy in the agriculture, food and forest industries. Investment strategies are also targeted to the creation of markets for biodiversity and ecosystem services, and for developing uses for biomass from forest and agriculture leading to bioindustrial growth in Alberta. Direct investment in promising company ideas to support the sustainable growth and diversification of the agriculture, food and forest industries.

- Programs: Prion; Sustainable Production; Bioindustrial Innovation, Alberta Bio Future; Ecosystem and Biodiversity

**Entrepreneurial Investments:** Supports an integrated innovation system to deliver accelerated commercialization of high-growth, high-potential, knowledge-based technologies and companies. Target clients are entrepreneurs with promising, novel ideas, job-building companies and SMEs that wish to scale using innovation as a growth strategy.

- Programs: Alberta Innovation Voucher; Industry Associates Program; Product Demonstration Program; ASBIRI; Technology Development Advisors; Regional Innovation Networks (RIN), RIN Enterprise; Entrepreneurship Incubator; Alberta-Zhejiang, Alberta-Jalisco, Export Readiness Voucher; Clinical Demonstration Program; Entrepreneurship Accelerator; Centre of Excellence: Tecterra

**Post-Secondary Investments Team (PSIT):** Supports the application and adoption of innovation into Alberta's R&I ecosystem through commercialization and/or provides expertise to inform policy

- Programs: Alberta Glycomics Centre; Amii; ACAMP; Nanotechnology Programming, Nanotechnology Accelerator

**Applied Research:** The diverse range of scientific, engineering and technological research and testing capabilities assist in accelerating technology application.

## Goal 5. Making a difference for our clients, Albertans and society: contribute to a diversified economy, cleaner environment, a healthier and more prosperous Alberta

| | |
|---|---|
| Goal Statement: | **Economy:** Benefits to Alberta's economy resulting from commercialization of a new product or research innovation, creation of a new innovative enterprise or growth of an existing enterprise because of an innovation, cost savings, etc. It also captures follow-on funding, which is additional R&I funding attracted by Alberta-based researchers and innovators.<br>**Environment:** Improvements in Alberta's air, water and land through the implementation of new technologies and strategies to reduce the impact of industry on the environment, improve water management and treatment technologies, and transform waste into useable products.<br>**Health:** Improvements in the health status of Albertans, health system performance including the quality of care delivered, and the determinants of health.<br>**Social:** Enhanced well-being of Albertans, including the improved inclusion of vulnerable populations and overall levels happiness of the province's citizens. |
| Intended Outcomes: | • AI contributes to improved economic prosperity in Alberta<br>• AI contributes to reduced environmental impacts in Alberta<br>• AI contributes to effective resource management in Alberta<br>• AI contributes to the improved health and well-being of Albertans |
| Potential Performance Measures: | **Economic Prosperity - Diversification and Job Creation**<br>• Count of new hires in Alberta's R&I SMEs that receive support from AI<br>• Proportion of SMEs that remain active up to five years post-funding/support<br>• Count of R&I spin-outs still active up to five years post-funding/ support, by sector<br>• Estimate of the amount of funding secured by a funding recipient/ client/delivery agencies after AI initial investment<br>• Proportion of SMEs that increased revenue |

- Proportion of SMEs exporting

**Environmental – Environmental Stewardship and Climate Leadership**
- Amount of potential reduced GHG emissions from projected deployments (lead)
- Amount of actual GHG emission reductions from new clean technology deployment (lag indicator)
- Amount of reduction in land disturbance intensity
- Metric tonnes of solid waste diverted from landfill for other use (conversion)
- Biodiversity maintained or enhanced
- Sustainable water management: Increase in water use efficiency

**Health – Engaged Individuals and Communities for a Healthy Alberta**
- Access to integrated (integrable) datasets: Count of available datasets (breadth) and proportion with linkage capability (quality metric)
- Measures as per the Alberta Performance Ranking: Acceptability (i.e., self-reported patient satisfaction); accessibility (i.e., wait times); appropriateness; competence; continuity; effectiveness; efficiency and safety
- Prevalence: avoidable mortality (PYLL) and QALYs

**Social – Better Society for Albertans**
- The proportion of the provincial population aged 18-64 who report early-stage entrepreneurial activity, including attempts to establish, own or manage a new business (Conference Board of Canada definition)
- Alberta's Innovation rank (Conference Board of Canada's Innovation Scorecard) (i.e., competitiveness)

| | |
|---|---|
| Core Line of Business: | Corporate goals 1-4 ultimately contribute to this goal as illustrated in the Research and Innovation Impact Framework (Figure 7, p. 38). Therefore, all AI business lines also ultimately contribute to this goal, albeit with some business lines contributing more to a specific aspect of this goal than others (e.g., Clean Energy is a key contributor to the environment aspect of this goal, etc.). |

## MOVING FORWARD

An implementation team including AI, EDT and other key representatives will be assembled and an implementation plan developed for finalizing outcomes, impacts and key performance indicators. AI will test the Research and Innovation Impact Framework internally/externally and conduct workshops to ensure diversity of perspectives (e.g. representatives from industry, specific sectors, public etc.). The great opportunity is that this framework brings AI, EDT and our ecosystem partners "closer," by having a shared understanding on a common set of objectives and innovation system knowledge. It provides us with a new toolbox that includes business, governance, outcome models, etc. – something that is necessary in a complex, inter-dependent ecosystem. AI understands it is in a unique position to develop, manage and measure the performance and effectiveness of these relationships. We can now start to work with our stakeholders to identify ways to optimize impacts across the Research and Innovation Impact Framework and create the conditions for a learning and innovative ecosystem. It also enables us to clarify our goals with a clean line of sight from actions, outcomes and indicators.

# RISK MANAGEMENT

Alberta Innovates is committed to ensuring that risk management practices are embedded in the development of the business and operational plans to drive consistent, effective and accountable action. AI actively manages the risks which could adversely impact the ability to deliver on the organization's business plan. The risk management framework designed by AI was informed by and is consistent with the best practices of generally accepted global risk management standard frameworks. Our risk management framework also aligns with that of the Government of Alberta. The following significant risks were identified by senior management:

1. **Impact on desired outcomes from budgetary constraints or declining revenue streams**

AI is funded to deliver its mandate through two revenue streams – funding from the Government of Alberta (approximately 80 per cent) and contract research for commercial enterprises and government clients (approximately 20 per cent). Budgetary constraints caused by an expenditure cap, for example, or declining contract research revenue can greatly diminish AI's ability to fulfill its funding commitments, or to sustain critical talent and infrastructure assets required to support the long-term nature of research and innovation. While there is increasing pressure on both revenue streams, multi-year funding agreements and a significant number of unionized and long-service employees also limit the Corporation's ability to course correct in the short term without jeopardizing desired outcomes.

*Potential impact: Medium-high. Likelihood of occurrence: High.*

> **Mitigation Strategy:** AI's business plan and budget has been developed prudently, balancing short-term fiscal pressures with the long-term demands and cost commitments for research and development. Discretionary expenses will be reduced and additional controls put in place to monitor AI's financial position monthly. The Corporation will continue to work closely with the Government of Alberta to collaborate further, given budgetary constraints caused by changing fiscal policies. Articulation of AI's contribution to the Province's desired outcomes through measures such as a system-wide scorecard and success stories will help mitigate reduction in funding from the Government of Alberta. A stronger focus on business development, client attraction and retention, and continued diversification of our client base will be maintained.

2. **Talent capacity**

AI requires the correct balance of human capital to achieve its business goals and long-term strategic plan. The focus on emerging technologies and digitization of our tools and systems will not only depend on the Corporation's ability to retain and attract employees with specialized skills, but also to retrain existing employees with similar skills necessary to the organization's success. Some staff at AI possess highly specialized skills and experience not easily reproduced or replaced. Furthermore, AI competes with industry and government for highly skilled workers from a limited pool of potential candidates. As a result, hiring decisions must be strategic and candidates must meet the requirements of a knowledge-based work environment.
*Potential impact: Medium-high. Likelihood of occurrence: Medium.*

**Mitigation Strategy:** As part of the 2017 Transitional Business Plan, AI completed a review of the current skills and experience within the organization. AI is currently identifying gaps and changes required to ensure the Corporation is adequately staffed to achieve its business and long-term strategic goals. Ongoing integration management will inform the potential reallocation of capacity to areas of the Corporation that are underserved. Recruitment strategies are driven by future talent needs as informed by the strategic plan. A focus on succession planning for key roles will help to mitigate the risk of loss of key personnel.

### 3. Cybersecurity

Ensuring the integrity, confidentiality and availability of information is a growing concern for both industry and government. AI is subject to potential deliberate or opportunistic cyber threats for which it may be unable to protect sensitive data, intellectual property and confidential information. As AI embraces digital technologies in its tools and systems, it is potentially at greater risk of a cyber threat. A breach in the Corporation's cybersecurity represents both an operational and reputation risk for which business continuity and disaster recovery planning will play crucial roles.

*Potential impact: Medium-high. Likelihood of occurrence: Medium.*

**Mitigation Strategy:** AI's cybersecurity strategy is comprised of four key strategies to mitigate potential attacks:

- Prevent – Includes communication with all business units, spam detection, firewall/network protection, file sharing, and security for third-party applications;
- Monitor – Information Technology (IT) professionals are trained to escalate data risk or data breach incidents as they occur, with backups monitored to ensure continuity;
- Detect – IT professionals are trained to ensure that if a cyber event happens, it is escalated to the right people to act quickly; and
- Handle – Disaster recovery plans are being revamped. There is new testing within IT to ensure processes can be executed properly.

AI's cybersecurity strategy continues to evolve to address the changing technical and business landscape. As the Corporation adopts the digital future in its tools and systems, AI's IT team will readily assess and deploy cybersecurity protocols and programs to ensure the integrity and confidentiality of AI's data.

### 4. Ability to convene partners

The research and innovation landscape is constantly evolving, and increasingly AI must provide leadership in the promotion and establishment of an integrated R&I system. An unco-ordinated or unaligned system will not be able to address complex challenges such as climate change or diversification of the provincial economy. Increased co-ordination and demonstrated collaboration on part of key stakeholders in an integrated R&I system is required to the drive the desired outcomes of the Government of Alberta. Insufficient support from our partners to accept and adapt to AI's refreshed mandate, role and operating model will impact the execution of AI's desired outcomes.

*Potential impact: Medium. Likelihood of occurrence: Medium.*

**Mitigation Strategy:** AI is focused on improving co-ordination within Alberta's innovation system, with the recognition that for the province to succeed, the building blocks of innovation – academia, industry, entrepreneurs and government – must collaborate to achieve targeted outcomes. AI will continue to scan the innovation and economic landscape for opportunities to partner at the municipal, provincial and national level to further Alberta's innovation priorities. AI will fulfill its role as a convener and bring its partners together to achieve mutually beneficial outcomes. AI continues to engage its partners through collaboratories, industry clusters and other partnerships to develop approaches for the discovery, development and use of emerging technologies to accelerate outcomes in multiple sectors.

## 5. An integrated entity

There remains an inherent risk that AI's 2017-18 Transitional Business Plan did not achieve the level of integration required for the Corporation to initiate execution of an integrated R&I system. Potential miscalculations on the scale, scope and execution strategy of the transitional business plan deliverables may have led to strain and engagement of staff, loss of key knowledge and expertise, damage to key relationships, insufficient management information systems and potential disruption in day-to-day business in the upcoming year.

*Potential impact: Medium. Likelihood of occurrence: Low.*

**Mitigation Strategy:** A significant majority of transitional business plan deliverables have achieved their original completion target date. A select number of deliverables have expanded their scope and thus extended their completion timelines into 2018. Integration of the four legacy AI corporations is an ongoing effort, and the proposed recommendations of the integration teams have been handed off to AI's Integration Management Office.

# CONSOLIDATED BUDGET

## BACKGROUND

This consolidated statement of operations reflects the consolidation of Alberta Innovates with its two wholly owned subsidiary corporations C-FER Technologies (1999) Inc. and InnoTech Alberta Inc., along with the Alberta Foundation for Health Research.

Total revenue is expected to increase slightly from 2017-18 due to the addition of the revenue associated with the Climate Leadership Plan. Grant revenue associated with endowments will be restricted to the predetermined use of those endowments.

The expenses have been expressed in terms of AI's business lines (Clean Energy, Health, Bio, Entrepreneurial Investments, and Post-Secondary Investments Team). Expenses for InnoTech Alberta Inc. and C-FER Technologies (1999) Inc. have been identified under the header of **Applied Research**. Additional expenses have been identified under the following headers:

- **Emerging Technologies:** Includes investments in emerging technologies and applications in the four core areas of data-enabled innovation, digital technology for business transformation, clean technology and innovative production and distribution. As highlighted earlier in this business plan, this is a new strategic priority for AI and one that we are shifting towards.
- **Administration:** Includes all corporate services such as finance, marketing and communications, information services, facilities, legal, human resources, purchasing, corporate planning and portfolio management (CPPMO), and performance management and evaluation (PME). Administration serves a critical function in the Corporation by providing essential supports to the operational business lines (Clean Energy, Health, Bio, Entrepreneurial Investments, Post-Secondary Investments Team and Applied Research). These corporate services enable the operational business lines to work productively and efficiently toward achieving AI's strategic priorities and goals. Corporate services play a direct role in advancing AI's strategic priority Embrace the Digital Future, given that many of them will be leading and/or actively participating in streamlining and automating our internal processes and operations.

Budgeted expenditures reflect primarily existing contractual obligations. Alberta Innovates received an expenditure reduction in 2018-2019. However, this reduction was offset by expected expenditures related to the Climate Leadership Plan. Therefore, total expenditures are consistent with prior years.

Budget amounts for 2019-2020 and 2020-2021 are estimates based on existing contractual obligations and average annual spending. Any significant reductions or adjustments reflect the end of existing programs (e.g., Health has a significant program ending in 2020).

Although an accumulated surplus exists, a total expense target has been assigned to Alberta Innovates through the government budget process, which limits total expenses and the use of the surplus.

An annual surplus of $23.3M is budgeted for 2018-2019, which increases the accumulated surplus to $84.2M. The accumulated surplus was generated from timing differences on expenditures over the last few years.

## ALBERTA INNOVATES
### CONSOLIDATED STATEMENT OF OPERATIONS
(dollars in thousands)

| | 2016-17 Actual | 2017-18 Budget | **2018-19 Budget** | 2019-20 Budget | 2020-21 Budget |
|---|---|---|---|---|---|
| **Revenues** | | | | | |
| Government Transfers | | | | | |
| Funding from Economic Development and Trade | | | | | |
| Base Grant | $ 155,207 | $ 160,849 | **$ 160,249** | $ 141,999 | $ 141,999 |
| Restricted Grant from Prior Years | 30,196 | 14,072 | **22,229** | 12,425 | 8,425 |
| Other Grants | 9,799 | 28,499 | **54,100** | 53,000 | 15,000 |
| Restricted Capital Contribution | 14 | 1,000 | **1,475** | 1,625 | 1,775 |
| Funding from Other Government of Alberta Entities - Other Grant | 11,493 | 3,240 | **13,193** | 13,000 | 13,000 |
| Federal Government Transfers | 6,888 | 4,479 | **5,369** | 7,583 | 3,000 |
| External Revenue and Industry Funding | 47,312 | 55,024 | **50,282** | 52,796 | 55,436 |
| Investment Income | 1,221 | 1,086 | **801** | 700 | 600 |
| Other Revenue | 974 | 768 | **3,835** | 3,834 | 3,834 |
| | 263,104 | 269,017 | **311,533** | 286,962 | 243,069 |
| | | | | | |
| **Expenses** | | | | | |
| Clean Energy | 25,726 | 25,645 | **61,616** | 58,316 | 20,616 |
| Health Innovation | 89,339 | 74,013 | **61,348** | 51,063 | 51,063 |
| Bio | 23,552 | 19,758 | **18,957** | 18,957 | 18,957 |
| Entrepreneurial Investments | 29,619 | 36,612 | **26,938** | 26,938 | 26,938 |
| Post-Secondary Investments Team | 32,581 | 26,709 | **21,047** | 21,047 | 21,047 |
| Applied Research | 66,826 | 67,140 | **67,170** | 67,170 | 67,170 |
| Emerging Technologies | - | 5,000 | **1,110** | 5,000 | 9,000 |
| Administration | 30,723 | 31,113 | **30,030** | 30,030 | 30,030 |
| | 298,366 | 285,990 | **288,216** | 278,521 | 244,821 |
| | | | | | |
| **Annual Surplus (Deficit)** | (35,262) | (16,973) | **23,317** | 8,441 | (1,752) |
| | | | | | |
| **Accumulated Surplus, Beginning of Year** | 113,085 | 77,823 | 60,850 | 84,167 | 92,608 |
| **Accumulated Surplus, End of Year** | **77,823** | **60,850** | **84,167** | **92,608** | **90,856** |
| | | | | | |
| **Adjustments to Deferred Revenue Accounts** | | | | | |
| Revenue Recognized During the Period | 99,947 | 104,072 | 22,229 | 12,425 | 8,425 |
| Funding Received | 89,621 | 90,000 | - | - | - |
| | | | | | |
| **Change in Total Deferred Revenue** | | | | | |
| Total Deferred Revenue, Beginning of Year | 110,407 | 100,081 | 86,009 | 63,780 | 51,355 |
| Total Deferred Revenue, End of Year | 100,081 | 86,009 | 63,780 | 51,355 | 42,930 |
| **Decrease in Total Deferred Revenue** | (10,326) | (14,072) | (22,229) | (12,425) | (8,425) |

**Alberta Innovates**
**2018-19 Key Outcomes**
(dollars in thousands)

| Business Line | Total Budget | Economic Diversification and Job Creation | Environmental Stewardship and Climate Leadership | Effective Resource Management | Engaged Individuals and Communities for a Healthy Alberta |
|---|---|---|---|---|---|
| Clean Energy | 61,616 | 12,323 | 49,293 | - | - |
| Health Innovation | 61,348 | 12,270 | - | - | 49,078 |
| Bio | 18,957 | 3,791 | - | 15,166 | - |
| Entrepreneurial Investments | 26,938 | 18,857 | 2,694 | 2,694 | 2,694 |
| Post-Secondary Investments Team | 21,047 | 14,733 | 2,105 | 2,105 | 2,105 |
| Applied Research | 67,170 | 47,019 | 6,717 | 6,717 | 6,717 |
| Emerging Technologies | 1,110 | 777 | 111 | 111 | 111 |
| Administration | 30,030 | 6,006 | 24,024 | - | - |
| | | | | | |
| **TOTAL** | **288,216** | **115,776** | **84,943** | **26,792** | **60,705** |

# CAPITAL PLAN & LEASING ARRANGEMENTS

## CAPITAL REQUIREMENTS

Alberta Innovates occupies a significant inventory of research and office facilities, most of which are owned and operated by Alberta Infrastructure. The Corporation operates across 11 locations: Edmonton (5), Calgary (3), Devon (1), Vegreville (1) and Victoria, B.C. (1), with well over one million square feet of space and 600 acres of research farmland. In addition to our facilities, AI also possesses a substantial inventory of research equipment with an estimated replacement asset value well over $100 million. With the significant innovation infrastructure, we have persistent, ongoing capital requirements to maintain, update, reconfigure and expand our infrastructure to meet the corporate and provincial priorities.

Alberta Innovates' capital funding traditionally has come from two sources – internal AI funding for research equipment and Alberta Infrastructure funding for program accommodation projects. There is a chronic capital funding shortfall which has been exacerbated in the last few years as program accommodation funding from Alberta Infrastructure has dried up. This shortfall has resulted in programs being delayed and has made facility planning problematic. In the absence of the program accommodation funding from Alberta Infrastructure, AI has been subsidizing its high-priority accommodation projects with the limited internal research equipment capital funding. This further jeopardizes our ability to maintain and acquire equipment for priority programs.

To address the chronic capital shortfall, AI has been working with EDT in the last three years to develop an Alberta Innovation Infrastructure Management Plan, with a view to provide a provincial framework for innovation infrastructure planning and management.

Through the development process, an annual budget of $1.6M to $2.6M has been earmarked for provincial innovation infrastructure capital maintenance and renewal projects for AI since 2016-17. A five-year total of $24M has been approved for core building improvements. AI will continue to work with the Ministry and strive to expand the provincial capital funding source to include new equipment investment, which is currently a self-funded capital expenditure for the Corporation. In addition to the Alberta Innovation Infrastructure and Management Plan, an asset management system was implemented at InnoTech Alberta to ensure effective utilization and management of AI assets for priority programs.

## 2018-21 CAPITAL PLAN FUNDING PRIORITIES

$ In thousands

| Projects by Location | Type of Project | Project Scope and Justification | Proposed Timeline | 2018-19 Est | 2019-20 Target | 2020-21 Target | 3-Year Total | Funding Sources |
|---|---|---|---|---|---|---|---|---|
| **Edmonton – InnoTech Alberta** | | | | | | | | |
| **Alberta – Canada Collaborator in Cleaner Oil Sands Development Memorandum of Understanding** | Major Capital | Devon Strategic Capital Plan (Former AITF) Safety Issues /Concerns – Fuels and Lubricants. Total Project Cost: $4,468K (only $4 M was approved in 2018 Fiscal Plan) Note: Approved funding has been transferred to Alberta Infrastructure for project development and implementation. | 2 to 36 months | $4,000 | $0 | $0 | $4,000 | **EDT and GOA** |
| **Govier Air Handling Unit Replacment** | Major Capital | Existing system has been posing carbon monoxide and air quality concerns which can only be effectively corrected by replacement. Total Projects Cost: $2M* Note: Approved funding has been transferred to Alberta Infrastructure for project development and implementation. | 2 to 24 months | $2,000 | $0 | $0 | $2,000 | **EDT and GOA** |
| **All Sites – InnoTech Alberta** | | | | | | | | |
| **Fume Hood Replacement Program** | Major Capital | Yearly certification testing and recent physical assessment reports indicate that the majority of fume hoods are experiencing critical challenges which can only be effectively corrected by replacement. Total Project Cost: $29,685K* | 2 to 120 months | $4,000 | $4,000 | $4,000 | $12,000 | **EDT and GOA** |
| **All Sites – Miscellaneous** | | | | | | | | |
| **Program Equipment, Minor Facility Projects and Corporate Systems** | Ongoing Capital Renewal and Investment | Miscellaneous corporate systems and equipment identified from annual budgeting process. Note: Annual Capital Renewal Budget from EDT/GoA: $1.6 to $2.6 M Annual Investment/Self- | 2 to 12 months (project dependent) | $10,500 | $10,500 | $10,500 | $31,500 | **Alberta Innovates, EDT and GOA** |
| TOTALS | | | | $20,500 | $14,500 | $14,500 | $49,500 | |

*  **Note: Approved funding will be transferred to Alberta Infrastructure for project development and implementation.**

## COMMERCIAL LEASE ARRANGEMENTS

| Location | Size | Termination date | Scope of Operations |
|---|---|---|---|
| 1. Victoria | 5,030 square feet | July 31, 2023 | InnoTech Alberta - Water Characterization Group |
| 2. Edmonton Pylypow | 12,925 square feet | June 30, 2019 | InnoTech Alberta - Instrument Technical Services |
| 3. C-FER East Pylypow | 36,650 square feet | March 31, 2019 | C-FER - Engineering Consulting and Full Scale Testing for C-FER's Pipelines and Structures |
| 4. Edmonton Bell Tower | 30,840 square feet | Dec. 31, 2020 & Sept. 30, 2022 | Alberta Innovates |
| 5. Edmonton Phipps McKinnon | 11,202 square feet | March 31, 2019 | Alberta Innovates |
| 6. Calgary AMEC Place | 5,945 square feet | March 31, 2021 | Alberta Innovates |

# APPENDICES

## APPENDIX A – FOUR CORE EMERGING TECHNOLOGY AREAS

**Data-Enabled Innovation**

AI's strategic planning process uncovered a key finding – **Alberta is lagging in digital technology research and development, talent growth and concentration**. This is a significant barrier to business adoption and development of critical technology. Specifically, increased and sustainable concentrations of computer and information systems professionals are needed, as are enhanced training capacities in computer and software engineering and computer programming. With digital technology blurring the lines between sectors, upskilling and continual learning programs are another means of providing Alberta-based digital technology companies with the labour pool needed to reach scale.

Data-enabled innovation synthesizes large, complex blocks of information to improve decision-making, predictability and efficiency. Companies can make (near) real-time decisions by using machine learning and artificial intelligence to reveal hidden value not readily apparent through traditional analytic methods. This enables companies to more readily respond to changing variables. Data-enabled innovation also leverages large pools of existing data; the world produces 2.6 quintillion bytes of data daily that remains largely used.

**Sample Data Enabled Innovation Technologies**

- Artificial Intelligence
- Machine Learning
- Data Analytics
- Computing
- Quantum Technologies
- Communication Technologies
- Cloud Computing
- Augmented Reality
- Virtual Reality

Alberta stands to benefit substantial economic gains through data-enabled innovation, with artificial intelligence alone contributing an estimated $15.7 trillion to global GDP by 2030.[13] For local economies such as Alberta, upwards of a 26 per cent increase in GDP by 2030 could be realized by fully leveraging artificial intelligence.[14] Alberta could also add an estimated 0.5 percent to its GDP – which translates to $15.1 billion – by pursuing open data instead of charging users for data access.[15]

Alberta is home to several data-enabled innovation assets that will improve its competitive position over time. Key among these is the Alberta Machine Intelligence Institute (Amii), a research institution that advances understanding and innovation in several machine intelligence subfields. The Alberta presence of Google DeepMind – a private, international, artificial intelligence research office that merges startup culture with academia – is also advantageous. DeepMind leverages Alberta's expertise in reinforcement learning and, as one of only four such Google research centres in the world, helps attracts top artificial intelligence researchers to the province. In addition, Alberta is home to several data-enabled innovation companies.

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[13] PwC. (2017). "Sizing the prize: What's the real value of AI for your business and how can you capitalise?"

[14] Mark Knickrehm, Bruno Berthon, and Paul Daugherty. "Digital Disruption: The Growth Multiplier" Accenture Strategy. 2016.

[15] Alberta Innovates.

**Digital Technology for Business Transformation**

The strategic planning process showed that expansion of AI's investment portfolio to include digital technology is crucial if Alberta is to maintain a leadership role in data-enabled innovation. It also assists the province's largest sectors to remain globally competitive (i.e., energy, health, manufacturing and agriculture). Digitization will allow Alberta to leverage data-enabled technologies capable of discovering hidden value and extracting costs from business or organization processes. The potential economic impacts are large, given that digital technology composes nearly one-quarter of the global economy. It has been estimated that $2 trillion in additional global economic output could be generated by 2020 through further leveraging of digitization.[16]

**Sample Digital Technologies**

- Cybersecurity
- Cryptocurrency
- Geomatics
- Geospatial Technology
- Internet of Things (IoT)
- Visualization

Legacy work in Alberta provides strong existing research capacity in advanced geomatics, remote sensing and geospatial technology. Conversely, capacity in Internet of Things (IoT) research and commercialization represents an emerging opportunity. Several digital technology companies and start-ups are currently operating in Alberta. Additionally, several supports are in place to incubate digital startups and to assist SMEs achieve sustainable commercial success.

**Clean Technology**

The negative impacts of climate change on ecological and economic systems across the world have created a political, economic and social imperative to respond. One response by the Government of Alberta (GoA) has been to establish targets in the Climate Leadership Plan[17] to reduce greenhouse gas emissions, including:

- Ending pollution from Alberta-based, coal-generated electricity by 2030;
- Developing more renewable energy;
- Capping oilsands emissions to 100 megatonnes per year; and
- Reducing methane emissions by 45 per cent by 2025.

**Sample Clean Tech Technologies**

- Water Technologies
- Climate Technologies
- Emissions Reductions
- Smart Grid
- Cleaner Fuels
  - Bio
  - Solar
  - Wind
  - Nuclear
  - Hydrogen ($H_2$)

The Climate Leadership Plan includes a $1.4-billion commitment from the GoA over the next seven years for innovative clean-tech solutions.[18] This and other clean-tech investments in Alberta are expected to yield significant economic benefits, with the Renewable Electricity program alone attracting at least $10.5 billion in investment and creating 7,200 jobs for Albertans by 2030.[19] Globally, renewable energy accounted for 61 per cent of total global energy production in 2015.[20]

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[16] Mark Knickrehm, Bruno Berthon, and Paul Daugherty.

[17] Government of Alberta. "Major funding for diversified, low-carbon economy." December 5th, 2017. Accessed from: https://www.alberta.ca/release.cfm?xID=5110991022019-FCE5-7A2E-5B3B7020CB44F8B3.

[18] Government of Alberta. "Major funding for diversified, low-carbon economy." December 5, 2017. Accessed from: https://www.alberta.ca/release.cfm?xID=5110991022019-FCE5-7A2E-5B3B7020CB44F8B3.

[19] Government of Alberta. (March 2017). New jobs, investment to come from renewables.

[20] International Renewable Energy Agency. (2017). Rethinking Energy 2017.

R&I capacity within Alberta's clean-tech ecosystem is highly variable, depending on the technology area. The most advanced clean-tech capacities are in the areas of waste-to-energy and biomass-to-energy technologies as well as municipal solid waste (MSW) to valued-added (W2VA) products. Several clean-tech companies are already established in Alberta and oilsands producers are investing more than $1.2 billion in 814 technologies and best practices through Canada's Oil Sands Innovation Alliance.[21] Clean-tech research capacity is further assisted by several organizations responsible for funding and efficiently bringing new technology to market.

**Innovative Production and Distribution**

Innovative production and distribution technologies enhance manufacturing competitiveness through product differentiation, material and waste-stream optimization, expanded market access and cost reduction to market. These technologies will help distinguish Alberta manufactured goods from those of competitors and are critical if Alberta- based manufacturers are to maintain and advance a competitive position in the globalized economy.

**Sample of Innovative Production and Distribution Technologies**

- Advanced Materials
- Autonomous Transportation
- Robotics
- Supply Chain and Logistics
- Value-added
  Food Processing
- Water Technologies

Manufacturing accounts for approximately 16 per cent of global GDP and 14 per cent of employment.[22] It also contributes disproportionally more to exports and innovation compared to all other sectors. Through exports, manufacturing can bring 'new' money into the community and reinvest it locally. This results in manufacturers typically paying higher average wages relative to other sectors of the economy, especially when educational attainment levels are factored in. In Alberta, product manufacturers and distribution companies pay an average wage that is nearly $11,500 above their national counterparts while accounting for nearly 270,000 jobs.

Diversification of Alberta's economy requires R&I organizations to address manufacturing and distribution challenges across all sectors. In addition to several innovative production and distribution companies currently operating in Alberta, capacity can also be leveraged from Alberta's extensive expertise in oil and gas product development and distribution. This expertise is already being refined and advanced through value-added oil and gas activities in the province. Alberta can also leverage its strong capacities in micro/nano technology when automation transforms the production line and manufacturers distinguish their products with advanced materials.

Together, these capacities place Alberta in an optimal position to lead certain portions of manufacturing and distribution innovation.

[21] Stastny, R.P. (2016). Four questions about Canadian oil and gas innovation with Duke du Plessis. JWN Energy. Accessed from: http://www.jwnenergy.com/article/2016/8/four-questions-about-canadian-oil-and-gas-innovation-duke-du-plessis/

[22] McKinsey Global Institute. "Manufacturing the future: the next era of global growth and innovation. November 2012.

## APPENDIX B - ALIGNMENT OF AI BUSINESS LINES TO ARIF

Alberta Innovates will identify opportunities and create the partnerships necessary to achieve the Alberta Research and Innovation Framework (ARIF) 2030 targets. The business lines of Clean Energy, Bio and Health have identified targeted strategies that align with Government of Alberta priorities as outlined in ARIF. Corresponding projects and programs, collaboration strategies and performance management will be developed as these strategies are operationalized. See following three charts.

| AI Business Line | ARIF Target Tagline(s) | Business Line Strategies |
|---|---|---|
| Clean Energy | Grow Alberta's Green Economy | • Clean power and heat, renewables, and energy storage<br>• Consumer, industrial, and community waste-to-value-added products<br>• Energy efficiency<br>• Water and wastewater treatment technologies |
| | Reduce GHG Emissions | • New technologies, processes and design standards to reduce fugitive methane emissions<br>• Carbon utilization solutions for industry sectors<br>• Strategic partnership growth, including interdisciplinary and global connections |
| | Increase Value & Market Access | • Partial upgrading of bitumen and heavy oil<br>• Enhanced value-added processing for natural gas<br>• Chemical polymers and feedstock<br>• Materials and new products from bitumen, including BBC<br>• Pipeline and transportation integrity and safety, and reducing environmental impact |
| | Improve Oil Sands Efficiency | • Lower-energy oil sands recovery (e.g. solvents and electromagnetic heating)<br>• Advanced combined heat and power, and CO2 reduction<br>• Smart technologies and carbon neutral processes<br>• Energy efficiency, steam oil ratio reduction |
| | Renewable Energy | • Indigenous and remote communities<br>• Utility scale renewables and micro-generation<br>• Smart grid<br>• Energy storage<br>• Energy efficiency |
| | Reduce Wastes (new addition to this document, part of ARIF) | • Value-add products from waste, including biofuels, bio-derived chemicals, and fertilizers<br>• Adaptation and deployment of global technologies and processes |

| AI Business Line | ARIF Target Tagline(s) | Business Line Strategies |
|---|---|---|
| Health | Improve Robustness of Health Data | - Secondary use data opportunities for new innovators.<br>- Patient empowered approaches using digital health data-powered technologies. |
| | Improve Quality of Care | - Remote monitoring using IoT connectivity.<br>- Precision health technologies.<br>- AR/VR technologies for training and development.<br>- Artificial intelligence and machine learning to support decision making. |
| | Reduce Burden of Disease | - Behavioral health technologies that augment support provided by medical health technologies.<br>- Point-of-care diagnostics.<br>- Precision health technologies.<br>- Patient empowered approaches for managing chronic disease.<br>- IoT for health care management and delivery. |
| | Accelerate Health & Wellness Innovation | - Support the development and retention of competencies in health commercialization and high-tech development.<br>- Introduce new and support existing platforms that will accelerate emerging technologies in health.<br>- New funding mechanisms that catalyze research, development and commercialization in emerging technologies and leading-edge medicine.<br>- Platforms to encourage investment in health companies in the Alberta. |

| AI Business Line | ARIF Target Tagline(s) | Business Line Strategies |
|---|---|---|
| Bio | Increase sales (Fibre & Bioindustrial and Food & Agriculture) | · Develop new ingredients, foods, beverages and natural health products that add value addition to key commodities, competitive in global market<br>· Small business support for innovative product development<br>· Improve productivity and profitability<br>· Identify new markets<br>· Increase adoption of research and technology |
| | Drive Investment | · Advance bio-based materials and value-added bioproducts<br>· Industrial applications<br>· Biorefining and new agricultural fibre products<br>· Bioenergy and biofuels |
| | Reduce Waste | · Value-added products from waste including biofuels, bio-derived chemicals, biomaterials<br>· Adaptation and deployment of global technologies and processes |
| | Increase Productivity | · Crop and animal genetics and breeding programs for yield and quality<br>· Nutrient use efficiency<br>· Sustainable intensification<br>· Ecosystems-based approaches<br>· Rangeland management<br>· Farmer learning strategies<br>· Technological approaches: VRT, AI, sensors, analytics, mapping, rapid phenotyping |
| | Strengthened Public Trust for Expanded Markets | · Enhanced animal care<br>· Bridging science communication<br>· Environmental and sustainability indicators<br>· Food safety and antimicrobial resistance<br>· Validate production processes |