



2020–2023 BUSINESS PLAN

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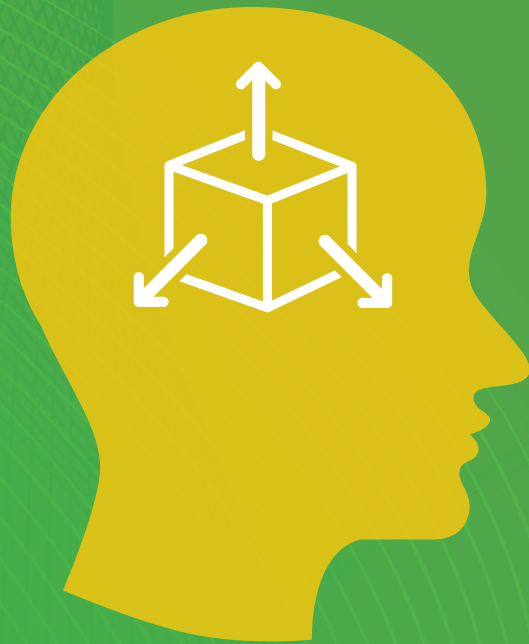
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Executive Summary



Executive Summary

The year 2020 so far has been marked by fiscal constraint in the province of Alberta, exacerbated by challenges from the COVID pandemic and depressed global oil prices. The impacts on Albertans and their businesses are real and acute. Alberta Innovates is able to harness powerful and complementary technologies to advance Alberta's economic response and recovery through research and innovation (R&I). The Alberta Innovates Business Plan 2020–23 charts a course through economic uncertainty facing the province and refocuses our priorities in response to the current realities.

Alberta Innovates was repurposed more than three years ago to ensure Alberta's innovation efforts were aligned and focused. As the largest and most comprehensive R&I agency in Alberta, we have always believed in the importance of research and innovation for Alberta. Now, more than ever, this calls for collective, unwavering resolve as we lean hard into the extraordinary urgency facing the Government of Alberta and its citizens. We were created to be the “whole of government” vehicle for innovation in Alberta. As reflected in this business plan, acute, immediate needs and mid-term recovery span many key sectors including health, energy, environment, agriculture and finance.

The 2020–23 Business Plan carries on the work of aligning our programs and activities to our strategic priorities and the Alberta Research and Innovation Framework. We will continue to stimulate R&I to propel great ideas forward, faster – through funding programs, advice, connections, technical expertise and applied research services.

Our mandate remains the same, but **how** Alberta leverages its innovation system at this time of crisis is crucial. Coming out of deep budget cuts in the past three years, Alberta Innovates enters the 2020–21 fiscal year with a tight operating budget and reduced workforce. Those changes, preceding the COVID 19 crisis, required us to rethink our programming. We have established **five focus areas for investment** that build on skills and supports we have already cultivated in the R&I system. These are still highly relevant to post-crisis recovery and we believe this plan to be appropriate as a starting point for the coming three years. Through these areas of focus, we will continue to foster the development and growth of new and existing industries and small & medium-sized enterprises (SMEs), contribute to environmental performance, and improve the health and well-being of Albertans.

Five focus areas

Alberta Innovates will focus on the following areas in the 2020–23 business planning cycle:

Digital Health

Advance digital health technologies to accelerate improvements in the quality and long-term sustainability of our health system and the health of Albertans.

Innovative Hydrocarbon Products

Invest in R&I that transforms bitumen into non-combustion, value-added materials such as carbon fibre, activated carbon and asphalt.

Smart Agriculture

Lead smart agriculture R&I and address food security challenges through adoption of technology for significant impact in Alberta and beyond.

Artificial Intelligence

Build on our past successes in creating world-recognized artificial intelligence capacity in Alberta by supporting further development and application of artificial intelligence across sectors.

Entrepreneurial Ecosystem

Continue to support a growing entrepreneurial ecosystem in Alberta through the programs, networks and connections we provide to entrepreneurs and start-ups to commercialize their innovations and scale their businesses.

As we refocus the organization to concentrate on the above five areas, we will remain flexible in our other, ongoing programming and adapt as needed.

Our subsidiaries, [C-FER Technologies Inc.](#) and [InnoTech Alberta Inc.](#), will continue to provide world-class expertise, testing and applied research services for a variety of industrial and public-sector clients.

Performance Management

The Performance Management section outlines the high-level activities we will undertake to accomplish our corporate goals. Included are intended outcomes for each goal and associated key performance indicators (KPIs) that will show progress towards the outcomes.

Hub and connector

Our overall approach to innovation shall remain the same during the 2020–23 period – Alberta Innovates will continue to support innovation from the generation of new ideas through to commercialization or end use. This multi-pronged investment approach helps drive the innovation agenda and creates pathways that help accelerate R&I to market for the benefit of Alberta and beyond.

Alberta Innovates will also continue to act as the hub and connector for innovation across the province. As before, we shall engage in a diverse range of collaborations with our many clients and partners, comprising post-secondary institutions, researchers, entrepreneurs, large, medium and small companies, and other R&I agencies and groups. In addition, we will engage with technical and program experts in several government ministries, including Advanced Education; Agriculture and Forestry; Economic Development, Trade and Tourism; Energy; Environment and Parks; Health, and Labour. Through these activities we will continue to work toward delivering impacts that benefit Albertans.

InnoTech Alberta will implement a new business model to better leverage opportunities and to increase the number of industry consortia it participates in. Partnerships will open new sources of revenue for InnoTech, and synergies that come from collaboration will lead to innovations that ultimately benefit Albertans.

We invite you to turn to the remaining pages for more details and discussion.

Learn how Alberta Innovates.

Message from the Board Chairperson



Brenda Kenny PhD

*Chairperson
Board of Alberta Innovates*

It's a pivotal time for Alberta as the province is buffeted by enormous challenges. Alberta Innovates stands ready to make a positive contribution in addressing those challenges.

The uncertainty of the impact of the global pandemic looms large as this plan is completed. We will need to remain nimble and adaptive. The immediate response and actions toward recovery will be unprecedented. Alberta Innovates is well-positioned to respond rapidly through programs and projects that support the needs and priorities of Alberta small and large businesses, while also looking ahead to recovery and economic growth.

Alongside the global crisis created by the COVID-19 pandemic, Alberta faces many other challenges. Decreasing oil prices, pipeline capacity and market access issues continue to impact the energy sector. Agricultural producers are challenged by a changing climate, constraints on land and water, declining soil quality, increased demand from a growing population and changing diets. A growing and aging population is contributing to increasing health-system spending to unsustainable levels.

Albertans have always been innovators, and transformational innovation has delivered significant returns to Alberta.

Therefore, in parallel with crisis response, Alberta Innovates will look to “game-changing” opportunities and accelerate their development.

Through this Business Plan, Alberta Innovates is focusing on several areas that can address these mega trends such as digital health, smart agriculture, biotech and innovative hydrocarbon production. Underpinning these focal points are the adoption of artificial intelligence, and a robust and expanding entrepreneurial ecosystem. These are foundational enablers that will create jobs now and into the future, advance existing technologies and develop new ones across sectors.

The benefits of this direction are significant. We expect to see reduced health spending, improved production efficiencies in agriculture and other sectors, and even the creation of entirely new made-in-Alberta manufacturing sectors as a result. This focus gives a boost to recovery from Alberta's current crisis, and resiliency into the future.

The opportunities outlined in this Business Plan align with the needs of investors, and private-sector needs for partnership, capacity and leverage. We have strong industry demand for the kind of support and partnerships Alberta Innovates builds and provides across sectors.

Alberta Innovates is strategically positioned to use our expertise, facilities and connections to make these transformative shifts. We will drive economic diversification and growth by leveraging Alberta's existing expertise with emerging technologies, because Alberta innovates.

Message from the CEO



Laura J. Kilcrease

*Chief Executive Officer
Alberta Innovates*

The COVID-19 health pandemic is sweeping the globe and it will take extraordinary collaboration, innovation and fortitude to address the impact on our communities, the economy and individual Albertans. As we pivot to crisis response and then to recovery, Alberta Innovates will continue to support robust economic development through these turbulent times.

This Business Plan focuses on companies that are positioned to grow today while also pursuing some significant opportunities whose impacts could generate multi-billions in revenue. We know achieving them will take time, but if we don't start now, we won't be ready when the world needs Alberta innovation. In the meantime, as these innovation streams are developed, jobs will be created, investment opportunities will emerge and new markets will evolve.

For example, we will be converting the large carbon molecules found in Alberta's bitumen into high value, non-fuel products such as asphaltenes, activated carbon, vanadium and carbon fibre. Through this new approach, we can create a new advanced materials manufacturing industry here in Alberta, supported by Alberta's vast and unique feedstock.

We will be driving the adoption of robotics, automation, sensors, drones and advanced data analytics across the agriculture and food sector. To this end, we will work within the Canadian smart farm network (Canadian Automation and Agri-Food Intelligence Network) to upscale Alberta's agriculture production and capacity so we can feed the world.

We will also continue to promote and advocate for Alberta's world-class expertise in artificial intelligence, an incredible tool that gives all sectors potential to shift to 21st-century solutions. In health care alone, the application of digital technologies and artificial intelligence to health data will result in better patient care and public health outcomes, as well as realize potential cost-savings and system efficiencies.

We are leveraging Alberta's established sectors as we keep our existing economy competitive and grow into a new economy. Innovation can't be commoditized. It's the outcome of a unique combination of human ingenuity and resources – both of which can be found in abundance in Alberta. Our enterprise is the engine of innovation with capabilities that are focused on diversification to deliver benefits to Albertans now and over the long haul.

The current health and economic crisis makes the need for innovation in Alberta more important and more urgent than ever. We have an amazing opportunity to shape the future of Alberta, and to strengthen economic resiliency for Albertans today and for generations to come.

Alberta Innovates Business Plan 2020–23 HIGHLIGHTS

We are Alberta's research and innovation engine.

We are working to address today's challenges, create new opportunities and forge a healthy, sustainable and prosperous future for Albertans today and for generations to come. We support innovation across multiple sectors through strategic investments, world-class research and leading-edge facilities – from the generation of new ideas through applied testing to commercialization or end use. We won't be found in one place, one thing or one idea. We are Alberta Innovates... solving problems, creating possibilities.

Our Vision

To be indisputably recognized provincially, nationally and internationally as a leader in catalyzing research and innovation (R&I) in Alberta.

Our Value to Alberta

As a catalyst for accelerating innovation

We are the largest research & innovation agency in Alberta. We are uniquely positioned to propel great ideas forward, faster through our programs, services and expertise. Our end-to-end approach helps guide our clients through the innovation journey – helping them succeed (or fail) faster and gather important market-driven evidence along the way.

As a partner and collaborator

With our extensive partnerships, collaborations and networks, we help ensure our clients are connected with the right resources at the right time. We have leading-edge facilities and on-site research capabilities to test, scale and validate ideas and prototypes.

As a convenor and connector

We connect R&I system players to reduce barriers and increase the adoption and spread of innovations. We bring together inventors, investors and thought leaders at INVENTURE\$ to discover and share the latest in innovation, research, capital access, deal-making and experiential learning.

About us

Alberta Innovates supports R&I aligned with Government of Alberta priorities outlined in the Alberta Research and Innovation Framework (ARIF). Our activities and impacts contribute to work in many areas of government and by our partners.



Five Focus Areas for Investment

We have identified five focus areas for our investments to help address challenges facing Alberta. These strategies build on the skills and supports we have developed in the R&I system.

Digital Health

Advance digital health technologies to accelerate improvements in the quality and long-term sustainability of our health system and the health of Albertans.

Innovative Hydrocarbon Products

Invest in R&I that transforms bitumen into non-combustion, value-added materials such as carbon fibre, activated carbon and asphalt.

Smart Agriculture

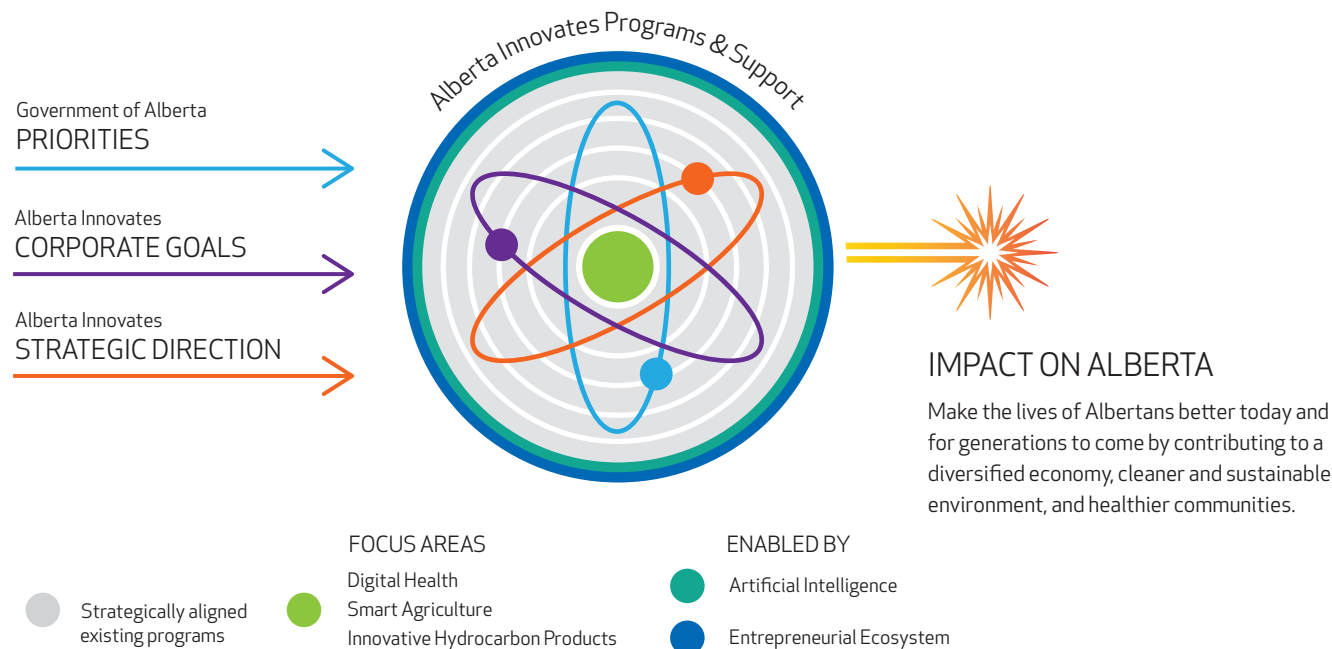
Lead smart agriculture R&I and address food security challenges through adoption of technology for significant impact in Alberta and beyond.

Artificial Intelligence

Build on our past successes in creating world-recognized artificial intelligence capacity in Alberta by supporting further development and application of artificial intelligence across sectors.

Entrepreneurial Ecosystem

Continue to support a growing entrepreneurial ecosystem in Alberta through the programs, networks and connections we provide to entrepreneurs and start-ups to commercialize their innovations and scale their businesses.



Our Value to Alberta



Our Value to Alberta

We are Alberta's research and innovation engine. We are working to address today's challenges, create new opportunities and forge a healthy, sustainable and prosperous future for Albertans today and for generations to come. We support innovation across multiple sectors through strategic investments, world-class research and leading-edge facilities – from the generation of new ideas through applied testing to commercialization or end use. We won't be found in one place, one thing or one idea. We are Alberta Innovates... solving problems, creating possibilities.

Alberta Innovates is the largest research and innovation (R&I) agency in the province. We are committed to stimulating the provincial R&I system to find more effective ways of solving the challenges of today and tomorrow and capitalizing on opportunities to diversify our economy. Our work with a range of sectors and industries gives us a unique role in the R&I system and provides us with a wide-angle lens to identify opportunities, challenges and gaps where R&I is of value. Our programs and services benefit Albertans by propelling great ideas forward, faster across the R&I continuum.

Vaulting a great idea to commercialization or end use is one of the most challenging aspects of innovation the world over. It is also essential if the value from R&I is to be realized. We use our expertise and leading-edge facilities to accelerate this progression in our clients' innovation journey. Internationally recognized applied research and engineering services provided by our subsidiaries – C-FER Technologies and InnoTech Alberta – provide a critical "bridge" that validates, tests and translates innovation into real-world use. Our expertise is valued by our strategic partners in government, industry and academia and enables us to improve co-ordination and results within the innovation system.

Our clients engage with us at any point along the client journey where they feel we can help. Not only do we assist in the early stages of an idea or concept, but also when validating and scaling is required or to help them explore global markets and partnerships as their innovations mature.

Figure 1 *Alberta Innovates Client Journey*



We convene and connect our clients and stakeholders to stimulate the translation of ideas into innovation. We bring together inventors, investors and thought leaders at our annual INVENTURE\$ event to discover and share the latest in innovation, research, capital access, deal-making and experiential learning.

Alberta Innovates' approach to R&I support ensures we can achieve more impactful outcomes from our portfolio of investments.

Discover

We build research capacity, innovation, culture, talent supply and research infrastructure in the province. These are the building blocks required for innovation.

Develop

We help move ideas towards commercialization and use through funding and other supports.

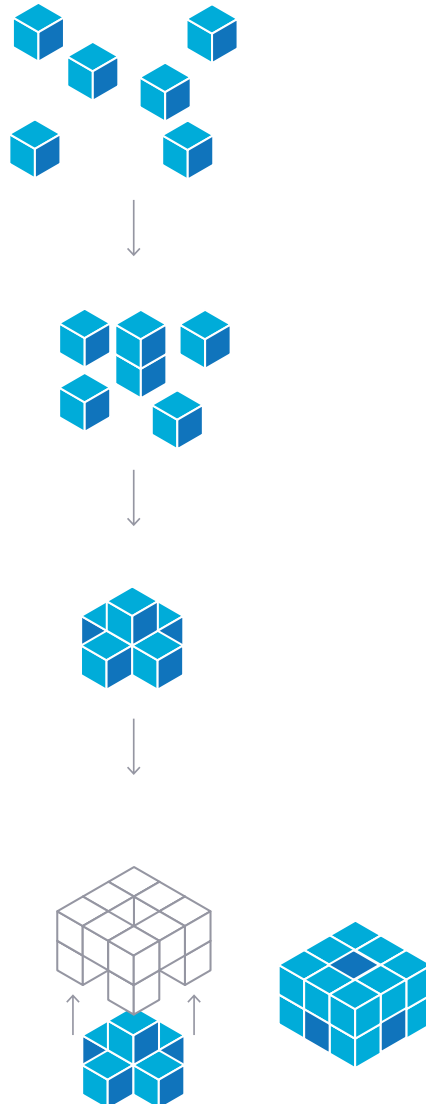
Testing & Refining

C-FER and InnoTech play a critical role in this process by de-risking, testing and translating innovation through applied research, and moving innovative projects from development into use.

Use

We accelerate the adoption of innovative products, technologies and processes.

Our business plan outlines how our strategic direction, actions and investments will contribute to achieving our corporate goals and ultimately our organizational mandate as set by the Government of Alberta (through the Ministry of Economic Development, Trade and Tourism). Cascaded and interconnected relationships exist between the government's R&I priorities¹ and our corporate goals, strategies and business and operating plans (see Appendices A and B).



5 Our five corporate goals are to:

- Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.
- Cultivate a world-class research and innovation system that meets the needs of Alberta.
- Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.
- Accelerate and broaden the use of innovative products, technologies and processes.
- Be recognized globally as a leading innovation engine.

3 We have aligned our operations to our three strategic priority areas:

- Develop emerging technologies, with a focus in areas such as Data-Enabled Innovation; Digital Technology for Business Transformation; Clean Technology; and Innovative Production and Distribution.
- Enhance our knowledge workforce.
- Embrace the digital future.

¹ The R&I priorities of the Government of Alberta are described in detail in the Alberta Research & Innovation Framework (ARIF). For more detail on our alignment with ARIF, see Appendix B.

Actions for Impact



Actions for Impact

Sustainable economic diversification and growth is critically important for the province.² Alberta Innovates recognizes that no single technology or industry will grow or transform the provincial economy – instead, a convergence of emerging technologies, platforms and applications is necessary. Collisions of discoveries and emerging technologies will develop and grow new industries and strengthen existing ones. Ultimately, this will contribute to economic diversification and insulate Albertans from vulnerabilities associated with our heavy reliance on the traditional oil and gas sector over the last 50 years.

When four provincial corporations were consolidated to become Alberta Innovates in 2016, our program offering was diverse and spanned a large breadth of R&I activity. We have been working diligently over the last few years to transform our programs so they have more depth in areas of greatest opportunity for Alberta. Our operations have been shifting away from sector-specific initiatives and toward an integrated approach to fostering development of emerging technologies. This shift, driven by the priority areas outlined in our five-year strategic plan (see Appendix A), aims to capitalize on Alberta's current strengths while leveraging technologies with the highest promise. This business plan advances this shift through a focus on five opportunities with greater potential for impact and value to Alberta.

As we further implement our five-year strategy and shift our investment portfolio, we will continue to invest in programs begun by our legacy organizations that remain aligned to our current strategic direction. This ongoing activity fosters discovery and growth in Alberta's R&I system and supports activities related to emerging technologies at the forefront of health, science and engineering. We will continue to support post-secondary, business and industry research programs, entrepreneurs, and small- and medium-sized enterprises (SMEs) – including support for the development and transformation of the knowledge workforce. We will continue to serve as a leader, influencer, convenor and connector while participating in and fostering partnerships and collaborations aligned to our business.

We support activities in a variety of areas, all with strategic importance to our organization and Alberta:

- Lead and co-ordinate activities that support the growth and diversification of Alberta's agriculture, forestry and food sectors.
- Develop and invest in applied R&I programs to sustain, grow and diversify the energy and resource industries, develop clean technology, reduce greenhouse gas emissions and protect the environment.
- Build a robust R&I portfolio that provides supports and services across the health innovation spectrum, with the aim of building a strong and resilient R&I health ecosystem.
- Invest in Alberta's post-secondary institutions to develop capacity in people, key infrastructure, collaborations and projects.
- Assist entrepreneurs and high-growth, high-potential SMEs to reduce the time it takes to commercialize their innovations, and to scale their business.
- Provide world-class expertise, testing and applied research services through our subsidiaries, C-FER and InnoTech, for a variety of clients, including industry.

² Government of Alberta. Budget 2020. Fiscal Plan: A Plan for Jobs and the Economy 2020-2023. <https://open.alberta.ca/dataset/budget-2020>

Evolving

*in response to Alberta's
needs and opportunities*

Digital Health

Innovative Hydrocarbon Products

Smart Agriculture

Artificial Intelligence

Entrepreneurial Ecosystem



Evolving in Response to Alberta's Needs and Opportunities

The accelerating speed of technological change and the capabilities it brings is altering the world we live in faster and more dramatically than any other time in history. Never has the world witnessed so many powerful and complementary technologies coming into our lives. This, combined with mega trends such as climate change, rapid urbanization and shifts in the global economic balance of power³ will have transformative influences on nearly every aspect of our lives, including our jobs and communities.

Figure 2 *Mega Trends Shaping Our Future*



In the coming decades, Alberta must intensify its efforts to discover, develop, use and export innovation if we are to thrive. Alberta's deep tradition in scientific inquiry and top-quality research, combined with our highly skilled workforce and world-leading foundations in artificial intelligence and machine learning, present us with a tremendous opportunity to be at the forefront of several innovation areas.

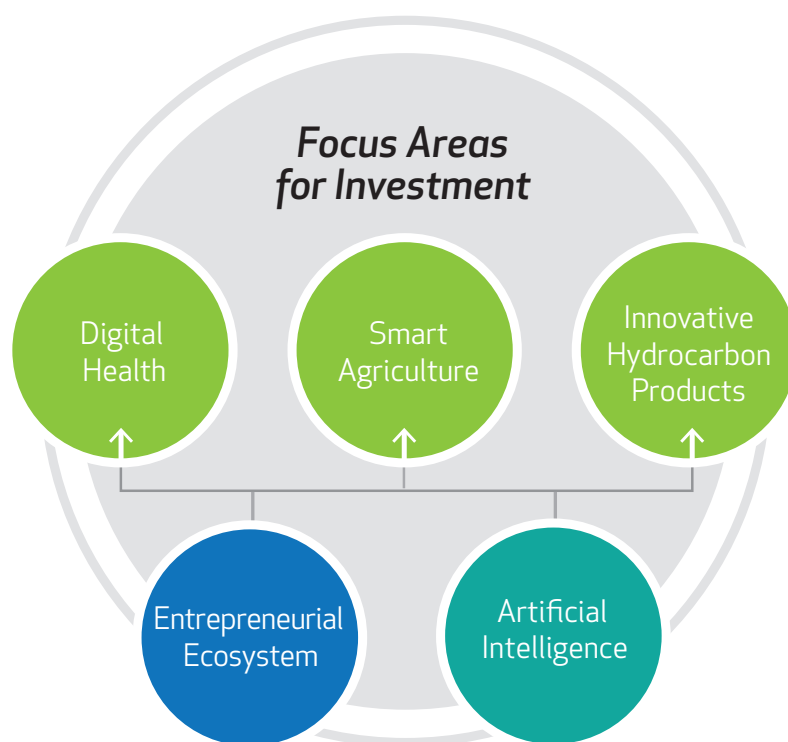
³ <https://www.blackrock.com/ch/individual/en/themes/megatrends/megatrends-in-action>

Alberta Innovates can leverage our province's strong R&I ecosystem and immense experience in energy, agriculture and health to drive innovations capable of addressing several mega-trend challenges currently facing Alberta:

- Ongoing economic hardships resulting from low global prices for oil, pipeline constraints and market access issues.
- Our agri-food industry is being pressured to do more with less, due to a changing climate, constraints on land and water, declining soil quality, significant increases in global food demand associated with a rapidly growing population, and dietary changes.
- A growing and aging population is contributing to greater spending in the health system to unsustainable levels; health currently consumes nearly 40 per cent of our provincial budget.

Alberta Innovates has identified **five focus areas** for our investments that will help address these mega-trend challenges (Figure 3). They build on the skills and supports we have developed in the R&I system through our investments over many years. These areas align with our corporate goals and provide a "laser focus" within our strategic priorities – establishing a more clear-cut, fiscally responsible path forward for our organization. Additionally, our investments in these focus areas will further contribute to the provincial government's Alberta Research & Innovation Framework (ARIF) targets.

Figure 3 Focus Areas for Investment

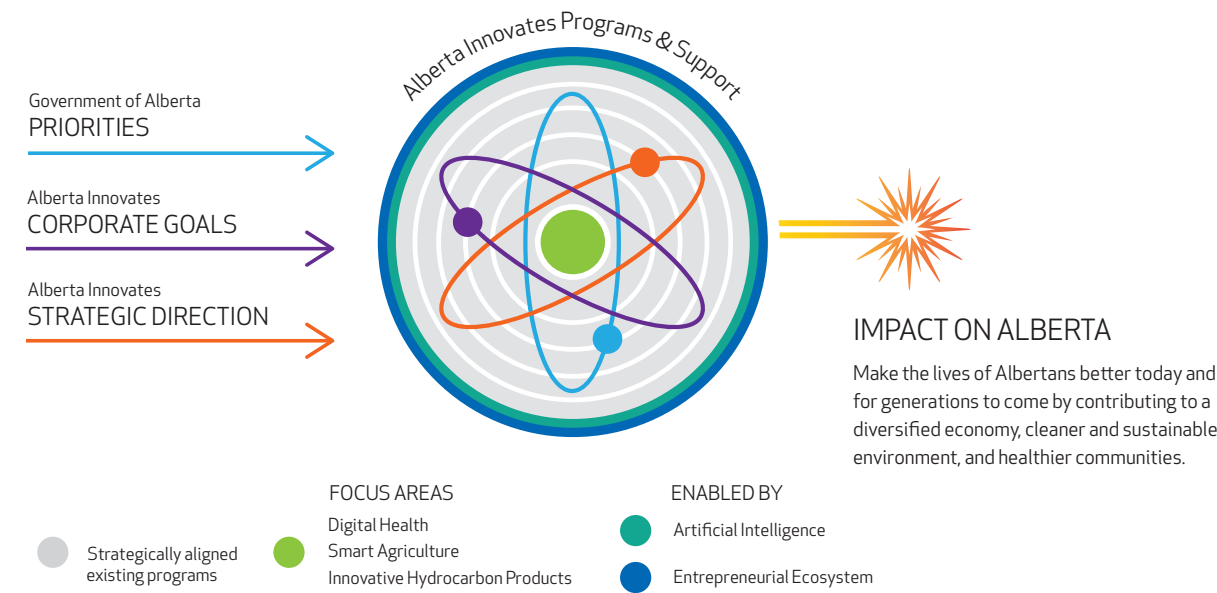


The focus areas Artificial Intelligence and Entrepreneurial Ecosystem serve as enabling tools that are necessary to drive much of the innovation in the other three (i.e., Digital Health, Innovative Hydrocarbon Products and Smart Agriculture). These enablers also have broad applicability to a multitude of activities and initiatives in the R&I system and contribute to the achievement of our corporate goals.

Alberta Innovates efforts in the five focus areas will capitalize on our previous and continuing investments in the [Alberta Machine Intelligence Institute \(Amii\)](#), the [Alberta Data Institute](#), entrepreneurial activities in information and communication technology (ICT) and the [Alberta Clinical Research Consortium \(ACRC\)](#) for digital health. These investments helped establish and advance the enabling infrastructure that is critical for the development and implementation of innovations that lead to positive economic, health, environmental and social impacts.

The following graphic shows the relationship between government priorities, our goals and strategies, and our focus areas to create impact for Alberta. We will also continue to invest in legacy programs aligned to our current strategic direction.

Figure 4 Priorities, Goals, Strategic Direction, Focus Areas and Resulting Impact on Alberta

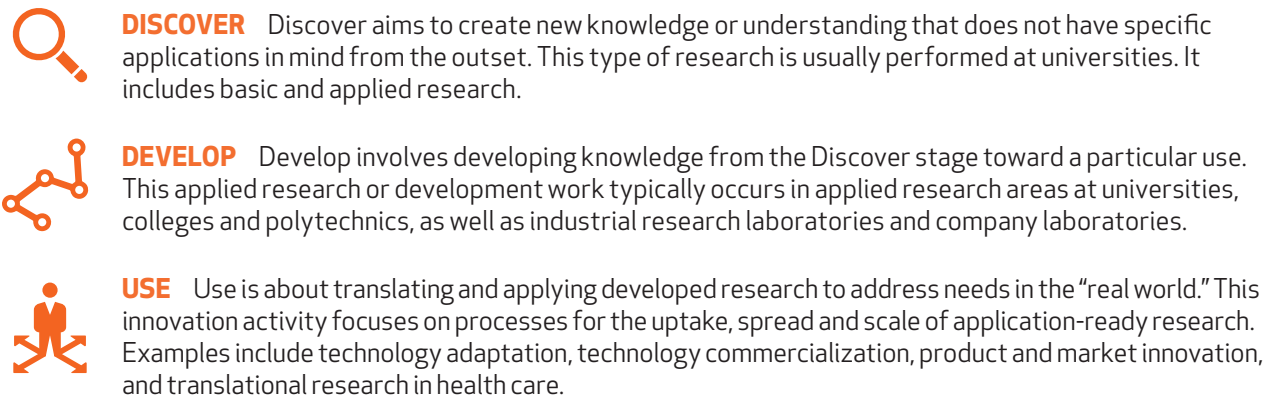


A successful response to Alberta’s biggest opportunities and challenges requires a collision of creative thinking and shared effort. That is why Alberta Innovates will continue to leverage and build collaborations with our world-class academic community, globally recognized artificial intelligence community, industry, public and not-for-profit-organizations, consortia, entrepreneurs, SMEs and multinational enterprises (MNEs). Also guided by our can-do spirit, these collaborations will drive the discovery, development and use of innovations in Alberta and beyond.

Each of our five focus areas span across the Discover, Develop and Use stages of the R&I continuum (see below for a description of these stages). We take into account the current state of knowledge or innovation as well as the state of readiness and capability in the R&I system as we plan our key actions. This approach assists our operational and resource allocation planning by categorizing what actions should commence in the near term (i.e., the next three years), mid-term or in the longer term. This process also creates a better understanding of what types of outcomes can be anticipated and when, knowing that near-term actions frequently set the stage for mid- and long-term actions and their outcomes. Collectively, the key actions will create a pipeline of opportunity for the province, with the goal of moving innovations into the hands of Albertans and the world.

Research & Innovation Continuum

Figure 5 The Stages of Research and Innovation



Solutions to Alberta's mega-trend challenges will not happen overnight, but through a series of planned and staged actions. Innovation is a complex process that requires appropriate resources over a reasonable period of time. The amount and timing of resources, including additional investment from government and other stakeholders, will be critical to advance early achievements, and ensure we are moving at pace and not missing opportunities for greater value creation.

Business Plan 2020–2023 highlights the near-term key actions that we will undertake across the R&I continuum in our focus areas. These key actions and the outcomes they produce are, in many cases, the precursors that need to be established before additional actions can be commenced. By keeping the desired impacts in mind, we ensure our actions today create the necessary conditions that enable the results we want tomorrow.

Digital Health

Digital technologies have set in motion profound changes in the management of health and health care. The emergence and use of technologies such as wearable medical devices, virtual reality, artificial intelligence and 5G wireless network technology make personalized health care possible, facilitate better preventative care and increase health system efficiency by streamlining workflows. Innovation is critical to providing effective solutions for patients' evolving needs and to providing the right care in the right place at the right time.

“

Digital health is the convergence of the digital and genomic revolutions with health, health care, living, and society. As we are seeing and experiencing, digital health is empowering us to better track, manage, and improve our own and our family's health, live better, more productive lives, and improve society. It's also helping to reduce inefficiencies in health care delivery, improve access, reduce costs, increase quality, and make medicine more personalized and precise.

Innovation expert Paul Sonnier, author of [The Fourth Wave: Digital Health](#)

Alberta is already well positioned to embark on a digital transformation in health. The province's health information systems – [Alberta Netcare](#), [Connect Care](#), [Community Information Integration \(CII\)](#) and [Central Patient Attachment Registry \(CPAR\)](#) – are gathering, integrating and making accessible standardized key health information in ways that could only be dreamed about not that many years ago. The amount of health data being produced in Alberta is at unprecedented levels, partially because Alberta Health Services (AHS) is Canada's largest integrated provincial health-care system, with more than 125,000 staff and 10,000 physicians serving 4.3 million Albertans across urban and rural settings.⁴

The volume and type of data available will continuously grow and evolve as the development and use of digital health technologies increase. The use of artificial intelligence and machine learning – already two of Alberta's strengths – will be necessary to manage, analyze and interpret this volume of data to identify problems and address specific health and health-system issues.

Having these data and analytical capabilities within an integrated health system will assist in attracting researchers and investments to the province, especially in relation to clinical trials and research. Access to clinical trials and medical advances through research provide Albertans the opportunity to benefit from earlier access to the best and most innovative health care possible.

Alberta Innovates' focused investments in Digital Health can accelerate improvements in the quality and long-term sustainability of our health system and ultimately our health. Over the next three years, we will:

Discover

- Create a digital health “collaboratory” with government and industry stakeholders to support the mobilization of a digital health ecosystem.
- Work closely with industry to identify mechanisms to attract the skills necessary for the growth of digital health in Alberta.

⁴ <https://open.alberta.ca/dataset/c0724ccd-832e-41bc-90d6-a0cd16bc6954/resource/1e03ea8a-7948-48c4-bca4-109c20ce0f02/download/health-ahs-review-summary-report.pdf>

- Deliver research programs to accelerate discovery in areas of Internet of Medical Things, xR, wearables, personalized health, clinical trials and health economics.

Develop

- Engage stakeholders to create buy-in for digital health as a key driver of economic and health prosperity for Alberta.
- Promote and add clarity to digital data management standards that support data quality.
- Deliver programs to accelerate the development of innovations in the areas of Internet of Medical Things, xR, wearables, personalized health, clinical trials and health economics.
- Build cross-jurisdictional partnerships that will enhance market access for digital health innovators.

Use

- Deliver programs to accelerate the adoption of innovations in the areas of Internet of Medical Things, xR, wearables, personalized health, clinical trials and health economics.
- Partner with academia and industry to create novel digital health platforms provincially that accelerate health research and innovation in Alberta.

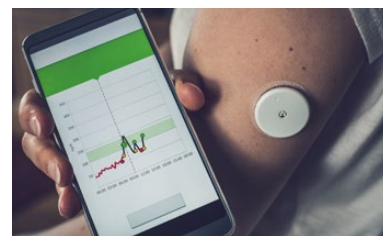
Our activities over the next few years will lay the foundation for investments aimed at furthering the delivery and application of artificial intelligence, quantum computing, Internet of Things (IoT) and other digital health technologies. This strategy benefits Alberta by enhancing clinical and operational workflows while building critical pathways for prevention-based care, disease discovery and overall health management.

The impact of digital health will be seen from therapeutic discovery, clinical trial management, digital therapeutics, patient navigation and continuity of care, health-care workflow optimization, population health informed by “big data,” health professional training and consumer health products.

Innovative Hydrocarbon Products

Mining, quarrying, and oil and gas extraction are major drivers of the provincial economy (27.3 per cent of GDP⁵), employing nearly 415,000 people.⁶ The boom-and-bust cycles of this industry therefore have major ripple effects on all Albertans in one way or another. Despite the global and continued rising demand for oil, Alberta's oil industry remains in a downturn. Sustained pricing pressure has our crude oil trading for less than \$40 USD per barrel – a double jeopardy given that it is expensive to produce. Our high-carbon crude oil (bitumen) is difficult to transport and expensive to refine, challenging market access and reducing product valuation. This is further intensified by pipeline constraints. Alberta's oil producers must find better ways of reducing costs and increasing capacity to offset these factors.

The very attributes that make Alberta's crude oil difficult to produce and market could be the key to transforming it into an enormously profitable – and environmentally friendly – new resource. The crude bitumen that Alberta produces is laden with large carbon molecules such as asphaltene. To make it



Internet of Medical Things

Internet of Medical Things refers to devices connected to the Internet that patients use or wear to collect data and enable remote care. Examples: smart glucose monitoring devices and insulin delivery systems, and monitoring sensors for a variety of conditions.



xR – Extended Reality

Extended reality combines “all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables.” It includes augmented reality, virtual reality and mixed reality – North of 41 tech networking group



Wearables

Wearables are smart devices such as rings, wristbands or watches that collect data and are typically are connected to a smartphone app.

⁵ <https://economicdashboard.alberta.ca/GrossDomesticProduct#type>

⁶ https://context.capp.ca/infographics/2019/infographic_a-vital-part-of-alberta-economy

light and viscous enough for transportation via pipelines, the crude bitumen is diluted (partially upgraded) into synthetic crude oil. Our bitumen contains close to 20 per cent asphaltene. This asphaltene extracted during partial upgrading could be the key to tapping into a rapidly growing global market for advanced materials such as carbon fibre and activated carbon. Developing innovative non-combustion hydrocarbon products from Alberta bitumen is a potential game-changer for the province, in light of the global demand for advanced materials.

Alberta's oil sands could contain the province's greatest untapped resource. That might be surprising, given that the province currently produces nearly three million barrels of crude bitumen daily.

Pivoting into the advanced materials market would strengthen Alberta's economy for many decades to come by opening a new industry for the province's oil resource. It is estimated that by 2035 nearly 750,000 barrels of bitumen per day could be used to make non-combustion, value-added materials such as carbon fibre, activated carbon and asphalt. This could create a significant number of manufacturing jobs and start-up companies and generate upwards of \$30 billion annually in revenue for the province. Using bitumen in this way is also more sustainable environmentally, since 80 per cent of the greenhouse gases (GHGs) associated with bitumen occur at combustion. This is reduced when bitumen is instead used to create advanced materials.

The Bitumen Beyond Combustion (BBC) program is an innovative approach to producing high-value, high-volume, non-combustion materials and products from the vast bitumen resources available in Alberta.

The Bitumen Partial Upgrading (BPU) program is focused on bitumen processing that reduces or eliminates the need for diluent addition for pipeline transportation.

BPU processes separate the most carbon-intensive components of bitumen, generating ideal feedstock for BBC opportunities.

Alberta Innovates' existing leadership and expertise in oil extraction, processing and transportation will accelerate the province's transition to non-combustion, innovative hydrocarbon products. We will work diligently to further develop opportunities related to the BBC program by bridging academia and industry. Our efforts in BPU and BBC over the next three years will be focused on:

Discover

- Actively pursuing new products such as carbon fibre, activated carbon and asphalt binder.

Develop

- Combining BPU processes with technologies aimed at improving efficiencies prior to use.
- Remaining actively involved with large industry in the development of BPU technologies.
- Developing technologies aimed at converting asphaltene to carbon fibre.
- Developing asphalt binders using bitumen.
- Developing technology to efficiently extract vanadium from materials such as bitumen, petroleum coke or gasification ash.

Carbon Fibre

A strong, lightweight material consisting of filaments of carbon atoms, used in everything from automobiles and bikes to protective clothing, microelectrodes and building materials.

Activated Carbon

Defined in Collins Dictionary as a porous, highly adsorptive form of carbon used to remove colour or impurities from liquids and gases, in the separation and extraction of chemical compounds, and in the recovery of solvents.

Asphalt Binder

Bitumen used as a binder in asphalt for paving and roofing applications.

Vanadium

A heavy metal found in bitumen with many potential uses which include storing renewable energy.

“

The oil sands could make an additional \$212 billion (USD) by 2030 making carbon fibres from millions of barrels of asphaltene-rich oil sands to be used for strengthening steel as well as concrete wood composites.)

Corporate Knights, October 2018

Alberta has a tremendous opportunity to produce high-value, large-volume, non-combustion products from bitumen in combination with a more valuable grade of oil product, while also creating additional capacity in the existing pipeline network. Successful achievement of the activities outlined over the next three years creates the foundation necessary for shifting the Alberta oil sands industry toward value creation and significantly enhanced sustainability in a low-carbon economy.

Smart Agriculture

The world's population is expected to grow by nearly one billion people, reaching 8.6 billion by 2030⁷, and urban areas will see a higher concentration of people. At the same time, the amount of food, arable land and water will become scarcer. This requires the agri-food industry to respond rapidly by learning how to do more with less and adapting.

Fortunately, innovative technologies are changing the face of modern farming around the world. Advanced sensors, remote monitoring, automation, artificial intelligence and blockchain technology are leading to increased production, more efficient and sustainable processes and land use, and the creation of new jobs – all this creating economic growth.

Alberta is quickly becoming a world leader in advanced and emerging technologies for agriculture and food. Our landscape is ideal for agricultural production – from growing pulses and other crops to raising livestock. Alberta is also home to Canada's third largest food and beverage manufacturing industry, with a reputation for high quality food and safety systems.⁸ These attributes, along with access to more than 20 research and innovation facilities,⁹ set up Alberta to be a key player in the next agricultural revolution.

The changing face of farming in Alberta will see the introduction of drones and “smart sprayers” to monitor crop and soil health while also watering and applying relevant treatments. The emergence of autonomous machinery will assist with labour-intensive activities and play a key role in addressing labour shortages in farming operations and increase food production.¹⁰ Artificial intelligence and predictive modelling will be used to identify solutions capable of preventing disease or pest outbreaks and decreasing pesticide use in crops. Innovations in blockchain technology will allow consumers to buy with confidence, with a view into where and how their food was produced.¹¹

Automation and robotics have the potential to solve one of the world's most urgent and fundamental problems: food security. *The Institute of Electrical and Electronics Engineers (IEEE)*

Digital and technical transformation in agri-food is fast-moving in a competitive industry and difficult to take on singlehandedly. With Alberta Innovates as a core partner in the recently announced [Canadian Automation and Agri-Food Intelligence Network \(CAAIN\)](#), Alberta has the opportunity to create provincial and national partnerships to begin this agricultural transformation. Our skills and expertise can be leveraged to respond to the challenge of addressing food security through adoption of technology for significant impact in Alberta and beyond.

Alberta's agri-food industry is a significant economic driver, with more than \$28 billion in sales and employing more than 75,000 Albertans,¹² and is poised to be an area of GDP growth for the province in the coming years. It is estimated that Alberta-based investments in smart agriculture will generate an additional cumulative impact of more than \$4 billion after 10 years.

Alberta Innovates will capitalize on the opportunity to discover, validate and implement smart agriculture innovations to effectively bridge the gap in agricultural potential and reality across the value chain. Specifically, in 2020–23, we will lead the industry by focusing on:

Discover

- New DNA tools and cross-platform technology applications for genetic prediction and breeding.
- Effective methods to standardize and digitize data collection along the agri-food value chain for effective data interoperability.
- Applied research in autonomous systems for farms, manufacturing, transportation and retail.

⁷ <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html>

⁸ <https://calgaryeconomicdevelopment.com/industries/focus-areas/agribusiness/value-added-food-processing/>

⁹ <https://investalberta.ca/industry-profiles/agri-foods/>

¹⁰ <https://www.bustedcubicle.com/features/industry-disrupted/agriculture>

¹¹ <https://caain.albertainnovates.ca/>

¹² <https://www.alberta.ca/agriculture-sector.aspx> & <https://investalberta.ca/industry-profiles/agri-foods/>

Develop

- Validation and demonstration of new DNA tools.
- Prototype development to validate and demonstrate the use of remote monitoring and imaging data with a focus on moving towards product development.
- Prototype development to demonstrate use of autonomous systems for farms, factories, transportation and retail.

Use

- Commercialization, technology, knowledge transfer and adoption of new DNA tools and cross-platform technology applications.
- Commercialization of demonstrated and proven technologies and products.
- Program for commercialization and adoption of autonomous systems for farms, factories, transportation and retail.

Over the next few years, our focus on Smart Agriculture will begin to accelerate the transformation of this industry and will provide an opportunity to impact performance at every step of the agriculture food value chain, from rangeland and field to our tables. Alberta will increase its ability to feed more people in an environmentally sustainable way while generating economic growth, new jobs and prosperity in Alberta.

Artificial Intelligence

Artificial intelligence is no longer a concept of the future – we are experiencing it every day in ways we likely do not even realize, through the services and products we use. Businesses are progressively changing the ways they work by using artificial intelligence and machine learning to save time and money. These applications help companies automate operations, generate real-time business insights including predicting outcomes, reduce errors and enhance client experience. In Canada, four out of five C-suite executives believe they risk going out of business entirely if they don't scale artificial intelligence in the next five years.¹³ There is little dispute that artificial intelligence will drive transformative changes for businesses, with early evidence showing increased profitability of nearly 40 per cent and cost savings that can be measured by an order of magnitude.¹⁴ As it is increasingly adopted, the impact of artificial intelligence in our everyday lives will increase exponentially with no limit in sight.

Alberta has great potential to be a leader in the development, and equally or more importantly, in the use of artificial intelligence. It would create a significant advantage for our province, given that artificial intelligence could add an estimated \$13-16 trillion USD to global economic output over the next decade.^{15,16} It is further estimated that artificial intelligence could boost GDP for local economies by up to 26 per cent.

Alberta Innovates investments over the last two decades helped establish artificial intelligence capacity and infrastructure in the province, which have produced some of the top technologies, discoveries and talent in the industry. These achievements have been noticed by the rest of the world. Alberta is home to the [Alberta Machine Intelligence Institute \(Amii\)](#); its expertise and that of others in the province, has been recognized by Google's [DeepMind lab](#) which chose Alberta as the site for its first international artificial intelligence research lab. Alberta Innovates' world-class reputation and desire to partner has resulted in additional investments from the Government of Canada and numerous industrial partners. There is now even greater potential to support the translation of knowledge generated by Amii and its partners, not only to solve challenges facing Alberta, but also for the province to prosper.

“

Artificial Intelligence heralds dramatic potential for growth for both the economy and for humans.

Mark Purdy, Managing Director-Economic Research, Accenture Institute for High Performance

¹³ https://www.accenture.com/_acnmedia/Thought-Leadership-Assets/PDF-2/Accenture-Built-to-Scale-PDF-Report.pdf#zoom=50

¹⁴ https://www.accenture.com/fr-fr/_acnmedia/36dc7f76eab444cab6a7f44017cc3997.pdf

¹⁵ McKinsey Report: Notes from the AI Frontier

¹⁶ <https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html>

A large amount of Alberta's investments in artificial intelligence over the last 20 years has been in the discovery stage of the R&I continuum. The success of those investments now enables our province to develop and apply that knowledge toward a particular use. Alberta Innovates is in an ideal position in the R&I system to support this transition by connecting artificial intelligence expertise with industries seeking solutions to their needs. Our activities over the next three years and during this period of transition will see us:

Discover

- Provide funding and supports that will allow Amii to continue to develop and accelerate artificial intelligence capacity in Alberta.
- Ensure that skills development aligns to and supports the Government of Alberta post-secondary and labour market development plans.
- Ensure data governance and access platforms, such as the Alberta Data Institute, support our focus areas of Digital Health, Smart Agriculture and Innovative Hydrocarbon Products.

Develop

- Attract highly qualified and skilled artificial intelligence talent to Alberta, capitalizing on reduced supports in other jurisdictions such as Ontario.
- Explore opportunities to deploy artificial intelligence in the resource industry by optimizing oil sands and unconventional oil and gas or improving the efficiency and safety of crude oil transportation, as examples.
- Explore skill development programs aligned to Government of Alberta strategies.
- Develop opportunities for digital transformation to improve reliability and maintenance of data in the energy sector.

Our actions over the next three years will continue to build artificial intelligence capacity in Alberta and begin to optimize artificial intelligence use across multiple sectors, with a focus on the areas of Digital Health, Innovative Hydrocarbon Products and Smart Agriculture.

According to a report prepared for Alberta Innovates, the potential impact to the Alberta economy by adoption of data-driven technologies by 2025 is GDP growth of \$1.027 billion, with employment gains of 7,000 jobs and 140 new companies.

Entrepreneurial Ecosystem

Creating an entrepreneurial ecosystem is not a new concept. Silicon Valley has spent 70 years perfecting its environment and community for entrepreneurship. In the Valley, the largest companies in the world interact with ambitious entrepreneurs driven for success and talented graduates who embrace risk and growth opportunities. The ecosystem is further fuelled by a highly networked and experienced mentoring and venture capital industry.

The global start-up economy continues to grow, creating nearly \$3 trillion in value between 2016 and 2018.¹⁷ With leading universities, an active venture capital market and successful entrepreneurs and businesses in the province, Alberta's entrepreneurial ecosystem has great potential to expand and grow. We are beginning to see a shift in the innovation system away from large, established businesses to entrepreneurial ventures and start-up companies. In fast-growing sub-sectors like artificial intelligence and blockchain, Edmonton has been identified as an emerging, vibrant ecosystem to watch.¹⁸

Creating a strong entrepreneurial ecosystem is a fundamental enabler for building a technology-rich economy. Alberta Innovates is well positioned to continue to support a growing entrepreneurial ecosystem in the province through the programs, networks and connections we provide to entrepreneurs and start-up companies working to commercialize their innovations and scale their businesses. This support for high-growth, high-potential SMEs helps reduce the time it takes to commercialize innovations and knowledge-based products.

Coaching, community and capital are our pillars of support for the entrepreneurial ecosystem and they work closely together as a system. The innovation community collaborates within this system to bring Alberta's R&I to the next stage

¹⁷ <https://www.thegeniusworks.com/2019/10/the-3billion-global-start-up-economy-where-and-how-start-up-ecosystems-are-driving-new-growth/>

¹⁸ <https://startupgenome.com/gser2019>

in its evolution more rapidly. Alberta’s innovative technologies get to market sooner by shortening the time to initiate interactions between R&I stakeholders and increasing the speed of commercialization. This, in turn, increases the number of successful SMEs that contribute to our economy.

Our actions are designed to support the advancement of commercial and non-commercial technologies into use that benefits the province. Over the next three years, we will bolster the evolution of the Entrepreneurial Ecosystem in several ways:

Develop

- Explore mechanisms and pilot programs to create entrepreneurs from researchers or to support moving our research investments into development and use.
- Maintain and leverage partnerships to connect SMEs with researchers in Alberta Innovates focus areas.

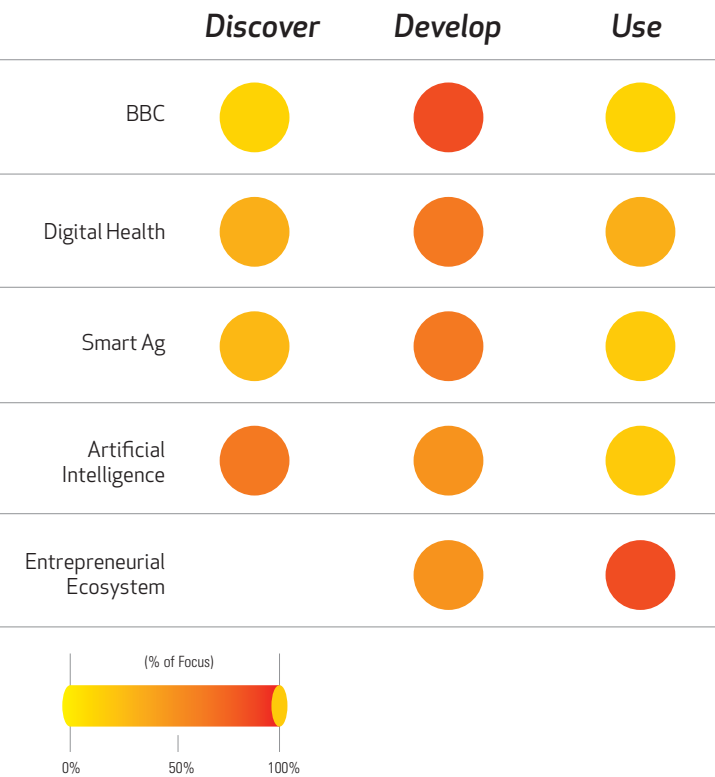
Use

- Work with the Regional Innovation Networks to balance early-stage start-up supports with the need to create more supports for companies in the scale-up phase of their evolution.
- Expand start-ups’ investment readiness knowledge and connections to investors.
- Explore and launch new pilot investment programs targeted at strategic focus areas and marketplace need, such as industry pull, global technology partnerships and scale-up requirements.
- Increase investments in start-ups according to our strategic focus areas and invest in more scale-up companies and activities.

Our Focus Areas – Across the R&I Continuum

The following graphic depicts the near-term distribution of our activities in each focus area across the Discover, Develop, Use stages of the R&I continuum. Each focus area is at a different level of maturity and our efforts across each stage are highlighted accordingly.

Distribution of focus across Discover, Develop, Use Continuum. Short Term: 2020–2023



Performance Management

GOAL 1

Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.

GOAL 2

Cultivate a world-class research and innovation system that meets the needs of Alberta.

GOAL 3

Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.

GOAL 4

Accelerate and broaden the use of innovative products, technologies and processes.

GOAL 5

Be recognized globally as a leading innovation engine.



Performance Management

Each of our corporate goals is accompanied by a goal statement that briefly describes the high-level activities by which the goal will be accomplished. Included are intended outcomes for the goal and associated key performance indicators (KPIs) that will show progress towards the outcomes.

GOAL 1

Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.

Goal Statement

Innovation will create a stronger economy and improvements in our environment, and will enhance our health system and our overall well-being.

Intended Outcomes

- Contribute to improved economic prosperity in Alberta.
- Contribute to the mitigation of negative environmental impacts.
- Contribute to the improved health of Albertans.

Performance Measures

GOAL 1 Performance Measures	Actuals 2018-19*	Targets 2020-21	Targets 2021-22	Targets 2022-23
# of new hires (jobs) in Alberta from R&I investment	2,079	2,580	3,130	3,730
Net SME revenue growth for every \$1 of Alberta Innovates funding	\$6.29	6.02	6.14	6.26
% of SMEs supported by Alberta Innovates that are exporting	42%	42%	44%	46%
# projects with GHG emissions reduction	65	75	90	100
# of projects leveraging digital health technologies to improve the lives of Albertans	N/A	10	15	30

*Due to data availability, the actuals above do not reflect the full suite of Alberta Innovates Investments. Actuals for 2019-20 are currently unavailable.

GOAL 2

Cultivate a world-class research and innovation system that meets the needs of Alberta.

Goal Statement

Continue to develop a highly qualified and skilled R&I talent pool and improve system connectivity.

Intended Outcomes

- Sustain and/or grow client access to R&I physical and virtual infrastructure supported by Alberta Innovates.
- Continue to support the development of Alberta's R&I knowledge workforce.
- Clients have a positive experience with Alberta Innovates.

Performance Measures

GOAL 2 Performance Measures	Actuals 2018-19*	Targets 2020-21	Targets 2021-22	Targets 2022-23
# of clients accessing R&I infrastructure supported by Alberta Innovates	620	800	800	800
# of people supported (e.g., trainees, researchers, entrepreneurs, etc.)	1,040	1,100	1,175	1,200
% clients with a positive client experience	76%	85	85	85

**Due to data availability, the actuals above do not reflect the full suite of Alberta Innovates Investments. Actuals for 2019-20 are currently unavailable.*

GOAL 3

Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.

Goal Statement

Enable the production of new knowledge and innovations in areas of strategic importance. Leverage our network of partnerships, collaborations and emerging technology platforms to share these new advances in ways that lead to their adoption and use.

Intended Outcomes

- Generate knowledge, discoveries and developments to drive innovation in areas of strategic importance.
- Establish partnerships with organizations to generate knowledge, discoveries and developments for specific needs/issues.

Performance Measures

GOAL 3 Performance Measures	Actuals 2018-19*	Targets 2020-21	Targets 2021-22	Targets 2022-23
# peer-reviewed publications from R&I investments	1,700	1,700	1,740	1,775
# patents produced from R&I investments	136	190	190	190
% of investments in the Discover & Develop stages of the R&I continuum	N/A	TBD		
# partnerships with organizations to generate knowledge, discoveries and developments for specific needs/issues	N/A	TBD		

*Due to data availability, the actuals above do not reflect the full suite of Alberta Innovates Investments. Actuals for 2019-20 are currently unavailable.

GOAL 4

Accelerate and broaden the use of innovative products, technologies and processes.

Goal Statement

Apply knowledge, discoveries and developments to address the province's needs. These innovations include policies, processes, technologies and products, practices and services. The adoption of innovation is the cornerstone to achieving wider impact.

Intended Outcomes

- Support (financial and non-financial) provided to support entrepreneurs and SMEs in innovation development and commercialization.
- Innovations supported by Alberta Innovates demonstrate TRL progression.
- Innovations are produced with the support of Alberta Innovates.

Performance Measures

GOAL 4 Performance Measures	Actuals 2018-19*	Targets 2020-21	Targets 2021-22	Targets 2022-23
\$ invested in the support of entrepreneurs and SMEs	\$35.6 million	\$38 million	\$42 million	\$45 million
Average advancement of innovations across the Technology Readiness Levels	2.1	2.1	2.1	2.1
# of innovations created with support of Alberta Innovates	760	820	860	900

*Due to data availability, the actuals above do not reflect the full suite of Alberta Innovates Investments. Actuals for 2019-20 are currently unavailable.

GOAL 5

Be recognized globally as a leading innovation engine.

Goal Statement

Invest in R&I activities in strategic areas of importance to Alberta and build on evidence and global trends. These investments solve challenges in our province and have significant opportunity on a global scale.

Intended Outcomes

- Shift investments to better align with areas of strategic importance.
- Partner with industry, government, academia and others to stimulate innovation in areas of need.
- Increase awareness of Alberta Innovates among Albertans and others.

Performance Measures

GOAL 5 Performance Measures	Actuals 2018-19*	Targets 2020-21	Targets 2021-22	Targets 2022-23
% invested in strategic areas of importance	N/A	50	60	70
# national and international contractual partnerships	N/A	TBD		
\$ attracted to Alberta Innovates from external sources	\$50 million	\$38.4 million	\$38.4 million	\$38.4 million
# of local, national and international participants attending INVENTURE\$	> 3,000	3,500	4,000	4,000

*Due to data availability, the actuals above do not reflect the full suite of Alberta Innovates Investments. Actuals for 2019-20 are currently unavailable.

Our Research & Innovation Impact Framework

Alberta Innovates is committed to demonstrating the impact and value of our investments. Reflecting international best practices, Alberta Innovates is guided by an impact framework that helps us plan, measure, evaluate and communicate our progress. Working together with the community, the framework (outlined in Appendix A) guides our investment and key implementation activities to achieve intended outcomes and impact. Alberta Innovates is a learning organization and uses evidence to learn what works and share lessons learned so that we can continuously improve.

Highlights from 2018-19 Annual Report

Alberta Innovates delivers results that matter to Albertans.

New jobs, revenue, partnership investments, value-added agricultural and forest products, environmental benefits and cost savings for our health-care system. The results speak volumes about the power of innovation.

We generated \$49.2 million in external revenue and industry funding.

Our entrepreneurial investments:

- Resulted in significant job creation. Technology-based small and medium enterprises supported by Alberta Innovates created 2,079 net new jobs. 89 per cent of them full time.
- Generated \$6.29 in SME net revenue growth for every Alberta Innovates dollar invested.
- Generated \$29,83 in follow-on funding for every dollar we invested; about 79% came from the private sector.

We:

- Rolled out five clean-tech programs with nearly \$42 million allocated to 49 projects. Estimated cumulative GHG reductions from these projects by 2030 – 6,343,911 tonnes of CO₂e.
- Supported creation of 760+ new innovations through investments by our Bio, Clean Energy, Entrepreneurial Investments and Health teams.
- Created a safe way to transport bitumen to market. InnoTech Alberta developed solidified bitumen pellets called CanaPux™ in collaboration and under contract with CN Rail.
- Worked closely with Alberta Health Services and Covenant Health to decrease turnaround times for accessing health data from 150 days to 9 days. Faster access to data can improve patient care, enable better health outcomes and create cost-savings.
- Continued building artificial intelligence capacity in Alberta. Artificial intelligence enables the use of data to predict and learn – transforming how business and organizations do things.
- Opened the [Alberta Carbon Conversion Technology Centre \(ACCTC\)](#) to test carbon dioxide capture and conversion technologies. ACCTC is key to helping companies accelerate development and adoption of technologies that reduce GHG emissions.

We also supported:

- New products, processes or technologies to strengthen the forestry industry, including:
- Development of an advanced biomaterial from wood pulp called cellulose nanocrystals (CNC), for use in industrial, construction and medical applications.
- An extraction process to recover a natural compound in trees called lignin, for development of bio-based resins used in engineered wood products and other new applications.



Developed by CN with InnoTech Alberta, CanaPux™ technology is an innovative and safe way to transport extra-heavy crude, also known as bitumen in Canada. CanaPux™ pellets are formed by blending and coating bitumen with polymer. The “pucks” are transported by rail and freighter to global markets. They float in water and do not leak or dissolve. When they reach their destination, the bitumen is separated and can be refined. The polymer can be reused.

InnoTech Alberta Inc.



The demand for applied research and development (R&D) services in Alberta is increasingly exceeding the supply. Demand is partially driven by industrial companies seeking innovation (market pull) that enhances their competitive position in the marketplace, addresses their growth challenges and/or disrupts the status quo with new advances.

Conversely, academia, innovators, entrepreneurs, and small, medium and large companies require R&D services along with access to pilot facilities where they can test and scale up technologies from proof-of-concept to push innovation for industry adoption. InnoTech Alberta, our wholly owned applied research and technology development subsidiary, together with Alberta Innovates business lines, help fill this gap.

InnoTech was set up by the Government of Alberta nearly a century ago for use by the public sector and industrial/corporate innovators, to invest in and conduct R&D. The intent then, and now, is to share the risks, accelerate initiatives and remove barriers by providing facilities, equipment and expertise. This better enables clients to conduct industrial-scale research, technology development, and innovation. From generating new ideas to testing, de-risking and scale-up, InnoTech's work has always focused on productive commercial applications and end uses that build business in Alberta.

Supported by client revenue and public funding, InnoTech is uniquely positioned to provide applied R&D and laboratory services where others lack:

- **Capability and Capacity** – InnoTech has highly trained staff, specialized equipment, and more than one million square feet of unique facilities.
- **Risk Tolerance** – InnoTech leverages its scale, experience and expertise to support and share the risks associated with industrial-scale, applied R&D initiatives.
- **Neutrality** – InnoTech provides independent and unbiased applied R&D that is globally recognized and trusted.

In our public-sector work with government departments and agencies, InnoTech is committed to stimulating R&I aligned to the Government of Alberta's priorities to find more effective ways of solving the challenges of today and tomorrow.

InnoTech Partnerships

InnoTech brokers public-private partnerships that create a greater return on public investment than would occur by working separately. We refocused in 2019 to better leverage opportunities and to increase the number of industry consortia we participate in. This enables us to meet the needs of a changing innovation ecosystem, one that requires greater public-private collaboration. Partnerships open new sources of revenue for InnoTech, and synergies that come from collaboration lead to innovations that ultimately benefit Albertans.

Opening new sources of revenue is important, since revenue generation remains InnoTech's top priority. Revenue generation is also a clear indicator of industry's continued commitment to investing in R&D in Alberta. However, InnoTech's responsibility to remain revenue-neutral due to limitations imposed by a government expense target creates challenges. (See the Consolidated Budget section.)

Services and Key Activities

InnoTech will continue to invest in and utilize its assets and knowledge to increase applied R&D spending by Alberta's industries. InnoTech will aim to:

- Catalyze growth and diversify the economy.
- Drive private-sector profitability enabling job creation and employment.
- De-risk and accelerate industrial technology development that facilitates innovation and a competitive business environment.
- Grow Alberta's reputation for responsible environmental stewardship in development of its natural resources.

Sector Divisions

Energy Services

- Bitumen extraction & processing
- Enhanced reservoir & processing
- Wear, corrosion & fouling mitigation
- Advanced metal manufacturing

Environmental Services

- Biodiversity monitoring & ecosystem management
- Carbon capture, conversion & utilization
- Reclamation & native plants
- Water management

Bioindustrial Services

- Bioindustrial product development
- Cannabis research & analysis
- Crop yield optimization & microbiological testing
- Fermentation

Monitoring, Analytics & Informatics Services (Cross-Sectoral)

- Chemical analysis & testing
- Industrial digital life cycle
- Support & sandbox services
- Measurement systems
- Pilot & bench-scale experimental apparatus development

InnoTech will continue to serve Alberta's traditional sectors through several existing and new initiatives in the areas of manufacturing capability; oil and gas well remediation; improving pipeline capacity and oil sands efficiencies; new crops and bioproducts; and carbon capture, conversion, utilization and storage (see Appendix C).

Several of InnoTech's key initiatives for 2020–23 aim to increase the external revenue-to-grant-dollar ratio and increase InnoTech's overall economic and social impact in Alberta. These initiatives include:

- Increasing the number of collaborative projects.
- Increasing total external revenue
- Better measurement and articulation of the impact of InnoTech's activities.

Financial, Capital & Risk Overview

Consolidated Budget

Capital Plan & Leasing Arrangements

Risks & Risk Management



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. C-FER Technologies is recognized as a Government Business Entity and recognized in one line of their net income, while InnoTech is consolidated on a line-by-line basis.

The expenses have been expressed in terms of Alberta Innovates business lines:

- **Research, Innovation & Commercialization:** Includes investments in Health, Clean Resources, Entrepreneurial Investments, Post-Secondary Investments and Strategic Initiatives.
- **Applied Research:** Includes expenses for InnoTech Alberta Inc.
- **Administration:** Includes all corporate services such as finance, marketing and communications, information services, facilities, legal, human resources, purchasing, corporate planning and portfolio management, and performance management and evaluation. Administration serves a critical function in the Corporation by providing essential supports to the operational business lines (Research, Innovation & Commercialization and Applied Research). These corporate services enable the operational business lines to work productively and efficiently toward achieving Alberta Innovates strategic priorities and goals. Corporate services play a direct role in advancing Alberta Innovates 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.

Trends

Revenue

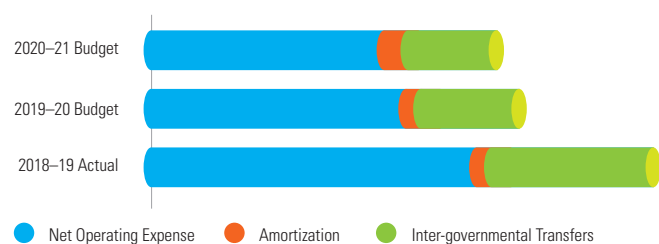
Total revenue is expected to decrease in 2020-21 primarily due to the decrease of \$11 million in funding in the base grant from the Government of Alberta (GOA). Other transfers from the GOA – including other grants, capital contributions and recognition of restricted revenue – are projected to be \$29 million lower than last year. External revenue of \$38 million is consistent with 2019-20 but lower than 2018-19 due to the change in the accounting treatment of C-FER, whose revenue was included in the 2018-19 results but are now consolidated differently.

Expenses

The gross operating expense target includes amortization and inter-governmental transfers. Inter-governmental transfers are grants or contracts to other government entities that are then eliminated upon consolidation at the GOA. Alberta Innovates' net expense target of \$131 million is spending that the organization can direct to strategic priorities and operations. Over the last three years this amount has decreased by approximately \$50 million.

Figure 5 Expense Targets

Expense Targets



	2018-19 Actual	2019-20 Budget	2020-21 Budget
Gross Operating Expenses	278,145	202,425	191,201
Amortization	(6,750)	(7,200)	(7,200)
Inter-Governmental transfers	(90,391)	(52,750)	(52,750)
Net Operating Expenses	181,004	142,474	131,251

Alberta Innovates receives a budgeted revenue and expense target from the Government of Alberta. Although the organization has an accumulated surplus from prior years of underspending, the organization is limited in how much it can spend on an annual basis.

An annual deficit of \$2.1 million is budgeted for 2020-2021, which decreases the accumulated surplus to \$100.8 million. The accumulated surplus was generated from timing differences on expenditures over the last few years.

Consolidated Statement of Operations*(dollars in thousands)*

	2018-19 Actual	2019-20 Budget	2020-21 Budget	2021-22 Budget	2022-23 Budget
Revenues					
Government Transfers					
Funding from Economic Development and Trade					
Base Grant	\$ 160,249	\$ 131,168	\$ 119,944	\$ 119,944	\$ 119,944
Restricted Grant from Prior Years	35,590	33,426	14,703	9,253	1,403
Other Grants	20,654	10,756	5,000	5,000	1,000
Restricted Capital Contribution	1,341	1,540	1,700	1,800	2,000
Funding from Other Government of Alberta Entities - Other Grants	12,354	9,200	4,200	4,200	4,200
Federal Government Transfers	5,245	4,000	1,000	1,000	1,000
External Revenue and Industry Funding	50,191	39,000	38,394	38,394	38,394
Investment Income	2,288	2,000	2,000	2,000	2,000
Other Government of Alberta Revenue	2,192	5,523	3,023	3,023	3,023
Net Income from Government Business Enterprise	-	-	(900)	(300)	15
	<u>290,104</u>	<u>236,613</u>	<u>189,064</u>	<u>184,314</u>	<u>172,979</u>
Expenses					
Research, Innovation and Commercialization	183,302	117,395	117,395	117,395	115,135
Applied Research	60,355	43,302	35,000	35,000	35,000
Administration	27,738	34,528	31,606	31,206	31,206
Amortization	6,750	7,200	7,200	7,200	7,200
	<u>278,145</u>	<u>202,425</u>	<u>191,201</u>	<u>190,801</u>	<u>188,541</u>
Annual Surplus (Deficit)	<u>11,959</u>	<u>34,188</u>	<u>(2,137)</u>	<u>(6,487)</u>	<u>(15,562)</u>
Accumulated Surplus, Beginning of Year	<u>56,770</u>	<u>68,729</u>	<u>102,917</u>	<u>100,780</u>	<u>94,293</u>
Accumulated Surplus, End of Year	<u>68,729</u>	<u>102,917</u>	<u>100,780</u>	<u>94,293</u>	<u>78,731</u>

Capital Plan and Leasing Arrangements

Alberta Innovates and its subsidiaries occupy a significant inventory of research and office facilities, most of which are owned and operated by Alberta Infrastructure. In addition to the Government of Alberta facilities, we also occupy space with commercial lease arrangements as shown in the table below. We currently operate across 11 locations: Edmonton (5), Calgary (3), Devon, Vegreville and Victoria, B.C., with well over 1.2 million square feet of space and 600 acres of research farmland. In addition to our facilities, we also possess a substantial inventory of research equipment with an estimated replacement asset value well over \$150 million.

Adequate infrastructure is a vital requirement to support our vision, sustain program effectiveness and manage program growth aligned to corporate and provincial priorities. Over the next three years, an estimate of \$53 million will be required to support implementation of priority capital projects.

Commercial Lease Arrangements

Location	Size	Termination date	Scope of Operations
1. Victoria Group	5,030 square feet	July 31, 2023	InnoTech Alberta - Water Characterization
2. Edmonton Pylypow	12,925 square feet	June 30, 2024	InnoTech Alberta – Industrial Sensor Technologies Team
3. C-FER East Pylypow	36,650 square feet	May 31, 2023	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. Calgary AMEC Place	5,945 square feet	March 31, 2021	Alberta Innovates

Risks and Risk Management

Risk Governance and Oversight

Alberta Innovates is committed to ensuring that risk management practices are embedded in the development of strategic, business and operational plans to drive consistent, effective and accountable action and decision-making in management practice and Board governance oversight. We have designed our risk management framework to be consistent with the practices suggested by generally accepted global risk management standard frameworks and alignment with the Government of Alberta's risk management framework.

Our risk management standard is based on five key principles:

1. Focus resources and mitigation activities to address significant near-term corporate risks, with ongoing monitoring of all other identified and potential risks.
2. Commit to implementing the Enterprise Risk Management (ERM) standard in a staged fashion, allowing for continuous improvement and efficiencies.
3. Operationalize the standard across the organization through Alberta Innovates' operational, business and long-term strategic plans.
4. Administer the risk management standard in a cost-effective manner by embedding it in the Corporate Planning processes.
5. Commit to enhanced transparency and shared understanding between our organization and our stakeholder as to our organization's key risks and mitigation strategies.

Responsibilities for Risk Management

Role	Responsibilities
Board of Directors	Has ultimate responsibility and accountability for risk management, including responsibility for governance and oversight of Alberta Innovates' risks and responses to them.
Audit Committee	Is responsible for assessing the adequacy and effectiveness of the Corporation's risk management and internal controls and making recommendations to the Board concerning these matters as it deems appropriate.
Chief Executive Officer (CEO)	Is responsible for ensuring the ERM standard is implemented and operational and keeping the board and its committees informed of changing risks on a timely basis.
Vice President, Investments, and Vice President, Finance Vice President, Finance	Have overall responsibility for managing the risk management program and are responsible for ensuring timely and complete reporting on risk management activities to the CEO.
Vice Presidents <i>*In addition to responsibilities above</i>	Vice Presidents are responsible for active participation in the risk assessment process, ownership of designated risks and actively identifying, mitigating and monitoring risks that impact Alberta Innovates' strategic goals and objectives.
Executive Directors and Directors (Management)	Alberta Innovates Directors are responsible for active participation in the risk assessment process, the identification and monitoring of risks that impact the organization's strategic goals and objectives, as well as monitoring progress in managing risks and implementing improvement opportunities.

Key Risks

The following represent key risks to Alberta Innovates. These risks are identified based on their potential impact and likelihood to impact our ability to deliver on our business plan.

- Government of Alberta reductions to our budget and limitations on expenditures, that would adversely affect our ability to fund & transform Alberta's R&I system. Expense targets that limit the use of our accumulated surplus may inhibit the organization from sufficiently investing in new ideas, and/or sustaining funding in high priority areas.
- Multi-layered reporting requirements combined with a long-term investment model challenges our ability to adequately report on the outcomes of our investments, potentially leading to loss of confidence in Alberta Innovates.
- Inadequate environmental scanning and a low level of readiness to respond to unforeseen health, safety, security, environmental or media events can potentially affect our operations, resources and reputation.

Appendices

APPENDIX A

Alberta Innovates – Our Context

APPENDIX B

Contributing to ARIF Outcomes

APPENDIX C

InnoTech Alberta

APPENDIX D

C-FER Technologies



APPENDIX A

Alberta Innovates – Our Context

Vision and Mandate

Our vision is to be indisputably recognized provincially, nationally and internationally as a leader in catalyzing research and innovation (R&I) in Alberta. We have a clear mandate, summarized in Figure 6, that drives our actions, programs and initiatives. We carefully steer the innovation system to bring benefit to Albertans, within the mandate set by the Government of Alberta.

Figure 6 *Alberta Innovates – Who we are*

Alberta Innovates is...



Corporate Accountability

Alberta Innovates was created as a provincial corporation under the Alberta Research and Innovation Act to support R&I activities aligned with Government of Alberta priorities, “including activities ... directed at the discovery, commercialization and application of knowledge.” Alberta Innovates has two applied research subsidiaries – C-FER Technologies and Innotech Alberta.

We are governed by an appointed board and report to the Minister of Economic Development Trade and Tourism (EDTT). Most of our activities are funded in large part through the Ministry of EDTT from a budget approved by the Legislative Assembly. We receive additional funding from other provincial and federal government entities, industry, non-governmental organizations (NGOs), and we also generate revenues through contract research activities. Our activities and impacts contribute to work being done in several areas of government and by our partners.

We believe the province’s R&I ecosystem is stronger and more sustainable when it broadly reflects the overall diversity of our community. We strive to ensure all interested and qualified researchers and innovators have an equal opportunity to participate and contribute. To assist this, we are in the process of rolling out equity, diversity and inclusivity (EDI) principles, across our programming.

Five-Year Strategy

Our five-year strategic plan reflects insights gathered through extensive provincewide consultations with stakeholders across the R&I continuum. It is also based on research into global best practices with applicability to Alberta.

We recognize no single technology or industry will sufficiently transform and diversify our economy – instead, a convergence of emerging technologies, platforms 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.

We have come to appreciate the use of data, digital technology and artificial intelligence to shift innovation within Alberta Innovates and are applying it to provide more seamless business operations for our benefit and that of our clients. Our key initiatives, programs and services will focus on the opportunities within these strategic priorities.

Strategic Priorities to Drive Innovation

Our five-year strategy charts a course to align our investments and business lines with three R&I priorities:

- **Develop Emerging Technologies**
We will facilitate the growth and development of emerging technologies in Alberta that have demonstrated potential for high return and lower risk, with a focus on four core areas as outlined in Figure 7.
- **Enhance Our Knowledge Workforce**
Working with our post-secondary partners and others, we will play a key role in enhancing the province’s knowledge workforce by collaborating to help build and accelerate new training that will enable Albertans to adapt to emerging technologies and the digital future. We will encourage uptake of trained personnel into new industries.
- **Embrace the Digital Future**
We will streamline and automate our internal processes and operations and ensure target clients are aware of and have seamless access to our programs and services.

Figure 7 Core Emerging Technology Areas

Four Core Emerging Technology Areas



Our Research & Innovation Impact Framework

Alberta Innovates is committed to demonstrating the impact and value of our investments. Reflecting international best practices, Alberta Innovates is guided by an impact framework that helps us plan, measure, evaluate and communicate our progress. Working together with the community, the framework (outlined in Figure 8 below) guides our investment and key implementation activities to achieve intended outcomes and impact. Alberta Innovates is a learning organization. We use evidence to learn what works and share lessons learned so that we can continuously improve.

Figure 8 Research & Innovation Impact Framework

Research & Innovation Impact Framework



APPENDIX B

Contributing to ARIF Outcomes

The Alberta Research and Innovation Framework (ARIF)¹⁹ focuses the work of government, provincially supported R&I organizations and post-secondary institutions on the needs of Albertans through established outcomes and aspirational innovation targets (see Figure 9). The clear direction provided by ARIF helps inform our strategic and business planning. It also empowers us to work with other stakeholders as we contribute to transformational solutions in priority areas – ensuring sustainable economic, environmental and social prosperity for Albertans.

Figure 9 ARIF 2030 Targets

ARIF 2030 Innovation Targets²⁰



Alberta Innovates contributes to the ARIF innovation targets in multiple ways through our diverse suite of programs and services, as highlighted in this business plan, in various sectors and across the R&I continuum. Our activity includes and requires a diverse range of collaborations with our many clients and partners, comprising post-secondary institutions, researchers, entrepreneurs, industry, and other R&I agencies and groups. In addition, we engage with technical and program experts in several government ministries, including Advanced Education, Agriculture and Forestry, Economic Development and Trade, Energy, Environment and Parks, Health and Labour.

¹⁹ <https://www.alberta.ca/alberta-research-innovation-framework.aspx>.

²⁰ <https://www.alberta.ca/assets/documents/arif-report.pdf>

APPENDIX C

InnoTech Alberta Inc.



Key Activities

- **Advancing Alberta's Manufacturing Capability (Additive Manufacturing Network)**
InnoTech will leverage its status as a neutral third party to advance a member-supported additive manufacturing network which brings together universities, colleges, local manufacturers and local tech companies to enable additive manufactured products to be designed and produced locally by network members.
- **Remediating Alberta's Oil & Gas Wells (Optimizing Well Asset Retirement)**
Alberta has a backlog of approximately 165,000 wells that are waiting to be reclaimed. The Alberta Energy Regulator estimates the liability from these assets as \$58.7 billion. InnoTech will collaborate with Alberta Innovates to explore ways to address this challenge by supporting digital technology development, creating opportunities for SMEs, refining best-management practices, and by looking across the entire well life cycle.
- **Improving Pipeline Capacity (Bitumen Partial Upgrading)**
Partially upgrading bitumen has the potential to free up one-third of existing pipeline capacity by eliminating the need for diluent. InnoTech will focus on conducting client-led batch test studies of partially upgraded bitumen to arrive at simple models that can be used to guide further technology development and pilot scale plants.
- **Improving Oil Sands Efficiencies (Solvent and Non-Aqueous Extraction)**
Using solvents as part of the SAGD process or to separate bitumen from mined oil sands has the potential to greatly reduce the amount of water used by such operations. InnoTech will carry out client-directed research in these areas to aid the advancement of these technologies to commercial deployment, in addition to understanding how best to reclaim non-aqueous tailings from mining processes.
- **Carbon Capture, Conversion, Utilization and Storage (Alberta Carbon Conversion Technology Centre [ACCTC])**
Owned and operated by InnoTech, ACCTC enables users to test and advance carbon dioxide (CO₂) capture and conversion technologies that assist in greenhouse gas (GHG) emission reductions, by enabling the conversion of CO₂ into commercially viable, value-added products.
- **New Crops and Bioproducts (Cannabis, Hemp and Smart Ag)**
InnoTech will leverage its current status as Canada's leading centre of hemp expertise to assist industry in developing product-specific crop genetics, production practices and fibre-processing protocols. In Smart Ag, InnoTech will focus on merging academic, government and in-house biological and engineering expertise to develop sensors that support real-time collection of data needed for crop management.

APPENDIX D

C-FER Technologies Inc. (C-FER)



C-FER's vision is to have global impact in an evolving energy industry by advancing safety, efficiency and environmental performance in partnership with the energy industry. C-FER is a not-for-profit company. It aims to be self-sustaining, generating enough surpluses to enable ongoing investment in the development and optimization of its key assets: its people and its testing facilities.

The company employs approximately 95 people, mostly engineers and engineering technologists. Many of the senior staff are well known for their technical contributions to industry in their area of expertise. The company operates out of two large-scale testing facilities in Edmonton, where equipment can be tested and qualified in conditions close to what they are in the field.

The large-scale testing services are combined with engineering analysis and field instrumentation services, supporting the development and commercial deployment of new technologies in the energy industry. The company has a strong reputation in the industry as an independent provider of these services and attracts clients from around the world.

Nevertheless, the oil and gas industry downturn that started in 2014 has had a significant impact on the company's ability to acquire new business. Over the last three fiscal years (2016–17 to 2018–19), revenues decreased by about 30 per cent compared to the previous three years (2013–14 to 2015–16). Measures were taken to reduce expenses, including reductions in staff, to minimize financial losses.

An assessment of the company's operation concluded that neither reducing its facilities nor its current staff would lead to long-term sustainability. Therefore, C-FER's management focus has been on finding new ways to attract new business and generate more revenue, as well as improve overall operational efficiency. Increases in revenue are expected to be achieved mostly through a focus on market segments in which the company can clearly differentiate themselves, and tuning marketing and business development activities more towards understanding and meeting client needs.

Recent increases in the volume of projects under contract (backlog) indicates that a recovery is indeed underway.

A review of C-FER's strengths, weaknesses, opportunities and threats revealed four Priority Strategic Objectives that are expected to help the company meet its business goals and return to a profitable operation within the next two years. Specific initiatives have also been identified for each Priority Strategic Objective, and measures have been developed that are being tracked quarterly to monitor progress towards each objective.

The Priority Strategic Objectives and the associated initiatives being undertaken include:

Motivate, Engage and Align Staff

- Create employee working groups to address important business improvement initiatives.
- Recognize employees for living the C-FER values.
- Conduct career development discussions, separate from performance reviews, with all employees.

Pursue Opportunities in Different Regions and Industries

- Expand C-FER's client base in regions outside North America with a focus on oil and gas operators in Southeast Asia and Latin America.
- Reduce C-FER's reliance on the oil and gas industry by offering services to other industries such as aerospace, defence and geothermal energy production.

Establish Partnerships with Key Clients

- Increase contact with top clients at all levels to better understand their challenges and strategic priorities, as well as to increase their awareness of C-FER's capabilities.
- Make it easier to do business with them; maintain Master Services Agreements and improve understanding of their budgeting and procurement processes.

Improve Operational Efficiency

- Improve internal processes for project management and financial reporting.
- Assign Market Segment Co-ordinators to manage marketing, business development and sales (proposal) activities in selected markets.

The responsibility for creating tactics and executing on these initiatives lies with the Engineering Operations, Corporate Services and HR Directors, in consultation with the Department Managers. Operating plans and budgets have been developed that align with these initiatives and respective measures.



ALBERTA INNOVATES

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