Discussion Paper
Innovation Plan Engagement

Yukon

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Introduction

What is innovation?

Innovation brings about creation of new products, services or processes; or the improvement of existing ones. Broadly defined as new ideas that meet a need while creating value additions throughout the process. Innovation is not limited to the technology sector. It can include the creation of new businesses, social models, or improving processes or service delivery in established businesses and industries.

Innovation in the Yukon economy means growing entrepreneurial activities towards product development, and commercialization with high export potential; as well as encouraging technology, process and innovation opportunities within established sectors within Yukon.

Innovation in the Yukon economy provides a stimulus to sectors of the economy that will strengthen Yukon's fiscal foundations. It helps to grow the share and role of the private sector in the Yukon economy over the long term.

Why do we need an innovation plan for Yukon?

The 21st century has brought a wave of profound changes to how we work. Building on the momentum and success stories of the entrepreneurial ecosystem in the past five years, Yukon is taking action to grow innovation, across all business sections within the territory.

A strong innovation culture gives our territory a competitive edge and positions Yukon for continued success in the knowledge economy. It contributes to sustainable economic growth and diversification, fostering a robust and resilient economy with social and wealth benefits for all citizens.

This engagement is seeking industry and public input into the programs, services, and global innovation trends that would create a positive impact in Yukon. The insights gathered will be compiled into a What We Heard Report and contribute to the development of a five-year innovation strategy for Yukon.

Innovation plan: vision and objectives

The overarching vision of this plan is to encourage innovation across all sectors of the Yukon economy and establish the technology and innovation sector as a growing job creator in Yukon. To develop an innovation plan that will realize this vision for the Yukon economy, the Government of Yukon conducted a range of secondary research to identify emerging global technology and innovation trends. This discussion paper summarizes our findings and presents a draft innovation plan for stakeholder review and input.

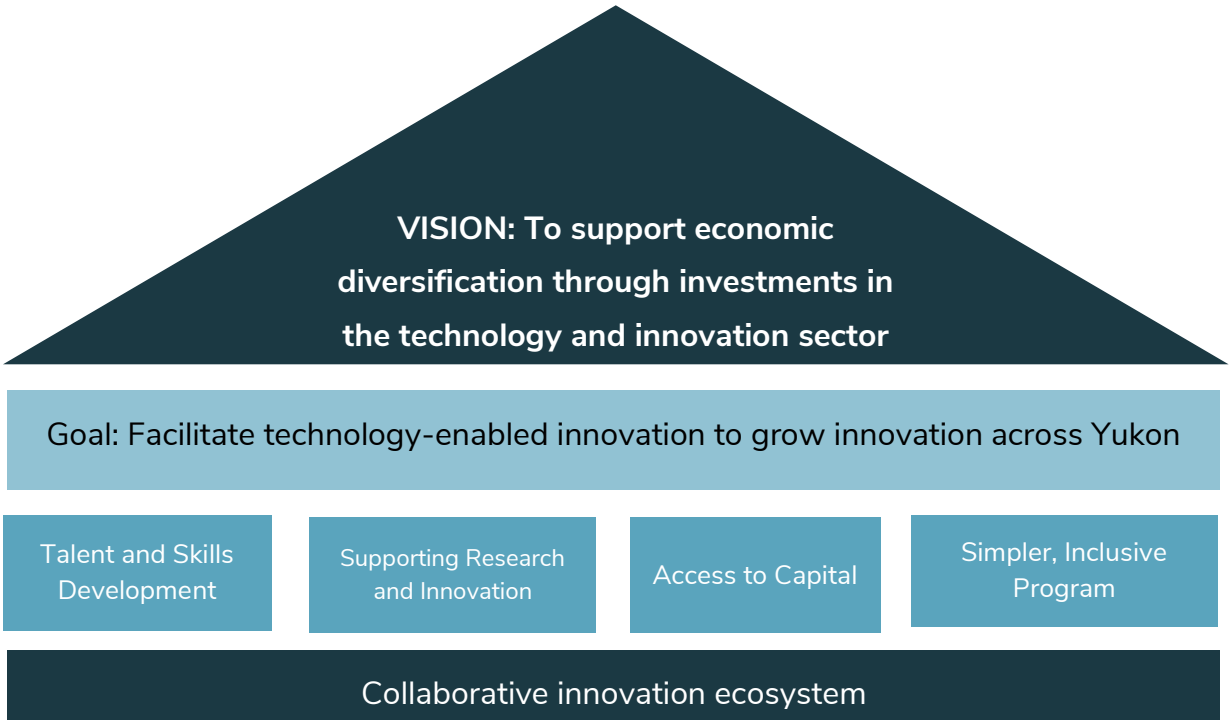

Figure 1: Innovation plan: Vision and thematic structure

Based on secondary research on industry practices, the Government of Yukon will focus its efforts in the following four key areas:

- **Talent and skills development**
  Growth in innovation relies upon a talented, skilled workforce that is well-matched with current challenges. Rapid advances in technology are resulting in significant changes in the knowledge and skill sets required by employers. Half of all Canadian jobs are expected to see a significant change in skills required over the next decade[1].

[1] Humans Wanted. How Canadian youth can thrive in the age of disruption - https://www.rbc.com/dms/enterprise/futurelaunch/humans-wanted-how-canadian-youth-can-thrive-in-the-age-of-disruption.html

Sub pillars:

- Preparing Yukon youth with marketable skill sets as they enter the innovation-driven economy.
- Helping Yukoners adapt to changing work requirements and promote a culture of innovation.
- Attracting skilled talent to Yukon.

What it means for Yukon: For Yukoners to be competitive in the global economy, it is important to build and leverage talent from both within and outside the territory. It requires investment in activities such as skills development programming, certification, entrepreneurial incubation and development, helping youth transition into the workforce and developing innovative immigration programs.

- **Supporting research and innovation**
  Research and development are primary drivers of innovation and the research infrastructure must operate at required levels of quality. At a government level this mean support for research clusters as well as facilitating national/international partnerships that connect researchers with global leaders in their fields. At an industrial level, firms must increase business investments in research and development while simultaneously improving their ability to adapt business models to fit changing consumer demands.

  Sub pillars:

  - Increasing partnerships between firms and post-secondary institutions.
  - Further developing Yukon's research strengths in areas such as energy efficiency, mining and climate change.
  - Increasing investment in research and development by private firms.
  - Strengthening support for startups.
  - Facilitating access to first customers for Yukon firms building innovative products and services.
  - Providing infrastructure support.

  What it means for Yukon: For Yukon to lead in research and innovation, it is important to build research capacity and supporting infrastructure. This includes supporting Yukon University and other research institutions to build on existing research strengths and facilitating knowledge exchange and partnerships across academia and industry stakeholders.

- **Access to capital and scale-up opportunities**
  Capital investment is necessary for innovation to take hold. For new companies (especially in the technology sector) this means the ability to access early-stage private investment opportunities while for more established companies this can take the shape

of funding made available to initiate/scale-up innovative projects that could add significant value to the parent firm.

Sub pillars:

- Incentivize the inflow of private venture capital into Yukon.
- Promote angel investments amongst Yukoners.
- Increase awareness of various private investment channels (equity financing and debt financing).

What it means for Yukon: Yukon innovators require access to capital if their endeavours are to succeed. This requires increasing venture capital flows into Yukon through activities such as ensuring access to private and equity financing as well making efforts to increase the availability of private capital funds in Yukon.

- **Simple, inclusive program development and implementation**
  Government initiatives to support innovation must minimize administrative barriers and facilitate equitable access to all Yukoners. This requires ongoing consultation to assess what is needed, ensuring territory-wide access to digital services and targeted efforts to support firms operating in small communities.

  Sub pillars:

  - Simplifying structures and application processes for programs funding innovation.
  - Creating targeted initiatives to improve participation of underrepresented groups.
  - Regularly evaluating innovation support programs for efficiency, simplicity and inclusiveness.

  What it means for Yukon: Government of Yukon must look to reduce red tape while ensuring the inclusion of First Nations and small communities as part of the Yukon innovation ecosystem.

Global trends in innovation (and their growing impact in Yukon)

Recent advances in technology have been accompanied by rapid growth in innovation across all sectors of the economy. While a number of trends have made headlines at different points in time, some of the most prominent innovation trends visible in the global economy are:

- Internet of things and digital transformation;
- Big data;
- Artificial intelligence and machine learning;
- Upskilling and reskilling;
- Moving from CSR to ESG;
- Venture capital and growth of angel investors;
- Behavioural insights and gamification; and
- Remote workforce.

All these trends are interrelated and each trend is making a significant impact on the tech sector as well as a number of more traditional sectors and the impacts of these shifts are also beginning to be felt in Yukon. These trends provide a starting point for the stakeholder engagement for developing an innovation plan where the engagement could ascertain which of these innovation trends are making the biggest impact on the Yukon economy and where the Government of Yukon is best placed to step in with targeted assistance and initiatives.

Internet of Things and digital transformation

Internet of Things (IoT) refers to everything connected to the internet. With over 22 billion connected devices worldwide[2] at the end of 2018, IoT is already everywhere. And this ubiquitous presence is changing all sectors from tech to mining to healthcare to finance.

Presence in Yukon: In Whitehorse, ColdAcre Food Systems is using IoT to provide CropBox – a containerized agriculture solution that uses automated lights, PH levels, heating and CO2 – to reduce growing times and provide year-round produce in any climate[3]. The Government of Yukon is also making efforts to provide better access to internet (critical to the growth of IoT) in Yukon communities through the Dempster fibre network[4].

Best practices: Companies in Calgary are utilizing unmanned and autonomous systems, coupled with geospatial computing technologies, in sectors such as oil and gas, agriculture, construction, film and television and logistics. This research has been aided by City of Calgary providing land for idea testing and for commercial drone flights[5]. Estonia's National Road Administration has implemented a system that uses sensors and GPS-based monitoring to provide real-time information about road conditions – including air and road temperatures, wind speeds and visibility – to help users, particularly during harsh winters[6].

[2] Number of connected devices reached 22 billion, where is the revenue? - https://www.helpnetsecurity.com/2019/05/23/connected-devices-growth/
[3] CropBox - https://www.coldacre.ca/cropbox
[4] Yukon communities to benefit from more reliable internet - https://yukon.ca/en/news/yukon-communities-benefit-more-reliable-internet
[5] Providing City land for drone flying - https://www.calgary.ca/General/Pages/Living-labs/Drone-testing.aspx
[6] Utilisation of road, traffic and weather information in effective road maintenance - http://tapahtumat.tieyhdistys.fi/site/assets/files/1284/tootsi_eng_nettiin.pdf

Big data

Internet has led to a dramatic increase in data generation and the onset of IoT has accelerated this data generation even more. Research suggests that worldwide data would hit a size of 175 zettabytes (10^{15} megabytes) and 90 zettabytes of this data will be derived from IoT devices[7]. The term big data is commonly used to describe extremely large data sets that may be analyzed to reveal patterns and trends. These data sets are often to complex or too large for traditional software to deal with. In a few years, big data has gone from being a new frontier for big organisations with lots of capital to becoming a technology that is being leveraged by firms of all sizes.

Presence in Yukon: The Yukon Bureau of Statistics[8] is the government body with direct expertise in data analysis and the bureau is using more complex tools in recent years. In the private sector, organisations such as Proof Data Technologies[9] are leveraging data analytics to provide to enterprise software solutions that not only facilitate a user process but also provide actionable insights.

Best practices: Taiwan is leveraging big data and social media to crowd-source legislation. The vTaiwan platform[10] finds areas where public agrees and frames a legislation around this agreement. Unlike most forums, the users of vTaiwan rate others' suggestions instead of commenting themselves. The system then clusters the responses and displays statements that cut across political divisions – it has already been used to regulate on-demand ride services such as Uber and in helping pass the fintech sandbox act – a regulation that financial technology firms use to conduct small-scale, transparent experiments.

[7] Big Data Growth Statistics to Blow Your Mind (or, What is a Yottabyte Anyway?) - https://www.aparavi.com/data-growth-statistics-blow-your-mind/
[8] Yukon Bureau of Statistics - https://yukon.ca/en/statistics-and-data/yukon-bureau-statistics/get-help-statistics-and-data-yukon-bureau-statistics
[9] Proof Data Technologies - https://proofgov.com/
[10] vTaiwan - https://info.vtaiwan.tw/

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Artificial intelligence and machine learning

Machine learning is a branch of computer science that focuses on algorithms that improve automatically through experience. It is part of a larger knowledge domain of artificial intelligence (AI) that aims to build machines capable of performing tasks that typically require human intelligence. While the terms AI and machine learning are often used interchangeably in the modern world, it is in the smaller area of machine learning that there have been key breakthroughs in recent years. And these breakthroughs have significantly contributed to the growth of artificial intelligence.

Presence in Yukon: In Yukon, Minerva Intelligence is introducing a cognitive artificial intelligence product in some White Gold mines[11]. The software can compare specific data captured by mining firms to identified vectors to hundreds of past and present mines worldwide. This comparison can then serve as a reliable model on which White Gold's staff can base their mining strategies. The Yukon Human Rights Commission[12] is now using a chatbot, Spot, to provide an anonymous way to document harassment or discrimination.

Best practices: UK Driver and Vehicles Standards Agency is using machine learning to improve road safety[13]. The growing data analysis capabilities are also being leveraged to create a better picture of environmental impact of human behaviour and more accurate forecasting on future environmental trends through efforts such as IBM's Green Horizon Project[14].

[11] AI selected for Yukon exploration - https://www.miningmagazine.com/exploration/news/1384883/ai-selected-for-yukon-exploration
[12] Document an incident - https://app.talktospot.com/
[13] Kainos and AWS Help DVSA Utilize Machine Learning to Minimize Fraud and Improve Road Safety - https://aws.amazon.com/partners/success/dvsa-kainos/
[14] Green Horizons - https://www.research.ibm.com/green-horizons/interactive/

Upskilling and reskilling

Rapid growth in innovations across sectors and industries detailed above has resulted in an equally rapid change in the skills demanded by employers as well as jobs that are offered by the employers. Research shows that 61 percent of people believe that global megatrends of technological innovation and globalization greatly affect their jobs and will continue to do so in the future[15]. This has resulted in a significant number of people devoting time to refining their skills (upskilling) and learning new skills that can be applied to completely new jobs (reskilling).

Presence in Yukon: In Yukon, continuous education in face of technological innovation has been a regular part of government planning. In 2019, the federal government and Government of Yukon signed agreements that will see Canada provide Yukon with approximately $45 million over six years to invest in Yukon's workers[16]. Specific organisations and programs (such as Yukonstruct's Launchspace and Makespace initiatives) are already beginning to make an impact but more can be done.

Best practices: Specific programs that could serve as best practice examples to Yukon stakeholders include Rio Tinto's investment of $2 million in a vocational education and training initiative to prepare potential and existing workers for advances in technology and innovation[17]. The Government of Singapore's SkillsFuture offers a number of tailored programs for professionals at all stages of their careers, as well as employers and training providers and its e-services help encourage individuals to adopt a lifelong learning mindset[18].

[15] Decoding Global Trends in Upskilling and Reskilling - https://www.bcg.com/en-ca/publications/2019/decoding-global-trends-upskilling-reskilling.aspx
[16] Governments of Canada and Yukon announce agreements to help Canadians improve their skills and prepare for the future of work with good quality jobs - https://yukon.ca/en/news/governments-canada-and-yukon-announce-agreements-help-canadians-improve-their-skills-and
[17] Mind the gap: training mining workers for a digital future - https://www.mining-technology.com/features/mind-gap-training-mining-workers-digital-future/
[18] SkillsFuture - https://www.skillsfuture.sg/

Moving from CSR to ESG

Corporate social responsibility (CSR) is a common term for big businesses and is used to refer to a firm's efforts to manage its social, environmental and economic impacts in a self-regulated manner. While a number of impactful initiatives have resulted from CSR efforts, in recent years there has been a shift[19] towards specifically measuring the actions of firms. Environmental, social and governance criteria (ESG) focuses on specific metrics that can be used by the public (including potential investors) to understand how firms are responding to environmental, social and corporate governance concerns. With developments in IoT, machine learning and big data, there is now much data that firms can analyze and report on – and thus a significantly greater opportunity for corporate transparency.

Presence in Yukon: In Yukon, Golden Predator is applying ESG principles while reopening their Yukon gold mine[20] and has built close relationships with the Tr'ondëk Hwëch'in First Nation as well as other communities where their mines are operational. In another example of transparency on ESG criteria, the Government of Yukon has recently published a map that marks contaminated sites throughout the territory[21].

Best practices: IBM is using blockchain to provide food supply chain transparency[22]. California Public Employees Retirement System (CalPERS), the largest public pension fund in the US, is integrating ESG risks and opportunities into its investment processes[23]. Intel conducts year-round outreach to investors on ESG issues and its ESG reporting is closely tied to the firm's overall annual reporting.[24]

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[19] Why ESG is replacing CSR – and what this means to your business - https://www.npower.com/business-solutions/blog/2019/04/26/why-esg-is-replacing-csr-and-what-this-means-to-your-business/

[20] Golden Predator: Reopening of a Gold Mine in the Yukon - https://www.b-tv.com/golden-predator-mining-gold-mine-in-yukon-feature-ep-344/

[21] Yukon's contaminated sites now mapped online - https://www.cbc.ca/news/canada/north/yukon-contaminated-sites-map-1.5084939

[22] IBM Food Trust. A new era for the world's food supply - https://www.ibm.com/blockchain/solutions/food-trust

[23] Environmental, Social & Governance Integration - https://www.calpers.ca.gov/page/investments/sustainable-investments-program/esg-integration

[24] Engagement and Outreach - https://www.intc.com/investor-relations/governance-and-corporate-responsibility/engagement-and-outreach/default.aspx

Venture capital and growth of angel investors

Venture Capitalists (VCs) rose to prominence during the dot com boom in the 1990s and have stayed in the limelight since. Their focus has changed over this period of time and in the current moment it is focused on IoT, big data and AI/machine learning, with US startups focused on AI raising $18.5 billion in 2019 – a new funding record[25]. Alongside big firms making large financial investments, angel investors (who provide smaller, initial capital to firms) have also risen to prominence with rapid growth of firms such as Shopify[26].

Presence in Yukon: The Yukon First Nation Investment Corporation, made up of Yukon First Nation development corporations, recently invested a total of $5 million into Panache Ventures including $2 million provided by the Government of Yukon[27]. In a nod to the potential of angel investors, the Yukon Business Investment Tax Credit program provides Yukon residents investing in an eligible Yukon-based firm with a 25 percent tax credit on the amount invested[28]. A number of Yukon-based firms including Proof Data Technologies and Proskida have successfully raised venture funding[29].

Best practices: In Ontario, the Northern Ontario Angels (NOA) established in 2005 has seen significant success, raising investments from NOA members valued at over $155 million and resulting in the creation/protection 4,000 full-time/part-time jobs through these investments[30]. In British Columbia, the government provides investors with a 30 percent tax credit on their investment in an eligible venture capital corporation or an eligible business corporation. The government also recently added "convertible right" (i.e. Simple Agreement for Future Equity or

[25] AI startups raised $18.5 billion in 2019, setting new funding record - https://venturebeat.com/2020/01/14/ai-startups-raised-18-5-billion-in-2019-setting-new-funding-record/
[26] Shopify's Soaring Stock Creates Fistful Of New Billionaires - https://www.forbes.com/sites/laurendebter/2020/02/25/shopifys-soaring-stock-creates-new-billionaires/#328863d14ff8
[27] Government of Yukon supports First Nation investment in technology venture fund - https://yukon.ca/en/news/government-yukon-supports-first-nation-investment-technology-venture-fund
[28] Get a tax credit from the organization you invest in - https://yukon.ca/en/doing-business/funding-and-support-business/get-tax-credit-organization-you-invest
[29] Yukonomist: Silicon Taiga taking off - https://www.yukon-news.com/opinion/yukonomist-silicon-taiga-taking-off/
[30] Northern Ontario Angels - http://www.northernontarioangels.ca/en/

"SAFE") to the definition of "equity share" under the *Small Business Venture Capital Act* to facilitate greater investor participation[31].

[31] Venture Capital Program - https://www2.gov.bc.ca/gov/content/employment-business/investment-capital/venture-capital-programs

Behavioural insights and gamification

As more and more human interactions become rows of data, public and private sector organisations are leveraging this data to validate hypotheses on public behaviour and subsequently nudge the public in specific ways to create positive outcomes. The scientific theories behind this work are relatively old – lessons in decision making, psychology, cognitive science, neuroscience, organisational and group behaviour – but the way they are being used is completely new due to development of technological tools that can capture and analyze big data sets.

Best practices: In the UK, the behavioural insights team was instrumental in significantly increasing monthly tax receipts and has now been spun out into a social purpose company[32]. A similar group in the Government of British Columbia, the BC Behavioural Insights Group, is using data and analysis to design better programs and services[33]. The Ontario Behavioural Insights Unit has tested different types of bin labels and improved the citizens' recycling behaviour[34].

Presence in Yukon: The Government of Yukon conducts several surveys including the Health Behaviours of School Aged Children Survey[35] and other informational surveys through the Yukon Bureau of Statistics that could be leveraged for designing specific government interventions.

[32] The Behavioural Insights team - https://www.bi.team/
[33] Behavioural Insights - https://www2.gov.bc.ca/gov/content/governments/services-for-government/service-experience-digital-delivery/behavioural-insights
[34] Behavioural Insights in Ontario: Update Report 2018 - https://www.ontario.ca/page/behavioural-insights-ontario-update-report-2018
[35] Health Behaviours of School Aged Children Survey: Yukon – Canada - http://www.hss.gov.yk.ca/health_behaviours.php

Remote workforce (dislocation of where people work and earn from where they live and spend)

A shift to a distributed workforce seems to be a natural corollary to the ongoing growth in communications technology. This shift has been visible in recent years through multiple firms such as Toptal and Github hiring employees that complete all their work remotely. With the COVID-19 pandemic, this shift to remote work has gone from being an innovative practice to a reality for a large number of people across the world[36].

Best practices: There are many ramifications to a remote workforce with one impact being the ability for people to move to any location they consider suitable to their needs without worrying about securing employment. This has already resulted in a number of jurisdictions, including Tofino[37] (British Columbia), offering incentives to remote workers to consider moving there. In the mining sector, Rio Tinto has been working for a decade towards remote mining and automation[38] that is aimed at eventually running all mines from ones location[39].

Presence in Yukon: For Yukon, the COVID-19 pandemic has meant most of the workforce working remotely where possible. Even as social distancing restrictions begin to be lifted, there is likely to be significant data gathered in recent months about the efficiency of remote work that could be utilized to make informed decisions at various firms across the territory. For the Government of Yukon, the gathered data is also likely to be leveraged while implementing labour policies both internally for government staff as well as at a territorial level.

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[36] Why remote working will be the new normal, even after COVID-19 - https://www.ey.com/en_be/covid-19/why-remote-working-will-be-the-new-normal-even-after-covid-19

[37] World Renowned Tofino Innovating to Become a Workplace Destination for Global Nomads - https://www.newswire.ca/news-releases/world-renowned-tofino-innovating-to-become-a-workplace-destination-for-global-nomads-683692841.html

[38] Pioneering Automation and Robotics in Mining - https://www.riotinto.com/about/innovation/automation

[39] Rio Tinto: Mine of the Future - https://www.miningglobal.com/operations/rio-tinto-mine-future