AG-TECH MICRO-CREDENTIALS IN BRITISH COLUMBIA:

Review of and Recommendations on Supporting the BC Ag-Tech Sector through New Micro-Credential Training

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FOOD AND AGRICULTURE INSTITUTE

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1. Introduction

The Food and Agriculture Institute at the University of the Fraser Valley (UFV) is working on an initiative to develop four new micro-credentials. These micro-credentials aim to create accessible training opportunities on a range of topics that are needed to help progress a resilient and robust agricultural technology (Ag-Tech) sector across British Columbia.

Roslyn Kunin and Associates (RKA) in partnership with Human Capital Strategies (HCS), two independent economic and human resource research consultants, have been retained to conduct the research and analysis with key Ag-Tech sector employers and stakeholders to understand the industry's willingness to participate in these micro-credential program development and implementation.

2. Research Methodology

This study included three phases: (1) literature and secondary data review; (2) primary data collection, (i.e., interviews of key informants – Ag-Tech businesses and other industry stakeholders); and, (3) a report with estimated employment growth and conclusions and recommendations.

Research Approach

Our research team has undertaken an extensive literature review, with a focus on the Ag-Tech sector performance, latest industry trends and outlooks, talent recruitment and retention, challenges and barriers in talent management, as well as skills and competency requirements.

We have also researched existing statistical data with an emphasis on the size of Canada's information and communication technology sector, as well as labour demand projections to assist in understanding the dynamics of the labour market.

Where existing literature and statistical data do not close the gap, as well as to get location-specific information for analysis, we engaged with industry and other stakeholders to obtain their first-hand experience with the current development of the Ag-Tech sector in BC; labour shortages in their day-to-day operations; where they experience barriers to talent recruitment and retention, and; their insights into the role of the post-secondary education institution in ensuring a supply of qualified technology-savvy workers for the future of the Agri-Food system.

Once the secondary information and primary research were completed, the research team analyzed the data and information by summarizing, synthesizing, and creating themes. The final part has been to provide this report with data and evidence-based findings and recommendations for UFV to consider in program development.

Stakeholder Engagement

Industry and stakeholder engagement have been a key part of this project, particularly during the primary data collection phase. The purpose of this engagement was to engage experts on insights regarding key labour market challenges, opportunities, risks, and solutions. Specifically, we needed to understand industry's perception and buy-in to develop Ag-Tech competency training using a micro-credential approach.

The focus of the primary research has been a combination of virtual key informant interviews and the use of a survey instrument. The potential respondents included a cross-section of Ag-Tech companies from the group of 150 (identified by the BC Government) based on a spreadsheet received from UFV, as well as stakeholder groups (industry associations, professional associations, and government agencies).

3. Sector Profile

Status of Current Adoption of Ag-Tech in Canada's and BC's Agri-Food System

In February 2017, the federal Minister of Finance's Advisory Council on Economic Growth identified Canada's Agri-Food sector as having great potential to be a driver of economic growth for the nation.[1] After assessing global and domestic trends and growth opportunities, the Agri-Food Table set an ambitious target of $85 billion in agriculture, Agri-Food and seafood exports by 2025 (32% increase from $64.6 billion in 2017).[2] The Agri-Food Table also set a target for the domestic market of reaching $140 billion in sales of agriculture and food processing products by 2025 (27% increase from $110 billion in 2017). These growth targets will position Canada as a global leader in high-value markets and reclaim previous lost domestic opportunities.[3] However, achieving these targets will require bold action in regulations, infrastructure, and market readiness, supported by innovation and a future-fit workforce.

Innovation is nothing new to Canadian farmers. Over the past century, Canada has already gone through three technological revolutions, each transforming farm and food production skills.[4] In the early 1900s, a proliferation of seeds, fertilizers and machines began to allow subsistence farmers to specialize. By the middle of the 20th century, the spread of diesel- and gas-powered tractors changed things again, turning farmers into farm operators. In the 1970s and '80s, the advent of software and advances in crop genetics changed the role once more, into that of business manager and entrepreneur. The fourth revolution in agricultural technology is underway and it is all about data. Farmer 4.0 will need to focus on strategy and systems, leaving past tasks to a new generation of smart machines.[5]

Dubbed the "Transformative Seven", these technologies and innovations, if applied in a way that is equitable and supported by producers and communities, hold the most promise to cut emissions and store or sequester them in soil.[6]

- Precision technology – involves a suite of technologies that collect and share information about the local soil, climate, plants, and livestock, and then use that data to inform agriculture processes and decision-making. Included in this suite of technologies are GPS, sensors, big data and AI, application programming interfaces (APIs), broadband connectivity, and high-tech farming equipment. In terms of benefits, precision agriculture enables increased productivity and cost savings, as well as enables regenerative agriculture practices like reduced tillage that protect soil quality and biodiversity.

[1] Innovation, Science and Economic Development Canada. (2018). The innovation and competitiveness imperative: seizing opportunities for growth: Report of Canada's Economic Strategy Tables: Agri-Food.
[2] Ibid.
[3] Ibid.
[4] RBC Thought Leadership. (August 2019). Farmer 4.0: How the coming skills revolution can transform agriculture.
[5] Ibid.
[6] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Transformative Seven: Technologies that can drive Canada's next green revolution.

Canadian farmers have made some progress in adopting precision technologies. In Saskatchewan, for instance, adoption of precision tech has helped 80% of farmers use no-till or conservation tillage. Auto-steering for tractors has been a mainstay on farms for decades. In terms of using the next generation technology, much remains be caught up. Mostly, it is happening only at the start-up stage.

In BC, the Salmon Arm based 4AG, a company that makes mushroom-picking robots, is poised to become one of Canada's breakout agriculture technology stars after landing $40-million in growth capital.[7] The company brought its first robots into service last year and has sold 53 machines. It expects revenue to top $7-million this year, up from $2.5-million in 2024 and zero in 2023. The company is a rare success story in a challenging Ag-Tech market. According to the news article, "agtech companies (globally) raised US$3.4-billion in venture capital in the first half of 2025, down 55.4 per cent from the peak in the second half of 2020". "Several Ag-Tech firms struggled and shut while 4AG was in the market".

- Carbon capture, utilization, and storage systems (CCUS) – trap carbon dioxide emissions before they enter the atmosphere, reuse them or compress them into liquid that is then shipped via pipeline to a storage facility.

  According to the RBC report, in Canada, Saskatoon based fertilizer manufacturer Nutrien has been using CCUS to capture carbon dioxide since 2019 in its Redwater plant. However, beyond this incidence, CCUS is not widely applied in fertilizer production.

  A Vancouver BC-based cleantech company, Svante, while not a pure-play Ag-Tech company, has developed a structured adsorbent beds (filters) to capture and release CO2 in less than 60 seconds, making large-scale commercial carbon capture possible.[8]

- Anaerobic digesters – turn methane captured from manure (from cows as well as pigs, chickens, and other ruminant animals) and off-farm organic waste like crop residue, food waste, and silage into renewable natural gas, biogas, and electricity. Digestate, a byproduct, can also be used as an organic fertilizer on fields or as dairy bedding.

  There is a huge opportunity for growth, especially in agriculture, where crop residues and animal manure make up two-thirds of Canada's easily available biogas resources for biogas development. Yet investment and development in this area is far from ideal, as the high cost of building these facilities is a significant barrier, according to an RBC report.

- Controlled environment agriculture (CEA) – is defined by Innovation Science and Economic Development Canada (ISED) as "an indoor technology-based production system where crops are grown under a modified and highly conditioned environment". Greenhouses, vertical farming, and hydroculture are identified as the most common forms of CEA.

[7] Silcoff, S. B.C. mushroom-picking robot maker 4AG raises $40-million, led by European funds. *The Globe and Mail (Online)*.
[8] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Transformative Seven: Technologies that can drive Canada's next green revolution.

According to the 2021 *Census of Agriculture*, Canada has roughly 5,000 greenhouses and nurseries. However, costs for developing vertical farming remain a hurdle. In addition to capital costs such as land and the buildings themselves, electricity expenses for LED lighting, which take the place of natural sunshine in the growing cycle, tend to be the biggest budget item for vertical farms. Zoning bylaws in some jurisdictions that do not recognize indoor-farming as agriculture are another major hurdle for producers.

Vancouver, BC-based CubicFarm Systems Corp. is one of Canada's leading indoor agriculture technology firms, selling a system that grows salad greens and another one that grows livestock feed. At the time this news story was reported, the CubicFarm system would cost $25 million in capital and five acres of space to build.[9]

- **Feed additives and supplements** – the methane from cattle is shorter-lived than carbon dioxide, but 28 times more potent in terms of warming the planet. Scientists have discovered how to reduce cattle emissions through the gut microbiome. However, to scale up the technology, the biggest challenge is regulatory approval. [10]

  One such additive, called 3-NOP, became approved in Canada for use as a component of gut modifier products for cattle in 2024, [11] and has been shown to cut emissions by as much as 45%. Adding seaweed to the diet of dairy cows could also cut emissions by as much as 82% while also improving the efficiency of cattle. [12]

- **Cellular agriculture** – is a discipline that can transform yeast, bacteria, cell samples, and fungi into novel forms of proteins that can serve as alternatives for dairy or lab-grown meat and fish. It has the potential to produce alternatives to livestock and dairy products that require less land and inputs.

  The lab-grown process is considered more sustainable since it uses less water and land to produce food and emits fewer greenhouse gases. However, high upfront costs make starting a cellular agriculture company difficult. Investors' lack of understanding of the potential of the technology has also been a barrier. [13]

- **Agricultural biotechnology** – is a biotechnology that uses selective breeding, genetic engineering, gene editing, and tissue culture to accelerate and complement traditional approaches to produce crops and livestock with desirable traits, such as enhanced disease or drought tolerance (among other things). Its origins are in plant and animal breeding, which have been used for thousands of years to help produce new varieties of crops and increase yields. [14]

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[9] Edmiston, J. The rise of indoor-farming is exploding, but Canada is lagging behind. *Financial Post.*
[10] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Transformative Seven: Technologies that can drive Canada's next green revolution.
[11] Canadian Food Inspection Agency: https://inspection.canada.ca/en/about-cfia/transparency/consultations-and-engagement/completed/proposed-new-livestock-feed-ingredient-3-nop/what-we-heard-report-3-nop.
[12] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.
[13] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.
[14] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.

The use of ag biotech approaches for carbon emissions reduction is relatively new and in the R&D phase. In Canada, regulations of plants with novel traits, which are more stringent than those of competitor countries, are some of the most challenging barriers. [15]

Summerland, BC-based Okanagan Specialty Fruits, grows novel tree fruit varieties developed through bioengineering. It holds worldwide intellectual property rights in compositions and methods for regulating the expression of polyphenol oxidase (PPO) genes to control enzymatic browning in tree fruits. It has been working on solutions to a number of challenges affecting a variety of other crops. Its flagship product is Arctic® apple varieties which don't brown when bitten, sliced, or bruised, offering orchard freshness that lasts longer and less waste.

While these "next generation" Ag-Tech innovations can hold the keys to a more productive and more sustainable agriculture and food production landscape, there appears to be a long way to go before their full potentials are realized. Farm operators already face substantial increases in input costs (feed, fuel, and labour) since the pandemic, and unpredictable growing challenges related to weather conditions, they also need to deal with the challenges in the trade environment. They are less willing to put up with the high cost of technology adoption. Table 1 below shows statistics available from the 2021 Census of Agriculture on the adoption of precision technology by farmers in Canada and in BC. Table 2 shows the use of Global Position System (GPS) equipment on farms and its purposes. In either case, the data shows adoption of these technologies in BC lagged behind Canada.

Table 1: Farmer Adoption of Precision Technologies in Canada and BC, 2021

	Number of Farms Reporting		Percentage of All Crop Farms*	
	Canada	BC	Canada	BC
Automated guidance steering systems (auto-steer)	50,917	640	26.8%	4.0%
Geographic Information System (GIS) mapping	25,058	400	13.2%	2.5%
Variable-rate input application	30,567	1,458	16.1%	9.2%
Drones	6,781	303	3.6%	1.9%
Soil sample test	60,687	2,811	32.0%	17.7%
Slow-release fertilizer	44,484	3,182	23.4%	20.1%

** Excluding Christmas tree area*
Source: RKA, based on Statistics Canada Table 32-10-0379-01 Technologies used on the operation, Census of Agriculture, 2021, and Table 32-10-0233-01 Farms classified by area in crops and summerfallow, Census of Agriculture, 2021.

[15] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.

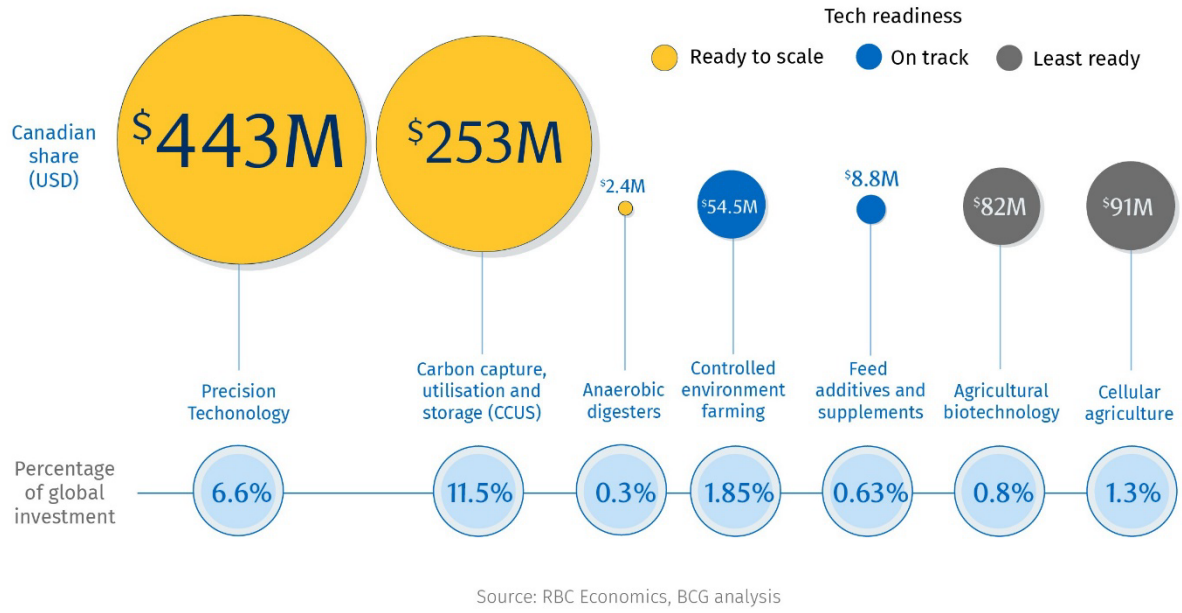
Table 2: Use and Purpose of GPS equipment on Farms in Canada and BC, 2017 and 2021

	Canada				BC			
	Field Crop Production		Forage Production		Field Crop Production		Forage Production	
	2017	2021	2017	2021	2017	2021	2017	2021
Used Global Positioning System (GPS) equipment, total [10]	84%	84%	32%	32%	..	..	18%	13%
-- Used Global Positioning System (GPS) equipment as a tracking or guidance system [11]	90%	92%	78%	85%	..	..	57%	81%
--Used Global Positioning System (GPS) equipment to generate yield maps from a combine yield monitor [11]	32%	37%	16%	17%	..	..	F	F
--Used Global Positioning System (GPS) equipment to target or vary fertilizer application rates across a field [11]	28%	23%	19%	16%	..	..	29%	22%
--Used Global Positioning System (GPS) equipment to target or vary pesticide application rates across a field [11 12]	..	14%	..	10%	..	..	..	F
--Used Global Positioning System (GPS) equipment to target or vary application rates of other crop inputs [11 12]	20%	2%	15%	3%	..	..	x	x
--Used Global Positioning System (GPS) equipment to design improved drainage of land [11]	13%	13%	10%	10%	..	..	F	F
--Used Global Positioning System (GPS) equipment to enhance record keeping by georeferencing the location of specific field operations or features [11]	18%	17%	9%	10%	..	..	F	13%
--Used Global Positioning System (GPS) equipment with drones to automatically monitor and map field observations [11]	5%	4%	4%	4%	..	..	F	F
--Other use and purpose of Global Positioning System (GPS) [11 12]	5%	F	6%	1%	..	..	16%	F
Did not use Global Positioning System (GPS) equipment [10]	16%	15%	67%	67%	..	..	82%	86%

.. data not available for specific period
X suppressed to meet the confidentiality requirements of the Statistics Act
F too unreliable to be published
Note 10: As a percentage of all farms producing forage or field crops.
Note 11: As a percentage of farms producing forage or field crops that used Global Positioning System (GPS).
Note 12: In 2017, Used Global Positioning System (GPS) equipment to target or vary pesticide application rates across a field was not an answer option. Comparisons to 2017 should be made with caution.
Source: Statistics Canada Table 32-10-0207-01 Use and purpose of Global Positioning System equipment on farms.

Most support for Canadian research comes from public funding, but current funding programs can be onerous for researchers, particularly for emerging technologies that don't fall easily into specific funding categories. And certain regulatory requirements – including those surrounding novel plant traits – can act as barriers to approval and investment in emerging areas of plant science like gene editing.[16] Other countries, including the U.S., are seeing most of their overall research dollars come from the private sector. Competing in the next era of agriculture will depend on our ability to mobilize more of this capital.[17] Figure 1 is a reproduction of a chart in the RBC Economics report on global venture capital and private equity investment in Ag-Tech from 2017 to 2022.

Figure 1: Canada's share of global funding for most key technologies is low



Source: Reproduced from The Transformative Seven: Technologies that can drive Canada's next green revolution.

Estimating the Current Workforce in BC's Ag-Tech Sector

In a report, *BC AgriTech Labour Market Study* by Human Capital Strategies, it was established that the size of the workforce in BC's Ag-Tech sector ranged between 3,560 and 7,575 in 2020. The lower estimate represents the size of the current workforce in all "tech" companies, while the upper estimate represents the combination of all "tech workers" in agriculture and all workers in the "tech companies" (without double counting tech workers in the tech companies).

While it is not the main focus of this study, it is important to understand the workforce development in this sector at the present time.

[16] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.
[17] RBC Economics and Thought Leadership, BCG Centre for Canada's Future and Arrell Food Institute at the University of Guelph. The Next Green Revolution: How Canada can produce more food and fewer emissions.

As pointed out earlier, the lower estimate of 3,560 represents the total number of workers in the Ag-Tech companies. This was derived based on the key informant interviews conducted during the study. At the time, there were approximately 150 Ag-Tech companies in the province, according to information published on the BC government website. During the course of this study, our literature review has not revealed much change to the size of this cluster of 150 Ag-Tech companies. Therefore, the estimate of the number of workers in the "pure-play" Ag-Tech sector remains approximately 3,560 in 2024.

The upper end of the estimate was derived based on an approach from an ICTC report, *Onwards and Upwards: Digital Talent Outlook 2025*, combining all "tech workers" in agriculture and all workers in the "tech companies" (without double-counting tech workers in the tech companies). Using this approach, the size of the BC Ag-Tech sector would be approximately 4,250 in 2024 (about one-quarter of the workforce in agriculture).

Therefore, the size of the Ag-Tech sector in BC would be between 3,560 and 4,250 in 2024.

4. What Talent will Ag-Tech Need

Competencies (Knowledge, Skills, Attitudes), Experience and Educational Requirements of the BC Ag-Tech Sector

Our literature review shows that while the skills needed for specific occupations vary, seven general skills are outlined below.

Soft skills – in a recent Information, Communication and Technology Council (ICTC) report, *Canadian Agri-Food Sustainability: Skilled Talent Needed to Meet Food Demand and Reduce Environmental Impacts*, "soft skills are critical to all Agri-Food roles": many employers in the study state that soft skills are even more important to them than technical skills. Soft skills include work ethic, interest, communication, teamwork, trustworthy, empathetic, and an innovative mindset. [18]

Multidisciplinary skills – given the complexity of the Agri-Food system, it is important for an Agri-Food candidate to have multidisciplinary knowledge of agriculture business, technology, and sustainability. Individuals need to have at least a general understanding of the different aspects of agriculture to develop technology solutions that are meaningful to operators.

Agri-Food domain knowledge – while a candidate for a specific role will need to have specific knowledge, it is also important to understand animal husbandry, plant science, genetics and plant breeding, agronomy, and trends in the Agri-Food market.

Environmental knowledge - according to the ICTC study, the two most in-demand environmental skill sets are "the ability to carry out awareness programs and present on environmental matters, and the ability to collect, analyze, and interpret agricultural samples and data for environmental purposes." It is also helpful to have a general understanding of the Agri-Food regulatory environment in the jurisdiction.

[18]. Clark, A. and Matthews, M. (April 2023). Canadian Agri-Food Sustainability: Skilled Talent Needed to Meet Food Demand and Reduce Environmental Impacts.

Scientific research skills – "a strong understanding of the general scientific process, the ability to implement objective, sound methods and procedures, and the ability to attain scientific results" are considered "lab and research best practices" and are in high demand.

Digital skills – competencies in geography and surveying technologies such as GPS, ArcGIS, remote sensing, along with the ability to operate drones, are considered most important and in high demand. The ability to understand, analyze, and interpret data was also cited as being in-demand, according to the ICTC report. Interpreting and analyzing data are also important for supply chain traceability and life cycle analysis reports, both of which are used to validate environmental and social governance standards. Therefore, "making use of data will require a variety of skilled data scientists and analysts with an understanding of programming languages like Python, JavaScript, Java, and SQL." For those in operation and maintenance roles, the ability to "recommend and implement changes or repairs" is in demand. These tasks will require diverse individuals to understand agricultural technologies and to have general experience in engineering, mechanics, electronics, robotics, and automation.

Business and management skills – last but not least, those in charge of operation will need not only the soft and human skills, but also the ability to conduct market analyses or financial analyses to better manage an agribusiness, or to calculate the costs and benefits of specific Agri-Food practices, to understand the use of customer relations software and other business software such as Excel, Visio, and Salesforce.

Micro-Credentials

Canada's digital economy has long faced a labour and skills shortage. To meet current and future talent needs, Canadian employers are increasingly looking for a balance of job-specific technical skills and transferable social-emotional skills. Micro-credentials provide one such avenue for needed training and upskilling.[19]

Micro-credentials are a relatively novel education model, and definitions of what constitutes a micro-credential vary, but in general, digital economy micro-credentials can be understood as short-duration, targeted, and skills-based learning focused on helping learners develop and demonstrate a predefined set of competencies.

ICTC's March 2024 report, *Accelerating Canada's Workforce: Micro-Credentialing in the Digital Economy,* outlines a framework of five must-have elements for digital economy micro-credentials in Canada: (1) connection to labour market needs, (2) proof of mastery, (3) validation process, (4) portfolio-based learning, and (5) flexible delivery. Micro-credentials may also be designed to be stackable or a ladder into larger academic or professional credentials, such as certificates, diplomas, degrees, or professional designations in some cases. [20]

The following seven attributes outline how micro-credential providers—such as higher education institutions, professional associations, and private training providers—can operationalize these essential elements in their micro-credential program design and delivery.

[19] Henningsmoen, E. and McGeer, H., (March 2024). Accelerating Canada's Workforce: Micro-Credentialing in the Digital Economy.
[20] Henningsmoen, E. and McGeer, H. (Jul 4th, 2024) Seven Attributes of Effective Micro-credential Programs.

Attribute 1: Micro-credentials are structured around practical, skills-focused learning

Micro-credential providers should focus on practical, skills-focused learning in the design and delivery of their programs. Practical learning helps to bridge the gap between theoretical knowledge and practical application. Skills-focused learning is tailored to develop specific competencies directly relevant to job performance. Ensuring learners gain hands-on experience and skills that can be immediately applied in the workplace is an effective way for micro-credentials to enhance learner employability. By emphasizing practical, skills-focused learning, micro-credential providers can best position their programs as workforce development tools, delivering tangible value to learners and employers.

To ensure the skills are aligned with current industry needs, institutions should work directly with industry when developing programs, and both parties should maintain ongoing relationships throughout each micro-credential lifecycle. This alignment with industry not only benefits learners by making them job-ready but also meets the expectations of employers who seek candidates with proven, demonstrable abilities.

Attribute 2: Micro-credentials use project-based assessments

Alongside adopting a practical, skills-focused learning approach is providing project-based assessments. Competency-based evaluations, based on practical projects, can demonstrate that learners understand a concept in both theory and practice and emphasize learners' proven ability to complete tasks. This involves developing practical, project-based capstone or final projects that directly correlate with job performance and address specific workplace needs. Such evaluations ensure that the skills acquired through a micro-credential are relevant and valuable in a professional setting. Project-based assessments allow learners to build a portfolio of work that effectively demonstrates their newly developed skills to potential employers.

Attribute 3: Micro-credentials are developed and delivered with support from and in direct collaboration with industry

Welcoming and soliciting industry involvement during the development and delivery of micro-credentials is an essential activity that ensures program curricula are aligned with contemporary labour market needs. Industry involvement, which equates to direct collaboration with employers, is not only a requisite when developing new micro-credentials but should also be leveraged throughout a micro-credential's entire lifecycle. One strategy for maintaining direct collaboration includes the establishment of governance bodies, such as industry advisory councils.

Industry advisory councils for micro-credential programs should not be carried out in a pro forma manner but as a committed and ongoing dialogue between micro-credential providers and their industry stakeholders. Individual council meetings should be approached with a high level of importance. Providers should thoughtfully consider input, ideas, and feedback from industry. If ideas or recommendations from an industry advisor or committee are not adopted, providers should offer clear, practical reasons for their decisions. Additionally, individual members of the industry advisory council should be encouraged to commit to long-term involvement.

Attribute 4: Micro-credential programs include embedded career development and job search services

A key element for creating a stronger connection to the labour market is to provide embedded career services for micro-credential courses. These can include job search assistance, career coaching, and resume review. If the resources are available, providers could even consider developing work-integrated learning (WIL) programs, like internships and practicums, to coincide with micro-credential offerings.

Such embedded services help job seekers secure gainful employment upon completing their micro-credential studies, as well as help those already employed develop tactics to highlight their newly learned skills and advance their careers. Micro-credentials that can demonstrate direct employment and career results will enjoy enhanced credibility among employers and learners.

Embedded job search and career support should be a part of the core services offered by micro-credential providers. While smaller resource-constrained providers may struggle to provide beneficial career supports to learners, they may be able to partner with career service organizations that have the needed programs and services. For larger providers, such as colleges and universities, campus career service offices can offer tailored career support for micro-credential learners.

Attribute 5: Micro-credential program performance metrics place emphasis on learner employment and career outcomes

When micro-credential providers develop performance metrics for their programs, it is imperative that they emphasize learner employability and post-program career outcomes. Other measures of program performance, including financial stability and enrolment, are also key considerations, but learner career outcomes are the most vital.

While measuring graduate career outcomes is notoriously difficult, the reduced scope and focus of micro-credentials on specific skills and industries make the process of defining success more straightforward than, for example, an academic degree program.

Micro-credential programs that produce revenue and enjoy sustained and strong enrolment numbers but do not help learners find relevant employment or career advancement post-program cannot be considered effective. In fact, micro-credential programs that do not deliver positive career outcomes for learners, even if popular among learners, could be seen as exploitive.

Attribute 6: Micro-credentials embrace inclusive design principles

Adopting inclusive design principles helps ensure program development is driven by the needs of both learners and employers. Micro-credential programs that focus on delivering a high-quality learning experience can help to minimize the perception of micro-credentials as cash grabs. Quality micro-credentials should be inclusive, targeting a diverse audience and not only current students and youth but also alumni, working professionals, and newcomers to Canada who seek upskilling, skills validation, and credential recognition.

Short, flexible micro-credentials are particularly beneficial for meeting the needs of a broad range of learners and employers. Additionally—where possible—programs that can be part of publicly subsidized

education offerings rather than fee-for-service models help improve affordability by prioritizing inclusivity.

To incorporate greater inclusivity into program design, providers can also consider offering the opportunity to stack or "ladder" their micro-credential programs with other academic or professional credentials, such as certificates, diplomas, and degrees, or professional designations. In this way, micro-credentials can act as pathways to further education. This approach helps learners with a wider variety of educational backgrounds signal their skills and knowledge to prospective employers and provides greater context about a candidate's skills to employers.

Attribute 7: Micro-credential marketing and promotion is directed at both learners and employers

Traditionally, the marketing and promotion of micro-credentials has been wholly focused on potential enrollees. Yet, this approach leaves out one of the key consumers of digital economy micro-credential programs: the employers who will hire learners once they successfully complete their micro-credentials. After all, the core value of digital economy micro-credentials is the practical and labour market skills they impart.

Forward-looking micro-credential providers can strive to make employers aware of relevant micro-credential program offerings and regularly touch base with employers to ensure these micro-credential offerings remain aligned with industry and employers' contemporary needs. Micro-credential providers should inform employers when new cohorts of learners graduate from micro-credential programs of interest. Ideally, employers with job openings should watch for applicants graduating with relevant digital economy micro-credentials.

5. What We Heard from Entrepreneurs & Stakeholders

Our survey and interviews yielded much valuable and relevant information even though seasonal factors limited the response rate to our survey and interview requests.

A detailed summary of the responses is provided in Appendix A.

Most were aware of micro-credentialing and recognized its value. Both stakeholders and entrepreneurs agreed on its importance across the different categories. Training to use agricultural data was especially important with drone applications. Training on regional and local food production should be tied in with government policies. Basic business skills are needed, but are harder to fit into the micro-credential model. Case studies on why certain ventures failed would be useful and entrepreneurs would benefit from learning how to cope with the variability in agriculture, where technology is not the only factor that is changing.

Entrepreneurs and stakeholders differed on what skills were most needed. Entrepreneurs rated production metrics low, while stakeholders rated it high. Both groups rated knowledge of farm software highly. Entrepreneurs also valued broad skills like farm intelligence, troubleshooting and business sales. Some respondents provided detailed lists of very specific skills (see Appendix A).

The major gap that needs to be filled is between technology and business applications. Suitable training programs, including micro-credentialing, can help overcome barriers to applying technologies such as vertical farming and attracting appropriate people.

Steady growth was expected in the ag tech sector and in the employment it generates. Provincial programs and those like UFV's work on sustainable food along with proper support to insure capital and human resources, could make ag tech a strong pillar in the BC economy.

Most agreed that more workers were needed. Staff were acquired from new graduates, advertising, or word of mouth. Flexibility, benefits, and remote work were seen as helpful in attracting and retaining staff. However, working remotely is not viable in field applications.

Needed business skills as seen by entrepreneurs included regulatory navigation, IP management, and finance. Also mentioned were relationship building; communication; scaling operations; impact reporting; and soft skills such as determination and resilience.

The biggest barrier to launching or scaling an Ag-Tech venture was financial, including access to capital and high costs. Regulatory complexity and talent gaps were also limitations.

Most seemed aware of and had made use of the various government and other programs available to the sector. Such programs were often not seen as friendly to small businesses.

Mentoring among corporations was seen as valuable, as was peer mentoring among company founders. Help would also be useful in fitting products to market demand.

Robotics, IoT, AI, and drones are mentioned as the most impactful factors in the ag tech sector. Basic biotech and database management would underlie these.

Lack of connectivity at every stage between the developers of technology and those who will apply it is seen as the biggest disconnecting factor. Technology developers are rarely aware of business factors such as return on investment. Field tests are not conducted. Technology is not sufficiently user-friendly for potential users.

The need for appropriate policies and regulations was recognized. Not appreciated were the regulatory differences among provinces, long timelines for approval of changes, and the cost of adopting those changes.

Better policies around grants were sought to increase access to capital. More general knowledge of the ag tech sector would yield more funds from angel investors and venture capitalists, as would developing more pilot projects and networks.

Stakeholders do make use of data, but feel that governments and universities could work more closely in Ag-Tech, especially with independent producers. Digital tools are seen as expensive, and stakeholders cannot always determine which would be worth the expenditure. Technology and access to it need to be simplified. Universities can demonstrate what is important and what is not, and provide training and access to the former.

6. Conclusions and Recommendations

Conclusions

Agriculture is an important component of BC's economy. The sector has the potential for steady growth if it can overcome the constraints that are currently limiting it. One such constraint is the limited supply of suitably trained workers. Applying advancing technologies to Ag-Tech is vital if it is to continue to contribute. This study shows that making micro-credentials available is a valuable tool to support this sector and meet its labour force needs.

However, if the micro-credential courses provided are to be effective, they need to take the following factors into account in their design and implementation.

1. Micro-credentials should be structured around practical, skills-focused learning
2. Micro-credentials should use project-based assessment
3. Micro-credentials must be developed and delivered with support from and in direct collaboration with industry
4. Micro-credential programs need to include embedded career development and job search services
5. Micro-credential program performance metrics should place emphasis on learner employment and career outcomes
6. Micro-credentials must embrace inclusive design principles
7. Micro-credential marketing and promotion must be directed at both learners and employers

These factors emerged from both our research and our review of the literature. Their justification is described more fully in the report above.

This report shows that the potential number of subjects that micro-credential courses can cover is large. They include soft skills, general business and entrepreneurial skills, acquiring and using technical tools like data and drones, and applications that are very specific to certain operations. A major conclusion of this study is that educational institutions like UFV should work very closely with those in the industry in selecting and designing courses. Ideally, other relevant bodies like government departments and potential investors should be involved.

Conclusions from this study begin with the recognition that micro-credentials are seen as valuable and have a place in the Ag-Tech sector. Micro-credential programs should be developed in conjunction with those working in the sector. Most should have a field component. They should be modular and developed into a training and career path for on-going advancement, possibly tied into internships.

Recommendations

Clearly emerging from this study is the need for government bodies and educational institutions to work more closely with those actually in the field if agricultural technology is to be successfully implemented.

UFV should work with the industry to:

1. Determine the most urgent training needs
2. Select those that can best be met by micro-credentialing
3. Design the courses to include applied and field applications where appropriate
4. Inform potential learners about Ag-Tech to attract them to the field
5. Connect learners and employers to develop career paths
6. Use a modular structure to encourage on-going learning
7. Evaluate micro-credential programs on an ongoing basis to keep them useful and relevant

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Appendix A

Summary of Survey & Interview Responses: Ag-Tech Entrepreneurs and Stakeholders

RKA engaged with 10 Ag-Tech business and stakeholder representatives in late July and early August of 2025 through virtual (Zoom) interviews and an online questionnaire.

The following is a summary of what RKA heard. We have organized it by question, and we differentiate between entrepreneur respondents and stakeholder respondents; and between whether it was from an interviewee or an online survey.

1. **How familiar are you with micro-credentials programs?**

One of four entrepreneurs was not very familiar with micro-credential programs, while the rest were somewhat or very familiar.

Stakeholder familiarity ranged from “not familiar at all” to “somewhat familiar.”

2. **Can skills that are listed below be readily acquired through micro-credential training? (Select all that apply)**

Entrepreneurs thought that problem solving, and data analysis skills would be the most difficult to acquire through micro-credential training. Project management skills were seen as relatively less difficult to acquire.

There was variability among stakeholders as to which skills are relatively difficult or easy to acquire through micro-credential training. Most responses were neutral ("neither difficult nor easy") and others varied between "difficult/very difficult" and "easy/very easy" for the same type of skill. Therefore, not much can be interpreted from this.

3. **How would you rate the current level of education and training available for the Ag-Tech sector in British Columbia?**

In rating of the current quantity and quality of education and training for the Ag-Tech sector in BC, entrepreneurs were mixed, but the quantity was rated higher (3 out of 5 versus 2.75 on quality).
Only two stakeholders responded to this question and responses varied to the extent there are hard to interpret. Examples: "We have excellent educational institutions"; "we have room for improvement to include a wider range of Ag-Tech, but we also have great education partners available to pursue it."

4. **What specific competencies do you believe future employees will need to succeed in the Ag-Tech sector? (Select all that apply)**

The most important competencies for future Ag-Tech employees as rated by entrepreneurs was farm software and lowest were production metrics and ERP systems. For the "other" categories they

mentioned drone-based operations, climate resiliency, regenerative agriculture design, field hardware troubleshooting and farming intelligence (IoT- AI) and business sales.

The skills most frequently identified by stakeholders as being needed by future Ag-Tech employees were production metrics and farm software, and less so were precision software and ERP systems. The other choices were identified less or not at all. Some stakeholders did mention that skills/competencies may not be universally applicable as Ag-Tech sector is a broad term and competencies may be job specific.

Competencies noted by an interviewee included:

- Some financial assessment tools like Net Present Value and Internal Rate of Return, so you can compare investment opportunities value.
- GIS/Mapping
- Data Visualization – how do you spot outliers, trends, and other patterns that represent learning or improvement opportunities?
- How certain data on the farm be kept as a scoreboard for employees
- Irrigation equipment, control, software, sensors
- Grading, sorting packing equipment and automation – There seems to be a high demand for these systems as farms look to recapture outsourced costs.
- What the right-size fit/saturation level of vertical integration on the farm makes sense remains a question.

Another interviewee identified the Which digital tools or platforms currently in use in his operations and which have implications for required workforce skills:

- Tend
- Stocky
- Agrivi
- VinTrace
- AgCode
- eVineyard
- Sectormentor
- iTrade Network
- Quickbooks
- DairyComp (dairy)
- Delaval's DelPro (dairy)
- Sollum SF-Pro (lighting controls)

5. **Please share with us your thoughts on the proposed micro-credential: agricultural data.**

Interest in agricultural data as part of micro-credential training was very high among entrepreneurs; for example, "this is the cornerstone of Ag-Tech", "critical for future tech-enabled agriculture" and "data analysis, etc. are key to the development of the Ag-Tech sector."

For the drone-based agricultural data component, a strong understanding of both GIS and Remote Sensing would be required. GIS and Remote Sensing as a micro-credential would not be recommended if

students had no prior knowledge of these subjects. Training also needs to be practical, with field use cases.

Entrepreneurs preferred mixed (online modules + in-field demos) methods- hands-on for things like part of the drone training. They indicated that the training needs to be accessible throughout BC in farm-based regions. The scheduling should be flexible, modular and mostly in the spring, summer and fall seasons according to the respondents.

There was strong support for modularized training, which, of course, is the essence of the micro-credential model.

Three stakeholders responded to this question. They all identified agricultural data as important for being part of micro-credential training. Online or mixed formats were preferred, and modular training was deemed suitable.

6. **Please share with us your thoughts on the proposed micro-credential: local/regional food system development.**

In terms of local/regional food system development content in the training, entrepreneurs see this as critical; and that it should be practical and integrated with the policy/regulatory context.

Responses regarding delivery methods and locations, scheduling and modularized training, entrepreneurs emphasized the same things as for the data training: mixed methods; province-wide, on-farm; short, flexible courses and support for modularized training.

This topic was also deemed very interesting and important by stakeholders. Online and mixed delivery and modularized training formats were supported.

7. **Please share with us your thoughts on the proposed micro-credential: the business of Ag-Tech.**

In regard to the business of Ag-Tech, entrepreneurs indicated this is very important subject matter to cover in Ag-Tech micro-credential training: "high- this is often missing and highly valuable"; and "there are many great ideas and prototypes- bringing them to market is a very complex and multifaceted process.

They identified marketing, capital raising, IP, commercialization and the "financial runway" to build Ag-Tech solutions. Again, the entrepreneurs preferred mixed formats of training, throughout BC and on-farm settings; flexible scheduling of training; and support for modular training.

The business of Ag-Tech is also seen as important by stakeholders and micro-credential training should focus on failed Ag-Tech companies and what went wrong. Online and modularized formats would work with this subject matter, but one stakeholder believed that in-person format would work best.

8. **Please share with us your thoughts on the proposed micro-credential: entrepreneurship.**

Again, the entrepreneurs rated entrepreneurship content as very important for the Ag-Tech micro-credential training. Like with other content areas, mixed formats, flexible locations and on-farm settings and modular training had the most support.

In terms of entrepreneurship content in micro-credential training for Ag-Tech, stakeholders deemed it important, and it was suggested that the "highs and lows" should be emphasized with a module on "mental fortitude" and how Ag-Tech is a "challenging road." Online and modularized training formats would work, according to two stakeholders. One stakeholder considered in-person training a better format.

An interviewee added that the ability to adapt and pivot and adjust to the environment; and the manufacturing and business sides of Ag-Tech were important for entrepreneurs.

9. How important do you think micro-credentials programs are for the future workforce in the Ag-Tech sector?

All of the entrepreneurs rated micro-credential training for the future Ag-Tech workforce was somewhat (1) or very (3) important.

All stakeholders rated micro-credential programs for future workers in Ag-Tech as “somewhat important” or "very important."

10. What gaps do you see in the current training programs for the Ag-Tech sector?

In terms of gaps in currrent training, the entrepreneurs identified "new programs [are needed to] bridge technical skills and real-world business execution"; "[there is a] Lack of mentorship and real use-case integration"; and there is a "limited flexibility for working professionals or entrepreneurs."

One leader stressed the importance of "making use of the technology in the industry" and "using training to break down barriers to adoption."

Stakeholders offered some comments about current training:

- There needs to be more focus on vertical and other non-traditional farming applications.
- Courses are needed to get people into the field and lead to further training.
- Fragmented training program with limited information stored.

11. How do you perceive the business growth prospects for the Ag-Tech sector in British Columbia over the next 5 years?

In terms of Ag-Tech sector annual sales growth, the entrepreneurs estimated from 3% to 5% over the next five years. Their annual employment growth estimate was similar but closer to 3%.

Of the two stakeholders who responded to this question, annual sales growth was expected to grow 2% and 5% respectively; and annual employment growth was expected to grow 0% to 5% respectively.

One interviewee’s response was:

- Very optimistic
- Looking at our waste streams with a clear eye
- Leaders in this
- High density chickens and cows – how to sustain

Another interviewee had a very detailed sense of the outlook for growth in economic output in BC for agriculture and Ag-Tech.

"The short-term outlook for growth in economic output in BC's agriculture sector is concerning. Over the past five years, farm incomes and profitability have declined, and severe weather events have disrupted production—impacting both crop quality and harvest yields. According to Statistics Canada, 67% of BC farms report annual revenues under $50,000, and these farms also report the greatest net losses.

Meanwhile, the remaining 33%—those with revenues above $50,000—are the ones generating net profits. Notably, 41% of BC farms report revenues under $10,000, raising important questions about how we define commercial farming versus hobby operations, and whether current thresholds for farm status, support payments, and funding access are appropriately set.

Despite these challenges, BC remains uniquely positioned within Canada's agricultural landscape. The province boasts diverse and high-value production systems—from berries in the Fraser Valley and broiler/egg production in the Lower Mainland to world-renowned orchards and vineyards in the Okanagan. Proximity to a major Pacific port in Vancouver ensures global market access, strengthening BC's strategic importance in the national food system.

Where BC shows the most promise is in Ag-Tech. The province's strong tech talent pool, combined with initiatives like the BC Centre for Agritech Innovation and Dr. Lenore Newman's Sustainable Food Systems for Canada at UFV, highlights BC's potential to lead Canada in Ag-Tech innovation—especially in specialty crop and controlled-environment sectors that align with BC's unique climate and production niches. Vancouver-based Ag-Tech companies can innovate for global markets while leveraging the province's research infrastructure and skilled workforce.

While BC producers are constrained by biophysical and infrastructure limitations, BC-based innovators are not. With the right investments and policies, Ag-Tech could become a major economic driver, even as traditional agriculture navigates increasing pressures."

They cited a few sources for this:

https://www.cbc.ca/news/canada/british-columbia/bc-farmers-net-losses-1.7571207
https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210024001

12. To what extent is there a current talent demand/supply gap?

Three of the four entrepreneurs indicated there was a shortage of Ag-Tech talent in BC.

Two of the four stakeholder identified a current demand supply gap (i.e., supply shortage). The other two stakeholders indicated a current demand/supply balance.

13. What suggestions do you have for improving the micro-credentials programs to better meet the needs of the Ag-Tech sector?

In terms of suggestions for improving micro-credential programs for Ag-Tech, the entrepreneurs offered, for example: "involving industry in course design", "include pilot projects or paid internships"; "create stackable career paths with micro-credentials"; create "partnerships with startup incubators and funders"; and "cost-free certifications."

Stakeholder suggestions for improving micro-credential programs for Ag-Tech were: increasing awareness of alternative agriculture as an employment opportunity; needing support from government and universities, and feedback from different levels of stakeholders.

14. How many employees do you have in the following categories?

Three entrepreneurs answered this question. Most positions were in operations (28 out of a total of 51 across the three); and in management (8) and research (9). They had few front-line and support/admin positions.

An interviewee add that they had two lab technicians that are part-time and that they are kind of between projects now and expect growth later.

15. How many additional employees are you likely to need to fill vacancies now and in the next five years as new technology is applied? Please list the areas with the biggest gaps by occupation and/or skills.

Of the three entrepreneurs who responded, growth for most over the next five years was in the range of 1, 2 or 3- except for one entrepreneur they expected an increase of 5 to 9 management positions and another expected growth of 20 or more in operations positions over the next five years.

In terms of five-year projections, the three entrepreneurs who provided numbers, each projected growth of positions in all occupational categories over the next five years- mostly in management, operations and front-line roles and slightly less in research and support positions.

16. From where do you get your workers?

The most common sources of talent among the entrepreneurs were recent graduates from post-secondary institutions, advertising and word of mouth, as a well as from internal referrals, accelerator networks and government placement programs.

An interviewee indicated that two of his lab tech employees came from UFV (biology and chemistry). These positions have a wage of 50$/hour, require “smart hands and smart minds” and 10-15 years’ experience.

17. What strategies can be used more to attract and retain talent?

Entrepreneurs cited the following strategies:

- Remote work flexibility, reduced work weeks, access to great health care benefits including mental health;
- Flexible work arrangements, upskilling through micro-credentials, a clear mission-driven culture and equity or incentive programs;
- Having a purpose that can effect positive change.

An interviewee added the following strategies:

- There are good programs out there now that support the workforce;
- Universities should be looking at the future of fermentation;
- Carbon-based feedstocks are needed – grown on traditional fields; can we start to manufacture without major adverse environmental impacts?

Another interviewee offered this:

- Comes down to location. Rural settings. Science folk tend to migrate to cities
- UFV – how to educate people towards precision fermentation – everything to spec, super clean, right media and balance of chemicals, measurements are accurate.

18. **What are the most important business skills needed to succeed in Ag-Tech today?**

The most important business skills in Ag-Tech were reported by entrepreneurs as regulatory navigation, IP management and finance. "Other" skills identified were relationship building; communication; scaling operations; impact reporting; and soft skills such as "determination" and "resilience."

An interviewee added the following skills as important:

- Fermentation-centric
- Engineering
- Mechanical

19. **What barriers have you or others encountered in launching or scaling an Ag-Tech venture?**

Barriers to launching or scaling Ag-Tech identified by the entrepreneurs were: identifying an "Ideal Customer Profile"; capital access; regulatory complexity; talent gaps; limited early adopter engagement; and understanding the "financial runway."

Stakeholders cited “a lack of infrastructure” as the most frequent barrier, followed by “cost”; and less so, training and interoperability. A comment was added that we "need to take advantage of Buy Canada, government restrictions and regulations on vegetables."

An interviewee suggested that Ag-Tech in BC is ahead of the market. So, for now, his company is offering scaling services: “CAPEX, OPEX and customer uptake are key considerations, so it is tough being out in the front end where we need to know where our feedstocks (inputs) come from and have clear supply chain management.”

20. **Are you aware of or have you accessed Ag-Tech incubators, accelerators, or funding programs? If so, how useful were they?**

Three of the entrepreneurs have accessed such programs:

- AERIUM has accessed many programs to assist with the development of our product(s). They have been instrumental/vital to development;
- Programs like CDL, Foresight Canada, and Co Canada, Innovate BC support have been useful—though more ag-specific resources would help;
- Telus Incubator was an excellent foundation to build Farmer's Hive. Later developed with Foresight. Now Farmer's Hive is among the THRIVE SVG Ventures Alumni. All are important to network and challenge your ideas.

An interviewee added the following comments:

- Absolutely, they are there and are a good place to meet people and see if we are moving correctly – also need a pathway to some sort of funding;
- Need more programs to help these startups;
- Government doesn't seem to like small business;
- Brain drain is a real problem in Canada.

21. **What kinds of mentorship, networking, or market intelligence are most needed in the Ag-Tech space?**

Examples of such programs or arrangements offered by two of the entrepreneurs included:

- Corporate partnerships, government procurement pathways, peer founder networks, real-world problem-solving mentorships;
- Product market fit is key and having help determining that early is great.

An interviewee added the following:

- "Accelerators are kind of doing this. How do you get all these programs working together so two companies aren't spending money on the same thing?"
- "Universities could take more of a role in developing companies – what does their business model look like?"

22. **What types of Ag-Tech innovations do you see as most promising or disruptive for the sector?**

The entrepreneurs identified robotics, IoT and AI for restoration and drones as the most promising innovations for Ag-Tech. An interviewee added biotech and that all data and database management.

23. **Where do you see disconnects between technology developers and producers or users?**

The entrepreneurs identified the following "disconnects" between technology developers and producers/users:

- The hurdles involved in the implementation of the great idea (Ag-Tech development).
- Often the creators are working in a "closed loop" or bubble and it is critical to involve your ICP or potential ICPs very early in the development process.
- Tech is often not field-tested
- Poor communication of the return on investment
- Limited user feedback loop
- Providing intelligent intuitive technology that can be actioned to improve operations and the bottom line

A stakeholder added, that as well as producers needing help in sorting the sellers, another reported disconnect was that "technology developers usually have a certain pattern of thinking and may not have usability at the forefront; whereas producers need simple easy to read tools that don't add complexity to an already tough business."

24. **What regulatory or policy environments support or hinder Ag-Tech entrepreneurship in your context?**

The entrepreneurs identified the following regulatory and policy factors which can hinder or support Ag-Tech development:

- Neither of these are hinderances, as they are in place to ensure safety and compliance; but they are often very underestimated in the hurdles they represent. These are airspace regulations (NavCanada and Transport Canada) and the PMRA (Pest Management Regulatory Agency)
- Approval timelines for new tools
- IP protection hurdles
- Inconsistencies across provinces
- Not enough access to grant funding to support technology adoption

An interview made the following observations:

- *Looking at traditional Ag-Tech practices – existing farmers are going to have to pay when there is no space to put their waste (when the "environmental police" come along)*
- *When precision agriculture comes online – when and how fast – when environmental police start looking at the polluters in agriculture*
- *Circular economy eventually*

25. **What kind of financial literacy, capital access or other supports would help entrepreneurs succeed in Ag-Tech?**

When asked this question, two entrepreneurs referred to the need for a clearer grant process, pilot project funding, more angel/venture capital awareness of Ag-Tech and supporting networks for the sector.

An interviewee added that government has created an extremely unfair environment by allowing companies coming in from foreign countries that do not have to pay the same labour rate and follow the same environmental regulations and have to see product to the same markets (e.g., companies from China).

The following four additional questions were only asked of stakeholders:

26. **How is data currently used to inform decision-making in your organization or work?**

The stakeholders described the use of data to show productivity of the farming equipment as well as to determine where Ag-Tech can make better environmental impacts; and the use of lots of data gathering on plant health, water temperatures, etc.

Also, an interviewee offered this observation of challenges:

- "Currently decision-making through paper-based systems that rely on double entry and are prone to error. Transitioning to digital first workflows can unlock processes."

27. **Are data used effectively to support collaboration across departments, with government, or among stakeholders?**

One stakeholder replied "yes", two other stakeholders commented that "universities are not working with independent growers and producers" and that governments have been ineffective.

28. **How accessible are digital tools and agricultural data to different types of producers, if known?**

Comments by stakeholders on the accessibility of digital tools and agricultural data were as follow:

- Too expensive for small scale producers
- A lack of understanding in what would be of value or work the expenditure
- Barriers/roadblocks to Black, Indigenous and People of Colour (BIPOC)
- Barriers to those in remote regions
- Government and universities should work more closely with producers

29. **What could be done to improve data literacy and access across diverse farming communities?**

There were two suggestions from stakeholders to this question:

- Effective training and education on what is important and what is not; and simplifying data streams and accessibility
- Ensuring access is available; and universities helping educate on choices.

One interviewee offered deeper insights:

- GIS is certainly a key skill. Having spatial data, mapping your farm, and understand any infrastructure like irrigation is key to farm planning, and critical to succession planning between generations or owners.
- Training for new and emerging technologies, products, machinery:
    i. Opportunities for robotics in packing and sorting lines.
    ii. Opportunities in service and repair with new equipment types especially those with sensors, calibrations, programming, component replacements… etc.
    iii. Familiarity with new softwares and their capabilities.
    iv. OMS / ERP / Farm Management – whats the difference? Which do you need?
    v. How to lead tech adoption and change management in an organization
    vi. Getting everybody to switch to a new way of doing this is tough
- A great program available from EMILI on farm-data: https://emili-data-initiative.slite.page/p/HX2maCOboXWekx/Fundamentals-of-Farm-Data