Supporting Rural Agriculture Entrepreneurship

Reframing the Discourse

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Contents

Executive Summary

Canada's agriculture sector is a cornerstone of the national economy. The sector employs 2.3 million people and generates $150 billion—7% of the country's GDP—annually. Agriculture has evolved dramatically from traditional family operations to technology-driven enterprises that lead rural innovation. Despite being one of the world's largest agri-food exporters ($92.8 billion in 2022) with 70% of major crops sold internationally, Canadian agriculture faces several challenges, including labour shortages (there will be 24,000 fewer workers than needed by 2033), rising operational costs, trade disruptions from tariffs, and transportation restrictions.

Rural entrepreneurs face unique constraints, including:

> geographic isolation

> limited infrastructure,

> distance from urban markets.

Therefore, a comprehensive approach is needed to address these challenges and capitalize on opportunities.

*Canada's agriculture sector employs **2.3 million people** and generates **$150 billion.** That's 7% of the country's annual GDP.*

Technological innovation in rural agriculture

Rural agriculture entrepreneurship is benefiting from emerging methods and technologies. The Canadian Agri-Food Policy Institute contends that digital tools for in-field and in controlled environments (e.g., greenhouses) have been proven to boost productivity, improve enterprise competitiveness, and reduce environmental impacts, carrying the potential to unlock a further $750 million to $1.5 billion in annual revenue for Canadian agribusiness.

Data aggregation platforms help drive agricultural innovation. Innovative AI platforms, Internet of things, and data analytics are supporting sustainable and cropping advancements; these technologies are also being used to automate climate controls to improve energy efficiency and cropping outcomes in controlled environment agriculture (CEA).

Vision sensors are being used to detect environmental factors such as soil and air moisture to manage crop phenology, disease, and pests.

Optimized resource usage for nutrient and water delivery systems – these systems ensure correct dosing of liquid or granular fertilizer, broadcast foliar spray, or drip to substrate.

In CEA, there have been pilots of various biochar-enriched substrates, peat-based media, and spent material (e.g., coconut-coir, wood fibre, and bark products), as well as soilless systems like hydroponics and aeroponics. These media improve water retention, nutrient availability, and overall plant growth.

Renewable energy source integration and optimization supports production where utilities access may be limited, like in remote and rural areas. Renewable energy systems provide the ability to self-sustain. Robotics-led production is improving growing outcomes in harvesting, especially in CEA, addressing growing short- and limited-term worker shortfalls over the last decade. Robotics has also improved cultivation outcomes through disease and pest detection and supported optimized crop monitoring in CEA. Innovations in germplasm modification supports crop innovation while addressing agriculture and agri-food sector workforce transitions and growing calls for climate resilience in production.

Labour market and skills challenges

Labour market challenges

Canada's agriculture sector faces a "severe and chronic labour shortage." Labour shortages have had a critical impact on the industry, with the sector experiencing a 3.7% decline in sales—equating to an estimated $3.5 billion loss in sales in 2022—and is projected to worsen; the labour gap is expected to increase by 15% from 2023 to 2030. Compared to other sectors, agriculture has an older workforce: 40% of Canadian farm operators are expected to retire by 2033 and almost one-half of managers and owner-operators are expected to retire within that timeframe. In addition, a significant portion of farm operators are unprepared for succession, with only 25% actively planning for it.

The sector also faces challenges in attracting and retaining workers. Several reasons make agricultural work less attractive, including manual labour, seasonality, rural locations, and lower wages.

Skills gaps and challenges

The agricultural sector faces the highest rate of skills misalignment across all economic sectors. Agricultural entrepreneurs need to be agile and adaptive to the changes in their day-to-day operations and decision-making. Agility and adaptation are especially important in areas critical to the trends in the sector including technological, entrepreneurial, and green transition skills. There is an increasing need for developing competencies and training for agricultural entrepreneurs. The review of existing agricultural competency frameworks reveals significant gaps in adopting inclusive systematic approaches that address sector diversity. Most existing frameworks focus on technical components such as risk management, health and safety, and operations, but fail to address the unique challenges and structural barriers faced by entrepreneurs from equity-deserving groups.

Equity, diversity, and inclusion in rural agriculture

Indigenous populations often reside in rural or remote locations and remain under-represented in Canadian agriculture; Indigenous Peoples make up only 2.1% of farm operators despite comprising 5% of the total population. There is also a noticeable gap in self-employment and entrepreneurship, as Indigenous entrepreneurs face systemic barriers, including a lack of knowledge and training in key areas, such as financial literacy, business planning, regulations, and management. Legislation, namely the Indian Act, imposes further restrictions on entrepreneurship, hindering Indigenous Peoples' participation in the sector, and ultimately reinforcing cycles of economic marginalization.

Women in agriculture continue to face barriers to entry and success within the sector. Gender stereotypes and pervasive gender bias not only devalue their contributions but also create challenges that impede their business success. Additionally, women often shoulder a disproportionate share of household work and

child care, which is a challenge to manage alongside their professional roles. They also remain under-represented in leadership positions. These barriers are exacerbated in rural communities due to geographic isolation, limited access to training, and the need to pursue off-farm income to help support their families.

While immigrants make up a small proportion of the rural agricultural workforce, they hold significant potential to drive sector growth and innovation. However, immigrants face numerous barriers to entering and staying in the industry; many of their skills go unrecognized or are underutilized. These challenges also include negative employer attitudes, cultural differences, the seasonal and insecure nature of work, and isolation. These factors are compounded by government policies that fail to align the immigrant labour supply with the agricultural sector's demands.

Recommendations and way forward

To mitigate the barriers in agriculture entrepreneurship, recommendations should address multiple levels of intervention. For example, the Canadian government should work toward integrating agriculture systematically into its core strategies like economic development frameworks, research and development, trade policies, and business support services. In addition, more data systems with a focus on interpreting disaggregated data should be implemented. Strategic investments in transportation infrastructure are essential to facilitate the connection between rural production areas and urban markets. Interventions should challenge stereotypes and showcase representation and potential career pathways while celebrating agricultural entrepreneurial successes. Immigration policies for the sector should recognize a broader range of agricultural skills, from short-term general labour to specialized or technical expertise. Rather than relying on temporary foreign workers (TFWs) for non-specialized roles, policies should aim to attract and retain talent with long-term potential and industry-specific knowledge.

Agriculture education and skills development must be strategically integrated across multiple education levels and age groups. Implementation should begin in K–12 education through integrated curricula and hands-on experiential learning opportunities. At the post-secondary level, multiple pathways should be created to enable students to gain agriculture entrepreneurship competencies beyond traditional programs. In addition, a comprehensive, culturally appropriate framework should be developed to identify the core knowledge and skills required to succeed across the stages of the agri-business cycle. The framework must also include culturally responsive approaches along with clear guidance for designing wraparound supports.

Context

Agriculture is a critical sector in the Canadian economy; it is also increasingly important for our country's self-sufficiency in food production and food system sustainability. Understanding the needs of agricultural entrepreneurs, particularly in rural areas, is essential for addressing current challenges and future prospects. While there are significant shifts and a rise in urban agriculture, Canadian farming is still predominantly in rural areas. Rural communities are often characterized by small populations, low population density, and distances from urban centers; these factors create unique entrepreneurial challenges that require targeted solutions.

Farmers, along with hunters, are arguably the first entrepreneurs. There are around 189,900 farms in Canada covering 6.3% of Canada's land area, or approximately 62.2 million hectares.[1] Across all farm types, the 2021 Census of Agriculture showed the predominance of rural enterprise.[2]

Core rural agriculture and agri-food industries are often land-intensive, including dairy and milk production (93.6% of the rural farm population), livestock activities like sheep and goats (90.5%) and cattle (84%), as well as commodity cropping (about 72%).[3]

Many entrepreneurs across sectors credit their upbringing on farms as instilling their entrepreneurial mindset and skills, although the needs of agricultural entrepreneurs are often overlooked in discussions of entrepreneurship. Not only is farming changing with shifts to urban agriculture, but farming businesses are diversifying to include other dimensions like hospitality, tourism, and food production. Value-added on-farm businesses in Canada have grown extensively.[4, 5] In 2018 taxation amendments were introduce in Ontario to support expansion through farm retail opportunities (such as farm stores), and value-added production facilities (including local goods preparation and subsequent direct-to-consumer sales), and agri-tourism (e.g., farm stays, tours, and other recreational opportunities).[6]

Additionally, agriculture has been transformed by technology, and the sector leads the innovative application of sensors, artificial intelligence, and data analytics. Yet, farming remains stereotyped as a non-technical discipline, with the image of plowing fields for commodity crops prevailing in the popular imagination.[7]

Like the face of Canada, the face of agriculture is changing with growing proportions of women, Indigenous Peoples, racialized people, and newcomers entering the sector. While agricultural businesses majority operated by women represent only 30.4% of enterprises,[8] a substantial proportion of agricultural businesses are partnerships, and this number is increasing as a function of sector diversification and many being family businesses. There are a host of issues that affect the sector, including shortages in labour and skills and succession planning for operations,[9] as many children raised on farms leave the business.

Furthermore, equity-deserving groups encounter barriers; for example, while gardening is often associated with women, farming is typically associated with men. Although agricultural businesses can provide excellent opportunities for business acquisition, they are often not on the radar of newcomers. Additionally, women, racialized people, Indigenous Peoples, and newcomers who do enter agriculture often face barriers. A critical skills strategy is needed to address technological advancements and new competencies while attracting and retaining a diverse talent pool.

The purpose of this report is to review the current trends in agriculture with respect to technological trends, labour market and skills challenges, and issues around equity, diversity, and inclusion (EDI) to explore the ways in which prevailing assumptions and stereotypes present barriers to growth and sustainability.

The rural economy, entrepreneurship, and agriculture

While Canada continues to urbanize, rural areas remain important to our economy, self-sufficiency, and sustainability. One in five Canadians reside in rural communities, which account for 97.1% of Canada's total landmass[10] and contribute over 25% of the Canadian GDP.[11] In 2020, there were about 299,533 small businesses in rural areas (15.5% of all small businesses in Canada), and 7,500 medium-sized businesses (15.1% of all medium-sized businesses in Canada).[12] The share of businesses in rural areas remained stable, with less than a percentage point difference on a year-to-year basis. (In 2022, the number was increased to 320,585 small businesses.)[13]

Rural communities face unique entrepreneurial opportunities and challenges shaped by small population size, low population density, and large distance to agglomerations.[14] According to a recent Statistics Canada report, businesses in rural and small town areas have experienced various economic challenges like increased input costs, labour stages, and heightened debt burdens.[15, 16] In 2024, rural and small town enterprises reported cost-related obstacles as the most anticipated challenge at 66.7% and inflation was reported as the most pressing short-term obstacle at 44.3%. Moreover, 19.9% of enterprises expected to increase their goods and services prices over the next three months to accommodate production costs and challenges.[17] These issues have reduced the ability of rural enterprises to thrive.

Rural entrepreneurship happens in various sectors. Tourism and hospitality is an important sector in the Canadian rural economy. Nearly 18,000 Canadian tourism businesses operate in remote communities and there are more than 1,900 Indigenous tourism businesses operating across the country.[18] Rural areas generally have a lower GDP compared to urban areas, but the rural-urban income gap has decreased to 6% in 2020 from 12% in 2000.[19] In 2019, average annual labour productivity in rural areas (116,000 GDP per worker) was higher than in urban areas (112,000 GDP per worker).[20] In addition, rural enterprises can create multiplier effects throughout local economies. For example, research shows that every $1 spent on local food generates up to $2 in local economic activity.[21]

Canada's agriculture sector is critical to the national economy. The agri-food industry, which also includes food and beverage processing, employs 2.3 million people and provides one in nine jobs in Canada. In 2023, it generated 7% of Canada's GDP, which is worth $150 billion.[22] According to the 2021 Census of Agriculture, farms were trending

Although a large portion of rural entrepreneurs are owners of small or medium-sized enterprises, agriculture is no longer just the legacy of small, family-owned operations in rural areas.

toward more cost-effective operations, as the expense-to-revenue ratio for farms in Canada averaged 82.9 cents per dollar in 2020, down from 86.9 cents per dollar in 2015.[23]

Additionally, according to a recent OECD report, among rural firms that engage in innovation, the leading innovations occur in the rural agricultural sector (44% of firms).[24]

Canada is one of the few countries with an export-dominated agriculture industry, selling upwards of 70% of crops like soybeans, wheat, canola, and pulses internationally.[25] Canada also ranks among the largest exporters of agri-food and seafood in the world with $92.8 billion in agriculture and processed food exports in 2022.[26] The United States is our largest trading partner, however, new tariffs pose a significant threat to our bilateral trade of agri-food and seafood products at CA$101.3 billion.[27] Canada is a primary importer of phosphorus fertilizers from the United States and synthetic nitrogen fertilizers from Russia.[28]

Only recently have import costs made Canadian-produced fertilizers market-competitive.[29] Rising fertilizer costs, influenced by geopolitical events like Russia's invasion of Ukraine, and trade tensions with major partners like the United States and China, create ongoing volatility. However, there are also opportunities to expand markets, leveraging our reputation for producing high quality and safe agriculture and food products. Today, China maintains a 25% duty on Canadian aquatic products and pork, affecting export markets worth $300 million in seafood[30] and $609 million in pork.[31] For commodities, Canadian canola—the second largest export crop—generated $13.6 billion, with $941 million exported to China in 2024.[32]

Although a large portion of rural entrepreneurs are owners of small or medium-sized enterprises, agriculture is no longer just the legacy of small, family-owned operations in rural areas. The modern agricultural landscape has transformed dramatically from traditional family farming operations. The average farm size has more than tripled over the last 70 years to an average of 315 hectares.[33] Regional differences exist with smaller, more intensive operations in Ontario and Quebec (operations less than 100 hectares) to extensive farms in Saskatchewan, Alberta, and Manitoba, which are nearly 630 hectares on average.[34] In livestock operations, intensification has been fuelled by processing innovations, notably in hog farms (operations are about 20 times larger than before).[35]

Despite this success, the agriculture sector faces significant obstacles. Major challenges in the agriculture and agri-food sector include business continuity, operation succession, and ongoing sector shifts in light of global strains on Canada's food export economy. Technology-driven innovations in the agriculture and agri-food sector are improving operation cost-effectiveness by enhancing efficiency, reducing waste, and optimizing resource utilization;[36] however, support is required for the retention of diverse agricultural enterprises, including small operations and those led by equity-deserving groups.[37] In addition, RBC predicts that 40% of Canadian farm operators will retire by 2033, resulting in an expected shortage of 24,000 workers.[38]

Rising operational costs adds pressure and may change the cost-effective trajectories of farming operations, which earned 17.1 cents on the dollar in 2020, up from 13.1 cents on the dollar in 2015.[39] In 2018, production expenses for livestock feed increased by 9.4%, and on-farm labour prices have increased by 7.3%.[40]

Transportation and market access present additional barriers for rural agricultural innovation. Smaller rural and remote agriculture enterprises are often excluded from market participation due to the high costs of long-distance food transportation.[41, 42] Growing enterprise in remote areas relies heavily on long-distance transport, given Canada's dependence on food export.[43] Where global export is unavailable, small and remote agricultural enterprises also are limited in interprovincial trade; current regulatory barriers and production quotas cost the industry about $1.7 billion annually.[44] The Canadian Federation of Agriculture has identified the two largest barriers to interprovincial trade in agriculture: differing provincial transportation regulations and inconsistencies between provincial and federal inspections required at food processing facilities.

The federal government has responded to recent trade disruptions with several support programs,[45] including Farm Credit Canada (FCC)'s $1 billion Trade Disruption Customer Support program,[46] Export Development Canada's $5 billion Trade Impact Program,[47] Business Development Bank of Canada's $500 million in low-interest loans for tariff-affected business enterprises,[48] and Work-Sharing Program enhancements through the Employment Insurance program.[49] However, ongoing economic agribusiness uncertainties in export and raw material acquisition, coupled with agricultural enterprise support mechanisms, impairs the ability of agri-businesses to improve their expense-to-revenue ratio. These may be particularly felt among small agricultural enterprises where alternative suppliers and production contingency plans are limited.[50]

Technological Innovation in Rural Agriculture

Rural agriculture entrepreneurship is benefiting from emerging methods and technologies, which provides opportunities to drive continued growth for agriculture and agri-food enterprises.[51] A variety of technologies are common in rural indoor and outdoor agriculture—including autonomous guidance and equipment steer, crop optical and chemical sensors, harvesting innovations (crop grasping), smart watering and nutrient supplementation (fertigation)—which collectively require advanced technical skills for successful implementation. This section provides an overview of the technological shifts occurring in Canadian agriculture while introducing some of these key technologies.

Technological innovation in rural agriculture

While agriculture is dominated by stereotypes of old-style farming, the sector is a hot bed of technological innovation in Canada. In addition to new scientific formulations and genetics for crops and livestock, digital technologies including sensors, data analytics, robotics, and more are transforming the rural landscape.

Agriculture and agri-food entrepreneurs are familiar with a variety of technologies, including crop monitoring, fertigation, and irrigation systems; however, unfamiliarity arises in the integration of multiple data sources. For instance, a farmer may know how data from crop moisture sensors should be used to modify watering regimes, but they may be unfamiliar with how to combine humidity, data on the different growing rates of crops, and soil moisture into an optimized watering plan. Data-integration technologies and AI can consolidate data on external and internal environments, for instance, to automate climate controls and improve energy efficiency and cropping outcomes in CEA systems.[52] The Internet of Things (IoT) is made up of hardware components like sensors, actuators, gadgets, appliances, or machines designed for applications that are capable of transmitting data over the Internet or other networks.[53] Internet of Things technology is a highly applicable platform for AI models[54]; for example, data collected by moisture sensors, crop locations, irrigation valves and volumes, and plant masses, among others, can be transformed into online objects to be monitored or remotely controlled in crop and easing tasks that otherwise require farm labour.[55, 56]

The agricultural sector benefits from general inventions and technical expertise; technologies from other disciplines—including medical imaging, robotics, machining and biomedical research—are being used to enhance productivity. For instance, robotics-led production is improving growing outcomes in harvesting, particularly in CEA, like greenhouses, where it is addressing growing short- and limited-term worker shortfalls over the last decade.[57] Worker labour remains the largest share of greenhouse expenses, accounting for 31% of average operation costs in 2019[58] in crop protection and harvesting practices.[59, 60] Robotics in food production represents a sector shift from a predominantly labour-intensive industry; through emerging methods, robotics can improve upon natural processes, such as self-pollination in vertical stacking farms,[61, 62] improve cultivation outcomes, as well as disease and pest detection.[63]

Environmental sensors are also increasing in adoption. Field, pasture, barns, and CEA all utilize a variety of environmental sensors to monitor the cultivation environment; common sensors include those for soil and air moisture, temperature, wind speed, and ion concentration, as well as specific conductance sensors to understand the outcomes of fertigation regimes.[64] Vision-based systems for crop, disease, and pestilence monitoring are also used. New technologies are improving cultivation through profiling biomarkers and microenvironmental parameters and transducing bio-signals to electric readouts for data analytics.

Electrochemical crop signal monitoring technologies (e.g., Vivent Biosignals) and non-invasive on-plant bio-based and biodegradable sensors provide an increasing amount of data to farmers. For detecting plant growth, onboard sensors can measure traits including cell expansion and elongation; other sensors have been developed to measure transduction mechanisms for transfer of gases, liquids, and sugars throughout plant tissues.[65, 66]

Previously non-agricultural technologies are also being adapted to the sector. For example, medical imaging cameras, such as portable computed tomography (CT) scanners, are being used to assemble three-dimensional plant models to improve the estimation of biomass and substrate utilization, as well as track growth. Biomedical advances have always been part of genetically modified crop development and crop management but have expanded as a part of the sustainable transition and to meet growing issues in nutrient supply, environmental pollution, and climate-change accelerated disease, pestilence, as well as drought and flood tolerance for plants. Biological innovations address fertigation requirements and disease and pest management (e.g., biocontrols)[67, 68, 69]; biostimulants can include humic and fulvic acids (for soil or cultivation substrate amendment), nitrogen-containing compounds and atmospheric-nitrogen fixers, and beneficial bacteria and fungi (e.g., mycorrhizal fungi and endophytic fungus species) in pest control and management.[70, 71, 72] Biostimulants can also be used directly into food and beverage processing to improve consumer marketability, such as incorporating seaweed and botanical extracts into beverages.[73]

Challenges and opportunities for innovation in rural agriculture

Invention is not innovation, and the availability of advanced technology does not ensure adoption but requires careful attention to building infrastructure, capacity, and skills. The variety of technologies for rural agriculture and agri-food enterprises present further secondary benefits for the sector,[74] including local food production, potential local employment, and reduced costs where large scale operations disproportionately have benefited.[75] For example, in remote and rural environments, renewable energy source integration and optimization—such as integrating across geothermal and solar power—can support production where utilities access is limited.[76]

In northern rural environments, limited daylight exposure may inhibit large-scale dependence on agrivoltaics (coupled with natural lighting and solar power generation), however, these environments have marked success with geothermal, passive heating. On traditional farmlands, technology adoption has increased. Many agricultural entrepreneurs are now using new technology-enabled crop monitoring, feeding and management regimes, nutrient management practices, integrated pest management and monitoring, and new tilling methods.[77]

In 2018, dairy farmers were investing between $1.2 to $3.2 million for:

> technology licensing

> infrastructure

> servicing contracts

There are several challenges and barriers to technology adoption. More recent farmer surveys indicate that yield cost remains a large barrier, especially for small operations.[78, 79, 80] For example, in livestock production, technologies to support the handling of feed, excrement, bedding, and ventilation have been slower to surface compared to those designed to advance commodity cropping.81 In dairy barns, 23% of operations use robotic milking equipment.[82] In 2018, dairy farmers were investing between $1.2 to $3.2 million for technology licensing, infrastructure, and servicing contracts over the life of the instrumentation.[83]

Technology adoption is generally led by large farms (4% of farming operations), which generate more than one-half of agriculture and agri-food sector revenue.84 Large farms, particularly those with more than 5,000 acres, are more likely to introduce new technology to their operations, with 81% either using or planning to use at least one digital agriculture tool. Medium-sized farms (2,000 to 5,000 acres) follow closely at 76%, while smaller farms relative to the national average (under 2,000 acres) lag significantly at 36%.[85]

Often, technologies are not developed for the needs of smaller operations, and especially not applicable to traditional and culturally-appropriate plants cultivated by Indigenous and immigrant communities in Canada. For instance, about 95% of agriculture data and insights is generated in unstructured raw data formats, where SMEs and entrepreneurs lack the capacity to organize and adapt data to inform operational decisions.86 Agriculture technology firms tend to create tools that have a narrow frame of farming operations and align better with larger operations as well as those working with commodity row crops.[87] Smaller operations are also less likely to collect data or follow insights from technology platforms, often due to mistrust in how large corporations store and use data, as well as limited skills to operate the technology.[88, 89]

Technological adoption within the sector creates new opportunities for sector engagement among workers with digital skills and analytical competencies, and addresses stereotypes that farming is a labourer practice and not for new highly educated technical entrepreneurs.[90] The impact of automation may reduce the need for labour while increasing demand for workers with more advanced skills and education to support an automation transition.[91]

Labour Market and Skills Challenges

Canada's agriculture sector is experiencing a labour shortage crisis complicated by skills gaps that is creating challenges for agricultural entrepreneurs and the industry as a whole. Several interconnected factors contribute to these workforce challenges, ranging from demographic shifts and changing worker expectations to evolving technological developments and skills misalignment. This section examines the current state of labour market issues and skills gap challenges in the Canadian agriculture sector and provides an analysis of the underlying factors.

Labour market challenges

Canada's agriculture sector faces a "severe and chronic labour shortage,"[92] which significantly affects employers and the overall industry. Based on a recent survey conducted by the Canadian Agricultural Human Resource Council (CAHRC), Canada's agriculture sector experienced a 3.7% decline in sales—an estimated $3.5 billion—due to open vacancies in 2022. In the same year, more than 28,200 jobs went unfilled, and it is estimated that, by 2030, this number will increase, especially over the peak season.[93]

Figure 1

Canada's agriculture sector faces a widening labour gap[94]

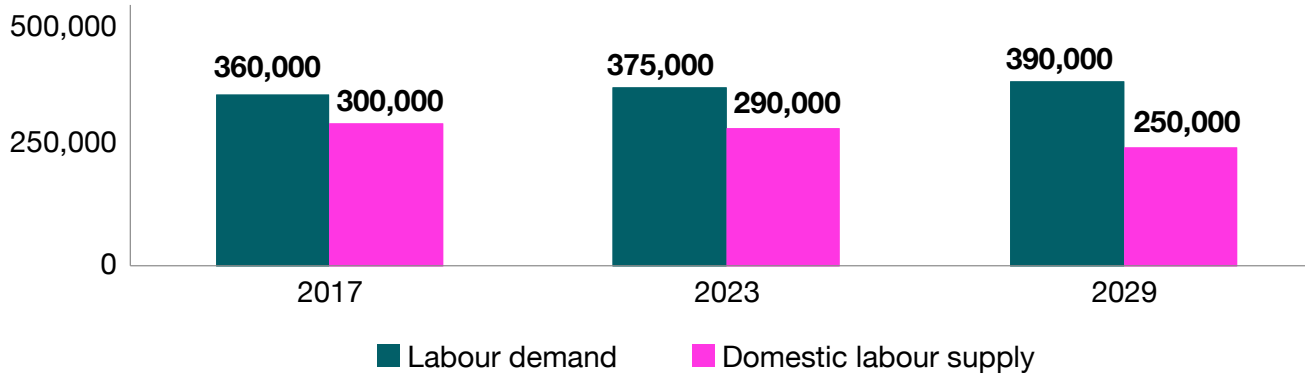
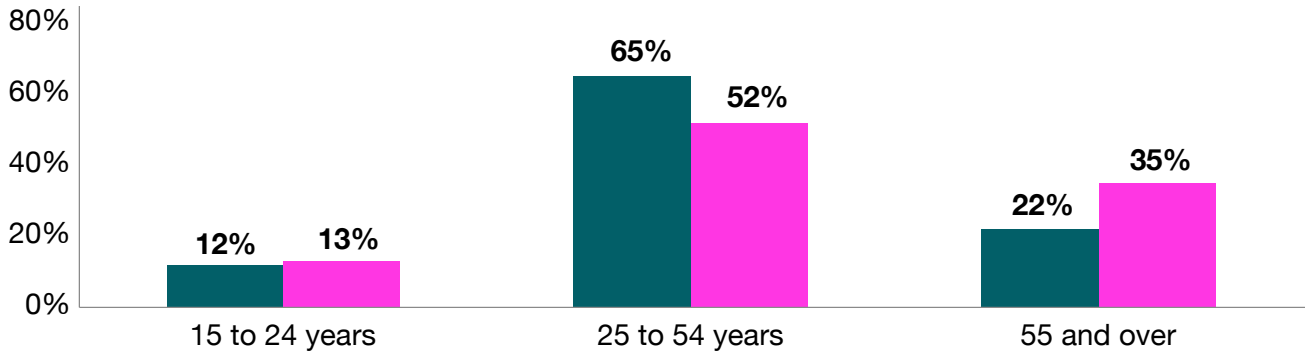


Figure 2

Share of Canadian workforce by age group, 2022[95]



The domestic labour gap is expected to increase by 15% to 101,100 in 2030 during peak season from 87,700 in 2023.[96] Figure 1 illustrates Canada's growing agricultural labour crisis from 2017 to 2029. In 2017, Canada's agriculture sector employed 348,560 people but faced a labour shortage, with 16,500 jobs going unfilled. It is estimated that this gap will worsen by 2029, with an estimated 123,000 agricultural positions remaining vacant (equal to 32% of total labour demand).[97]

Several factors contributing to labour market challenges are described in the following sections.

Demographic shift and aging population

Compared to other sectors, the agriculture sector has an older workforce. In 2022, 35% of the workforce was aged 55 years or older, compared to only 22% across all sectors (Figure 2).[98] According to an RBC report, 60% of today's farm operators will be over the age of 65 in the next 10 years. Furthermore, the report notes that 40% of Canadian farm operators are expected to retire within the next decade.[99]

It is also estimated that almost one-half of managers and owner-operators—a total of 47,600—are expected to retire by 2030; this retirement will leave a significant void in leadership and industry knowledge.[100]

This is important because there aren't enough young workers projected to enter the sector. According to CAHRC, the number of young workers entering the agriculture sector will remain constant until 2030.[101] This trend is consistent with the overall demographic shift in Canada. According to the country's demographic projections, the younger age cohort is growing more slowly compared to older age groups.[102]

Interestingly, older individuals aged 55 to 64 show higher entrepreneurial engagement rates in rural areas (0.23 probability) compared to traditional working-age groups of 25 to 44 (0.19 probability); this reflects a broader demographic shift as rural areas experience accelerated aging due to younger populations migrating to urban centres. This demographic imbalance is complicated by information asymmetries, where older entrepreneurs demonstrate greater utilization of tax incentive programs compared to younger individuals,

suggesting unequal access to information about available support mechanisms and capital resources. Addressing these EDI challenges requires comprehensive strategies that simultaneously support older populations in leading innovative business ventures while implementing approaches to retain younger working-age individuals in rural agricultural environments.

Succession of owners

In Canada, 98% of farms are family owned and operated. It is estimated that about 40% of farmers will retire by 2033 and about 66% of farmers are not prepared for succession with no plan in place.[103] The results from Farm Financial Survey—which is conducted every two years and used by Agriculture and Agri-food Canada—indicate that only 12% of Canadian farms have completed a written succession plan and 13% have one in progress. This means just 25% of Canadian farm owners are actively planning succession. It is also reported that the majority of Canadian farm owners (98%) intend to keep the operation within the family, and men family members are more likely to be successors.[104] This is a value of about $53 billion in agricultural land that is expected to change hands in the next decade as farmers retire.[105] The Government of Canada has developed tax tools to facilitate the transfer of farm ownership within families. The Lifetime Capital Gains Exemption and Intergenerational Farm Rollover are some examples.[106]

Sector attractiveness

The agriculture sector struggles with fundamental attractiveness and retention issues that compounds the labour shortage and makes it increasingly difficult to build a stable workforce. A key factor is that people generally have outdated perceptions and have a lack of awareness about modern agriculture. It's reported that more than one-half of Canadians still associate agriculture primarily with traditional farming, despite the growing need for highly skilled professionals in areas such as biotechnology, food science, engineering, and data analytics.[107]

The agriculture sector had the highest voluntary turnover rate among all Canadian sectors. Based on findings from the 2023 CAHRC Employer Survey, the agriculture sector experienced a voluntary turnover rate of 14% in 2022, which was a 4% increase from 2018 (10%) and almost double the overall turnover rate across all sectors (7.7%) in Canada.[108] It's also reported that, in 2022, two of five employers could not hire all the workers they needed. One-third reported that they received no applications from Canadians and 28% received only one or two during the hiring season.[109] There are several reasons that make agricultural work less attractive, including manual labour, seasonality, rural location,[110] lower wages compared to other sectors,[111] outdated perceptions and lack of awareness,[112] and perceptions of no work-life balance.

Skills gaps and challenges

The agricultural sector has the highest rate of skills misalignment across all economic sectors, and it is projected that it will be amplified in the future.[113] In addition, the agricultural sector faces increasingly volatile weather conditions, evolving technological advances, and changing market demands. These shifting conditions require agricultural entrepreneurs to be agile and adaptive in their day-to-day operations and decision-making. Adaptation and agility are particularly important in areas critical to the trends in the sector including technological, entrepreneurial, and green transition skills.[114]

Technological skills are increasingly important for workers to be able to operate and maintain the new technologies. As automation and technology are adopted in the sector, new skill sets, such as product design, robotics, equipment maintenance, digital production, and digital literacy are required.[115] Agricultural entrepreneurs need to be able to incorporate new technologies and innovative tools, including sensors, drones, and AI, into their farming practices for improved productivity. For instance, the use of technologies can optimize irrigation, fertilization, and pest control, resulting in maximized efficiency and reduction in waste.[116] Furthermore, agricultural entrepreneurs must develop strategies such as seasonal planning and risk management to face increasingly volatile and unpredictable weather conditions.[117] Seasonal plans must be responsive and adaptable, taking changing weather patterns, pest pressures, and market fluctuations into consideration.[118]

In addition, farmers and entrepreneurs in the agriculture sector need a wide range of entrepreneurial and business skills to thrive. With all the complexities and innovation in the sector, the required entrepreneurial skills go beyond traditional farm management and operation. Some of these skills include:

> financial management

> strategic planning and management[119]

> key concepts of marketing (e.g., pricing strategies, branding, etc.)

> risk management

> human resource management, and

> networking, among others.

However, the sector's training infrastructure remains inadequately equipped to support the average Canadian farmer, who is 56 years old, creating a mismatch between educational resources and demographic realities.

The transition toward a more sustainable, and net-zero economy also requires green skills which are particularly important in the agriculture sector. Green skills include fundamental environmental awareness, knowledge of eco-friendly practices, and a basic understanding of the sustainability context. Farmers and entrepreneurs in the agriculture sector must acquire green skills to establish and manage sustainable businesses. To support producers who adopt more sustainable farming practices, the Government of Canada and the Government of Quebec announced $35.3 million in support of farmers, part of which is funded under the Sustainable Canadian Agricultural Partnership.[120]

The transition toward a more sustainable, and net-zero economy also requires green skills which are particularly important in the agriculture sector. ***Green skills include:***

> *fundamental environmental awareness*

> *knowledge of eco-friendly practices*

> *basic understanding of the sustainability context*

Eligible practices under the new initiative include crop diversification, off-season soil protection, reducing the use of herbicides, improved fertilizer management, and biodiversity-friendly landscaping.

Competencies and training for agricultural entrepreneurs

A review of current agricultural competency frameworks (Appendix, Table 1) highlights the growing global attention to developing frameworks that outline the skills and competencies required for the agricultural sector. There are international frameworks, such as the Centre for Agriculture and Bioscience International Skills Framework for Agriculture, that provide a common language for illustrating skills and competencies across the global agricultural sector.

More regional and national focused frameworks—including The Institute for Agriculture and Horticulture Capability Framework in the United Kingdom and the Agriculture and Agri-Food Canada Priorities & Responsibilities in Canada—prioritize and address a range of skills and competencies relevant to the local and domestic industry. While most frameworks reviewed focus on technical components such as sector risk management, health and safety, and technical operations, the Catholic Relief Services SMART Skills Competency Model offers a more holistic approach to agricultural livelihoods programming, focusing on both on- and off-farm competencies.

However, this review reveals gaps in adopting an inclusive systematic approach that addresses diversity within this sector. Entrepreneurs from different equity-deserving groups may require specific skills and competencies based on their unique experiences and the structural barriers they face within the agricultural sector. For example, findings from recent Future Skills Centre research identified a lack of culturally relevant and responsive models that can meaningfully support Indigenous and newcomer agricultural entrepreneurs beyond general agriculture training.[121]

Therefore, there is a need for a more comprehensive and inclusive competency framework that addresses technological change and new competencies; attracting and retaining more diverse talent is also necessary. The competency frameworks must integrate EDI and intersectionality perspectives and accurately reflect the diverse experiences of agricultural entrepreneurs.

Equity, diversity, and inclusion in rural agriculture entrepreneurship

The agricultural sector faces significant EDI challenges that create barriers for equity-deserving groups, particularly Indigenous Peoples, women, and immigrants. These groups encounter multifaceted barriers, including deeply entrenched gendered and cultural stereotypes, limited awareness of opportunities within the agricultural sector, and inadequate capacity development support systems. Resource constraints present another major challenge, with limited access to essential financing, land acquisition, and infrastructure development. Furthermore, these groups often lack crucial networking opportunities and face restricted access to marketing channels, compounded by an absence of targeted policies and programs designed to address their specific needs. This section sheds light on the challenges and barriers faced by these equity-deserving groups in the agriculture sector.

Indigenous Peoples in rural agriculture entrepreneurship

Indigenous Peoples often reside in rural or remote locations and remain under-represented in Canadian agriculture. In 2016, roughly 60% of Indigenous Peoples lived in predominantly rural or remote areas; this was 33% more than the share of non-Indigenous

peoples living in rural regions.[122] Indigenous Peoples consist of 2.1% of farm operators despite constituting 5% of the total national population; they also face significant revenue gaps compared to non-Indigenous operators ($25,960 compared to $73,440 median annual income).[123]

One key factor contributing to these disparities is the historical dispossession of traditional territories, where Indigenous communities were forcefully moved to lands in worse locations or of inferior quality. Although Indigenous communities have a history of entrepreneurship that was vibrant pre-contact and during early colonization, when reserves were created, they were generally located away from the best lands in terms of agriculture, limiting conventional agricultural activities.[124]

Although Indigenous communities continue to face barriers and challenges in rural agriculture, there is a growing movement toward sustainable, community-driven solutions, as well as structural changes. Research from the Future Skills Centre reveals that many northern and Indigenous communities are embracing community-based agriculture to advance food security.[125, 126] Farm Credit Canada offers financing—such as through the Women Entrepreneur and Young Entrepreneur loan programs—to address some barriers to participation. New initiatives are emerging through the National Circle for Indigenous Agriculture and Food, offering targeted skills development in communities; this includes asynchronous learning

opportunities, networking opportunities for Indigenous business to connect with agricultural industries and traditional knowledge keepers, hands-on learning arrangements in the community, and business development planning.[127] New and emerging projects aim to address food insecurity, which is acute among Indigenous populations at 37% in 2022, compared to 23% for the overall population.[128]

Further to these efforts, in rural Indigenous communities, it is crucial to ensure programs do not perpetuate colonial legacies, as well-intentioned programs may.[129] It is also important to be cognizant of agricultural and agri-food practices that may be purpose-designed to not participate in other markets outside of the community. Culturally appropriate food and support for food sovereignty and self-determination are essential, and accomplished when diverse lived experiences are effectively braided into the discourse, strategy, and execution of community cropping efforts.

Women in rural agriculture entrepreneurship

Advancements in the representation of women farm operators are evident in some areas. For example, while the number of Ontario farming operations decreased by 14% from 2006 to 2016, the number of women operating farms increased by 12%.[130] Similarly, across Canada between 1991 and 2021, women farm operators increased from 25.7% to 30.4%, although not from higher sector participation, but from the proportion of men-dominated operations going through succession planning and or consolidation.[131] The gender pay gap in agriculture is also narrowing, particularly among smaller farm operators and in rural environments. In 2020, the gender pay gap was smallest among farm operators in rural areas, at 24.8%. By comparison, farm operators in medium population centres faced the largest gender pay gap (43.6%).[132] Further, women are more likely to start a new firm—which are often one-operator businesses—in rural areas than in urban areas, but have lower participation in employment and are less likely to apply for formal tax credits for innovation.[133] Women operators in agriculture are, on average, more educated than their men counterparts, with a higher proportion receiving apprenticeship or trades certifications and bachelor's degrees or higher, which enables women to take advantage of new tools and technologies of farming as they emerge.[134]

While women in agriculture make significant contributions to the industry, they face a range of barriers that limit their ability to enter the sector and succeed within it. Gender stereotypes undermine women's entry into entrepreneurship, limiting their potential for success within agriculture.[135] When surveyed, the Ontario Federation of Agriculture found that 67% of women farmers reported experiencing disrespect due to their gender, a stark contrast to just 2% of their men counterparts.[136] Such stereotypes, often rooted in societal norms, not only devalue the contributions of women in agriculture, but also create distinct challenges that

impede business success. These challenges include pervasive gender bias, as women often shoulder a disproportionate share of household work and child care, which has implications on women's funding and resources.[137, 138] In addition to barriers to entry, women are also under-represented in leadership positions, despite the proportion of women engaged in agriculture and agri-food industries.

On farms, operational succession planning often favors men heirs and limits access to ownership opportunities.[139] On-farm employment for women predominantly includes finance and administrative occupations (including professionals such as accountants, business services such as HR managers, and administrative supervisors), at 82%. Conversely, 75% of production and operations are led by men. According to a CAHRC survey, 40.9% of women respondents believe there are barriers to advancement, compared to 12.1% of men respondents, which supports the incorrect belief of many men (63%) that there are no barriers for women to advance in agriculture.

Farm Credit Canada has dedicated over $500 million to agriculture, agribusiness, and food sector development to support women's business competencies and skills development needs; this includes information about how to utilize grant and tax incentive programs as well as business operations support.[140] Smaller scale opportunities include FCC's Women's Entrepreneur Loan program to help women access skills development training.[141]

Immigrants in rural agriculture entrepreneurship

As of 2021 immigrants make up almost one-quarter of the Canadian population but only 6.9% of the farming community. Immigrants support rural farm succession planning, replacing operations of aging Canadian farmers who are not succeeded by their children, as their children increasingly favour urban environments. Immigrants and racialized people are active in community-based agriculture programs, addressing food security while developing skills (e.g., Scadding Court). Between 2023 and 2030, 9,800 workers are expected to retire and will be replaced by the 4,300 immigrants and 8,600 program graduates who are projected to enter the industry's workforce.[142] While rural areas have fewer immigrants, there is opportunity to foster immigrant-driven innovation in these regions, as immigrants are more inclined to start new firms, and diversity can lead to more creative and impactful solutions.

Immigrants display a strong interest in agricultural careers, however, they face barriers to entry and retention, and their skills often remain underutilized in the sector. Immigrants express interest in learning about agricultural careers (57% vs. 45% of non-immigrants) and are more open to switching careers into agriculture (58% of recent immigrants).[143] Immigrants view agriculture more positively compared to other industries in terms of skill level, cleanliness, pay, benefits, work-life balance, and career progression. Immigrants are familiar with agricultural sub-fields of food and beverage manufacturing, food science, and biotechnology, although familiarity drops when it comes to farming itself and the business of farming.[144] The industry's retention of immigrants entering through temporary foreign work programs with the intention of securing residency is low. Many immigrant sector participants transition to other sectors upon receiving permanent residency. Between 2011 and 2015, over one-half (52.2%) of temporary foreign workers (TFWs) were employed in agriculture and agri-food, while 38.7% moved to another sector. Within five years of receiving permanent residency, retention rates in agriculture were low (18.8%), as employment grew in other sectors (66.2%). The retention rate continues to drop; from 2016 to 2019, less than one-half (44.4%) of immigrants remained in the sector, while 44.5% were employed in other sectors.

Between 2023 and 2030, ***9,800 workers are expected to retire*** *and will be replaced by the 4,300 immigrants and 8,600 program graduates who are projected to enter the industry's workforce.*

Retention of immigrant workers in primary agriculture and agri-food industries is closely tied to their skill level, with higher-skilled individuals more likely to remain in the sector.[145] However, current government responses fail to align the immigrant workforce supply with agri-sector demand. Specifically, there is an ongoing mismatch between the practical job requirements within the agriculture sector and immigrant skill sets prioritized by immigration policies, which tend to focus on short-term and lower-skill roles rather than long-term, strategic labour market integration.[146] This disconnect is evidenced by the persistent vacancies within the sector, highlighting slow government adaptation to matching immigrant workforce skills with industry demand, despite substantial consultations.[147] There is an overreliance on TFWs, which only serves as a temporary solution, failing to address the underlying structural labour shortages in agriculture.[148]

While government responses continue to fall short in matching the immigrant workforce supply with the sector's demand, another critical issue persists: immigrant credentials and prior experience are not recognized in the agriculture sector, causing skill underutilization in a sector that needs talent.[149] While credential recognition programs exist, they offer limited targeted support for agriculture-specific credential issues.[150] As a result, immigrant agricultural workers frequently experience skill underutilization due to widespread discounting of their credentials and prior experience, resulting in occupational downgrading.[151]

This devaluation of immigrant expertise places skilled immigrant workers into low-skilled positions, exacerbating skill mismatches and hindering sector productivity and innovation.[152] Some existing programs in agriculture lead to significant deskilling of immigrants by relegating them to menial tasks, further undermining their potential contribution to the sector.[153] In some cases, immigrants with advanced agricultural qualifications, including PhDs, face significant underemployment, exemplified by cases of immigrants with doctorate degrees in agriculture driving taxis in Toronto due to barriers like unaffordable farmland.[154]

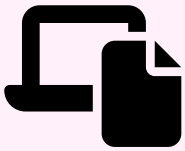
More recently, the governments of Canada and Ontario are investing up to $1.5 million in the new Agricultural Workforce Equity and Diversity Initiative to help minority groups start and build businesses in the agri-food sector.[155] The Government of Canada has also introduced the Advance Payments Program, which is not gender-specific, but addresses identified financial barriers and general lower awareness by women in rural agriculture, offering low-interest cash advances on products until they are sold to meet business cash flow requirements.[156]

Recommendations and Way Forward

The agriculture sector is a cornerstone of the Canadian economy, and agricultural entrepreneurs are potential contributors to economic growth, advance innovation, and can support a substantial portion of the country's export market. Canada's agriculture sector faces challenges in fostering entrepreneurship. This section provides recommendations to enhance entrepreneurial activities in the agriculture sector. These recommendations include multiple levels of intervention, from broad societal considerations—including policy frameworks, regulatory environments, challenging stereotypes and structural barriers, and government-led strategies—to targeted individual-level factors such as skills development and competency building.

Government development strategies

Government should systematically integrate agriculture into its core strategies such as economic development frameworks, research and development, trade policies, and business support services. Government economic development strategies must explicitly include agriculture as a priority sector, with dedicated funding allocations, infrastructure investments, and policy frameworks that recognize agriculture's role in national economic growth, food security, and rural development. The lack of explicit support for technology skills development for Canadian farmers has made agricultural operations solely responsive, not proactive, to global competitors who, for example, are advancing by using digital technologies to tackle challenges related to rising input costs. Where government support is available, policies are reactive, where it might be better to take a proactive stance in addressing evolving climate-related challenges. Not investing in technological skills development limits long-term business viability and market competitiveness, and is likely to result in increasing economic strain over time. Further, following the threat of tariffs from the United States, the Canadian government launched extensive support for agribusiness; however, the funding was reactive to offset the costs of export, not in capacity building to ensure operations become more self-reliant.



***Business support systems** are also needed to ensure credit access, technical support, and training programs are available to agricultural enterprises of all sizes with specific wraparound supports.*

There should also be improvements in public and private research and development initiatives that focus on agricultural innovations, such as digital and technology skills training for farmers, offsets to the costs of farming technologies—which remain the largest barrier to adoption—and continued research on plant germplasm, substrate, and farming operations to support climate adaptation.

Other policies and regulations, including trade policies, should facilitate agricultural exports through trade agreements and market development programs to help Canadian agricultural products compete globally and protect local farmers. Interprovincial trade barriers limit the market success of several major agricultural enterprises, including livestock production and processing. Additional business support systems are also needed to ensure credit access, technical support, and training programs are available to agricultural enterprises of all sizes with specific wraparound supports—such as flexible and or hybrid learning, fee waivers, tailored education programs to cultural contexts, and mental health services—for Indigenous Peoples and equity-deserving groups to participate.

Data collection systems

There should be robust data systems that capture comprehensive agricultural sector participation information, with a focus on interpreting disaggregated data. Data on factors such as gender, age, income level, farm scale, crop type, and geographic location, among others, can inform more targeted interventions. Additionally, a focus on regional differences in agricultural operations is needed as community context often determines adoption differences among enterprises led by Indigenous Peoples, in remote communities, or by equity-deserving groups. Data on agricultural sector participation and outcomes can help effective evidence-based policy making and program design that can address the diverse needs of all agricultural stakeholders.

Infrastructure investment

Canada's current infrastructure requires development to support modern agricultural entrepreneurship, especially in rural areas, which relies on Internet and broadband access to fully leverage the market transformation capacity of agricultural technologies. Strategic investments in transportation infrastructure are essential to facilitate the connection between rural production areas and urban markets. Government initiatives have begun to rectify

regional discrepancies in reliable, high-speed broadband Internet coverage across rural and urban regions, but stark discrepancies in consistent and high-quality access exist for diverse agricultural stakeholders. Infrastructure access is fundamental to modern agriculture, from farming technologies and supply chain management systems, as well as e-commerce platforms that enable export market participation. Infrastructure investment can provide agricultural entrepreneurs with access to broader markets, support improved access to advance on-farm or operation technologies, and generate global market competitiveness for Canadian agriculture and agri-food businesses.

Stereotypes and public perceptions

Embedded cultural and institutional perceptions are preventing new workers from entering Canadian agriculture and agri-food industries, which are exacerbated by low knowledge of the sector and gendered or racialized stereotypes, for example, that Canadian farmers are white men, and all others are gardeners. Intervention is needed to challenge stereotypes, showcase representation in the sector and potential career pathways, while celebrating agricultural entrepreneurial successes. The current dominant view of agriculture (e.g., traditional farming stereotypes) must shift to recognize it as a dynamic, technology-driven, and highly entrepreneurial sector; perceptions must shift to include a view where women run urban and highly-technical agricultural systems—like remote harvesting in controlled environments—women-led rural operations generate more job opportunities compared to their men counterparts, and Indigenous Peoples lead in sustainable agriculture techniques. National awareness campaigns are needed to highlight agricultural innovation; strategic media coverage can celebrate diverse entrepreneurial success stories (i.e., those belonging to women, Indigenous peoples, and newcomers) within the sector.

Immigration policies

Immigration policies for agricultural workers should include a greater range of agriculture skills— from manual labour to specialized and technical knowledge —to break dependence on TFWs for non-specialized positions; leveraging pre-existing competencies and sector-specific knowledge of qualified newcomers through broader recognition can help address talent gaps in the industry. A recent Statistics Canada report focused on TFWs whose first employment was in primary agriculture and who entered the sector between 2005 and 2020, revealed that most TFWs who entered primary agriculture left the sector after receiving permanent residency. One year after permanent residency admission, one-half of former TFWs or less stayed in the sector; five years after permanent residency admission, around one-fifth were still employed in the sector and more than 60% had moved to another industry.[157]

The Rural and Northern Immigration Pilot is an immigration policy that admitted 2,855 people in 2023, but there is no public breakdown specifying how many of those entered Canada for employment in agriculture specifically.[158] Therefore, immigration policies should focus on attracting skilled experts in the field, including agriculture managers, technology experts, data analysts, and agriculture engineers who can drive change and improve the sector's sustainability. The Agri-Food Pilot[159] is a new program focused on farm workers and supervisors. There were 1,565 people (690 women and 875 men) admitted to Canada through the Agri-Food Pilot in 2023.[160] The Agri-Food Pilot ended on May 14, 2025, and is no longer accepting applications.

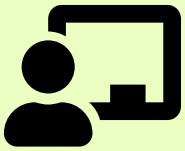
Comprehensive skills strategies

Agriculture education and skills development must be strategically implemented across multiple educational levels and age groups. Early exposure to farming and modern agriculture should begin in K–12 education through integrated curricula and hands-on experiential learning opportunities. At the post-secondary level, multiple pathways should be created to help students gain agriculture entrepreneurship competencies beyond traditional agriculture programs. Work-integrated learning programs show success in improving post-program employment and earning. Case studies and internship opportunities in agriculture can also be integrated into entrepreneurship, business, and technology programs. Courses and faculty

exchange programs can combine agriculture with business curricula, engineering, natural sciences and biomedical sciences, as well as computer science.

In the context of immigrants and newcomers, specialized pathways must be developed to help them gain exposure and skills in Canadian agriculture systems. Pathways should include pre-arrival programs, mentorship initiatives that connect newcomers with Canadian agriculture entrepreneurs, and improved funding opportunities to ensure that immigrants can participate in work-integrated learning programs as well as internship and apprenticeship programs.

Skills development initiatives must extend beyond prospective workers, and should include comprehensive training for decision makers to support women, Indigenous Peoples, racialized people, and newcomers in agricultural business (drawing on some of the feedback provided by women farmers, etc.) throughout the agriculture ecosystem. These can include EDI and unconscious bias training and cultural- and trauma-informed approaches.



Skills development initiatives *must extend beyond prospective workers, and should include comprehensive training for decision makers to support women, Indigenous Peoples, racialized people, and newcomers in agricultural business.*

Comprehensive competency framework

A comprehensive, culturally responsive competency framework should be developed that identifies the core knowledge, skills, and attitudes required to succeed across the stages of the agribusiness cycle, such as inputs and equipment, processing, distribution, marketing, and sales. The framework must incorporate culturally responsive approaches, including Indigenous knowledge systems, land-based learning, trauma-informed pedagogy, and support for navigating systemic barriers. The framework should also include a design guide for wraparound supports, covering child care, elder mentorship, mental health support, peer networks, and flexible learning options. This ensures that training is not only technically sound, but also accessible and responsive to the lived realities of Indigenous Peoples, women, and immigrant participants.

Appendix

Table 1

Agriculture competency frameworks

Title	Description
TIAH Capability Framework (United Kingdom)	The Institute for Agriculture and Horticulture (TIAH)'s framework outlines core competencies relevant to everyone working in the agriculture industry. It covers six main areas: business, environment, health and safety, leadership, people, and technical operations.
CABI Skills Framework for Agriculture (International)	The Centre for Agriculture and Bioscience International (CABI) uses this framework as a foundation for its courses and certifications. It is designed to assess skills gaps, plan training, create job descriptions, and guide individuals on career pathways. The Skills Framework for Agriculture is becoming the globally standard for the skills and competencies for the agricultural world. Many occupations in the agricultural sector are within its scope, including: smallholder farmer, extension worker, agronomist, agricultural input supplier, and farm equipment supplier.
Agriculture and Agri-Food Canada: Priorities & Responsibilities (Canada)	While not a formal competency framework document listing specific skills per role, Agriculture and Agri-Food Canada's strategic plans and departmental results outline core responsibilities and priority areas for the Canadian sector. These implicitly define areas where competencies are crucial, such as sustainable agriculture, science and innovation, domestic and international markets, and sector risk management.
Transferable Skills Checklist for Farmers (U.S. - Wisconsin Extension)	This checklist helps farmers identify the wide range of transferable skills acquired through farming and is useful for career transitions or planning. It covers areas like livestock management, crop production, equipment operation and maintenance, financial management, and marketing. While not a formal framework, it offers a detailed list of practical competencies.
Competency Framework for Agriculture & Agritech: Empowering the Future of Farming (India)	This framework outlines the essential skills, knowledge, and abilities required for various roles within the sector. It provides a common language and sets of expectations for professionals, ensuring consistency and clarity across the industry.

Title	Description
CRS SMART Skills Competency Model (U.S.)	Catholic Relief Services (CRS)'s SMART Skills Competency Model includes competencies in six core technical areas of agriculture and livelihoods programming: organization; natural resources management and climate-risk management, including innovation; livestock production; finance; agricultural marketing; and off-farm business.
Exploring Entrepreneurial Skills and Competencies in Farm Tourism (England)	The aim of this paper is to explore the range of skills and competencies that farmers in northwest England identify as important when adopting a diversification strategy to farm tourism. The findings indicate that, while a range of managerial skills are valued by farmers, they lack many of the additional business and entrepreneurial competencies required for success. This paper also acknowledges two key needs: to generate consensus on the requisite skill set for farm tourism operators; and to address gaps in the rural tourism literature by recognizing the role of rural entrepreneurship and the characteristics of successful farmers and farm tourism ventures.
Farmer Organisations (FOs) Business Skills Training and Coaching (Germany)	The Farmer Organisations' Cycle Training and Coaching methodology builds upon a model developed by GIZ Malawi and draws substantial inspiration from recognized GIZ methodologies such as Farmer Business School, Cooperative Business School, Module d'Affaires d'OPA, and SME Business Training and Coaching Loop.
Agrientrepreneurship Key Competencies: A Scoping Review (U.S.)	This study identifies the key competencies of agri-entrepreneurship education and research through a scoping review. A total of 10 themes were found among 76 articles. The themes are: business skills, characteristics, social skills, knowledge, communication skills, external support, other skills, agricultural skills, values, and background. Business skills were the most popular, indicating an assumption that agri-entrepreneurs need more capacity in this field.
Competency-Based Framework For Agriculture Supervisor (Bhutan)	The Competency-Based Framework focuses on the highly interrelated attributes—mainly the knowledge, skills, and abilities—essential for agriculture supervisors to achieve a high level of professional competence and deliver the standard agricultural services.

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