

Overview of the Canadian Public Agricultural Extension and Advisory Service

Dr. Derek Brewin, University of Manitoba, Dr. Ataharul Chowdhury, University of Guelph, Tracy Kittilsen, P. Ag., Dalhousie University

There is no coordinated university or national government-led extension service in Canada. Stemming from constitutional responsibilities, publicly supported extension services have mainly been the domain of the individual provinces without federal government directives. However, both universities and federal research stations have taken a role in the past. The history of extension services is deeply rooted in a myriad of modalities and delivery by many actors. These include schools of agriculture, federally funded research farms, and provincial and federal public service agencies. The elements of the system have evolved over the years to be interwoven into the fabric of many agricultural organizations, both public and private. This chapter outlines several uniquely Canadian features of agricultural advisory services, including its origins and evolution, the role of various stakeholders, and future opportunities.

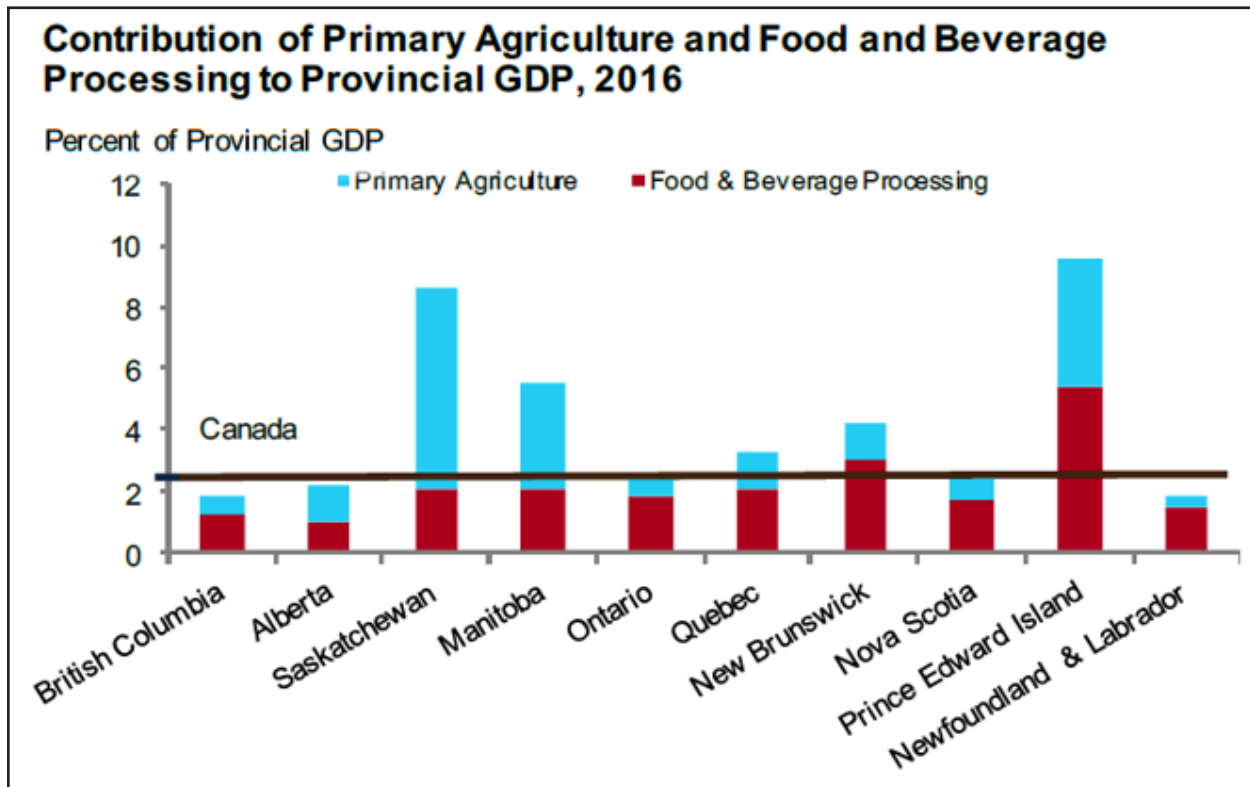
1.0 Importance of Agriculture in the Canadian Economy

Agriculture is an important source of national income and employment in Canada. In their last major overview of the sector, Agriculture and Agri-Food Canada estimated that 7.4% of Canada's Gross Domestic Product was supplied by agriculture, food production, and related services (AAFC, 2020). An estimated 2.3 million people (roughly 11% of Canada's laborforce) worked on 193,492 farms or firms supplying inputs to farms, or firms processing primary production or in food retail and food service.

The allocation of farms and cultivated land varies significantly across the 10 Canadian provinces and three territories. The bulk of Canada's arable land is situated in the three prairie provinces of Alberta, Saskatchewan, and Manitoba (Stats Canada, Census 2016). However, there is substantial agricultural production in Canada's more urban provinces of Ontario and Quebec. Prince Edward Island, Canada's smallest province in size, receives 10% of its GDP from agriculture and food processing. Figure 1 shows the relative importance of agriculture to each of Canada's provinces. There is also a small amount of agricultural production and/or food processing in all three of Canada's northern territories.

The sizes of farms in Canada have been increasing for generations. The use of extension services is much lower on smaller farms (revenue of \$25,000 to \$99,000), with only 24% of farms reporting the service of third parties to be an important factor when preparing to adopt innovation. This contrasts with 61% of larger farms (\$1,000,000+) in Canada (Agriculture and Agri-Food Canada, 2016). From 1961 to 2016, the total number of agricultural operations dropped from 480,000 to 193,500, or a 60% decrease. Meanwhile, the total acreage of farm area has only dropped by 8.8% in the same period, indicating that farm operations are getting larger (Statistics Canada, 2016).

Figure 1
The importance of Agriculture by Province in Canada



Source: AAFC, 2018.

Economic viability continues to be a challenge for smaller farms, and the reduction in public extension services means that unconditional services are less accessible (Maynard & Nault, 2005). Currently, provinces with significant agricultural production have civil servants assigned to extend useful agricultural information for farmers related to the types of farms and crops produced in their province. Provincial roles in agricultural programming differ according to their natural endowments.

2.0 History of Agricultural Extension Service in Canada

The early definition of extension focused on information dissemination that supported rational decision-making, mainly by farmers (Swanson and Clarr, 1984; van den Van and Hawkins, 1996; Franz, 2007). Leeuwis and van den Ban (2004) defined agricultural extension as "a series of professional communicative interventions amid related interactions that are meant, among others, to develop and/or induce novel patterns of coordination and adjustment between people, technical devices and natural phenomena, in a direction that supposedly helps to resolve problematic situations, which may be defined differently by different actors." When the Federation of Canada was formed in 1867, education—including the education of farmers—was clearly defined as a provincial role and not a federal focus (Justice Canada, 2021). In most cases, the early role of extension was directly connected to activities with early schools of agriculture, although that changed over time. For example, the agricultural representative (Ag Rep) service was established in Ontario in 1907 as an activity where agricultural students were placed in secondary schools, across the province creating a link between farmers, the agricultural school, and the provincial government. This idea was eventually adopted across the country. In another example, in Manitoba, the former Manitoba Agricultural College organized "Better Farming Trains," which moved throughout the province to provide demonstrations and consultations to farmers (Steppler & Switzer, 2014).

Rivera (1998) linked the history of agricultural extension in Canada to many prominent adult education movements such as the Women's Institute, 4-H, and the United Farmers of Canada. The first agricultural schools to train farmers were established in Quebec (1670) followed by the first English-speaking schools in Ontario in 1874 and Nova Scotia in 1885 (Steppler & Switzer, 2014). Blackburn (1994) discusses accounts of extension in Canada back to as early as 1606 when experimental seed plots were established at Port Royal, Nova Scotia in an attempt to transfer European Farming methods to First Nations communities. He also traces the hiring of the first extension staff to 1906 in Ontario and discusses that the Canadian system has been heavily influenced by the Cooperative Extension System in the USA. There are long-standing relationships in border provinces and states, such as collaborative research in the wild blueberry industry near the coasts and wheat research in North Dakota and Manitoba.

Of note is the development of extension services across the country were not inclusive of Indigenous communities, and that providing direct extension support to First Nations was neglected across the country, even though the Indigenous people kept many of the first European settlers alive (Hambly, 2020). There were other farming rules imposed on the First Nation reserves created by the Colonial settlers and the establishment of an agricultural school for the First nations at Rice Lake near Peterborough, in Ontario in 1836. Hambly (2020) argues that these historical initiatives related to agricultural extension were intended to destabilize indigenous communities' food sovereignty and to create dependency on the settler economy. Most of the numbered treaties that allowed for an expansion of European settlement, mentioned provisions for agricultural development. Hambly (2020) stated, referring to the confederation constitution (1867), that agricultural development was the shared responsibility of the federal and provincial government in Canada. In this setting Canada was created as a commonwealth federation of provinces. The federation also addressed regional differences, especially in French-speaking Quebec and the emerging western territories.

"In each Province the Legislature may make Laws in relation to Agriculture in the Province, and to Immigration into the Province; and it is hereby declared that the Parliament of Canada may from Time to Time Make Laws in relation to Agriculture in all or any of the Provinces, and to Immigration into all or any of the Provinces; and any Law of the Legislature of a Province relative to Agriculture or to Immigration shall have effect in and for the Province as long and as far as it is not repugnant to any Act of the Parliament of Canada." (British North America Act, 1867)

Although education was not constitutionally a federal responsibility, agricultural extension was a central role of the federal Experimental Farm Stations Act of 1887. Federally controlled research stations were built to provide locally specific agricultural advice to help recruit and retain immigrants as farmland in Canada was being made available to immigrants (Hedley, 2015). Canada still has 21 research facilities controlled by the Science and Technology Branch of AAFC. The bulk of the staff is made up of Research Scientists involved in the full spectrum of discovery research activities, with very few federal civil servants across Canada taking an extension role (Canada, 2021; GEDS, 2021). Hedley (2015) suggested the early capacity for tax revenue limited the ability of provincial governments to generate significant local agricultural research or offer much farm extension.

A second significant federal investment related to extension was the Prairie Farm Rehabilitation Administration (PFRA), created in 1935. The PFRA had a mandate to address the threat of drought and soil degradation of the dirty thirties. Although the bulk of this service was focused on water and pasture projects (Marchildon, 2009), extension regarding soil and water conservation was a major part of the activities of the staff up to the mid-1990s (Gilson and Baker, 2020). The PFRA was dissolved in 2009. One last remaining federal arm of agricultural extension resides in the Farm Credit Corporation of Canada (FCC) created in its present form in 1959. Technically a crown corporation funded by interest payments made by producers, the FCC uses significant resources to deliver online extension in financial planning and services (FCC, 2021).

Along with the establishment of federal research stations across the country, several other early provincial initiatives were launched to advance agricultural education and training (Hambly, 2020). The Ontario Veterinary College (OVC) began in 1862 followed by the Ontario Agricultural College, OAC (1874) under the Ontario Department of Agriculture. These two colleges are part of the foundation of the University of Guelph in 1964. The University of Guelph has been committed to providing agricultural extension and advisory service from its inception. The Macdonald Manual Training Fund (now known as the Macdonald Campus of McGill University in Montreal) was established in 1905.

In Atlantic Canada, the School of Agriculture was established in Nova Scotia in 1885 at the Provincial Normal School in Truro. The first provincial farm was established in 1889 at Bible Hill and the School of Horticulture was established in 1894 in the Annapolis Valley. In 1905 these three organizations merged to form the College of Agriculture, later became known as the Nova Scotia Agricultural College (NSAC). The role of the college was deeply rooted in extension. In the 1880s, talks were delivered to farm groups as part of the first extension activities in the region. During the winter, college graduates also delivered talks to farmers (Dalhousie University, 2021) <https://www.dal.ca/faculty/agriculture/about/history/our-story.html>). In 2012 the Nova Scotia Department of Agriculture relinquished the NSAC. The school then merged with Dalhousie University to become the Dalhousie Faculty of Agriculture, the newest of eight faculties of agriculture in Canada (<https://www.cfavm.ca>). Until the late 1990s, many graduates from the NSAC entered public services and held roles in extension across the country.

Table 1
Establishment of Agriculture Schools by Date

Year	School
1862	Ontario Vet College (OVC)
1874	Ontario Agricultural College (OAC)
1885	The School of Agriculture (Atlantic located in Nova Scotia)
1905	Macdonald Manual Training Fund (Macdonald Campus of McGill University)
1905	Manitoba Agricultural College
1912	Faculty of Agriculture, University of Saskatchewan
1915	Faculty of Agriculture, University of Alberta
1915	Faculty of Agriculture, University of British Columbia

Source: Stepler and Switzer (2014).

Stepler and Switzer (2014) provide an overview of the birth of the western Canadian schools of agriculture. The Manitoba Agricultural College was established in 1905, building on a foundation of a dairy school that had been part of the Manitoba Department of Agriculture since 1894. In 1924 it was then transferred to the University of Manitoba. In Saskatchewan, the Faculty of Agriculture was developed simultaneously as the university. The first classes were held in 1912. Alberta and BC followed in 1915, with the first students entering agriculture programs. Many colleges that were held within provincial departments of agriculture moved to become part of university or college systems over time.

3.0 Contemporary Practices of Agricultural Extension and Advisory Services in Canada

Canada's public agricultural extension and advisory services have been developed less consistently and pervasively than in the USA (Milburn et al., 2010). As a result, public support for agricultural extension, including funding and services, was drastically cut at the beginning of the 21st century (Maynard & Nault, 2005). By 1985, there were over 1,000 professional staff and nearly 4,000 support staff in federal research and demon-

station farms across Canada (Hambly, 2020). As per Davis et al. (2020), there were 978 federal agricultural advisory professionals in 1981, which was reduced to 380 in 1991. Indeed, the federal withdrawal occurred with little documentation or press and was deemed to have “disappeared with a ‘whimper’, rather than a ‘bang’” (Milburn et al., 2010). This withdrawal was also observed by those involved in the larger provincial extension efforts. Unfortunately, the authors could find no institutional data to measure the provincial withdrawal.

Gosselin (2009), using Alberta as an example, describes the change in structure and delivery of the extension service over time. Starting in the 1960s, extension staff were decentralized and regional offices were established to offer programming including farm visits, tours, and field days to the community. In the 1990s, because of policy change and attempts to reduce government budgets, the extension service was diminished with closing of offices and the re-centralization of staff. Further “efficiency” was found by the hiring and sharing of specialists, and the delivery of extension services using new methods such as call centers. The reduction can also be attributed to policymakers’ views of extension and farming. Small-scale farms were struggling, and the view of extension was that of an outdated system. This was echoed by industry, who felt the extension services were obsolete and not adding real value as farms became more advanced and business-focused. These factors, combined with a downturn in the economy during the 1990s contributed to the erosion of what was left of the extension system’s structure. These trends can be extrapolated across the nation.

Milburn continues to note that extension services were seen as outdated and commodity-oriented, leading to a lack of funding and support (p.2). Hambly has argued that these changes did not lead to the disappearance of advisory services in Canada but redirected them in two ways: a) technology “pull” or demand-driven, and to a lesser extent “push” or supply-driven advisory services in the private and provincial public sectors and b) capacities at the individual, organizational, and network-system levels that transitioned agricultural extension toward communications and media (e.g., advocacy and campaign) as well as learning (non-formal, adult education). Thus, agricultural advisory services have shifted toward agri-business advisory and training services operated by the private sector, on the one hand, and more holistic, community-based projects in the not-for-profit sector, on the other hand (Hambly, 2020; AIC, 2018).

Canada’s extension audiences are primarily producers, future producers, including students, and commodity groups (Blackburn 1994). As mentioned, the decline in support and funding for public agricultural advisory services in Canada has created a situation in which various other actors, such as producer organizations, private consultants, input dealers, have intervened to fill the gaps in Ontario (Hambly, 2020). Canadian provincial and federal governments started allocating financial support for agricultural research and extension based on the return on investments (ROI). As extension usually has less immediate tangible outcomes and rising costs associated with public extension programmes resulted in decreased support from federal and provincial governments. In turn, the role of the agricultural extension advisor experienced a shift towards agri-business advisory and training services operated by the private sector (Hambly, 2020; AIC, 2018). Indeed, this has led to the system’s transformation into what is best defined as a pluralistic system of extension. Pluralistic advisory services in agriculture are characterized as an extension system in which multiple public and private providers with diverse funding streams provide services to farmers and agricultural communities (Birner et al., 2009).

While provincial governments remain important stakeholders of agricultural extension service, their ability to influence the uptake of new technologies has been reduced (Chowdhury et al., 2021). Commodity organizations and private sector advisors, such as certified advisory agents, veterinarians, and feed companies, are all seen as holding more ability to influence decisions around technology adoption on-farm (Chowdhury et al., 2021a & 2021b; Allen, 2021). Although there might be some variations in the speed of transformation, actors, and structure at the provincial level, there is a common trend of the rise of new and diverse

agricultural advisory actors (See Appendix: Table of Organization). Pluralistic systems have many advantages to incorporate diversities of services. However, it provides enormous challenges for the coordination of the initiatives of various agricultural advisory actors (Chowdhury et al., 2021a and 2021b).

Provincial responses to the need for coordination vary. For example, in Nova Scotia, with gross farm receipts of \$639.8 million (Statistics Canada, 2017) there is a novel advisory system in place. The Nova Scotia Department of Agriculture in the Agriculture and Food Operations branch delivers general extension services in production, rural leadership, and land protection and programming for youth from K-12. Specialized advisory services are provided in the areas of knowledge translation and transfer (KTT), plant and animal protection, lab services and food inspection, meat inspection, animal welfare, bees, weeds, and pests. The Nova Scotia Department of Agriculture also supports Perennia, a provincial development agency. Perennia provides a vast array of specialized services to the agriculture and seafood industries. These services include but are not limited to, specific crop production and research advice, research services around innovation, and support to increase the industry's competitiveness. Provincial funding accounts for approximately 40% of the organization's revenue stream, the remainder derived from consulting fees, research, and training. (Perennia, 2020).

In other provinces, such as Ontario, the terms extension and advisory services have been replaced by the label of knowledge translation and transfer (KTT). With KTT, which originates from public health, or knowledge mobilization (KM), the field of agricultural extension becomes ever more complicated and obscure (Hambly, 2020). The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph have long been collaborating on a unique provincial partnership to advance research and innovation that contributes to the success of the province's agri-food sector and promotes rural economic development. The partnership was last renewed in 2018 for another ten years in which the province would invest \$713 million to support Ontario's agri-food sector. In this partnership, KTT processes are embedded into research projects and seek to incorporate extension services, despite some notable differences to KTT (Ontario Agri-Food Innovation Alliance, 2018). Proponents of KTT claim that the discontinuation of the term 'extension' does not mean services or targets have been changed; instead, it can now be seen as practiced and continued under different guises (Hambly, 2020).

At the federal level, multi-year commitments of support to agricultural extension have been ongoing. Most recently, a \$3 billion-dollar Canadian Agriculture Partnership (CAP) was agreed upon in 2018 based on investments by federal, provincial, and territorial (FPT) governments to strengthen and grow Canada's agriculture and agri-food sector. In these cost-shared programs, provinces and territories offer extension services delivered directly by the provincial government and provide financial support to improve production practices, including to access private-sector delivered agronomic services. The proAction initiative by the Dairy Farmers of Ontario is an example of the extension-related KTT activities supported by CAP. This specific method of KTT utilizes the 'train the trainer' approach by providing education for 128 veterinarians across Ontario to become proAction advisors, later holding their own workshops with dairy farmers and other producers (Dairy Farmers of Ontario, 2021).

In CAP, principles of extension are mentioned and espoused. However, the distinction is made that they are pursuing knowledge transfer, education, and communication with producers. The change in terminology remains evident with most private sector organizations. In addition, the CAP itself parallels these changes as both the Agri-Innovate and AgriDiversity programs emphasize components of knowledge transfer, with no direct mention of agricultural extension (Agriculture and Agri-Food Canada, 2018). While OMAFRA manages the CAP within Ontario, it can be best understood as a supporting program to private initiatives, further demonstrating the waning role of the public sector.

3.1 Funding, Approaches, and Methods of Extension and Advisory Services

Alston et al. (2000) provided a meta-analysis of the returns to investment for research and extension, suggesting an average of 65%, and for extension alone, the average returns were around 80%. This is a remarkable rate of return compared to current deposit rates. But the process has lagged due to research time and adoption, so it experiences large upfront costs followed by very large benefits. The returns were high enough in non-public areas to attract private investments in agricultural advisory services globally. Once considered to be mainly a public good (See Davis et al., 2020), significant aspects of agricultural advisory services have been taken on by various private-sector agri-business firms, particularly in the industrialized countries including Canada (Figure 3). Canada has seen a similar type of privatization as seen in Australia, with some continuation of public funding for extension. However, there are some provincial variations, for example, half of Quebec's agrologists work in the private sector, while the government still leads the delivery of agricultural extension services in Saskatchewan according to Canada's main agricultural accreditation bodies (AIC, 2018).

More recently, Hurley, et al. (2015) calculated the internal rate of returns for agricultural research and extension based on various studies conducted to evaluate agricultural research and development initiatives between 1958 and 2015 (Table 2). Investments in extension received the highest median return, 46.0 percent per year, followed closely by applied R&D investments and investments in basic and applied types of R&D.

Table 2

Internal rate of returns per year for agricultural research and development (R&D)

R&D orientations	Number of observations	Average (% per year)	Median (% per year)
Basic research	16	42.9	29.8
Applied research	208	139.5	43.5
Extension	20	72.2	46

Source: Hurley et al. (2016)

A recent study in Ontario (Chowdhury et al., 2021a and 2021b) indicates that soil, crop, and livestock advisory services are supported by a range of funding sources, such as direct funding from provincial and federal government, federal/provincial partnership, and municipal support grants. A major source of funding is service tied to product sales and promotion by private sector industries. An additional avenue is from membership fees and indirect funding (e.g., charity and donation) through various organizations. Farmers also pay fees for service provided by individual consultants, such as veterinary agents and certified crop advisors.

Hambly summarized Canada's contemporary agricultural extension and advisory services as being characterized by three major approaches. The first, Agricultural performance, focuses on advisory and financial support to start new agricultural ventures (Hambly, 2020). Examples of this approach include Agri-Innovation Program Stream B: Research, Development and Knowledge Transfer (AAFC, 2017) and CAP (AAFC, 2018). The second approach is rural and community capacity development. In this approach, rural and co-operative development projects allowed recipients to leverage significant funding from other sources. This approach includes the Canadian Rural Partnership Initiative and Canadian Co-operative Development Initiative. The third approach is networked information and non-formal education. In this approach, citizen-centered responsive programs and services allow the federal government department, AAFC, to deal directly with the public in various ways (electronic and in-person visits).

As the agricultural extension and advisory services went under various structural transformations described above, the methods and tools of service delivery evolved over the years. A general trend is to move from one-to-one, such as in-person contact to one-to-many and many-to-many (e.g., various group and train the trainer methods) with the adoption of online and electronic forms of delivery (Chowdhury et al, 2021a and 2021b, Hambly, 2020). Some common methods used for extension and advisory services include the following:

- One-to-one meeting
- Tours/Demonstration
- Workshop/Panels/Regional Information days
- Peer-to-peer learning, such as focus Farm (Roche, 2014)
- Social media, website, and listserv emails
- Call centers
- Print publication, e.g. newsletter, farm magazine, factsheets, etc.
- Trade shows

3.2 Sectoral Focus

Agricultural and advisory services focus on the service needs of various sub-sectors of agriculture (See Appendix). The major sectors are crop and soil, livestock, environment, and conservation. There are some differences in service deliveries in various sectors. For example, in Ontario, the livestock sector relies more highly on a fee-based advisory service than the soil and crop sector (Chowdhury et al, 2021a and 2021b). Also, the type of organizations and service providers differ from one sector to another. For example, in addition to provincially funded staff members providing extension service to farmers across the country, many other organizations, non-profits, and others, have an extension mandate and provide service for the public good to various audiences.

3.3 Extension Service Providers Focusing on Youth

3.3.1 4-H Canada (age 6-25)

In Canada, there are 23,000 youth members and 8,700 volunteers in 1,800 clubs. 4-H members still participate in special projects to develop skills, but the overall program has a broader focus. The 4-H Canada website states:

“Together with our partners, we offer innovative, youth-centered programs that provide meaningful, positive experiences designed to build confidence, positive self-identity, self-esteem, and a sense of achievement.”

Early 4-H programs were linked closely with provincial departments of agriculture, with public servants providing much of the programming content and expertise (<https://4-hontario.ca/about-4-h/history>). Starting in the 1990s, provincial governments started to remove themselves from directly supporting and staffing 4-H, therefore 4-H had to develop a model to operate independently. Although some funding comes from various provinces, most funds are realized from member sponsorship, fees, fundraising, and endowment building. 4-H Canada lists the Federal Government, Farm Credit Canada, and RBC as their main supporting partners at the national level. Others listed, such as BASF, CN, and Syngenta are lead partners on key initiatives

(<https://4-h-canada.ca/about/partners>). Of note is that expertise, extension, education, and materials may be sourced from within the 4-H organizations and their partners, and not necessarily from provincial extension agents as in the past.

3.3.2 Agriculture in the Classroom (AIRC) (Grade K–12)

From their website, AIRC identifies as the “national voice for agricultural education” (<https://airc-canada.ca/en-ca/who-we-are/about-us>). AIRC is a charitable organization with provincial branches across the country that helps students understand and appreciate the agricultural industry. With a clear extension mandate - geared toward elementary and secondary students, AIRC promotes the industry and food systems and provides teaching tools, curriculum, and other resources to teachers and students. AIRC partners with many organizations across the country to enable students to see farming and agriculture as a viable career choice. Programming includes curriculum and resources for teachers, outreach programs, conferences, and at-home study of agriculture, including factsheets, among other items. AIRC also provides access to “thinkAG” which is an online career decision-making tool focused on ag careers (<https://thinkag.ca/en-ca/about-thinkag>)

Funding models for the provincial organizations vary across the country, either as part of provincial departments of agriculture (delivered by public employees) or delivered by an agricultural non-profit industry association.

3.3.3 Canadian Young Farmers’ Forum (CYFF) (Age 18–40)

The Canadian Young Farmers’ Forum (CYFF) was established in 1997 to support young Canadian agriculture producers of every commodity, across Canada. The organization's main goal is to provide information and encourage the exchange of ideas to ensure the success of the agricultural industry. CYFF’s main functions are to promote networking, education, leadership training, agricultural awareness, and funding to support capacity building of its’ members (<https://cyff.ca/>).

CYFF provides support and guidance to 11 provincial young farmers’ associations across the country. Funding is secured through the sale of memberships to young farmers, alumni farmers, and industry partners as well as through the Canadian Agricultural Partnership (CAP) Program and the federal government of Canada.

3.4 Colleges and Universities

As previously mentioned, colleges and universities were at the heart of early extension efforts in Canada. Over time, the decentralization of extension services across universities has happened both because of need and necessity. Some programming is being offered in concert with research activities and some semblance of extension programming is left either to continuing education units, departments, or faculties. University continuing education is the term used, mainly in North America, and other parts of the world, to refer to the administrative division within many universities which offers courses and programs, usually to persons at a distance from the university... “continuing education” implies that many of the students are casual and enrolled in time part-time courses. (English & Mayo, 2012)

Much like the extension paradigm, the current reality of continuing education is one of constant organizational and economic challenges and changes, including institutional restructuring, financial restrictions, and the growing expectation of revenue generation and on-demand programming (McRae, 2012). Topics related to extension and advisory services are offered in various forms by the college or university, including:

- Workshops and field days presented by researchers and institutes
- Short courses (f2f hybrid, online)

- Professional certificates. Credentialing CEU's
- Competency-based programming
- Micro Credentialing
- Apprenticeship programs
- Diploma and Degree programming

As per Hambly (2020), among 22 universities offering agriculture and related degrees, only two universities, the University of Saskatchewan and the University of Guelph offer a graduate degree related to agricultural extension. The MSc in Capacity Development and Extension at the University of Guelph is the only degree in which components of agricultural extension education are emphasized. Eight universities that offer agricultural economics undergraduate degrees. Seven of these schools also offer graduate-level degrees (Masters and PhD). The elements of agricultural extension are incorporated in several other degrees across Canadian universities, such as a Ph.D. in Rural Sociology (Brandon University), Ph.D. in Rural Studies (University of Guelph), and communication and technology (University of Alberta). According to Hambly (2020), seven non-agriculture certificate and degree training programs incorporate agricultural extension education components under names such as, “technical and scientific communication” (Dalhousie University undergraduate certificate), “science, technology, and society” (16 universities), “systems science and theory” (graduate programs at Trent University and University of Ottawa) and “community organization and advocacy” within schools of public administration (12 universities primarily offering certificates and undergraduate studies).

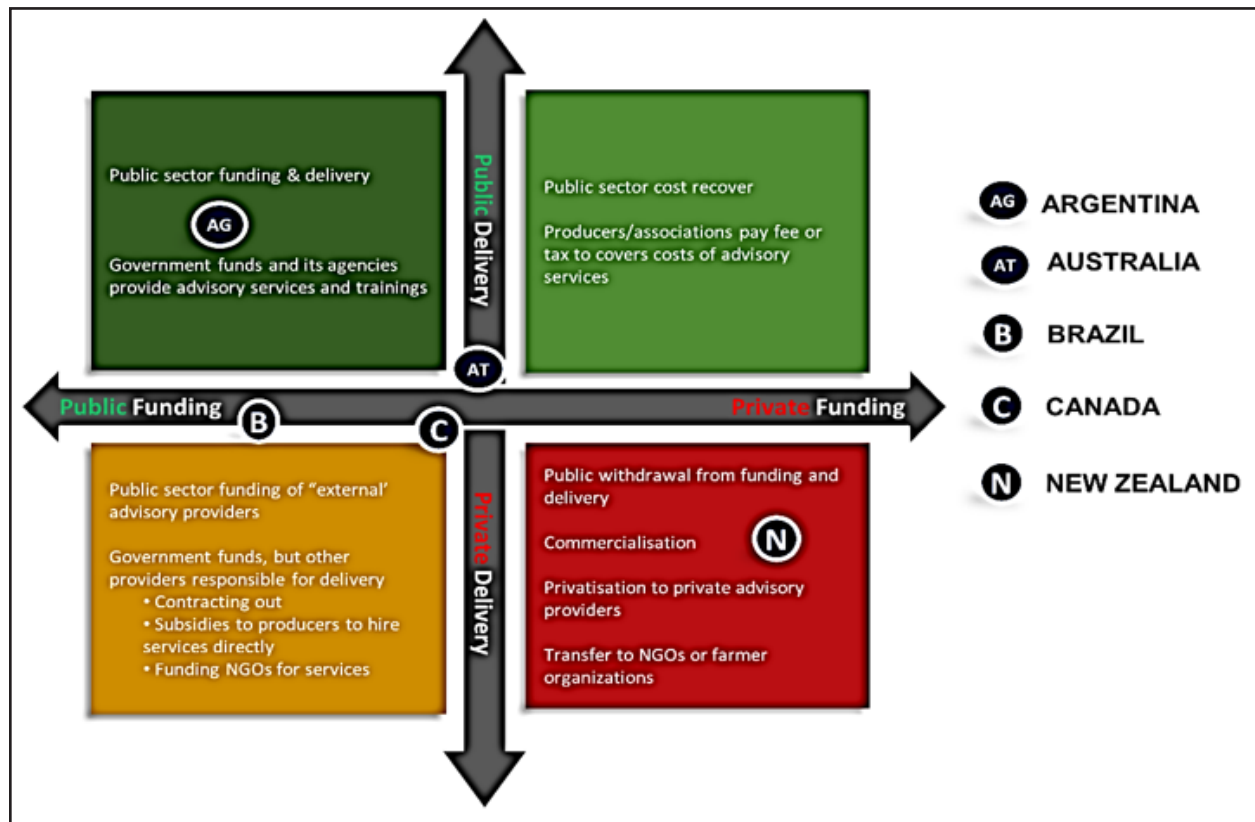
Several colleges across the country offer diploma and degree programming and advanced professional development in agriculture. Some of these include Lakeland College and Olds College in Alberta, CEGEP programs in Quebec, and other provincial community college systems. These schools are members of the Canadian Association of Diploma and Agriculture Programs (CADAP) (<http://cadap-apdac.ca/>).

3.5 Non-Profit and Commodity Associations

Non-profits and commodity boards play a significant role in the provision of agricultural extension and advisory services across the country. There are various non-profits, ranging from producer, market, cooperative, and charitable organizations. These organizations collaborate with academic, provincial, and federal partners on various funding schemes and implement various extension and advisory projects such as research projects, conferences, and speaker sessions. Many organizations also employ staff to support group and individual advisory services to their members. The types of organizations, and description of their services are presented in Appendix Table.

Figure 3

Delivery and funding alternatives of agricultural advisory services (Modified from Turner et al, 2021, and based on AIC, 2018 and author's judgment)



Source: Modified from Turner et al (2021), ad based on AIC, 2018 and author's judgment.

3.6 Professionalism of Advisory Service

Agrologists Agronomes Canada (AAC) (2021) oversees the profession of agrology in Canada and consists of nine provincial regulators. The two main initiatives of this organization are to improve labor mobility to assist in the movement of professionals between provinces and to promote the role of agrology and agrology professionals in Canada. AAC only oversees the Professional Agrologist (P. Ag.) and associated designations such as Technical Agrologist (T. Ag.) and Articling Agrologist (AIT, A. Ag.).

The Government of Canada uses a National Occupation Classification (NOC) system to classify jobs based on skills and duties. This system provides a repository of linked labor market information including wage rates, education levels, and job prospects (Government of Canada, 2021). Agrologists (NOC 2123) are defined as:

Agricultural representatives, consultants, and specialists who provide assistance and advice to farmers on all aspects of farm management, cultivation, fertilization, harvesting, soil erosion and composition, disease prevention, nutrition, crop rotation, and marketing. They are employed by businesses, institutions and governments that assist the farming community, or they may be self-employed.


Government of Canada, 2021. (<https://www.jobbank.gc.ca/marketreport/requirements/15315/ca>),

In an occupation report by the Ottawa Employment Hub (2019) there was a prediction of a 19.5% increase in the number of agrologist jobs across Canada by 2021. Data from the Government of Canada (2021) indicates

there were 26,300 working in this profession in 2018. Prospects for this growth vary across the country with Alberta, New Brunswick, and Saskatchewan showing good opportunities for growth. Quebec, Manitoba, and Ontario are rated as fair with the remaining provinces and territories undetermined. As of August 10, 2021, there were 53 vacant jobs available in Canada with the majority being posted in Saskatchewan (<https://www.jobbank.gc.ca/marketreport/requirements/15315/ca>).

AAC (Table 3) data highlights that the actual number of agrologists registered with the various provincial regulators, and practicing agrology is less than what is indicated in the labour market data. Comparing the 2018 Labour market data shows 26,300 in the national classification compared with only 9,884 registered as agrology professionals (AAC, 2021). It can be concluded that the occupational data includes both professional agrologists and others working in the field of agrology, but not necessarily registered, or eligible to register, as professional agrologists.

Table 3
Registered Agrology Professionals—by Province (Weir, 2021)

						
Registered agrology professionals – by Province (Information provided to AAC by provincial regulators)						
Institute (regulator)	2015	2016	2017	2018	2019	2020
Alberta Institute of Agrologists ¹	2,562	2,552	2,609	2,533	2690 ¹	2595 ¹
British Columbia Institute of Agrologists ²	1,198	1246 ²	1293 ²	1,379	1,418	1,466
Manitoba Institute of Agrologists	660	649	635	685	678	657
New Brunswick Institute of Agrologists	140	136	128	119	118	110
Newfoundland & Labrador Institute of Agrologists	30	30	30	30	30	30
Nova Scotia Institute of Agrologists	235	219	208	182	175	176
Ontario Institute of Agrologists	308	270	256	247	230	235
Ordre des Agronomes du Quebec	3,118	3,087	3,021	3,027	3,049	3,048
Prince Edward Island Institute of Agrologists	67	66	79	90	90	86
Saskatchewan Institute of Agrologists	1,341	1,365	1,459	1,592	1,440	1,759
Total	9,659	9,620	9,718	9,884	9,918	10,162
Figures represent agrology professionals registered with and under the regulatory control of the provincial body regulating agrologists (the Institutes). Data submitted by provincial Institutes (regulators) either represents membership as at the organization's financial year-end or data following its annual registration renewal process to 2017. Beginning in 2018, all data is as at the organization's financial year-end.						
¹ Terminated membership in May 2019. Information obtained from AIA 2020 annual report ² Withdrew from membership in 2015, re-joined in 2018. Information obtained from BCIA 2020 annual report						

Source: Weir (2021).

3.7 International Collaboration on Extension and Advisory Service

Agri-food schools at various universities are involved in various international partnerships for research and practices of agricultural extension and advisory services. This includes partnership projects, and initiatives to advance the knowledge and practices on various topics related to agricultural extension and advisory services. The initiatives receive support from the Social Science and Humanities Research Council of Canada (SSHRC), International Development Research Centre (IDRC), and Global Affairs Canada (Formerly known as Department of Foreign Affairs, Trade and Development, and Canadian International Development Agency). Canada has been active in its support to agricultural extension and advisory-related research and development initiatives globally in collaboration with other global partners, such as World Bank, OECD, Food and Agriculture Organization, and International Fund for Agricultural Development (IFAD).

4.0 Future challenges and opportunities of agricultural extension

This report summarizes the origins and evolution of agricultural extension in Canada. As noted throughout, Canada has seen diminished public sector investment, staffing, and activity in agricultural extension over the past couple of decades—and at the same time, vibrant growth in private sector agricultural advisory services of many types. The agricultural sector is now confronted with important challenges and opportunities (climate change, changes in the structure of the farming sector, the rapid development of digital tools, etc.) that suggest the need for ever more sophisticated management of farms and other lands across the country. A comprehensive review of the public sector and private sector agricultural advisory services from the past two to three decades would be most valuable at this juncture to understand how this new institutional landscape for agricultural advisory services has served the sector. Correspondingly, a forward-looking discussion of the type of public sector support for agricultural advisory services that would be needed to meet the various challenges and opportunities facing Canadian agriculture would also be manifestly warranted.

The challenges for the future of agricultural extension and the sector are many. Climate change and consumer concerns are likely areas that could constrain the sector and challenge the industry to produce in new ways. Agricultural extension and advisory services in Canada have been experiencing trends, also observed globally, which Klerkx (2020) described as ‘plurality’ and ‘disruption’. We have discussed current pluralistic agricultural advisory services in Canada. The ‘disruption’ highlights how extension services need to adapt to changes in technologies, vision, and mission in agricultural production. To respond to the ongoing disruptions, especially along with the digitalization of agriculture and the emergence of new technologies, such as synthetic protein, aquaponics, and vertical farming, agricultural extension, and advisory services need to transform existing capacity. For example, with the progress of digitalization and SMART FARM initiatives discussed below, agricultural extension professionals find that misinformation and the complexity of contentious issues are most challenging when communicating with clientele (Klerkx et al., 2021; Leal et al., 2021). There was a recent call for developing critical digital literacy to combat misinformation in agriculture (Alam and Chowdhury, 2021).

Soon, we may have to find ways of capturing the gains from sector-wide shifts like reduced carbon emissions, improved soil management, generational transfers, or more satisfied consumers. The public goods associated with these thematic development areas may be less likely to find extension champions in the private sector. This is evident in other jurisdictions, for example, privatization does not help to ensure inclusive agricultural advisory services, especially for small and medium-scale farmers in the European Union (Labarthe & Laurent, 2013).

Apart from the above arguments, the public role in extension is well justified from the perspective of economics of the public investment. The studies above show huge gains to public agricultural extension. If

Canada is looking for a good public investment—extension is a winner. Huge payments made to compensate for climate change may be reduced with modest investments in the extension of risk mitigation strategies. AIC (2018) noted that Canadian and global benefit-cost ratios for public and private agricultural research are also reported to be high, estimated to range from 10:1 to 20:1. Therefore, Canada needs more policy engagement and attention for funding research and engagement of the public sector in delivering agricultural extension.

The private sector is also evolving. There is an emerging role for private sector advisors to help improve data collection at the farm—preeminent firms like Farmers Edge. There is a new focused energy on funding and programs to support SMART farming, data collection, analytics, and innovation. Nationally there is an initiative to support the development of “SMART FARMS” on ag campuses. Olds College established the first and is leading the organization of smart farms in Canada (<https://www.oldscollege.ca/olds-college-smart-farm/index.html>). The Canadian Agri-Food Automation and Intelligence Network (CAAIN) has \$2.9 Million to support the Pan-Canadian Smart Farm Network and is led by Olds College in Alberta and includes Glacier Farm Media Discovery Farm located at Langham, Saskatchewan and the Lakeland College Student-Managed Farm in Alberta. The Smart Farm Network intends to accelerate the development and adoption of agricultural technologies across Canada. The network will build a collaborative framework for sharing data and expertise to help farmers, industry, and developers to understand, use and implement emerging technology.

To summarize, policymakers, researchers, and practitioners need to pay more attention to how extension services can build human capacity. A strategy should be found to facilitate coordination among agricultural extension communities of practices, their diverse capacities, and values at provincial and national levels. Investment in extension can add value and capacity, providing accessible skills in challenging circumstances. Retention of core agricultural extension capacity and expertise in the public sector should therefore be a strategic objective for community stakeholders, industry, and government policymakers.

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