



OECD Rural Studies

Enhancing Rural Innovation in Canada



OECD Rural Studies

Enhancing Rural Innovation in Canada

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Note by the Republic of Türkiye

The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the “Cyprus issue”.

Note by all the European Union Member States of the OECD and the European Union

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Please cite this publication as:

OECD (2024), *Enhancing Rural Innovation in Canada*, OECD Rural Studies, OECD Publishing, Paris,
<https://doi.org/10.1787/a9919c66-en>.

ISBN 978-92-64-55048-3 (print)
ISBN 978-92-64-50226-0 (PDF)
ISBN 978-92-64-76841-3 (HTML)
ISBN 978-92-64-38862-8 (epub)

OECD Rural Studies
ISSN 2707-3416 (print)
ISSN 2707-3424 (online)

Revised version, May 2024

Details of revisions available at: https://www.oecd.org/about/publishing/Corrigendum_Enhancing_Rural_Innovation_in_Canada.pdf

Photo credits: Cover © Mumemories/iStock by Getty Images Plus.

Corrigenda to OECD publications may be found on line at: www.oecd.org/about/publishing/corrigenda.htm.

© OECD 2024

The use of this work, whether digital or print, is governed by the Terms and Conditions to be found at <https://www.oecd.org/termsandconditions>.

Foreword

According to OECD definitions of rural regions, around one in five Canadians live in Canada's rural regions, which accounts for 97.1% of total Canadian landmass and over a third (36.4%) of the OECD's overall rural regional landmass. Like most countries, rural regions have lower aggregate gross domestic product (GDP) than urban areas. Nevertheless, rural areas show signs of progress in Canada. The rural-urban income gap in 2020 was half the size it was in 2000 and, in 2019, average annual labour productivity in rural areas (116 000 GDP per worker) was higher than urban areas (112 000 GDP per worker). Inequalities in high-technology innovation between rural and metropolitan regions are also relatively low compared to OECD countries. From 2016 to 2020, the difference in average patenting intensity, measured as the number of patents per capita, between rural remote regions and metropolitan regions was 0.08 in Canada, compared to an OECD average of 0.15.

However, this largely reflects relatively poor overall national innovation performance if we use patenting as a proxy for high-technology innovation. In 2020, patenting intensity in Canada, for example, stood at only 0.09 patent applicants per 1 000 inhabitants compared to an OECD average of 0.14. Mirroring this is relatively weak investment in research and development (R&D). Canada's gross domestic expenditure on R&D was 1.7% of GDP in 2021, well below the OECD average of 2.7% and lower than its share in 2010 (1.83%). The share of firms reporting R&D investment is also weaker in rural areas (0.8% in 2018) than in urban (1.1%) areas.

While rural areas are underperforming relative to the rest of the OECD and the national average regarding high-technology innovation statistics, much of this reflects the different characteristics of firms in rural areas as well as more challenging labour supply conditions. In that sense, it is important to stress broader notions of innovation that are more pertinent to rural areas, in particular, innovation closely rooted in entrepreneurship and, in turn, policies to support the formation of new firms and scale-up of existing firms, as well as upskilling programmes for the labour force.

Strengthening rural innovation is especially important in Canada because rural regions are dually impacted by demographic change, with slower population growth and an ageing population, and climate change, with places in the Canadian Arctic warming at close to twice the global rate. There is scope to boost innovation to address these challenges, including adapting federal, provincial and territorial programmes to better support rural entrepreneurs and green innovation initiatives, calling on good practices from Indigenous knowledge and exemplary rural firms.

This report draws on lessons from similar research in other OECD countries to provide a diagnosis of rural innovation in Canada as well as policy recommendations to support it, with a particular emphasis on innovation to address climate change.

Acknowledgements

This publication was produced by the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE), led by Lamia Kamal-Chaoui, Director, as part of the programme of work of the Regional Development Policy Committee (RDPC). The OECD would like to thank the Atlantic Canada Opportunities Agency (ACOA), the Canadian Northern Economic Development Agency (CanNor), the Canada Economic Development for Quebec Regions (CED), the Federal Economic Development Agency for Southern Ontario (FedDev Ontario), the Federal Economic Development Agency for Northern Ontario (FedNor) and Prairies Economic Development Canada (PrairiesCan) for their generous financial contribution and in-kind support. The OECD would also like to thank Innovation, Science and Economic Development Canada (ISED) and Pacific Economic Development Canada (PacifiCan) for their support. Furthermore, the OECD is grateful for the co-ordination work carried out by FedDev and PacifiCan.

This publication was co-ordinated by Michelle Marshalian, Economist and Project Manager, under the supervision of Jose Enrique Garcilazo, Deputy Head. The report also greatly benefitted from valuable guidance from Nadim Ahmad, Deputy Director of the CFE. Chapter 1 was drafted by Michelle Marshalian. Chapter 2 was drafted by Michelle Marshalian, with analytical support from Jiang Beryl Li (ISED), Bassirou Gueye (Statistics Canada), Philip Chan and Maximilian Günnewig-Mönert (OECD). Chapter 3 was drafted by Michelle Marshalian and David Freshwater (external expert) with support from Tamara Krawchenko (University of Victoria, Canada). Chapter 4 was drafted by Lisanne Raderschall (previously OECD) with support from Maximilian Günnewig-Mönert (previously OECD), Alexandre Banquet, Bridget Donovan and Jolien Neils (OECD). Support for generating maps was provided by Felix Winkelmayr (OECD).

This report benefitted from valuable comments and input from the OECD Enhancing Rural Innovation academic and business expert group and from several consultations with local teams, including substantial input from colleagues at the ACOA, CanNor, CED, FedDev Ontario, FedNor and PrairiesCan, as well as colleagues from Statistics Canada, including Alessandro Alessia, Chair of the OECD Working Party for Territorial Indicators. Stéphane Pronovost (CanNor), Isis Bozzano Bae and Gareth Hitchings (FedDev Ontario) provided critical co-ordination support throughout the majority of the collaboration, and Serge Desroches and Zoé Perin-Levasseur (CED) provided support for the special issues chapter on climate. Rory Brennan and Dianna Leonardo (FedDev Ontario), Megan Foster and Christopher Knoch (PacifiCan) provided final co-ordination and comments. Marie-France Chouinard (Canadian permanent delegation to the OECD) provided continuous support for co-ordination and comments. In addition, the report benefitted from six physical consultations with local stakeholders in Emerald Park and Regina (Saskatchewan), Inuvik (Northwest Territories), Fogo Island (Newfoundland and Labrador), the Gaspé Peninsula (Quebec), Kenora and Kincardine (Ontario), as well as multiple virtual focus group consultations.

Jeanette Duboys and Roxana Glavanov prepared the manuscript for publication and Pilar Philip co-ordinated the production process. Professional editing and formatting were conducted by Eleonore Morena. Translation services in French were reviewed by Miantsa Razafindramanana (DEC).

The OECD Secretariat thanks the delegates to the RDPC for their valuable input. This work is a part of the series of reports in the OECD Enhancing Rural Innovation project. It supports the implementation of the mandate of the OECD Working Party for Rural Policy and the RDPC. The chapters of the report were formally approved by written procedure on 4 December 2023 [CFE/RDPC/RUR(2023)18] and the Assessment and Recommendations on 16 January 2024 [CFE/RDPC/RUR(2023)18/ANN1].

Table of contents

Foreword	3
Acknowledgements	4
Abbreviations and acronyms	9
Executive summary	11
1 Assessment and recommendations	13
Assessment	14
Recommendations	20
References	26
Notes	26
2 Understanding innovation in rural Canada	28
Defining rural innovation	33
Setting the scene for innovation in rural Canada	38
Determinants of entrepreneurship and innovation in rural areas	66
Annex 2.A. Additional resources	72
Annex 2.B. OECD typology of geographical units based on accessibility	79
Annex 2.C. Defining sectors	82
Annex 2.D. The importance of the natural resource sector for rural Canada and the 2014 mini recession in Canada	84
References	86
Notes	91
3 Policies and programmes for innovation and entrepreneurship in Canada	95
Evolution of federal, provincial and territorial policies and programmes to promote innovation in Canada	98
Expanding federal regional support for rural entrepreneurs	117
Conclusions and findings from case studies	133
Annex 3.A. A review of provincial and territorial innovation and further information on case study areas	137
References	161
Notes	168
4 Green innovation in rural Canada	171
Introduction	174

Canada is facing a rural mitigation and adaptation challenge to address climate change	175
Green innovation definitions	183
Policy action to link up green innovation to rural climate challenge needs	185
Annex 4.A. Additional tables and figures	227
References	238

FIGURES

Figure 2.1. Rural and urban areas in Canada	34
Figure 2.2. Innovation challenges related to scale, density and distance for innovators in increasingly remote rural areas	36
Figure 2.3. Labour productivity is more volatile in rural areas	39
Figure 2.4. Regional differences in patenting intensity	40
Figure 2.5. R&D intensity in OECD countries	41
Figure 2.6. Size distribution of firms, innovation and new firm formation	43
Figure 2.7. Size distribution of firms, innovation and new firm formation	45
Figure 2.8. There is a larger share of older firms in rural areas	47
Figure 2.9. Ownership and trade status of firms	48
Figure 2.10. Growth in rural exports but not in exporting firms	50
Figure 2.11. Correlation between export value and number of exporters	51
Figure 2.12. Marginal returns to exports decrease for rural firms with multiple export partners	52
Figure 2.13. There is a growing gap in population between rural and urban areas	53
Figure 2.14. Changes in population shares, 2000-20	54
Figure 2.15. Society is ageing faster in rural areas than in urban areas	55
Figure 2.16. Age diversity in new firm formation and innovation	57
Figure 2.17. The rural workforce in Canada is ageing	58
Figure 2.18. Employment shares for 25 to 44-year-old workers are higher in urban areas	58
Figure 2.19. Employment and unemployment rates for Indigenous people	61
Figure 2.20. Share of Indigenous-owned businesses and business ownership per population	62
Figure 2.21. Women as entrepreneurs	63
Figure 2.22. Women are less likely to be employed in rural areas than in urban areas	64
Figure 2.23. New firm formation and innovation, by immigrant status	65
Figure 2.24. Increasingly, rural areas are gaining migrants interested in economic opportunities	66
Figure 3.1. Map of case study areas, by census division	98
Figure 3.2. Implied tax subsidy rates on R&D expenditures: Canada, 2021	99
Figure 3.3. Institutions working on building innovation capacity in rural areas	101
Figure 3.4. Map of RDAs	104
Figure 3.5. Spending by RDAs has increased over time	105
Figure 3.6. The largest share of expenditure is in innovation-related programmes	107
Figure 3.7. National broadband internet service availability map	123
Figure 3.8. Geographic variation in download speeds in OECD and G20 countries	124
Figure 4.1. Contribution to estimated GHG emissions in Canada, 2022	177
Figure 4.2. Emissions estimate disparity between TL3 regions within TL2 regions (province/territory), 2018	178
Figure 4.3. Production-based emissions estimates per capita in Canadian TL3 regions	179
Figure 4.4. Top and bottom emitters (total) per regional type (TL3) and time Canada, 1990-2020	179
Figure 4.5. Annual temperature departures from baseline (mean over 1961-90), 2021	181
Figure 4.6. Renewable public research, development and demonstration (RD&D) budget, OECD countries, 2021	190
Figure 4.7. Fossil fuel public RD&D budget, OECD countries, 2021	190
Figure 4.8. Innovation in selected climate change mitigation technologies per country	191
Figure 4.9. Share of total SDTC funding by population quartile, based on the number of residences	197
Figure 4.10. Photovoltaic power potential, Canada	204
Figure 4.11. Wind power potential, Canada	204
Figure 4.12. Towards a net zero carbon village system	217
Figure 4.13. Regions with employment in the extraction of crude petroleum, natural gas and manufacture of coke and refined petroleum products, and regional socio-economic indicators	219

Annex Figure 2.A.1. The gap in income between rural and urban households halved between 2000 and 2020	72
Annex Figure 2.A.2. There is a higher share of urban firms that report having expenditure on scientific research and experimental development	73
Annex Figure 2.A.3. There is a higher share of new firms in urban regions	73
Annex Figure 2.A.4. GDP is higher in urban areas than in rural areas, however both are showing similar signs of growth	74
Annex Figure 2.A.5. Number of firms in Canada, by sector, 2005-19	75
Annex Figure 2.A.6. Employment by sector	76
Annex Figure 2.A.7. Low-density and remote rural areas have the strongest challenges for gender parity	77
Annex Figure 2.A.8. After arrival, migrants are primarily choosing to resettle in urban and metropolitan areas	78
Annex Figure 2.B.1. OECD typology of TL3 regions with access to cities	81
Annex Figure 2.D.1. GDP in the mining, quarrying and oil and gas extraction sector	84
Annex Figure 2.D.2. Commodity price fall in 2014	85
Annex Figure 3.A.1. Economic Nutrition Label, Shorefast (Fogo Island, NL, Canada)	160

TABLES

Table 2.1. Start-up Analysis, 2010-19	67
Table 2.2. Innovation analysis, 2010-19, Part 1	69
Table 2.3. Innovation Analysis, 2010-19, Part 2	70
Table 3.1. Linking of different types of RIS, entrepreneurial discoveries and regional industrial path development	118
Table 3.2. Understanding approaches to rural innovation, by typology of regions	134
Table 4.1. Policy actions to support green innovation for the rural context	185
Table 4.2. Federal funding opportunities listed in the Clean Growth Hub	196
Table 4.3. Initial aspects to consider when evaluating rural development opportunities for sustainability transitions	202
Table 4.4. Environmental and clean technology employment Canada, 2021	207
Table 4.5. Challenges of the environmental shift for SMEs in Quebec	209
Annex Table 2.C.1. Sector classifications	82
Annex Table 4.A.1. Green innovation support through RDAs	227
Annex Table 4.A.2. Examples of key provincial and territorial level strategies for clean tech and green innovation	230
Annex Table 4.A.3. Taxonomy of products considered clean technologies by industry and sector/technology area	236

BOXES

Box 2.1. Measures for youth inclusion	59
Box 3.1. Innovation Norway: An integrated innovation agency	101
Box 3.2. Initiatives for innovation at the community level	107
Box 3.3. Encouraging co-ordination and simplification for the delivery of entrepreneurship and innovation support in rural areas	110
Box 3.4. Indigenous participation in rural economic development in Norway	113
Box 3.5. Firm-research partnership example from rural Yamagata, Japan	114
Box 3.6. Mechanisms to encourage university-firm linkages for innovation in Scotland	115
Box 3.7. Encouraging equity and supporting rural access to finance in the United States	120
Box 3.8. Innosuisse Innovation Booster	126
Box 3.9. Innovation sandboxes and Living Labs	127
Box 3.10. Building linkages to overcome challenges of scale	131
Box 3.11. Smart specialisation in Norway	133
Box 4.1. Canada's net zero-emission target	175
Box 4.2. Regional GHG emission data	180
Box 4.3. Canada is finalising its first National Adaptation Strategy	182
Box 4.4. Definition of green innovation	183

Box 4.5. Oil and Gas Emissions Cap	188
Box 4.6. Setting up interdisciplinary research in rural places	193
Box 4.7. Overcoming hurdles for renewable energy generation in Canada	205
Box 4.8. Creating rural development from the net zero transition – Example from Quebec	206
Box 4.9. Survey-based firm green innovation measurement in the United States	208
Box 4.10. Energicentrum Gotland, Sweden: Enabling local transitions	211
Box 4.11. Indigenous knowledge	214
Box 4.12. British Columbia’s CleanBC Local Government Climate Action Program	216
Box 4.13. Building capacity and enthusiasm for the bioeconomy and circular economy	218
Box 4.14. The just transition concept	221
Box 4.15. The European Centre of Excellence for Sustainable Water Technology, Leeuwarden	223
Box 4.16. National observatory on green skills and jobs in France	224
Box 4.17. Green skills in Scotland	224
Annex Box 2.B.1. OECD territorial classifications	79

Follow OECD Publications on:



http://twitter.com/OECD_Pubs



<http://www.facebook.com/OECDPublications>



<http://www.linkedin.com/groups/OECD-Publications-4645871>



<http://www.youtube.com/oecdilibrary>



<http://www.oecd.org/oecdirect/>

Abbreviations and acronyms

AAROM	Aboriginal Aquatic Resource and Oceans Management
ACOA	Atlantic Canada Opportunities Agency
AFN	Assembly of First Nations
AGF	Agtech Growth Fund
AI	Artificial intelligence
ATIS	Alberta Technology and Innovation Strategy
BDC	Business development centre
BIGS	Business Innovation and Growth Support
BRACE	Building Regional Adaptation Capacity and Expertise
CA	Census agglomeration
CAD	Canadian Dollar
CBDC	Community Business Development Corporation
CCTT	<i>Centres collégiaux de transfert de technologies</i>
CED	Canada Economic Development for Quebec Regions
CEEDD	Canadian Employer-Employee Dynamics Database
CEGEP	<i>Collèges d'enseignement général et professionnel</i>
CESAP	Climate Emergency Skills Action Plan
CFDC	Community Futures Development Corporation
CFO	Community Futures Organization
CFP	Community Futures Program
CIF	Community Initiative Fund
CMA	Census metropolitan area
CRA	Community Reinvestment Act
CSD	Unit of census subdivision
DUI	Doing-using-interacting
ECCC	Environment and Climate Change Canada
ECJRC	European Commission's Joint Research Centre
EDA	Economic Development Administration
EDGAR	Emissions Database for Global Atmospheric Research
EDI	Economic Development Initiative
FHQTC	File Hills Qu'Appelle Tribal Council
FSDS	Federal Sustainable Development Strategy
FUA	Functional urban area
GDP	Gross domestic product
GE	General Electric
GHG	Greenhouse gas
GI	Geographical indicator
GMF	Green Municipal Fund
GRA	Greater Regina Area
GVA	Gross value added
HEI	Higher education institution
ICT	Information and communication technology
IEA	International Energy Agency
IKRS	Indigenous Knowledge Research System
ILO	International Labour Organization

IOIC	Input-output industry classification
IPCA	Indigenous Protected and Conserved Area
IPCC	Intergovernmental Panel on Climate Change
ISED	Innovation, Science and Economic Development
ITC	Investment tax credit
LM	Labour market
NAICS	North American Industry Classification System
NEET	Not in employment, education or training
NII	Nuclear Innovation Institute
NL	Newfoundland and Labrador
NWT	Northwest Territories
OCI	Ontario Centre of Innovation
OECD	Organisation for Economic Co-operation and Development
ON	Ontario
QC	Quebec
R&D	Research and development
RCM	Regional county municipality
RD&D	Research, development and demonstration
RDA	Regional development agency
RDPC	Regional Development Policy Committee
REGI	Regional Economic Growth through Innovation
RIC	Regional innovation centre
RIS	Regional innovation system
RM	Rural municipality
RNTA	Research and National Technical Assistance
SAT	Survey of Advanced Technology
SDTC	Sustainable Development Technology Canada
SES	Scenario Exploration System
SIBS	Survey of Innovation and Business Strategy
SK	Saskatchewan
SLA	Self-contained labour area
SME	Small and medium-sized enterprises
SR&ED	Scientific Research and Experimental Development
STEM	Science, technology, engineering and mathematics
STI	Science, technology and innovation
TK	Traditional knowledge
UBCM	Union of British Columbia Municipalities
UN	United Nations
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UQ	Université du Québec
USDA	United States Department for Agriculture
WES	Women Entrepreneurship Strategy
YU	Yamagata University

Executive summary

Innovation is broader than science and technology, yet statistics and government programmes often narrowly focus on this type of innovation. This is particularly relevant in rural areas as not all firms have equal access to the same resources for high-technology innovation. With around one in five Canadians living in Canada's rural regions, better understanding how to promote broader notions of innovation for rural areas is critical to boosting productivity and, in turn, well-being in rural communities by mitigating population challenges, improving rural service provisions, increasing entrepreneurship, including for women, and advancing the green transition.

Key facts

- Although Canada is in the top quartile of OECD countries in terms of high-technology innovation (ranking 9th out of 37 OECD countries in terms of total patent applicants in 2020), it lags behind the OECD average on a per capita basis (Canada had 0.09 patent applicants per 1 000 inhabitants in 2020, compared to an OECD average of 0.14).
- Like other OECD countries, Canada's rural regions lag behind metropolitan regions in terms of patent intensity. And although the gap (0.08) over 2016-20 was lower than the OECD average (0.15), this in large part reflects Canada's relatively low national performance (0.09 compared to an OECD average of 0.14).
- On broader measures of innovation, Canada's gross domestic expenditure on R&D was 1.7% of GDP in 2021, also below the OECD average of 2.7%. Rural areas also displayed lower performance, with 0.8% of firms reporting R&D activities, against the slightly higher rate of 1.1% in urban areas.
- In 2019, labour productivity in Canadian rural areas (116 000 GPD per capita) outperformed the labour productivity in urban areas (112 000 GPD per capita). Compared with OECD TL3 regions, this trend runs counter to the relative trends between metropolitan and non-metropolitan regions. Furthermore, from 2011 to 2019, labour productivity was still growing in rural areas of Canada, but at half the rate as in urban areas (16% growth in rural areas and 36% growth in urban areas).
- The rate of population decline in rural areas in Canada was higher (3.1%) than on average in OECD rural areas (2.3%) between 2000 and 2020. Canada's population in non-metropolitan regions is also ageing faster than the OECD average in non-metropolitan regions. Between 2010 and 2020, the share of young working-age individuals (15 to 29 years) fell by 2 percentage points in non-metropolitan regions of Canada, compared to a fall of 1.1 percentage points in metropolitan regions. The decline in the share of young working-age individuals in Canada was greater than the OECD average in non-metropolitan (0.7 percentage points) and metropolitan regions (0.16). Thus in 2022, the average person living in a rural area in Canada was 2.5 years older than in urban areas.
- Although there is a higher likelihood of starting a majority women-owned firm in rural areas compared to urban, these firms in rural areas are less likely to participate in R&D than their urban equivalents.

- If the rate of new business creation in Canada's rural areas had been on par with the rate in urban areas, there would have been 8 100 more (50% more) new firms in rural areas in 2018.
- With a larger share of Indigenous peoples living in rural areas (around 60% in 2016), Indigenous entrepreneurship is an important dimension of rural innovation. The number of Indigenous businesses increased by 11% between 2009 and 2018. However, the number of non-Indigenous businesses increased by 17% over the same period of time.
- In 2022, over half (52%) of total greenhouse gas emissions were due to production in remote regions of Canada. This share was significantly higher than the latest harmonised statistics on the average contribution of OECD rural regions (16%) available for 2018. At the same time, Canada's most remote regions, including the Arctic and its coastal areas, are particularly vulnerable to climate change: some are warming at over twice the global rate.

Main recommendations

Based on the report's Assessments and Recommendations (see Chapter 1), the following provide a summary of the main set of recommendations from the report.

- **Continue to support efforts by Statistics Canada to increase the availability of statistics on rural areas and adopt a broader definition of innovation.** This would, for instance, entail facilitating access to and publication of harmonised statistics for both rural and urban areas that go beyond statistics in science and technology to capture the larger scope of innovation in the Oslo Manual, the international reference guide for collecting and using data on innovation.
- **Strengthen and develop the rural lens in innovation policy and programme design,** for example by developing programmes that foster experimentation and continuous learning for community-led or private sector-led ventures, as well as public sector delivery.
- **Adapt innovation support that better fit demographics of rural communities,** for example by conducting research to understand and address the challenges faced by women and Indigenous entrepreneurs in starting innovative companies and scaling-up.
- **Address governance challenges in delivering innovation services in rural areas** with low density by focusing on building scale (such as through increased capacity for locally-based, grassroots or bottom-up programmes in rural areas such as the European Union LEADER programme), networks (such as rural leaders programmes, or incubators, accelerators or Fab Labs located near or within rural hubs) and linkages (such as through research-firm collaborations or initiatives to connect rural entrepreneurs to research institutes through one-stop shops). This can include considering a functional area approach to eligibility criteria for administrative boundaries of programme delivery, particularly in the northern provinces and territories.
- **Encourage innovation to combat climate change,** for example by supporting diffusion and adoption of green innovation in rural communities through public procurement in clean technologies and green innovation.

1

Assessment and recommendations

Canada has the largest land mass among OECD countries, with the vast majority of its territory classified as rural. It has a stable, market-based economic environment that coexists with a system of taxes and benefits that promotes equality and redistribution. In fact, in 2020, in Canada, interpersonal income inequality (as measured by the Gini index) was at 0.28, lower than the OECD average in 2020 (0.31) and much lower than in its North American OECD peers, Mexico and the United States. Moreover, the income gap between rural and urban¹ households has been halved over the past 2 decades, from 12% in 2000 to just 6% in 2020.

Despite this progress, geographical disparities in high-technology (high-tech) innovation are present in Canada, with metropolitan areas displaying higher innovation performance than rural regions, which is consistent with the OECD trend. In Canada, however, the gaps are relatively smaller, especially in remote rural regions, confirming the active contribution of rural Canada to national innovation performance. Analyses based on OECD data which classify small regions² into regional typologies from 2016 to 2020, show that the gap in patenting intensity³ between rural regions and national averages is smaller in Canada than in OECD countries. On average, in OECD countries, rural remote regions had 8.5 times lower patenting intensity than metropolitan regions (0.02 patents per 1 000 individuals in rural regions, as compared to 0.17 in metropolitan regions). In Canada, patent intensity is also lower in remote rural regions than in metropolitan regions but the difference between regions is less stark. From 2016 to 2020, there were an average of 0.03 patents per 1 000 inhabitants in non-metropolitan rural remote regions of Canada, which is less than approximately 4 times the average of metropolitan regions with 0.11 patents per 1 000 individuals. Overall, the gap between rural remote and metropolitan regions in Canada is a quarter less than the gap in OECD countries (0.08 gap in Canada versus 0.14 gap in OECD countries). Although patent intensity is just one form of innovation, this trend demonstrates the relative differences between one type of innovation activity across geographies in Canada.

More can be done to boost high-tech innovation in Canada. Although Canada is in the top quartile of OECD countries in terms of high-tech innovation, ranking 9th out of 37 OECD countries in total patents in 2020, patenting intensity (measured as patent applications per 1 000 people) is close to the 50th percentile of OECD countries. Canada had 0.085 patent applicants per 1 000 inhabitants in 2020, compared to an OECD average of 0.14. The uptake of research and development (R&D) investment activities is also low compared to other OECD countries. Canada's gross domestic expenditure on R&D was 1.7% of gross domestic product (GDP) in 2021, well below the OECD average of 2.7%. In addition to room to grow in high-tech innovation, the development of new businesses that provide new services or products and participation in R&D investment in rural areas remains relatively low. For example, if the rate of new business creation in Canada's rural areas had been on par with the rate in urban areas, there would have been close to 8 100 new firms in rural areas in 2018.

Promoting green innovation in Canada's rural regions is important for two reasons. First, in 2022, over half (52%) of total greenhouse gas (GHG) emissions in Canada were attributed to production and economic activities in remote regions. This was largely a result of industrial activities, including energy exploitation and processing (19% of the total) and transportation activities (14%). In comparison, rural regions, on average in OECD countries, contribute much less, about 16.5% of production-based GHG emissions,

despite still emitting the highest per capita GHG. Second, Canada's most remote regions, including the Arctic and its coastal areas, are particularly vulnerable to climate change: some are warming at over twice the global rate.

This report includes a scene-setting chapter on rural Canada, a chapter on the state of rural innovation policy in Canada and a special chapter focusing on green innovation. The research for the report reflects a combination of statistical analysis, desk research and case study visits to Emerald Park/Regina (Saskatchewan), Fogo Island (Newfoundland and Labrador), the Gaspé Peninsula (Quebec), Inuvik (Northwest Territories) and Kenora and Kincardine (Ontario).

Assessment

Innovation in Canada is supported by an enabling policy environment and an educated labour market, yet challenges still remain for increasing innovation activity

Innovation is multifaceted and can include high-tech innovation as well as innovation in processes and, more broadly, in the way programmes and policies are delivered. Rural areas close to cities can benefit from knowledge spillovers and have more diversified economies, while more remote areas tend to have smaller and less diversified economies and labour markets. This poses a challenge to improve opportunities across different geographies, as access to innovation networks and economies of scale are critical for some types of innovation. In the absence of density and access to resources, generic business support services, social and community-based innovation have a greater role to play to support innovation. It is, therefore, important that both direct and indirect innovation policies in rural areas are designed to take into account the context in which innovation takes place.

Canada has many of the requisite conditions for innovation but the uptake of some innovation R&D incentives is still a challenge among rural firms

Supporting national framework conditions for innovators and entrepreneurs in Canada is strong. Canada has a relatively large share of individuals with tertiary education in information, communication and technology programmes (OECD, 2022^[1]; 2022^[2]) and an important inflow of talented immigrants who help fill skills gaps (OECD, 2022^[3]). Federal support for fostering bottom-up initiatives is reinforced by an ecosystem of institutions that includes universities, research institutes, public-private partnerships, community development and Indigenous people's development programmes.

Despite a host of federal support mechanisms, challenges remain in encouraging the uptake of government support for innovation. Canada's investment in research and innovation as a share of total domestic expenditure (1.7%) in 2021 is well below the OECD average (2.7%) (OECD, 2023^[4]) and lower than its share in 2010 (1.83%). These challenges are well recognised and successive federal governments have made persistent efforts over the years to address them.

Indicators measuring the uptake of R&D tax incentives in different geographies show that there may be more acute challenges for innovation in rural Canada, despite the fact that rural remote regions are lagging in relation to the national performance, but less so when compared to other OECD countries in terms of patent-based innovation. While the majority of firms in Canada (99%) reported that they had not spent any funds on R&D in 2018, the proportion of firms in urban areas reported as participating in R&D activities was slightly higher (1.1%) compared to those in rural areas (0.8%).

While Canada has policies and programmes that support the development of various types of firm-university or research linkages, there are still challenges to their uptake in rural areas. Post-secondary school-firm linkages are a catalyst for supporting the upgrading and upskilling of rural individuals and firms that contribute to "user-driven" innovation but these linkages could do more to: i) facilitate "demand-driven"

innovation;⁴ ii) bring innovative ideas to commercialisation; and iii) provide tailored upskilling and reskilling opportunities for rural areas. Nevertheless, some places, such as in the province of Quebec, demonstrate how a more defined and integrated approach to promoting university-firm linkages through research institutions can serve rural areas and Indigenous communities while supporting innovation and climate change goals.

Innovation support needs to go beyond direct science- and technology-based innovation support mechanisms

Low R&D investment and patenting statistics do not necessarily mean that certain geographical areas are not involved in innovation. In fact, many forms of innovation, including process and social innovations, are often not captured by these types of statistics. For example, in Quebec – a large province with a sizeable rural population and a low share of R&D and patents – 78% of firms self-report that they participated in innovation between 2017 and 2019. The vast majority of innovation in firms (around 71%) occurs through process innovation, while 51.3% said they focused on product innovation.

In the context of long distances and low density, enabling the creation of networks for innovators is crucial. The public sector is often critical for creating networks to facilitate firm-to-firm and firm-to-research linkages research and innovation.⁵ In remote rural areas, encouraging system entrepreneurs, social entrepreneurs and public sector innovation can bring systemic change to rural development and innovation. Often, these types of entrepreneurs do not develop for profit alone but also have a purpose that includes well-being outcomes and the development of more sustainable and robust local economies (OECD, forthcoming^[5]).

Rural Canada is an engine of economic opportunity and innovation, but rural businesses are still at a disadvantage when compared to their urban counterparts

About 1 in 5 people in Canada live in rural areas,⁶ which makes up about 98% of the country's land mass. In 2018, Canada's metropolitan regions produced almost three-quarters of total GDP (74%), meaning that rural areas accounted for around one-quarter of economic activity. Compared to other large OECD countries such as the United States, the contribution of rural Canada is substantial. In the United States, non-metropolitan⁷ GDP accounted for approximately 10% of total GDP in 2020.

Labour productivity, often used as a proxy for innovation, has been growing and is higher in rural areas than in urban areas of Canada. Labour productivity was higher in rural areas than urban areas in 2019.⁸ Moreover, productivity in rural areas grew by 16% between 2011 and 2019. While the growth was positive, it was not as strong as labour productivity growth in urban areas (36%).

Innovation in the growing trade and services sector lags in rural areas, while agricultural firms in rural areas are more innovative than their urban counterparts

Rural areas are often seen as being primarily agricultural. This argument is outdated in most OECD countries. In the period between 2010 and 2019, the largest employers in rural Canada were wholesale retail and trade (13%) and manufacturing (11%). However, as a share of all firms, the largest sectors are trade and services (58%), followed by agriculture, forestry and fishing (17%). These are the same sectors with the newest firms. However, the rural trade and services sector lags in terms of innovation. While only 1% of all firms applied for the national R&D tax incentive scheme between 2010 and 2019, only 21% of firms that applied for R&D incentives were in trade and services in rural areas, as compared with 55% in the urban trade and services sector.

In part, this reflects the different composition of the rural and urban economies, with urban areas having higher shares of trade and services (74%) than rural areas (58%). However, the composition of places only partially explains the trend, as over half (55%) of firms that applied for the R&D tax incentive in urban

areas were in the trade and services sector, while only one-fifth (21%) of firms that applied to the R&D tax incentive in rural areas were in the trade and services sector.

On the other hand, the primary sector (agriculture, fishing, forestry and hunting) is highly innovative in rural areas. More than two-fifths of all firms that applied for the R&D tax incentive in rural areas are in the primary sector (44%). By comparison, only 4% of innovative firms in urban areas are in the primary sector. The primary sector also continues to generate new firms, with close to 17% of all new start-ups in rural areas, compared with 1% in urban areas.

There is a higher proportion of small firms involved in R&D-type innovation in rural areas than in urban areas

Most rural firms are small. Between 2010 and 2019, 85% of firms in rural Canada were micro or non-employer firms (with fewer than 5 workers). Despite this, the share of micro and small firms that innovate based on R&D tax relief application data is higher in rural areas than in urban areas. The largest share of firms involved in formal R&D processes in rural areas tends to be micro (31% for micro firms with 1-4 workers) or small (27% for small firms with 5-19 workers). By comparison, in urban areas, the largest share of firms involved in formal R&D processes are small (29% for small firms with 5-19 workers), followed by medium-sized (25%, 20-99 workers) and micro firms (25% with 1-4 workers).

However, when controlling for other factors, larger firms are still more likely to innovate

Although descriptive results suggest that small firms tend to be more involved in innovation activities in Canada (as in other OECD countries), this is likely due to composition effects (e.g. large share of small firms in rural areas). Controlling for other firm characteristics such as sector, international linkages and ownership, the largest firms (100 or more employees) tend to innovate more than smaller firms in Canada. This is consistent in both rural and urban areas. Given this size trend, larger firms still have an increased propensity to innovate in rural areas compared to urban firms. This is consistent with findings that larger firms tend to innovate (Acemoglu et al., 2023^[6]), suggesting that helping firms scale up is critical to foster innovation.

Unlike their urban counterparts, rural firms tend to be relatively older when they start investing in R&D

Firms in rural Canada are older than those in urban areas. Almost half of all firms in rural Canada have been in business for more than ten years. Rural Canada has a larger share of mature (11-30 years) and old (30 years or more) firms than urban areas over the period 2005-19. Urban areas have a higher proportion of start-ups (16%) than rural areas (12%) and a higher proportion of young firms – 2 to 5 years of age – (24%) than rural areas (19%).

Canadian rural firms tend to be older than those in urban areas when they start participating in formal innovation. Among firms that have applied for R&D tax incentives in Canada, mature and old firms (between 11-30 years old and 30 years and over) account for the largest share of firms that have participated in formal innovation activities: 48% in rural areas and 37% in urban areas. In contrast, in urban areas of Canada, relatively younger firms participate more in formal innovation activities than the oldest (11 years or more) and youngest firms (less than 5 years), compared to rural areas.

The peak age at which firms are likely to innovate is older⁹ (between 11-30 years) in rural areas than in urban areas. For younger firms (2-5 years), the probability of innovating is 0.16 in urban areas and null (non-significant) in rural areas. The highest probability of a firm innovating in rural areas is in its mature age (11-30), where the probability is 0.105, compared with firms that have more than 30 years of operation. Despite the relatively higher probability of rural firms innovating when they are older, urban firms still have

an advantage at older ages. Firms in urban areas in this same age group are more likely to innovate than rural firms (0.195).

International linkages are crucial for rural firms but there is still a rural disadvantage in terms of how access to international markets affects innovation

Rural firms are less connected to international markets. Only 5% of rural firms participate in trade, compared to 7% of urban firms. However, a higher proportion of rural start-ups (0.71%) export than in urban areas (0.56%). While comparative data are not available, a recent study from the United Kingdom also found that there is a marginally higher proportion of firms in urban areas that export to rural areas (Mole et al., 2022^[7]).

At current levels in rural areas, 1 additional exporter is associated with a 0.01% increase in aggregate export values. On the other hand, while most firms that export are located in urban areas, at current levels of firm activity, the returns to increasing the number of exporting firms in urban areas are not statistically significant.

Getting rural Canadian firms to their first export partner is particularly beneficial. In rural Canada, close to 82% of firms have only 1 export partner country. This is a higher share than in urban areas. Increasing the share of rural firms that start exporting is associated with a substantial increase in export values. By comparison, the relationship is not as clear in urban areas, where the correlation between an increase in the share of exporting firms and trade value is spurious (close to zero and with lower explanatory power).

Export activities are correlated with innovation, despite a lower association for rural firms

Access to international markets can encourage innovation. A remarkable 41% of firms in rural areas that applied for R&D tax incentives were engaged in export or import markets. Nevertheless, this figure was higher in urban areas (52%). Furthermore, in urban areas, participation in import and export markets is associated with a 0.68 higher probability of participation in formal innovation, while the probability falls to 0.56 for rural firms.

International linkages through foreign ownership, and hence presumed foreign direct investment, are less clearly direct contributors to innovation in rural areas. While there is some significant relationship (correlation) between foreign ownership and innovation, there is no discernible (statistically significant) association between foreign ownership and innovation in rural areas. However, in urban areas, having a foreign owner increases the probability of participating in formal innovation activities by 0.175.

Indigenous-owned firms, while generally small, are innovative and participate significantly in export markets

Indigenous entrepreneurship is the creation, management and development of new ventures by Indigenous peoples for the benefit of Indigenous peoples. This encompasses both profit-generating activities and those pursued for the benefit of the community. An OECD (2020^[8]) report using data from the 2016 Aboriginal Business Survey found that a higher share of Indigenous businesses introduce new products/services or new production/delivery processes relative to the broader Canadian small business sector. Indigenous businesses are also reported to be more than twice as likely to have introduced a new product or service over the prior three years and nearly three times more likely to have brought in new ways of doing things than the broader Canadian business sector. While Indigenous businesses tend to be small and, like all small businesses, have a relatively lower propensity to export, the report finds that Indigenous businesses are more than twice as likely as all small businesses to export, linking these to activities in the arts, entertainment or accommodation and food service industries.

Managing demographic change is critical to better targeting policies for innovation and firm creation

Canada, like many other OECD countries, is facing demographic challenges. The rural population is growing in numbers but at a slower rate than the urban population. While this is not a unique trend, the loss of the relative share of the rural population in Canada is high, as compared to the OECD average. Between 2000 and 2020, 31 out of 38 OECD member countries experienced a demographic decline in rural areas. Between 2000 and 2020, the share of the population in Canadian cities grew by 6.8 percentage points, while the population share in rural areas decreased by 3.1 percentage points. This compares with an OECD average of almost half the gain in cities (3.6 percentage points) and a smaller decline in rural areas (2.3 percentage points).

As in most OECD countries, the rural population is getting relatively older. In 2022, the average age of the rural population was 43.8, compared to 41.3 in urban Canada. This was due to a greater loss of younger people of working age rather than a strong increase in the share of older people of working age. Rural areas had a nearly 6% higher share of individuals aged 55 and over in employment compared to urban areas.

Between 2010 and 2020, the share of young working-age individuals (15 to 29 years) fell by 2% in non-metropolitan regions of Canada, which was more than in metropolitan Canada, where the share of young working-aged individuals fell by 1.1%. The decline in the share of younger working-age individuals was greater than the average for OECD metropolitan (0.16%) and non-metropolitan (0.7%) regions.

As individuals get older, they are less likely to start a new firm in both urban and rural areas

The oldest working-age group (55 to 64 years) is the least likely to start a firm in both rural and urban areas. The findings on age and firm births are relatively consistent between rural and urban areas. In rural areas, the probability of starting a firm is higher for those aged 15-24 (0.23) than for older age groups (0.19 for those aged 25-44 and 0.086 for those aged 45-55). However, the same-aged person is more likely to start a firm in urban areas than in rural areas.

More can be done to support Indigenous entrepreneurship

Around 60% of Indigenous peoples lived in rural areas in 2016, which was 33 percentage points higher than the share of non-Indigenous peoples living in rural regions. According to the 2011 National Household Survey, approximately 43 000 First Nations, Inuit and Métis individuals in Canada own businesses across the country. The number of Indigenous businesses increased by 11% between 2009 and 2018. Despite progress, the number of non-Indigenous businesses increased by 17% over the same period of time. Furthermore, the rate of business ownership among Indigenous working-aged populations is lower than for the rest of the Canadian population. In 2018, there were 18 Indigenous entrepreneurs per 1 000 Indigenous individuals, whereas there were 56 entrepreneurs per 1 000 individuals among the rest of Canadians. In 2009, the gap between Indigenous and non-Indigenous peoples business ownership rates was 26 businesses per 1 000 individuals. By 2019, it grew to close to 38 businesses per 1 000 individuals. In other words, if the rate of entrepreneurship among Indigenous peoples was the same as the rate for non-Indigenous peoples, there would be almost 38 more Indigenous entrepreneurs per 1 000 Indigenous peoples in 2019.

Women in rural areas are more likely to start a firm but less likely to apply for R&D tax incentives

Women are more likely to start a new firm in rural areas than in urban areas, despite their lower participation in employment. The probability of starting a firm is higher for women (as compared to men) in rural areas (0.018) but not in urban areas. In urban areas, the probability of starting a firm, relative to men, is negative

for women (-0.005). Despite this positive association with starting new endeavours in rural areas, majority women-owned firms have a lower probability of benefiting from formal innovation (R&D) tax incentive schemes than men in both rural and urban areas. While it is unclear whether this is due to the type of businesses women start or whether there are challenges in accessing (applying for) the tax incentive schemes, understanding the challenges faced by women innovators will be a crucial step in increasing the potential of women entrepreneurs.

Immigrants are relatively more entrepreneurial and innovative than the Canadian-born but are less likely to start a firm in rural areas

Canada is attracting increasing numbers of immigrants, many of whom contribute positively to firm formation and innovation. In both urban and rural areas of Canada, immigrants are more likely to start a new firm than Canadian-born populations but the likelihood is lower in rural areas (0.124) than in urban areas (0.162).

Once a firm is established, owners with immigrant backgrounds are more likely to participate in formal innovation. For example, firms in rural areas where the majority of owners are immigrants are more likely to engage in formal innovation (0.226) than those with the majority of owners are Canadian-born. Conversely, the association is negative in urban areas (-0.200). In addition, firms with a higher share of immigrants in the workforce tend to be very positively associated with formal innovation activity. This positive association between the share of immigrants in the workforce and formal innovation is stronger in rural areas (0.44) than in urban areas (0.321).

Green innovation is an important part of the answer to addressing Canada's climate challenges

Canada's rural regions have a key role to play in mitigating and adapting to climate change. As in other OECD countries, rural remote regions in Canada contribute more to total and per capita production-based GHG emissions than any other regional type. No Canadian region is in line with the United Nations target of reducing the per capita carbon footprint to around 2 to 2.5 tonnes of carbon dioxide (CO₂) by 2030 and most large (TL2) regions are also above the OECD average of 11.5 tonnes of CO₂. Emissions are highly uneven and concentrated in a few provinces, with some emitting roughly six times the average of others.

Indigenous peoples and nations are essential leaders in green innovation

Approximately 1 807 250 individuals in Canada self-identify as Indigenous (corresponding to 5.0% of the total population) in 2021 (Statistics Canada, 2021^[9]). Indigenous peoples govern significant territories. For example, under modern treaties, Indigenous Nations control over 600 000 square kilometres of land, hold constitutionally protected Aboriginal and Treaty Rights, and participate in co-management regimes for natural resources, energy and transportation infrastructure projects. Recognising this, Canada has made firm commitments in plans and legislation to advance and support self-determined Indigenous Climate Action and Indigenous Climate Leadership.

The Canadian government has made important progress in supporting green innovation but challenges remain for rural small and medium-sized enterprises (SMEs) to engage in green innovation

The Government of Canada has significantly increased its support and ambition for green innovation. Over the past 5 years, Canada has more than doubled its cleantech spending to CAN 786.8 million. In 2022, it released key policy documents defining the country's path to net zero, including a focus on clean procurement. Despite this progress, Canada still lags behind other major OECD economies in terms of green R&D spending and patent generation.

Despite the pressures on rural regions, conventional green innovation support and strategies are, in many cases, largely place-neutral and likely better suited to urban economies. In many cases, they fail to address the specific needs, opportunities and challenges that exist in different geographies and regions. In addition, many rural SMEs face challenges in adopting green business approaches and engaging in green innovation. These hurdles include a lack of awareness, information and knowledge about changing environmental requirements; limited availability of resources for greening, such as skills, finance and technology; and uncertainties in markets and policies.

The range of support available to rural entrepreneurs is complex and many programmes may not meet their needs

Like other federal countries, Canada has a wide range of national, provincial and territorial policies to support innovation and entrepreneurship. As a result, entrepreneurs and firms in Canada navigate this multi-level governance landscape as they seek support for business development and innovation from a variety of sources, including federal government line department programmes, federal regional development agency (RDA) support, provincial and territorial programmes and, in some cases, local government support. There are also many different Indigenous governments, Indigenous development corporations, Tribal Associations and Indigenous organisations with innovation and entrepreneurship policies and services. In many cases, municipal, provincial, territorial and federal governments devolve responsibility for delivering funding programmes to non-profit community organisations. In federal countries such as Canada, co-ordinating support mechanisms is critical to avoid duplication and facilitate access to existing resources.

For rural entrepreneurs, the core national, provincial and territorial support mechanisms have a heavy focus on science- and technology-based innovation, which may overlook the types of innovation that are more common in rural areas, which include process innovation, systems-entrepreneurial activity, public sector innovation, social innovation and private sector innovation. Depending on the type of rural area, some of these are more appropriate for accessible rural areas than for remote rural areas. For example, in remote rural areas, system-based entrepreneurs have a greater role because they help build the ecosystem in which innovation takes place. In accessible rural areas, access to a larger labour or supply pool may mean that user-based challenges are more about finding appropriate delivery models. In contrast to science- and technology-focused programmes, federal regional innovation programmes play a facilitating role for local community organisations.

Recommendations

Canada's federal, provincial and territorial governments have an important role to play in encouraging rural innovation. The Canadian government's departments and agencies that support rural areas and innovation should consider the need to: i) continue to support efforts made by Statistics Canada to increase the availability of statistics on rural areas and adopt a broader definition of innovation; ii) strengthen and develop the rural lens in innovation policy and programme design; iii) address governance challenges in delivering innovation services to rural areas; iv) reinforce measures to support innovation that better fit the demographics of rural communities; and v) encourage innovation to combat climate change.

Continue to support efforts made by Statistics Canada to increase the availability of statistics on rural areas and adopt a broader definition of innovation

Canada is an exemplary country where statistics are often freely available for many indicators relevant to rural areas based on national geographic definitions (in this report, proxied by census metropolitan area [CMA]/census agglomeration [CA] as urban and non-CMA/CA as rural). However, Statistics Canada could

continue working in co-ordination with the Government of Canada's departments and agencies that have mandates and/or interest related to rural innovation to:

- **Facilitate access to and publication of harmonised statistics** in rural and urban areas by collecting and publishing data on:
 - Innovation as defined in the Oslo Manual, which includes information on significantly improved or new product or process innovation beyond those in science and technology activities.
 - Access to services critical to rural areas, including education, health and finance.
 - Green innovation, including data on green jobs, green product/process innovation, green technology patents, grant flows and additional financial support instruments such as tax credits, loans, equity and procurement targets.

Strengthen and develop the rural lens in innovation policy and programme design

Strengthen the rural lens in existing innovation initiatives

Broaden direct innovation programmes

Policy and programme design should specifically consider the characteristics and needs of rural remote and accessible regions in Canada. The Government of Canada's departments and agencies that support rural areas as well as provincial and territorial governments should co-ordinate to:

- Broaden innovation support mechanisms **beyond science and technology** and sectoral approaches, for example by:
 - Explicitly including support for rural “systems entrepreneurs”,¹⁰ social entrepreneurs, public sector innovation and local and community-driven initiatives as part of the array of existing rural innovation and entrepreneurship policies and programmes.
 - Supporting processes for developing rural innovation programmes that reflect rural and Indigenous values and opportunities, including, for example, prior consultation and consent with Indigenous communities.

Improve access to indirect innovation initiatives and business support services

As part of the continuous improvement of government support services for innovation and entrepreneurship, the Government of Canada's departments and agencies that support rural areas should coordinate to simplify access to indirect support mechanisms for innovation by:

- Regularly **consulting with smaller rural firms** to understand how to better target existing programmes, including the commercialisation of new products, digitisation of processes and access to labour force training programmes.
- Matching new entrepreneurs with seasoned entrepreneurs for **mentoring and counselling services**. For example, an initiative called Alberta Innovates sought to match established rural entrepreneurs with little or no experience in the technology world with innovators and prospective start-ups or other individuals considering starting a firm.
- Providing regular information sessions and capacity-building training to help rural communities gain better **access to digital and physical infrastructure**. An example of this is support for communities in applying for access to better broadband services or bottom-up approaches to providing broadband services, including open-access municipal and community-led networks.
- Facilitating rural entrepreneurs' understanding of and access to **export** promotion resources.

- Improve **access to finance** for rural entrepreneurs by:
 - Organising “pitch” roundtables for entrepreneurs with investors and financial institutions, as is currently being done by the CED.
 - Considering sharing funds for a programme that provides seed funding to a venture-type rural entity that has made equity investments in its region.
 - Encouraging financial partners to consider the different risk profiles of rural entrepreneurs, for example by reviewing interest rates and collateral practices for start-ups and potential entrepreneurs.

Developing new programmes that foster experimentation and continuous learning for new community-led or private sector-led ventures and public sector delivery

The Government of Canada’s departments and agencies that support rural areas, as well as provincial or territorial governments, should consider co-ordinating to incorporate more experimentation and bottom-up programme design aspects into regional development initiatives by, for example:

- Working with local, provincial and national government bodies to allow the creation of temporary **regulatory sandboxes** based on ideas for solving challenges in rural areas.
- Instilling the practice of regular **challenge-based initiatives** such as hackathons, think-a-thons and other forms of challenge-based competitions that seek to address rural challenges.
- Mainstreaming the availability of flexible funding for **experimentation in the delivery of public services**, for example through pilot programmes with new delivery models.
- Creating regular networks for **continuous peer learning** on best practices in the delivery of rural innovation support programmes with federal, provincial and territorial agencies. This should include systems-level entrepreneurs, social entrepreneurs and community stakeholders.

Address governance challenges in delivering innovation services in rural areas

The Government of Canada’s departments and agencies that support rural areas, as well as provincial/territorial governments, should address governance challenges related to density, scale and access to critical services in rural areas by:

- Strengthening **co-ordination and collaboration** between different levels of government (vertical) and government agencies (horizontal), including Indigenous, provincial, territorial and local governments, for example through:
 - **Increased capacity for locally based, grassroots or bottom-up programmes** in rural areas. Examples of such initiatives include programmes such as the European Union LEADER programme and the bottom-up approaches to setting priorities and implementing programmes based on engagements with local stakeholders in non-urban areas within the Swiss regional innovation system.
 - Regular co-ordination and **consultation** with government entities responsible for digital and physical infrastructure, education, health and social services, encouraging public-private partnerships to deliver services to rural and remote areas.
 - Promoting the use of **one-stop shop** tools such as the Business Benefits Finder and the Canada Business Application. This could include access to research and innovation partners, assistance with filing and registering patents, access to R&D voucher programmes, knowledge of R&D subsidies and other R&D incentives that vary by province.
- Considering a **functional area approach** for programme delivery. For example, consider whether northern areas are better suited to a joint development and innovation strategy or whether areas can be asked to self-identify with neighbouring development partners.

- Placing a rural lens on initiatives to support **university-firm linkages** by:
 - Encouraging stronger **links** between post-secondary educational institutions, firms and governments. This should include stronger support for rural “extension” programmes.
 - Working with **post-secondary institutions** to place a stronger focus on incentivising researchers to work with rural firms, “demand-driven” innovation, bringing innovative ideas to commercialisation and tailored upskilling and reskilling opportunities for rural areas. For instance, university researchers in Quebec are incentivised to work with rural firms.
 - Simplifying mechanisms that **connect** rural entrepreneurs with universities or research institutes, such as through one-stop shops or a specific innovation partnering tool (e.g. Interface in Scotland).
- Encouraging opportunities for **networking and exchange** between entrepreneurs and community members by:
 - Building a network of **rural leaders** that can create a network of rural entrepreneurs from different parts of Canada (and abroad), such as the Rural Leaders Network in Scotland.
 - Reinforcing the **practice of supporting incubators, accelerators, Fab Labs** or similar initiatives located in hubs near or within rural areas.
 - Encouraging partnerships between public, private and community stakeholders to **repurpose buildings and create multiple-use facilities** such as innovation hubs and community centres.

Reinforce measures to support innovation that better fit the demographics of rural communities

Strengthening support for different types of rural entrepreneurship

Policies and programmes developed by the Government of Canada’s departments and agencies that support rural areas, as well as provincial/territorial governments, should take into account rural demographics by:

- Co-ordinating across ministries to work on specific programmes to **support diversity in innovation and entrepreneurship** in rural areas. This can include:
 - Building public-private engagement in early entrepreneurship training for **youth** with local firms.
 - Conducting research to understand and address the challenges **women** and **Indigenous** entrepreneurs face in starting innovative companies and scaling up.
 - Incentivising **upskilling** for all workers, and especially older workers in rural areas.
 - Re-enforcing access to **foreign talent** through:
 - Retention programmes for migrants in rural areas that support the integration of newcomers to local communities, including measures such as language courses and settlement services that are more readily available in urban areas.
 - Support in access to immigration services for rural firms seeking to recruit foreign talent.

Strengthening support for Indigenous innovation and entrepreneurship

Indigenous innovation is based on a set of self-identified values. Indigenous communities, particularly those in remote northern territories, play a vital role in protecting the environment. In this regard, the Government of Canada’s departments and agencies that support rural areas and Indigenous economic development, as well as provincial/territorial governments, should continue to support innovation and entrepreneurship for Indigenous peoples and strengthen the framework conditions for Indigenous innovation and entrepreneurship to flourish by:

- **Strengthening Indigenous economic opportunities** through new rounds of engagement with modern treaties.
- Promoting **collaboration between local governments and Indigenous Nations and communities**. As described by the OECD (2020^[8]), the role of RDAs in supporting Indigenous entrepreneurship can be enhanced by:
 - Ensuring that staff have region-specific cultural competency training.
 - Recruiting and peer mentoring (Indigenous leadership/mentoring networks).
 - Developing opportunities to connect local entrepreneurs with Indigenous entrepreneurs and communities in the regions.
 - Actively communicating with Indigenous communities and organisations and sharing leading practices of engagement and programme design across RDAs.
 - Developing programmes flexibly to meet the needs of Indigenous businesses and infrastructure.
 - Updating performance measures to reflect the success of Indigenous businesses and effective engagement with Indigenous communities.
- Encouraging the **Government of Canada to amend Canada’s Copyright Act to protect Indigenous knowledge** from unauthorised use and to ensure that Indigenous concepts of ownership are respected while enabling the original community to actively leverage that knowledge.

Encourage innovation to combat climate change

Supporting the creation of new green innovations

The Government of Canada, as well as provincial, territorial, Indigenous and local governments, should promote green innovation by:

- Ensuring green growth potential aligns with **regional development strategies** accordingly, for example by using the OECD Rural Agenda for Climate Action as an assessment tool.
- Encouraging **clear government signals**, like carbon pricing, at all levels of the Canadian government, especially when innovation requires large, long-term, high-risk investments or involves SMEs.
- Incorporating **place-based considerations into federal, provincial and territorial support for green innovation**. This can include:
 - Facilitating emissions reduction **transitions** that are consistent with local characteristics.
 - Ensuring that **national strategies** reflect provincial, territorial and regional challenges.
 - Creating **communities of practice and peer learning opportunities** based on levels of green innovation readiness and climatic conditions. This could include community roadmaps.
- Continuing **investments in interdisciplinary, long-term research** on climate change innovation.
- **Increasing cluster initiatives to encourage greater public-private collaboration** that can help create new and sustainable technologies and link rural firms to sustainable value systems. A good example is the Ocean Supercluster, which engages with rural places and builds on regional assets.
- **Managing wealth from natural resources fit for purpose**. Royalty regimes should be set up to ensure future prosperity for communities, aligned with the goals of the green transition, including:
 - Addressing the challenges of displaced workers resulting from the green transition.
 - Reinvesting in more sustainable practices (such as low-carbon mineral processing).
 - Managing windfall gains and inflation proofing.

- Improving **collaboration between federal, provincial, territorial and Indigenous governments to support green innovation**. This includes:
 - Focusing on **the integration of strategies, policy tools and programmes**, for example, by incentivising preferential treatment, matching federal and subnational programmes and funding, and bundling information on green innovation and clean business solutions.
 - Creating a **dedicated communications campaign** on green programmes targeting rural innovators to increase rural business participation.
- Continuing to **champion the Indigenous Climate Leadership Agenda** in the spirit of implementing the United Nations Declaration on the Rights of Indigenous Peoples and advancing reconciliation with Indigenous peoples. This includes:
 - Continuing to remove barriers to **self-determined climate action** and providing adequate funding to become successful leaders in green innovation.
 - Seeking stronger **partnerships and collaboration** with Indigenous peoples and empowering First Nations, Inuit and Métis to engage in green innovation.
 - Supporting **Indigenous-led** entrepreneurial efforts to:
 - Meaningfully incorporate sources of local and traditional knowledge for clean energy.
 - Improve access to capital and support programmes in the green economy, for example by encouraging First Nations Banks of Canada to provide green finance to Indigenous communities.
 - Navigate resources and services available in the area of green innovation.

Supporting diffusion and adoption of green innovation in rural communities

The Federation of Canadian Municipalities, in partnership with provinces and territories, could help empower local governments and communities by raising the profile of important levers such as:

- Integrating **green skills into existing training programmes**.
- Encouraging the use of **public procurement** to stimulate domestic demand for clean technologies and green innovation.
- **Improving information sharing, peer learning and role modelling** for green innovation.

References

- Acemoglu, D. et al. (2023), “Advanced technology adoption: Selection or causal effects?”, *AEA Papers and Proceedings*, Vol. 113, pp. 210-214, <https://doi.org/10.1257/pandp.20231037>. [6]
- Mole, K. et al. (2022), *Rural Family Business and Exporting Behaviour*, <https://doi.org/10.13140/RG.2.2.30788.91523>. [7]
- OECD (2023), *OECD Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption*, OECD Publishing, Paris, <https://doi.org/10.1787/0b55736e-en>. [4]
- OECD (2022), *Education at a Glance 2022: OECD Indicators*, OECD Publishing, Paris, <https://doi.org/10.1787/3197152b-en>. [1]
- OECD (2022), *Education Policy Outlook 2022: Transforming Pathways for Lifelong Learners*, OECD Publishing, Paris, <https://doi.org/10.1787/c77c7a97-en>. [2]
- OECD (2022), *International Migration Outlook 2022*, OECD Publishing, Paris, <https://doi.org/10.1787/30fe16d2-en>. [3]
- OECD (2020), *Linking Indigenous Communities with Regional Development in Canada*, OECD Rural Policy Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/fa0f60c6-en>. [8]
- OECD (forthcoming), *Measuring Social Innovation Readiness in Rural Areas*, OECD Publishing, Paris. [5]
- Schlaile, M. et al. (2020), “Systems entrepreneurship: A conceptual substantiation of a novel entrepreneurial “species””, *Sustainability Science*, Vol. 16/3, pp. 781-794, <https://doi.org/10.1007/s11625-020-00850-6>. [10]
- Statistics Canada (2021), *2021 Census of Canada*, Government of Alberta, <https://open.alberta.ca/dataset/487a7294-06ac-481e-80b7-5566692a6b11/resource/257af6d4-902c-4761-8fee-3971a4480678/download/tbf-2021-census-of-canada-indigenous-people.pdf>. [9]

Notes

¹ The report uses two types of geographical classifications. The first refers to “areas” using the Canadian classification based on the unit of census subdivisions (CSD) belonging to census metropolitan areas (CMAs) or census agglomerations (CA)s. This is used when the analysis is drawn from microdata or national resources using this classification. When using Canadian national statistics, urban areas are defined as a CMA with a population of at least 100 000 inhabitants and a CA with a population of at least 10 000 according to the previous census. Rural areas are defined as non-CMA/CA. The second set of geographical classifications is used for international comparability. It refers to small “regions” or administrative units at territorial level 3 (TL3), grouped into a typology defined by distance and access to functional urban areas. Both classifications are described in more detail in Chapter 2.

² Small regions refer to regions classified as Territorial Level 3, which refers to, in this case, Canadian census divisions.

³ This is measured as the number of patent applications per 1 000 people.

⁴ User-driven innovation refers to innovation initiated as a solution to an underlying challenge of entrepreneurs within the process of delivering a product or service. Demand-driven innovation refers to more general market demand from customers and clients that can include the creation of new services or products to satisfy customer demands.

⁵ For example, Quebec has created a regional innovation support system for entrepreneurs that provides access to public education and training providers, innovation partners, institutional incentives at the university level to work with rural businesses. Another example from Ontario is the case of the Nuclear Innovation Institute in Bruce County (a nuclear site with a long-term procurement contract and a partnership with the city for developing the innovation ecosystem) lends nuclear reactors to small start-ups in different industries (such as robotics, pharmaceutical, etc.). A third example is the International Institute for Sustainable Development-Experimental Lakes Area (IISD-ELA) in Kenora, Ontario, a public-private partnership with international offices that creates a safe space for environmental testing.

⁶ These data are based on rural definitions that use population centre estimates.

⁷ This nomenclature is based on the Rural-Urban Continuum Codes from the United States Department of Agriculture.

⁸ Levels of labour productivity in Canada in 2019 was 112 units equivalent to close to 112 000 GDP per worker in urban areas versus 116 units equivalent to close to 116 000 GDP per worker in rural areas. However, this may be partly due to the impact of mining activities.

⁹ The benchmark category are firms with over 30 years of operation.

¹⁰ A systems entrepreneur can be described as an entrepreneur or community actor that works on a systems (network) base, often engaging with others in a community or place that can include public, private and non-profit sectors to solve challenges that are engrained in the system. These challenges often rooted in relationships that involved social, economic and environmental factors, rather than one issue challenges that can be reduced to cause-effect relationships (Schlaile et al., 2020^[10]).

2

Understanding innovation in rural Canada

This chapter undertakes a diagnosis of innovation and entrepreneurship in Canada by comparing rural and urban areas in terms of characteristics, innovation measures and new entrepreneurship. It identifies strengths and challenges for innovation in rural areas and sets the scene for the report's policy discussions. It pays special regard to demographic changes in Canadian rural areas.

Key messages

Rural areas in Canada are large, vast and varied. One in five people in Canada live in rural areas.* Rural Canada accounts for the quasi-totality of landmass** and approximately 18% of the population, based on population centre estimates of rural areas. With the largest landmass of all OECD countries, Canada's sparsely populated rural north and rural areas in the south often face different challenges, including providing services to Indigenous peoples in the north.

Between 2009 and 2018, Canada's total gross domestic product (GDP) rose from CAD 1.5 trillion to CAD 2.1 trillion (current prices). Metropolitan regions of Canada represented close to three-quarters of total GDP in both 2018 and 2009 (74% and 73% respectively), meaning that rural regions contained a stable quarter of the economy. Compared to other large OECD countries such as the United States, the contribution of rural Canada is substantial. By comparison, in the United States, non-metropolitan GDP accounted for approximately 10% of total GDP in 2020, while metropolitan GDP accounted for close to 90% of total GDP in the same year. At the same time, levels of income inequality are relatively low in Canada. The income gap between households in rural and urban areas halved, from 12% in 2000 to only 6% in 2020. Income inequality in Canada is close to the average of OECD countries and is much lower than in its closest neighbours, Mexico and the United States.

Canada, like many other OECD countries, is facing demographic challenges. The population in rural areas is growing in numbers but slower than population growth in urban areas. The level of employment in rural areas of Canada fell by 6% from 2011 to 2019 while still growing in urban areas.

As is observed in most other OECD countries, the rural population and workforce are also ageing and women are relatively less engaged in the formal labour market. In 2022, the average age of the population in rural areas was 43.8, while it was 41.3 in urban areas. Furthermore, as compared to urban areas, in rural areas, there was 6% less of a share of prime-aged individuals (25 to 44 years) in employment and close to a 6% larger share of individuals over the age of 55 in employment. There is a 1.4 percentage point difference between the employment share of women and men in rural areas as compared to those in urban areas, with 1.15 men to every woman employed in rural areas, as compared to urban areas where there are 1.09 men to every woman employed.

Despite these labour and demographic considerations, Canada is attracting an increasing number of migrants across all geographies, many of whom contribute positively to firm formation and innovation in firms. Labour productivity, frequently used as a proxy for innovation absorption, has been growing and is higher in rural areas than in urban areas of Canada. However, in rural areas, labour productivity grew by 16% between 2011 and 2019, compared to 36% in urban areas. Despite a relatively high level of aggregate labour productivity in rural areas as compared to urban areas, the overall share of total aggregate (rural and urban) labour in rural areas was 25% in 2019, as compared to 75% in urban areas in 2019, a 2.1-percentage point fall from the rural share of labour in 2011.

While indicators of growth and innovation absorption demonstrate positive trends, other innovation indicators demonstrate that there may be room for improvement. For example, the intensity of gross domestic expenditure on research and innovation as a percentage of GDP in Canada in 2021 is relatively low, at 1.7%, as compared to the OECD average of 2.7%. Furthermore, Canada ranks 9th out of 35 OECD countries with available data on total patent statistics and is close to the 50th percentile in terms of patenting intensity. Despite room to improve on high-technology innovation statistics proxied by patents, regional disparities between rural and metropolitan regions are lower than that of the OECD average.

Most firms (99%) do not report participating in research and development (R&D) in Canada. In 2018, 1.1% of firms in urban areas reported participating in R&D activities, against slightly less, 0.8% of firms in rural areas. On the other hand, new firm activity is a promising avenue for innovation in rural and urban areas. On average, close to 4.3% of firms in rural areas are start-ups, compared to 6.4% in urban areas.

Firm and individual characteristics vary across geographies and it matters for innovation and new firm formation.

Often, rural areas are characterised as primarily belonging to the agricultural sector. This argument is outdated in most OECD countries.

- **The largest employers in rural areas of Canada are wholesale retail and trade (13%) and manufacturing (11%).** However, in terms of the share of all firms, the largest sectors are trade and services (58%) followed by the agricultural sector (17%). These are also the same sectors in which the newest firm formation activities are located. Even though the trade and services sector accounts for the majority of firms in rural areas, only 21% of firms that participate in formal innovation activities are in the trade and services sector, while 44% are in the agricultural sector.

In rural areas, firms are often smaller and older, yet larger and younger firms are more likely to innovate.

- **Most firms are small in rural Canada.** Between 2010 and 2019, 85% of firms in rural Canada were micro firms, with fewer than 5 employees, or non-employers.
- **Larger firms tend to participate more often in formal innovation activities.**
 - **Larger firms (100 or more employees) tend to innovate more than smaller firms** when taking into account sector and other firm-specific characteristics. This is consistent in both rural and urban areas, but there is an increased propensity for larger firms to innovate in rural areas as compared to urban firms.
 - **Nevertheless, there tends to be a higher share of micro and small firms (fewer than five workers) that innovate in rural areas than in urban areas.** Of all firms involved in formal R&D processes in rural areas, micro (with 1-4 workers; 31%) or small (with 5-19 workers; 27%) firms tend to account for the largest share. In comparison, in urban areas, the largest share of firms that participate in formal R&D processes are small firms (29% for small firms with 5-19 workers), followed by medium-sized firms (25% for medium-sized firms with 20-99 workers) and micro firms (25% for medium-sized firms with 1-4 workers).
- **In rural areas, firms with more experience are more likely to innovate. This is not as strong a trend in urban areas.**
 - **Firms in rural Canada are older than those in urban areas.** Close to half of all firms in rural Canada have operated for more than ten years. Rural Canada has a larger share of mature (11-30 years) and old (30 or more years) firms over the period of 2005-19 than urban areas. In comparison, there is a higher share of start-ups in urban areas (16%) than in rural areas (12%) and a higher share of young firms (between 2 to 5 years of age) in urban areas (24%) as compared to rural areas (19%).
 - **Firms that participate in innovation activities in rural areas tend to be older than those in urban areas.** Among firms that have applied for an R&D tax incentive programme, the largest share are mature and old firms (between the ages of 11-30 and 30 or more). In rural areas, 67.2% of firms participating in formal innovation activities were mature or old, while this number is lower in urban areas (55.5%). In urban areas, relatively younger firms participate in formal innovation activities more than the oldest (11 or more) and youngest (5 or less) firms as compared to rural areas.

- **The peak age when firms are likely to innovate is older (between 11-30 years of age) in rural areas than in urban areas.** The probability of innovating for a firm that is young (2-5) is 0.16 in urban areas and null (non-significant) in rural areas, compared to firms over 30 years of age. For firms that are in their intermediate ages (6-10), the probability is 0.219 in urban areas and 0.086 in rural areas. The highest probability for a firm to innovate in rural areas is in its mature age (11-30), where the probability is 0.105. In comparison, firms in urban areas in this same age group have a higher probability than rural firms (0.195) but less than firms that are between the ages of 6-10.

In rural areas, firms tend to have less **connectivity to international markets**. Yet, access to global supply chains is particularly important for innovation and the formation of new firms in rural areas.

- **A remarkable 41% of firms in rural areas that applied for tax incentive programmes related to formal R&D investment participated in global value chains and markets through imports or exports.** While this number was higher in urban areas (52%), participating in the global supply chain is a strong characteristic of innovative firms in Canada. This is surprising as only 5% of rural firms participate in trade (compared to slightly more, 7% of urban firms). Furthermore, a larger share of new firms in rural areas (0.71%) participate in global supply chains than in urban areas (0.56%).
- **For rural firms with only one export partner country, the gains from exporting are substantial and large.** In rural Canada, close to 82% of firms have only one export partner country. This is a higher share than in urban areas (74%). However, 26% of firms in urban areas have more than 1 trading partner, while only 18% have more than 1 trading partner in rural areas. Increasing the share of firms exporting by 1% is associated with a close to sixfold increase in export values in rural areas and explains quite a strong share (57% of the variation) of the outcome for export values.
- **The monetary returns to export activity are stronger in rural areas than in urban areas.** Even though most firms that export are in urban areas, the returns to an additional number of exporting firms are neither positive nor statistically significant in urban areas. However, one additional exporter in rural areas is associated with an increase in export values.
- **While participating in global value chains is important for innovation, there is still a rural disadvantage.** In urban areas, participating in global value chains is associated with a 0.68 higher probability of participating in formal innovation, while the likelihood is only 0.56 for rural firms.
- The analysis finds that there is some association between foreign ownership (investment) and innovation. However, this finding does not hold when controlling for other characteristics. Nevertheless, in urban areas, foreign ownership does boost the probability of participating in formal innovation processes. Having a foreign owner increases the likelihood of participating in formal innovation activities by 0.175 in urban areas, while no perceivable (statistically significant) benefit is observed in rural areas.

Individual characteristics of entrepreneurs can also impact how places innovate.

- **As individuals get older, they are less likely to start a new firm** in both urban and rural areas. The oldest working-age group (55-64 years of age) is the least likely to start a firm in both rural and urban areas. The finding on age and new firm formation is relatively consistent across rural and urban areas. In rural areas, the probability of starting a firm is higher (0.23) than in older age groups (0.19 for those aged 25-44 and 0.086 for those aged between 45-55). However, the same-aged individual has a higher probability of starting a firm in urban areas as compared to rural areas.

- In rural areas, close to half (49%) of new entrepreneurs are between the ages of 25 and 44, and there are relatively fewer entrepreneurs in older age categories despite the fact that there is a relatively higher share of older individuals in the population and labour market in rural areas. In comparison, close to 42% of new entrepreneurs are between the ages of 25 and 44 in urban areas and there is also a higher share of younger entrepreneurs.
- **Women are more likely to start a new firm 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.** Being a woman increases the probability of starting a firm in rural areas by 0.018, but not in urban areas, where being a woman is negatively associated with starting a firm (-0.005). However, the majority of women-owned firms with more equal ownership have a lower probability of participating in formal innovation than firms predominantly owned by men in rural and urban areas.
- **While rural areas have fewer immigrants, the latter are good for innovation and new firm formation in rural areas.** The entrepreneurial drive of immigrants in Canada is more pronounced in urban areas than in rural areas. This is a missed opportunity for rural areas. In both urban and rural areas of Canada, immigrants are more likely to start a new firm than non-immigrants; however, the likelihood of starting a firm in rural areas for immigrants is lower (0.124) than in urban areas (0.162). Immigrants tend to start new firms and a workforce with more immigrant diversity tends to be very positively associated with formal innovation activities. The benefits are larger for rural areas than urban areas. However, there is also a penalty for immigrant entrepreneurs in rural areas as compared to Canadian-born entrepreneurs, and they are less likely than Canadian-born entrepreneurs to extend their entrepreneurial practices to formal innovation activities.
- Finally, despite the fact that rural firms in the province of Ontario are the most likely to participate in formal innovation processes and practices, urban and rural firms in Quebec are relatively more likely to participate in formal innovation practices than many other places in Canada. Chapter 3 argues that this may be due to the regional innovation support mechanisms that both provinces of Ontario and Quebec have developed to a larger extent. Firms in rural areas of the northern territories, where there are higher proportions of Indigenous entrepreneurs as a share of total Indigenous peoples and individuals, are the least likely to participate in formal innovation activities.

Notes: *This is based on population centre estimates of rural areas. **According to the CMA/CA definition, this refers to 98% of the landmass, while alternative estimates from Statistics Canada “rural areas” identify 99.82% of the landmass as rural.

Rural areas in Canada are vast and heterogeneous in population and geography. With 98% of the total landmass, rural areas of Canada account for 6.6 million people or 17.8% of the population in 2021. The population living in remote areas represents three-quarters (74.6%) of the landmass but only 12.0% of the total population. Despite the growth in rural population in absolute numbers, there was faster growth in urban areas of Canada from 2016 to 2021 (Statistics Canada, 2022^[1]).

The conditions for innovation in rural areas are distinct from those of urban areas. The challenges and opportunities are different in contexts where scale (agglomeration) and density are low and comparative advantages are tied to natural resources. This chapter will focus on how geography, firm characteristics and individual characteristics play a role in formal innovation (through R&D investment and in new firm formation). While the analysis focuses on firm-level innovation, it underlines the importance of going beyond firm-level innovation to social innovation and public sector innovation. Chapter 3 will look further at policies for innovation.

Defining rural innovation

Understanding innovation in rural geographies requires first identifying rural areas within the context of the study and placing a critical lens on better understanding what type of innovation occurs in rural areas before pursuing further analysis.

Defining rural areas

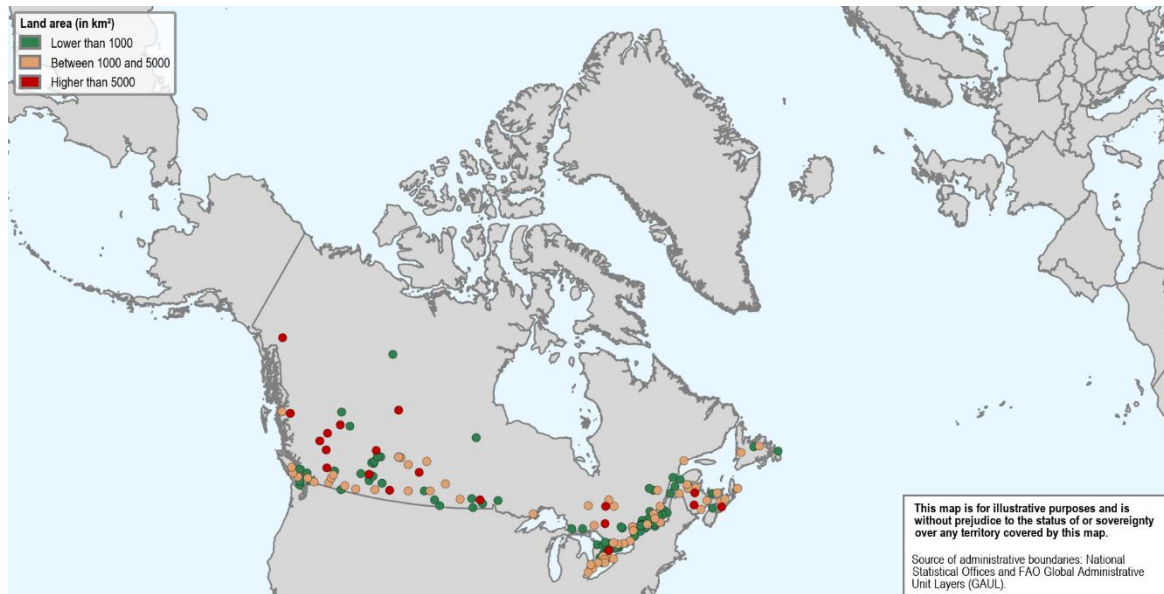
Understanding the geography of rural areas informs the perspective through which rural innovation policies can take place. In Canada, as in other OECD countries, no single definition of “rural” is consistently applied across all federal agencies and provinces in Canada. That is because different definitions are used in different contexts and for different purposes. Rural communities are diverse, and any comprehensive definition would need to have a clear purpose and likely capture key features to reflect the wide range of communities, including remote, island and coastal communities, as well as those that are urban-adjacent. Further, population cut-offs can be subjective, and “rurality” is perceived differently depending on the region (e.g. larger communities might be considered “rural” in Southern Ontario compared to Atlantic Canada).

In Canada, one publicly available and commonly used geographical classification is based on the unit of census subdivision (CSD) belonging to census metropolitan areas (CMA) or census agglomerations (CA). A CMA or a CA is formed by one or more adjacent municipalities centred on a population centre (known as the core). A CMA must have a total population of at least 100 000 inhabitants, based on data from the current Census of Population programme, of which 50 000 or more must live in the core based on adjusted data from the previous Census of Population programme. A CA must have a core population of at least 10 000, also based on data from the previous Census of Population programme. To be included in the CMA or CA, other adjacent municipalities must have a high degree of integration with the core, as measured by commuting flows derived from data on place of work from the previous census programme (Statistics Canada, 2022^[2]).

For the rest of this report, when using Canadian national statistics, urban areas are defined as a CMA with a population of at least 100 000 inhabitants and a CA with a population of at least 10 000 based on the previous census. Rural areas are defined as non-census metropolitan areas or census agglomerations (non-CMA/CA). In addition to the dichotomous CMA/CA versus non-CMA/CA definition that identifies urban and rural areas, there is a layer of complementary classifications used by some statistical programmes, particularly related to labour force statistics, that identify a core, a secondary core, a fringe area and rural areas (Statistics Canada, 2022^[3]). When used and available for a few specific statistical outputs, the disaggregation provides additional insights into geography.

Figure 2.1. Rural and urban areas in Canada

Census Metropolitan Areas (CMA) or Census Agglomerations (CA), by size



Note: This map shows CMAs and CAs coded by size of land area based on the census of population in 2021.

Source: Author's own elaboration based on Statistics Canada (2022^[4]), *Census of Population*, https://www12.statcan.gc.ca/census-recensement/alternative_alternatif.cfm?!=eng&dispext=zip&teng=lcma000b21a_e.zip&k=%20%20%20%2013083&loc=/www12.statcan.gc.ca/census-recensement/2021/geo/sip-pis/boundary-limités/files-fichiers/lcma000b21a_e.zip (accessed on 9 February 2024).

In consultation with the OECD Working Party on Territorial Indicators, a more recent development is the self-contained labour area (SLA). While not integrated into the primary classifications in the text, it provides an alternative system of classification. SLAs are a breakdown of non-CMA/CA areas into rural functional areas defined on reciprocal commuting flows among municipalities (census subdivision) (Statistics Canada, 2023^[5]). It was first released in the context of the remote working conditions applied to the quarterly Canadian Survey on Business Conditions (Statistics Canada, 2023^[5]; OECD, 2020^[6]). The release is experimental as it uses the new geographical concept of SLAs for the first time in response to the difficulties in gathering data on rural labour markets.

SLAs are a geographic concept that defines functional rural areas based on commuting flows comparable to that used for metropolitan areas. Compared to the CMA/CA-based classifications, SLAs offer a larger geographical coverage, using commuting data for all municipalities. Rural SLAs cover all Canadian municipalities outside CMAs and CAs. Each SLA consists of a self-contained grouping of areas where the majority of residents both work and live. Rural SLAs include only commuting flows among non-CMA/CA municipalities. The SLAs use census subdivisions as building blocks and the version used in this analysis is based on 2016 Census of Population data.¹

Placing a rural lens on innovation

When defined as a systematic effort to expand an economy by introducing new products or creating new processes, innovation can be supported by appropriate government policy. The majority of the literature on innovation today is focused on manufacturing or financial services sectors, where the main metrics for measuring innovation are still patent counts and expenditures on formal R&D. Nevertheless, there is a growing recognition that innovation can be found beyond manufacturing and that patent counts and research outputs are incomplete measures of innovation (OECD, 2022^[7]). In studies on the geography of innovation, Feldman and Kogler (2010, pp. 383-404^[8]) found that many of the conditions for a typical

science and technology-based innovation relied on access to universities and spillovers from agglomeration effects. Collectively, these facts suggest that innovation is most likely to take place in locations where it has already occurred and that urban areas offer the best geographic location for this to happen because they have universities and offer opportunities for many forms of knowledge spillover.

While this may be true, it does not preclude innovation from taking place in other types of geography, particularly if the notion of innovation is understood in the original sense and broadened beyond the manufacturing sector. Notably, Shearmur (2012^[9]) argues that much of the academic literature on cities and innovation that focuses only on metropolitan innovation systems may overstate both the role of cities in innovation and focus on the wrong reasons why cities play a large role. The first issue arises because of the narrow definition of innovation, while the second reflects the assumption that close interaction leading to spillovers is essential for innovation to occur. In contrast, Shearmur suggests:

“1. not all innovations require the same level and intensity of interaction... some types of innovation may rely more on observation, experimentation and cogitation than on constant interactions with external actors:

2. interaction can occur even if interlocutors are not co-located, yet it remains dependent on physical accessibility. This opens the door to certain types of innovation occurring in rural places.” (Shearmur, 2012, p. 513^[9])

While patents provide a useful metric for measuring innovation, they only measure types of innovation that can be or are patented. They overlook innovations that may be related to bringing social goods and public services or are considered “reverse innovations”.² Even in manufacturing, a firm may choose not to patent because the cost exceeds the perceived benefits. Further, patents are a measure of invention that is not necessarily acted upon through implementation, which is the true measure of innovation. For example, artisanal beer and drink innovators in the Gaspé region argue that innovation is a part of how they function. If they were to patent every new product they provide to the market, more time would be spent on legal and administrative procedures than their human resources could accommodate. Other forms of firm innovation may not be patentable, including innovations in logistical processes, labour relations or other management activities, all of which can increase productivity. This is because innovations in processes are often not patentable (both in terms of eligibility and in terms of financial, legal constraints and pay offs), nor is this the case when we look at some firm products that may not be incremental or not scalable (for example, bespoke engineering) (OECD, 2022^[7]). Such innovations are applicable to both firms in the service sectors and to manufacturing firms. Similarly, both governments and civil society organisations can engage in innovative actions that improve their ability to provide public and “third sector” services.

A similar argument can be made for innovation statistics focused on R&D expenditure and jobs. As proxy indicators of innovation, they are input-based measures of innovation activities rather than output-based measures (such as patents). They capture intent to innovate, perhaps more broadly than patent-based indicators. Nevertheless, they miss all forms of innovation from governments, civil society and firms that do not explicitly self-identify the creation of new products, services and practices (processes) as a form of innovation (OECD, 2022^[7]).

In rural areas, the importance of a broader perspective on innovation is particularly relevant because these regions do not fit the stylised facts of Feldman and Kochler, and it is easy to conclude that innovation does not occur in rural areas when what is true is that certain types of innovation do not occur in rural areas. When a broader notion of innovation is used, which is expanded to include any activity that leads to a new or improved good or service that increases productivity or the quality of life of the community, then it is fairly easy to find examples of rural innovation. Such a definition is followed by the OECD (2016^[10]): “It goes far beyond the confines of research labs to users, suppliers and consumers everywhere – in government, business and non-profit organisations, across borders, across sectors, and across institutions”.

As the scope of innovation expands beyond new products and technologies, the relevance of patents or expenditures on R&D as metrics of innovation also diminishes. In this regard, public sector innovation that focuses on improving services delivered by the public sector, civil society and social innovators has become increasingly important (OECD, 2022^[11]). Neither of these activities is captured by standard science and technology-based innovation statistics. Nevertheless, social enterprises provide goods and services to customers but under a business model that is something other than profit-maximising. In Canada, there is a long history of social innovators, co-operatives and credit unions in both urban and rural areas, and there is considerable evidence of innovative behaviour (McMurtry and Brouard, 2015^[12]).

The OECD recognises that the structure of the rural economy differs from that of the modern urban economy found in large cities (2016^[10]). In rural regions, more remote from urban centres, a “low-density economy” exists that is dominated by small local labour markets with few employers and only a limited number of goods and services being produced (see Chapter 3). Furthermore, the structures of Indigenous economies, in relevant OECD economies, within these regions are unique to other rural/remote populations for many reasons, for example because of the uniqueness of barriers to innovation and economic development on reserves and the different structures of governance among First Nations communities.³ In addition to there being only a limited variety of goods and private services, local governments and, where relevant, government department Indigenous Services Canada also provide limited public services because they lack the resources to fund more than essential activities.⁴ This places a far greater responsibility on local civil society to play a larger role in providing missing services commonly provided by the market or government in urban areas. Social enterprises (including co-operatives), church groups, service organisations (like the Lions Club or Kiwanis Club) and a variety of other community organisations voluntarily provide much of the social infrastructure in rural places.

In the context of this study, innovation can be thought of as being driven by the challenges of its environment, including the challenges of scale, density and distance to resources for rural innovators. Some of the challenges that accrue with increased distances and loss of density and scale can be summarised in the following way.

Figure 2.2. Innovation challenges related to scale, density and distance for innovators in increasingly remote rural areas



Challenges of scale, density and distance mean that innovation in rural areas has a very different context. First, for the most part, no local formal innovation system links research to innovation, where people are employed to bring new ideas into practice. Universities and other academic research facilities are rarely located in rural areas unless the nature of their research dictates their location.⁵ For example, the Experimental Lakes Area in the Kenora District of Ontario conducts globally recognised research on the effects of various forms of pollution on freshwater aquatic systems. However, its direct impact on the immediate area is limited because it focuses on a broad range of pollutants, few of which are experienced locally; it employs few local people and many of its purchases come from urban areas. In addition, rural firms are often small and have little or no formal investment innovation activity.

Second, there is a limited ability to purchase solutions to any problems a firm or household may face in carrying out its activities. This can lead to greater interest in user innovation, user-driven innovation and collaborative forms of user-driven innovation, such as in the following examples:

- **User innovation:** Individuals, such as Armand Bombardier, directly engage in innovative activity because they see no other possibility for a solution.
- **User-driven innovation:** The end user finds another actor to provide a solution that will resolve the problem, such as in partnership with research institutes when they are available and accessible in rural areas.⁶
- **Collaborative user-driven innovation:** In each small community, the mix of needs and capacities is different, which often leads to novel ways of providing services, including through volunteerism or co-operative efforts to attain scale.⁷

Third, while finding examples of innovation in rural areas is relatively easy, it is seldom directly marketable or in a form that has significant consequences for other people and places. This is even more the case for underrepresented business owners in rural areas. Most rural innovations improve the life of the community by giving households new or better services or increasing the competitiveness of local firms so they continue to operate. These local benefits are meaningful to the community and may be applicable in other places but, typically, there is no effort to apply the innovation to another place. Those producing the innovation either do not think to look for other applications or do not have the resources or inclination to promote their idea. They serve a local demand for local goods and services. For example, this could originate from different government initiatives to solve a local challenge with no real perspective for wider commercialisation. Furthermore, it is unlikely that a casual visitor will recognise the potential for the innovation to be applied elsewhere. Nevertheless, the cumulative effect of innovations in small places may well be significant in the aggregate, given the number of small places in Canada.

Source of data

In the majority of the chapter, we examine the structure of rural Canada as it relates to entrepreneurship and innovation using open data from Statistics Canada and the OECD, supplemented with confidential data from government agency Statistics Canada. For the analysis of the firm sector, size and age dynamics, as well as regression analysis on innovation and entrepreneurship, we make use of the Canadian Employer-Employee Dynamics Database (CEEDD) between 2005 and 2019, with the exception of urban start-up figures, which are only available from 2011 to 2019. The CEEDD is a large-scale matched database between workers and firms, covering all individual and corporate tax filers. The database capturing entrepreneurial characteristics of start-up entrepreneurs includes a cumulative count of 123 million observations in urban areas and 37 million in rural areas from 2011 to 2019.⁸ This represents a cumulative count of 17 million individual entrepreneurs⁹ in urban areas and 5 million in rural areas from 2011 to 2019. The analysis on innovation within firms (once already established) includes a cumulative count of 8 million observations in urban areas and 2 million observations in rural areas, capturing 1 million establishments¹⁰ (statistical clusters)¹¹ in urban areas and 250 000 firms (statistical clusters) in rural areas from 2011 to 2019.

Using this data, we examine how firms operating in rural areas differ from their urban counterparts in characteristics such as industry, firm age, size and patterns of start-ups. We then investigate the role of different individual and local characteristics in fostering entrepreneurship among youth, women and immigrants in rural areas. Data were gathered from openly available Statistics Canada resources to analyse gross domestic outputs, population, exports and labour market characteristics of wages. For analysis of immigration, data were gathered from Gure and Hou (2022_[13]) on the 2020 Longitudinal Immigration Database. For analysis related to the section on well-being, the data primarily come from the OECD.

Setting the scene for innovation in rural Canada

Innovation can breed both opportunities and inequalities (Aghion et al., 2018^[14]). When innovation leads to higher firm profits, more jobs, higher-paid jobs or better-quality jobs, it can bring prosperity to a region. A study using linked employer-employee data in 20 OECD countries found that firm characteristics determine half of wage inequalities (Criscuolo et al., 2023^[15]). In 2020, as in previous years, income inequality in Canada was lower than the OECD average ranking 9 out of 35 OECD countries with available data and much lower than its nearest geographical neighbours, Mexico and the United States (OECD, 2015^[16]; 2023^[17]).¹² In Canada, the income gap between households in rural and urban areas has been falling, from 12% in 2000 to only 6% in 2020 (Annex Figure 2.A.1). Across geographies, the fall in the income gap in rural areas was primarily due to faster growth of average income per household, after taxes and transfers, in rural areas. In addition to low inequalities, Canada is also a place of social mobility.¹³

The rest of this section will draw on statistics that identify firms that innovate through status as a recipient of the Scientific Research and Experimental Development (SR&ED) tax incentive through the CEEDD. While this is an imperfect measure of innovation, it provides some indicator of whether the firm participates in formal innovation activities through investment and expenditures. It then draws on descriptive data to set the scene for innovative activities.

Productivity, innovation and entrepreneurship in rural Canada

Rural areas are an important contributor to the national Canadian economy. Metropolitan regions of Canada represented close to three-quarters of total GDP in both 2018 and 2009 (74% and 75% respectively), meaning that rural regions contained a stable quarter of the economy (Annex Figure 2.A.1). Compared to other large OECD countries, the contribution of rural Canada is substantial.¹⁴ By comparison, in the United States, non-metropolitan GDP accounted for 10% of all GDP in 2020 (OECD, 2023^[18]).

Labour productivity, frequently used as a proxy for innovation absorption, is higher in rural areas than in urban areas of Canada and has been growing (Figure 2.3).¹⁵ In rural areas, the labour productivity was higher than in urban areas in 2019 (112 000 GDP per worker in urban versus 116 000 GDP per worker in rural areas) and grew by 16% between 2011 and 2019, compared to 36% in urban areas. Despite a relatively high level of aggregate labour in rural areas as compared to urban areas, the overall share of total aggregate (rural and urban) labour in rural areas was 25% in 2019, as compared to 75% in urban areas in 2019, a 2.1-percentage point fall from the rural share of labour in 2011.-

Despite some evidence suggesting a good level of absorption of innovation, as proxied by productivity, other innovation indicators demonstrate room for improvement. For example, Canada has a surplus of individuals with tertiary education in information, communications and technology programmes (OECD, 2022^[19]; 2022^[20]) and a growing number of migrants filling skills gaps (OECD, 2022^[21]). However, investment in research and innovation is low as compared to other OECD countries (OECD, 2023^[22]). In addition, many common innovation indicators, such as investment in R&D and patents, often are biased towards industries with a higher composition in rural areas. As such, interpreting such indicators should be taken relatively more cautiously when discussing development in rural areas.

High-technology innovation, as proxied by patents, is a substantial form of innovation in Canada. Canada has the 9th highest number of patent applicants, based on statistics on all available patent applications from 2020. With over 3 100 patent applications in 2020, Canada follows behind the United States, Japan, Germany, Korea, France, the United Kingdom, Italy and the Netherlands (from highest to lowest).¹⁶ While it grew 6% from 2010, where the total count was just over 2 900 applicants, it was still lower than the unweighted average of OECD countries (close to 4 700 applicants) (OECD, 2023^[23]).

Figure 2.3. Labour productivity is more volatile in rural areas

GDP per worker (labour productivity) in levels, growth rates and shares, 2011 to 2019



Note: Workers 15 to 64 years of age are considered. All sectors of the economy are included. The contribution of rural areas to aggregate labour productivity is the share of aggregate productivity that is due to the rural sector. It is calculated as GDP at basic prices in millions of current CAD by CMA (x 1 000 000). Labour productivity is in thousands in panel A. Exceptionally, due to lack of consistent data, labour productivity is estimated using CMA and non-CMA statistics, rather than CMA/CA and non-CMA/CA statistics, as in the rest of the report. Employment refers to the number of persons who, during the reference week, worked for pay or profit, performed unpaid family work or had a job but were not at work due to their own illness or disability, personal or family responsibilities, labour dispute, vacation or other reasons. Those persons on layoff and those without work but who had a job to start at a definite date are not considered employed. Estimates for employment are in thousands, rounded to the nearest hundred.

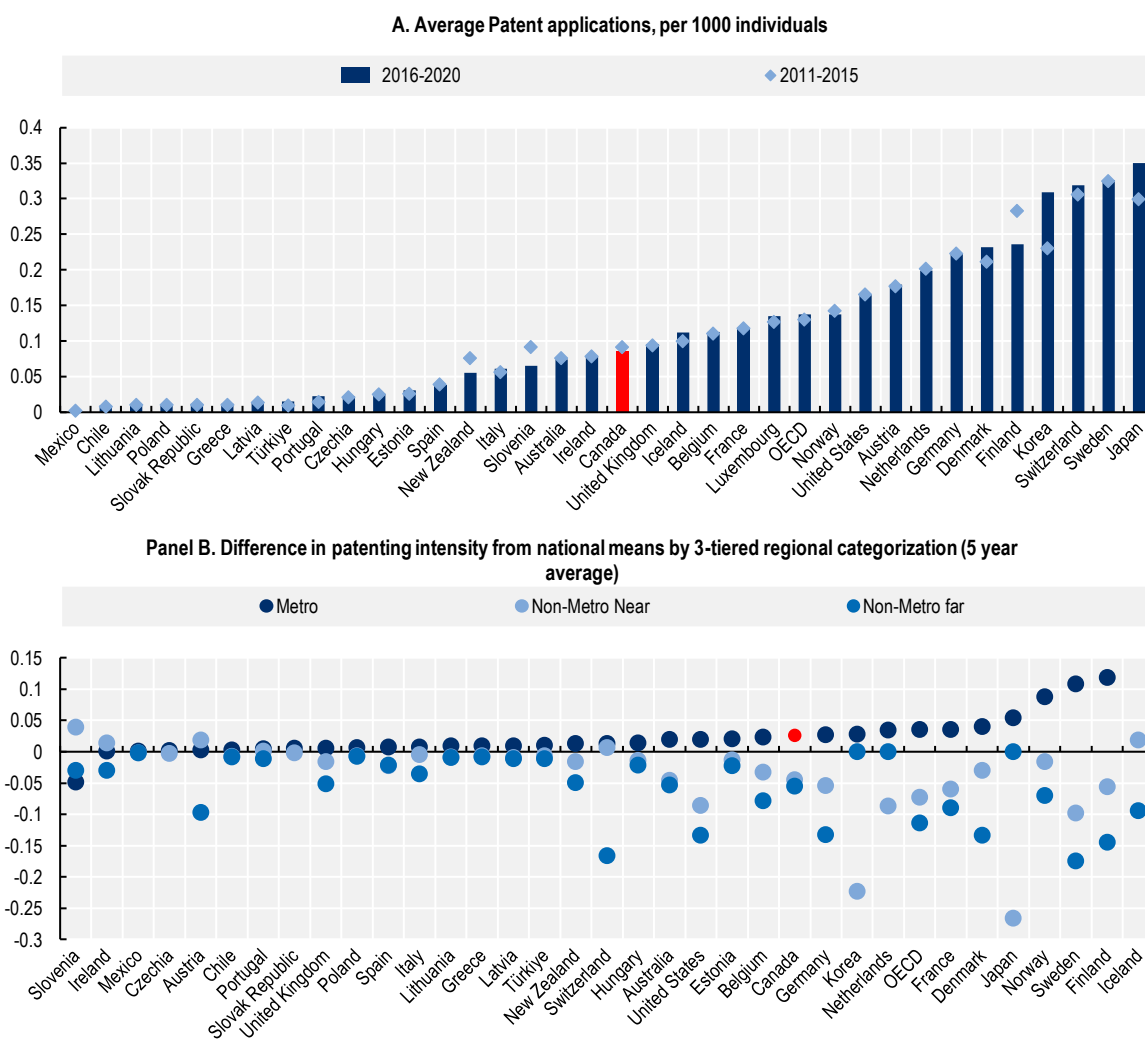
Source: Analysis based on Statistics Canada (n.d.^[24]), *Gross Domestic Product (GDP) at Basic Prices, by Census Metropolitan Area (CMA) (x 1,000,000)*, Tables 36-10-0468-01 (GDP), <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=3610046801>; Statistics Canada (n.d.^[25]), *Population Estimates, July 1, by Census Metropolitan Area and Census Agglomeration, 2016 Boundaries 17-10-0135-01 (worker)*, <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=1710013501>.

Scaling patenting statistics by the size of the population reduces Canada's ranking, as it does for many other countries. Patent intensity (number of applicants per 1 000 individuals) is relatively low in Canada over the 5 years from 2016 to 2020, standing at 0.085 patents per 1 000 individuals (or close to 9 per 100 000 individuals) (Figure 2.4, Panel A).¹⁷ In comparison, the OECD average is 0.14 patents per 1 000 individuals (or 14 per 100 000 individuals).

There is lower patent intensity in remote rural regions of Canada than in metropolitan regions (Figure 2.4, Panel B). The patenting intensity in non-metropolitan remote rural regions (using OECD harmonised regional definitions elaborated in Annex 2.B) is low as compared to national averages. Over the average of the 2016-20 period, there were 0.03 patents per 1 000 inhabitants in non-metropolitan rural remote regions of Canada. This was close to a third of the Canadian national average of 0.085 patents per 1 000 individuals. In comparison, in OECD countries, the average country-level patent intensity over the same period was 0.14 patents per 1 000 individuals from 2016 to 2020, with a patenting intensity that was 7 times lower in rural remote regions (0.02 patents per 1 000 individuals).

Figure 2.4. Regional differences in patenting intensity

Total patent applicants filed per 1 000 individuals, 5-year averages



Note: OECD values refer to unweighted country averages based on total population and patent applicant counts over the span of five years. Only countries with regional data for both patents and population were included in Panel B. Colombia was excluded because of only zero patent reporting across all years. Patent applications that were not assigned to a location were not included in the analysis. The small regional classification system (TL3) is based on the description found in Annex 2.B. The category “Metro” includes large metropolitan regions and (medium-sized) metropolitan regions; the category “Non-metro near” refers to non-metropolitan regions close to metropolitan regions and non-metropolitan regions close to small and medium-sized cities; and the category “Non-metro far” refers to non-metropolitan remote regions. Percentage deviations of patent intensity refer to percentage differences between each type of three-tiered region’s average patent intensity from national means.

Source: Based on OECD (2023^[23]), “Regional innovation”, <https://doi.org/10.1787/1c89e05a-en>.

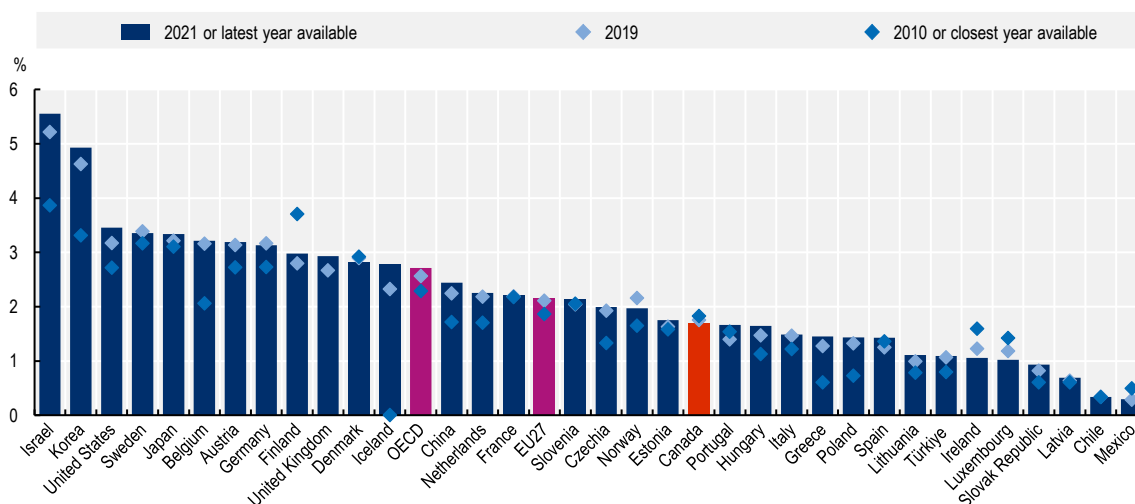
Unlike some of the top performers on patent-producing innovations, the geographical differences in patenting intensity between metropolitan regions and non-metropolitan remote rural regions are not as stark (Figure 2.4, Panel B).¹⁸ Over the 5-year period from 2016 to 2020, the average difference between patent intensity in non-metropolitan remote regions and metropolitan regions in Canada was 0.08 patents per 1 000 individuals (0.11 patents per 1 000 individuals in metropolitan regions versus 0.03 in non-metropolitan remote regions). In comparison, over the same period of time, the average difference between patent intensities in non-metropolitan remote regions and metropolitan regions in OECD countries was 0.14 patents per 1 000 individuals (0.17 patents per 1 000 individuals in metropolitan regions versus 0.02 in non-metropolitan remote regions). This makes the geographical differences three-quarters lower in Canada than on average in OECD countries from the period of 2016 to 2020.

Patent intensity differences across regions are also less than half as big as its nearest neighbour, the United States (0.16 patents per 1 000 individuals more in metropolitan regions than in non-metropolitan remote regions), and 4 times less of a gap than Japan (a high-patent intensity country with 0.35 patents per 1 000 individuals more in metropolitan regions than in non-metropolitan regions close to metropolitan regions).¹⁹ It is more closely on par with geographical differences in patenting intensity with Australia (0.07 more patents per 1 000 individuals in rural remote regions than in metropolitan regions).

As compared to other OECD countries, the intensity of gross domestic expenditure on R&D as a percentage of GDP in Canada in 2021 was 1.7% (Figure 2.5). In comparison, values were higher in countries such as Israel (5.6%) and Korea (4.9%). R&D intensity in the OECD area climbed from 2.3% in 2020 to 2.7% of GDP in 2021, falling from 1.83% in 2010 to 1.7% in 2021 in Canada. Over the same period, R&D intensity as a percentage of GDP increased in the European Union (EU27) area from 2.1% to 2.2% and in the United States from 3.2% to 3.5%.

Figure 2.5. R&D intensity in OECD countries

Gross domestic expenditure on R&D as a percentage of GDP



Note: Data for the United Kingdom are only available for 2018-20 and are preliminary. Following a major data revision by the UK statistical agency conducted in late 2022 and effective only from 2018, back series for previous years have been suppressed from the data available to OECD. 2021 data correspond to 2020 for Chile, Colombia, Mexico, Türkiye and the United Kingdom. See OECD Main Science and Technology Indicators, <http://oe.cd/msti>, for the most up-to-date indicators. (accessed 8 February 2023).

Source: OECD (2023^[22]), *OECD Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption*, <https://doi.org/10.1787/0b55736e-en>.

In 2018, the majority of firms in Canada (99%) did not report having spent funds on R&D. Among those that did report having expenditures on research and innovation, the share of firms was marginally higher in urban areas than rural areas, based on analysis from the CEEDD (Annex Figure 2.A.2). In 2018, 1.1% of firms in urban areas reported participating in R&D activities, against slightly less, 0.8% of firms reported participating in R&D activities in rural areas.

Low R&D investments and patenting statistics do not necessarily preclude areas from participating in innovation, as many forms of innovation, such as the wider (non-science and technology) concept of innovation and social innovation, are not adequately captured in these types of statistics. For example, Quebec, a large province with a large rural population, has seen low shares of R&D and patents but still observes that between 2017 and 2019, 78% of firms reported innovating in self-reported, broader measures of innovation (OECD/Eurostat, 2021^[26]; OECD, 2023^[27]). The large majority of firms' self-reforming innovation, about 71%, is done through process innovation, while 51.3% of firms stated their focus on product innovation and reported that lack of skills (28.9%) was the largest challenge for innovation.

Finally, an additional indicator of innovation through new activity is the rate of start-ups or new firm formation. While comparative data on start-up activity by geography are scarce, the formation of new firms in a competitive environment can still be an important determinant of innovation (Aghion et al., 2009^[28]). Unlike R&D and patent statistics, the challenges of the sectoral applicability of indicators of start-up activities are not as substantial. As such, the direct interpretation of such statistics are determinants of new activities are more easily reliable, despite the fact that it is not possible to know how innovative the firms may be in product or process development. In Canada, on average, close to 4.3% of firms in rural areas are start-ups, as compared to 6.4% in urban areas in 2005-19 (Annex Figure 2.A.3). Despite signs of positive activities in rural areas, lagging in terms of new firm formation can be a challenge for innovation. If the start-up rate was the same in rural areas as in urban areas in 2018, there would be an additional 8 100 new firms in rural areas.

Firm characteristics as drivers of innovation

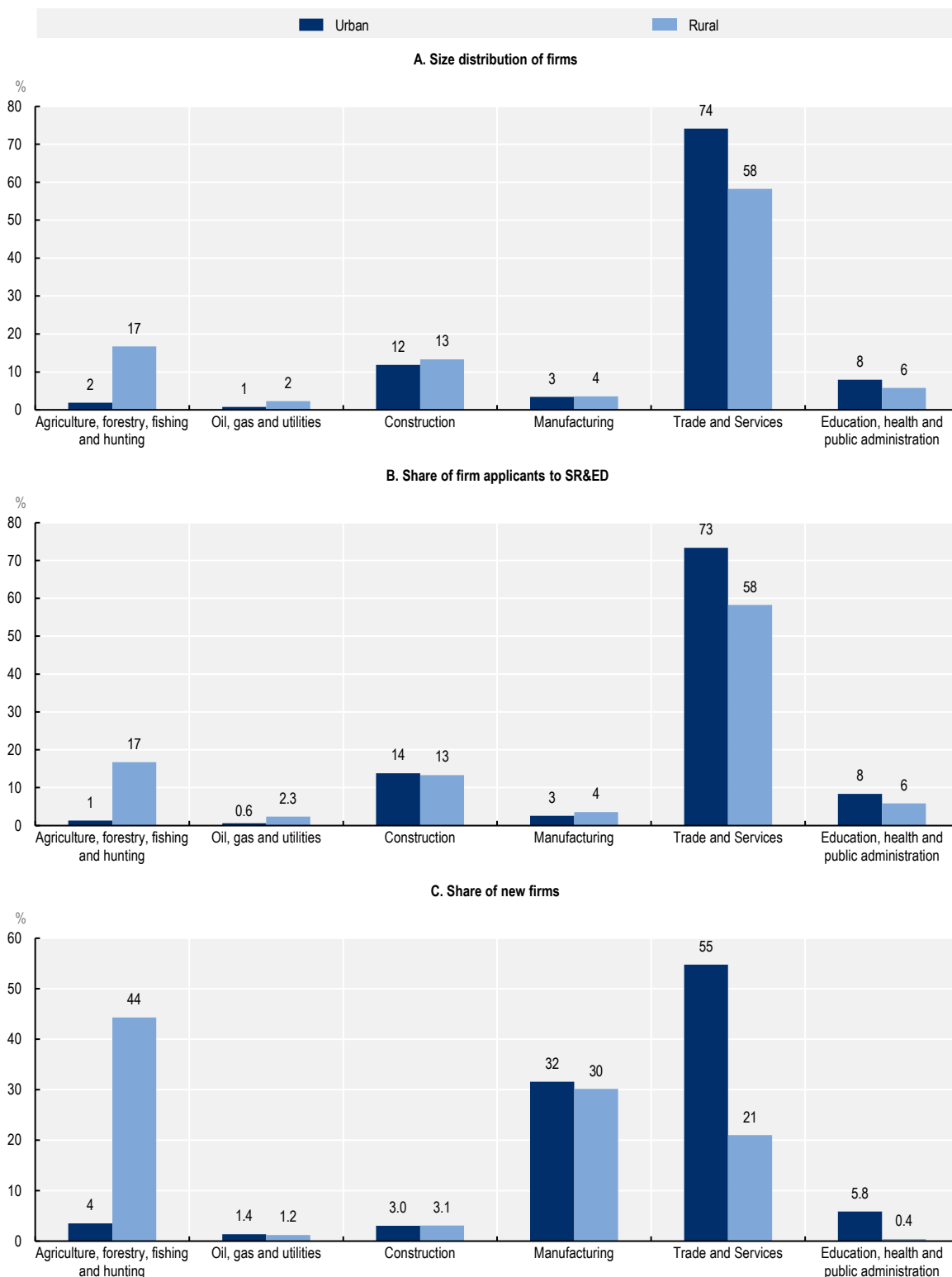
Firm characteristics impact how firms innovate in Canada (Galindo-Rueda, Verger and Ouellet, 2020^[29]). Primary and manufacturing industries tend to play a stronger role in rural areas compared to service-driven urban economies. Firms are often smaller, older and have less connectivity to international markets. Furthermore, larger and older firms often conduct heavy research and investment-type innovations (OECD, 2023^[30]). Nevertheless, younger firms tend to enter the market with new ideas for products and processes, despite the fact that they may not always have as easy access to heavy investment for traditional science and technology-type innovation. Small firms innovate through nimble adaption processes and can ultimately impact innovation in larger firms through mergers and acquisitions. Importantly, the characteristics of firms, such as age and size, are often targets of public policies for innovation and entrepreneurship. As such, understanding their distribution across geographies is important for encouraging rural innovation and entrepreneurship.

Sectoral activity

In rural areas of Canada, 44% of firms that participate in R&D are in the primary sector (agriculture, forestry, fishing and hunting) (Figure 2.6). In comparison, only 4% of firms in urban areas innovate in the primary sector. In fact, over half of the firms that participate in formal R&D in urban areas are in the trade and services sector. Manufacturing firms in urban and rural areas account for slightly less than a third of innovating firms. For rural areas, the third-largest sector of firms' innovative activities is the trade and services sector.

Figure 2.6. Size distribution of firms, innovation and new firm formation

Size distribution of firms, firm entry and SR&ED applicants in Canada, by sector and geography, 2010-19



Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

The rural trade and services sector is lagging in terms of innovation despite accounting for the largest share of firms. For example, the trade and services sector accounts for 58% of total firms and new firms but only 21% of innovating firms (Figure 2.6). As compared to urban areas, it accounts for 74% of total firms, 73% of new firms and 55% of innovating firms. On the other hand, the primary (agricultural sector) is highly innovative in rural areas, accounting for the highest share of innovating firms (44%) and 17% of both total and new firms.

Excluding the relatively large public sector, the top three industries in terms of employment size are wholesale retail and trade, manufacturing and construction²⁰ (Annex Figure 2.A.6, Panel A). Agriculture alone is still relatively important, accounting for 7% of total employment in rural areas, but is surpassed by wholesale retail and trade services (13%) and manufacturing (11%) sectoral activities. Though relatively important for developing an ecosystem of support services, professional, scientific and technical services are relatively low in rural areas, at 4%, compared to 9% in urban areas. The public sector²¹ plays an important role in terms of employment in rural and urban areas of Canada, with 25% of rural employment and 26% of urban employment. This share of employment is relatively similar to the public employment rates for OECD countries (OECD, 2021^[32]).²²

In rural areas, employment fell by 6% from December 2011 to December 2019 and by twice as much (12%) including employment figures for the first year of the COVID-19 pandemic in 2020. In comparison, urban areas saw a 14% growth in employment, which only fell slightly to 11% in the first year of the pandemic.

The services sectors observed the largest growth in both rural and urban areas. However, despite this growth, during the pandemic, there was less growth in information, culture and recreation services in rural areas, while the transport and storage sector observed losses in urban areas. In rural areas, there were only four sectors that grew in terms of employment from 2011 to 2020 and they were primarily in the services sector. These included education (11.5%), professional services (5%), utilities (3%) and public administration (2%). Looking at growth the year before the crisis (2019) indicates that there was still growth in several services sectors, but it additionally included the information, cultures and recreation sectors and other services. In comparison, in urban areas, the majority of sectors saw growth from 2011 to 2020, with the strongest in professional services (28%), education (24%), finance, insurance and real estate (24%) and healthcare (22%). Excluding 2020, growth from 2011 to 2019 was similarly strong in these service sectors but also included the transport and storage sector. The highest growing sectors from 2011 to 2019 were transport and storage (24%), healthcare (23%), professional services (23%), finance, insurance and real estate (21%) and education services (21%).

Despite some growth in a few goods and services sectors, the aggregate trends in the goods-producing sector fell by close to 8% from 2011 to 2019, while the service-producing sector fell by 5% (Annex Figure 2.A.6).

Both goods and services sectors fell further to 12%, from 2011 to 2020. In comparison, in urban areas, both goods and service-producing sectors grew. In urban areas, there was an 8% growth in the aggregate goods sector from 2011 to 2019, which fell 1 percentage point the following year, and a 15% growth from 2011 to 2019 in the services sector, which fell 3 percentage points the following year, in 2020. The weight of the goods-producing sector,²³ often associated with industries in the tradeable sector such as manufacturing²⁴ and agriculture, is relatively more important in rural than in urban areas.

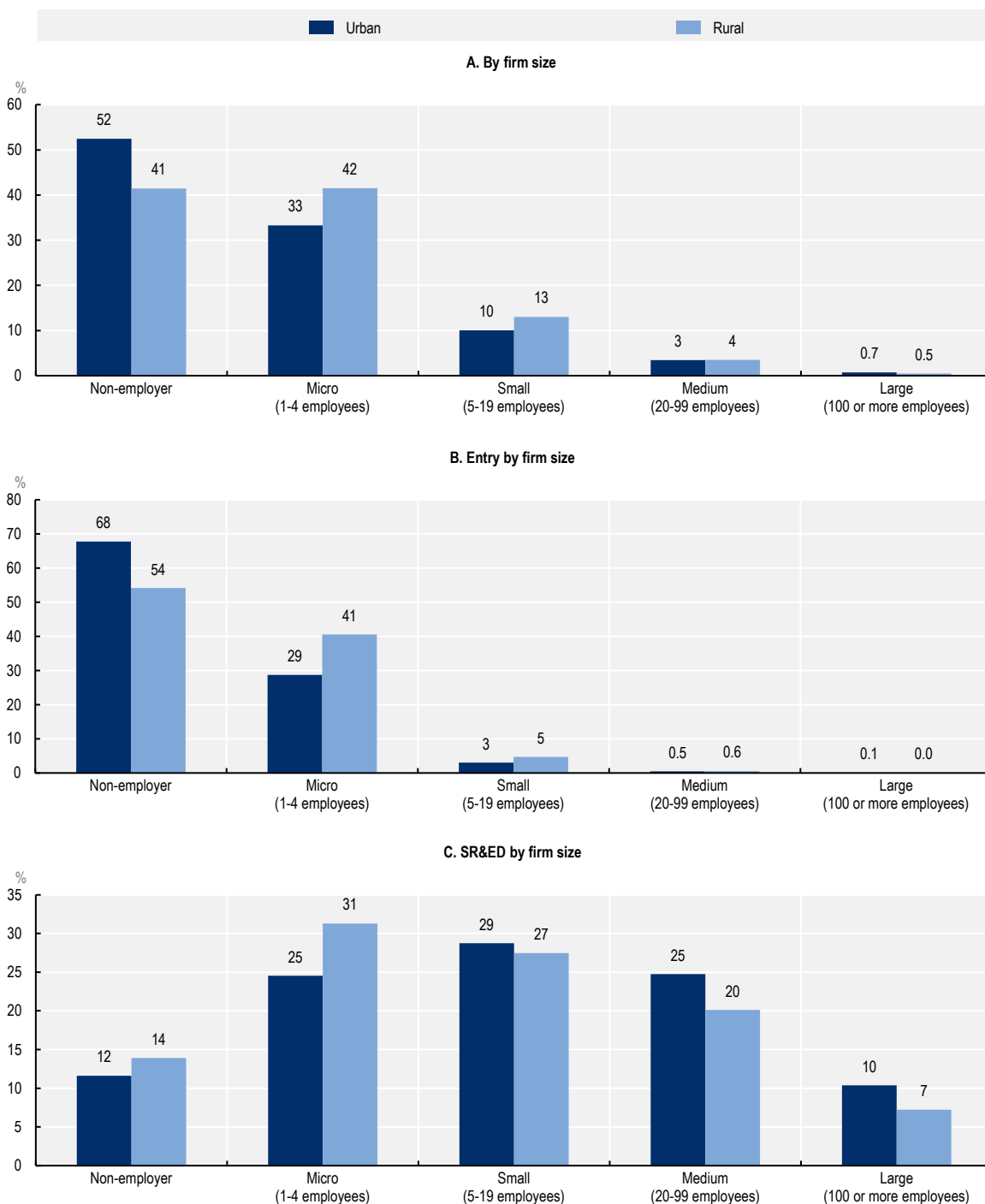
Size of firms

Most firms are micro in rural Canada. Between 2010 and 2019, 85% of firms in rural Canada were micro, with fewer than five employees, or non-employer firms (Figure 2.7, Panel A). This is a common finding in most rural areas that tend to have a cluster of small-sized firms rather than large firms (OECD, 2023^[30]; 2022^[33]). In comparison, 83% of firms in urban areas were micro or non-employer firms. As such, this finding is relatively consistent with other country studies. Of the share of small firms, there are fewer self-

employed individuals (non-employer firms) in rural areas (41%) than in urban ones (52%). There is a higher share of micro and small firms among firms with employees than in urban areas.

Figure 2.7. Size distribution of firms, innovation and new firm formation

Size distribution of firms, firm entry and SR&ED applicants in Canada, by geography, 2010-19



Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

There tends to be a higher share of micro and small firms (fewer than five workers) that innovate in rural rather than urban areas. The share of firms participating in formal R&D processes in rural areas tends to be micro (31% for micro firms with 1-4 workers) or small (27% for small firms with 5-19 workers) (Figure 2.7, Panel B). In comparison, in urban areas, the largest share of firms that participate in formal R&D processes are small firms (29% for small firms with 5-19 workers), followed by medium-sized firms (25% for medium-sized firms with 20-99 workers) and micro firms (25% for medium-sized firms with 1-4 workers).

Lastly, the formation of new firms follows a different pattern in rural and urban areas. While there are more non-employer firms in urban areas, there is a larger share of firms with at least one employee in rural areas. For instance, the share of new firms created with no employees is high in both rural and urban areas but higher in urban areas (68%) than in rural areas (54%). Relative to urban areas, rural areas have more new firms that have between 1 to 4 employees (41% in rural areas and 29% in urban areas) and more new firms that have 5 or more employees (5.6% of all new firm formation in rural areas and 3.6% of all new firm formation in urban areas).

Age of firms

Firm churning (the entry and exit, or openings and closings of firms) is often associated with dynamic and healthy innovative environments. However, too many barriers for young firms can lead to limited opportunities for scale-up, while too little competition can also mean that firms remain in the market past the optimal due date, removing resources from otherwise more innovative and younger firms.

Firms in rural Canada are older than those in urban areas. Close to half of all firms in rural Canada have operated for more than ten years. Rural Canada has a larger share of mature (11-30 years) and old (30 years or more) firms over the 2005-19 period than urban areas (Figure 2.8). In rural areas, 48% of all firms are between 11 and 20 years old, compared to 37% in urban areas%. There is a higher share of start-ups in urban areas (16%) compared to rural areas (12%) and a higher share of young firms (between 2 to 5 years of age) in urban areas (24%) as compared to rural ones (19%).²⁵

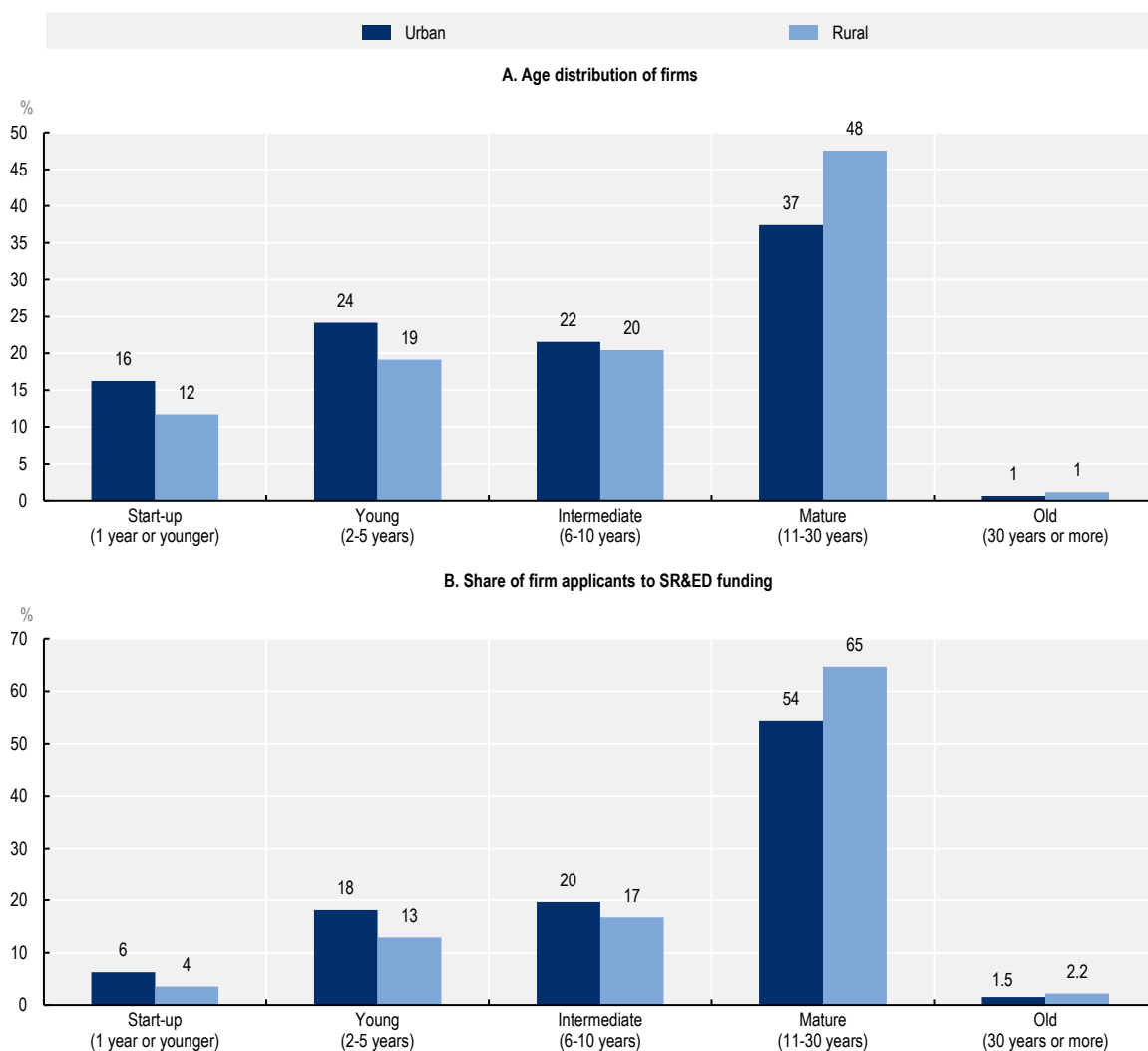
Firms that participate in innovation activities in rural areas tend to be older than those in urban areas. Among firms that have applied for an R&D tax incentive programme, the largest share has been operating for at least 11 years (corresponding to the age groups in Figure 2.8 of 11-30 and 30 and more). In rural areas, 67.2% of firms participating in formal innovation activities were mature or old, while this number was lower in urban areas (55.5%). In urban areas, larger shares of younger firms demonstrate R&D-related investment activities than those in rural areas. There are more start-ups (1 or younger), young (2-5 years of age) and intermediate (6-10 years of age) firms in urban areas that participate in formal innovation than in rural areas.

Connected firms and entrepreneurs

No inventor is an island. Networks between individuals matter for innovation and, in particular, for new entrepreneurs (Diemer and Regan, 2022^[34]). Innovation can occur through import and export competition as well as through networks of entrepreneurs (Shu and Steinwender, 2019^[35]; Guadalupe, Kuzmina and Thomas, 2012^[36]; Baldwin, 2004^[37]). Foreign owners may provide diverse ideas and opportunities to firms that may otherwise be more difficult, leading to new innovative products and processes. For example, a study on Spanish manufacturing firms found that multinational companies with foreign networks conduct more product and process innovation (simultaneously adopting new machines and organisational practices) and adopt foreign technologies, leading to higher productivity (Guadalupe, Kuzmina and Thomas, 2012^[36]).

Figure 2.8. There is a larger share of older firms in rural areas

Age distribution of firms and SR&ED applicants in Canada, by geography, 2010-19



Note: Categories represent average annual counts of firms by age group.

Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

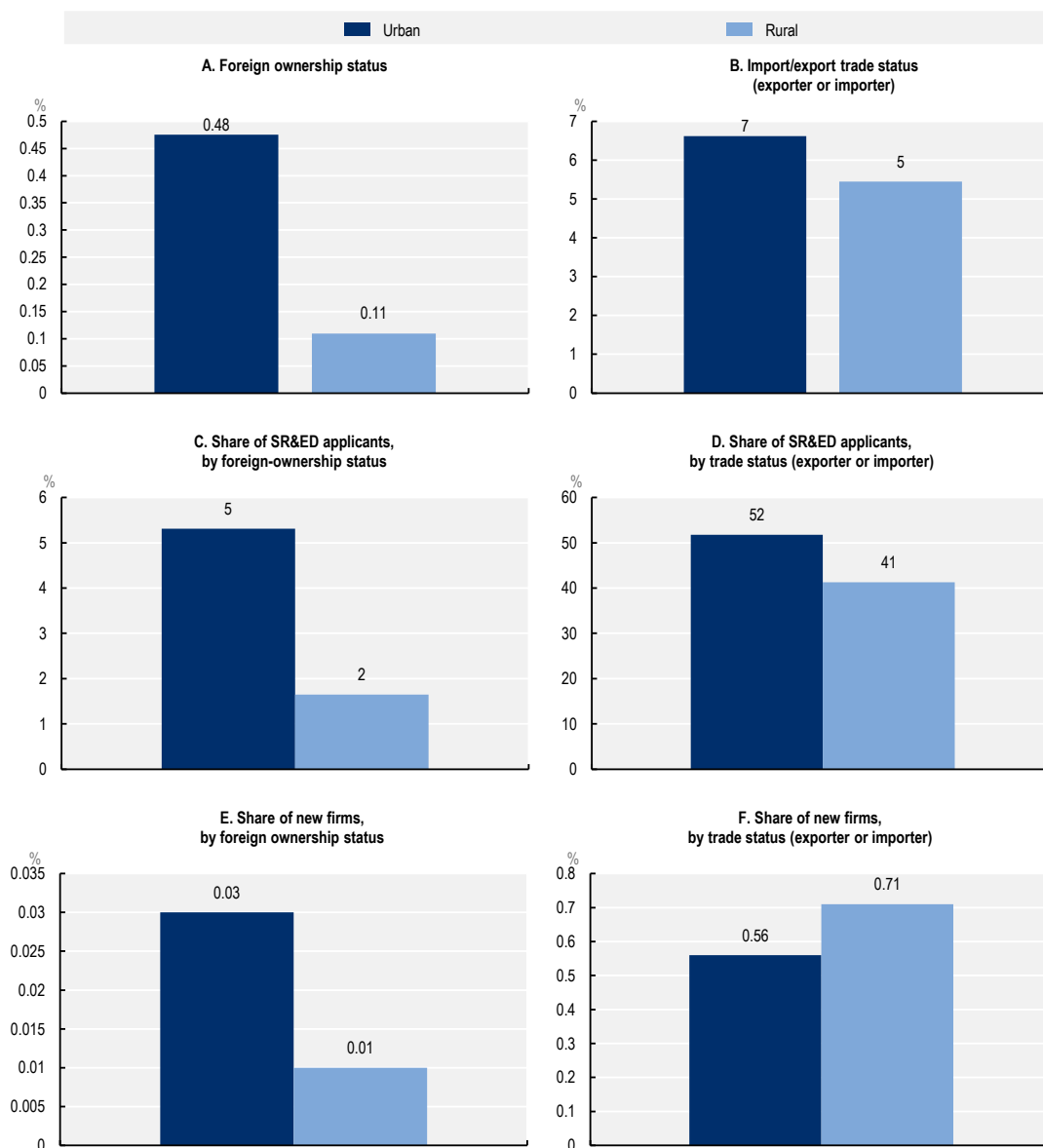
However, not all firms have equal access to networks in rural areas. One reason for this is the lack of quality communications infrastructure (OECD, 2022^[38]). For example, metropolitan regions in Canada have 40% higher broadband download speeds than the OECD average, while regions far from metropolitan areas have 4% slower speeds than the OECD average. This creates a gap of 44% between metropolitan regions and non-metropolitan remote regions, as compared to the OECD average speeds of Internet access. In comparison, speeds in the United States are higher than OECD averages for both metropolitan and remote regions, but the gap between metropolitan and remote regions is close to half of the gap observed in Canada. Similarly, not all people in places have the right skills for the digital economy (OECD, 2021^[39]).

International linkages through foreign ownership

In Canada, foreign ownership has been associated with more intensive use of advanced technology and business practices (Galindo-Rueda, Verger and Ouellet, 2020^[29]). However, in rural Canada, a very small share of firms is owned by foreigners and the share is larger in urban than in rural areas (Figure 2.9, Panel A). The share of foreign ownership in urban areas is 0.48%, while it is almost a fifth of the size, 0.11%, in rural areas. While, in part, this may be due to the cluster of firms and larger population centres near the border with the United States, it does suggest that access to international markets is a challenge for firms in rural areas.

Figure 2.9. Ownership and trade status of firms

Share of firms, new firm entry and SR&ED applicant firms in Canada, by foreign or trade status and geography



Note: Foreign ownership refers to firms with at least 10% of owners holding a foreign nationality. Trade status refers to firms that participate in either import or export markets.

Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Evidence suggests that firms with foreign ownership are more likely to participate in formal R&D activities. Despite having only 0.11% of total firms in rural areas, foreign firms account for 2% of total firms that apply for the R&D tax incentive programme (Figure 2.9, Panel C). While this is relatively high, it is less than half the share of foreign firms applying for R&D tax incentive programmes in urban areas (5%). The start-up patterns for firms with foreign ownership are similar (Figure 2.9, Panel E). There are 0.01% of new firms in rural areas that have some foreign ownership in the first year but this is less than half (0.03%) of the share in urban areas.

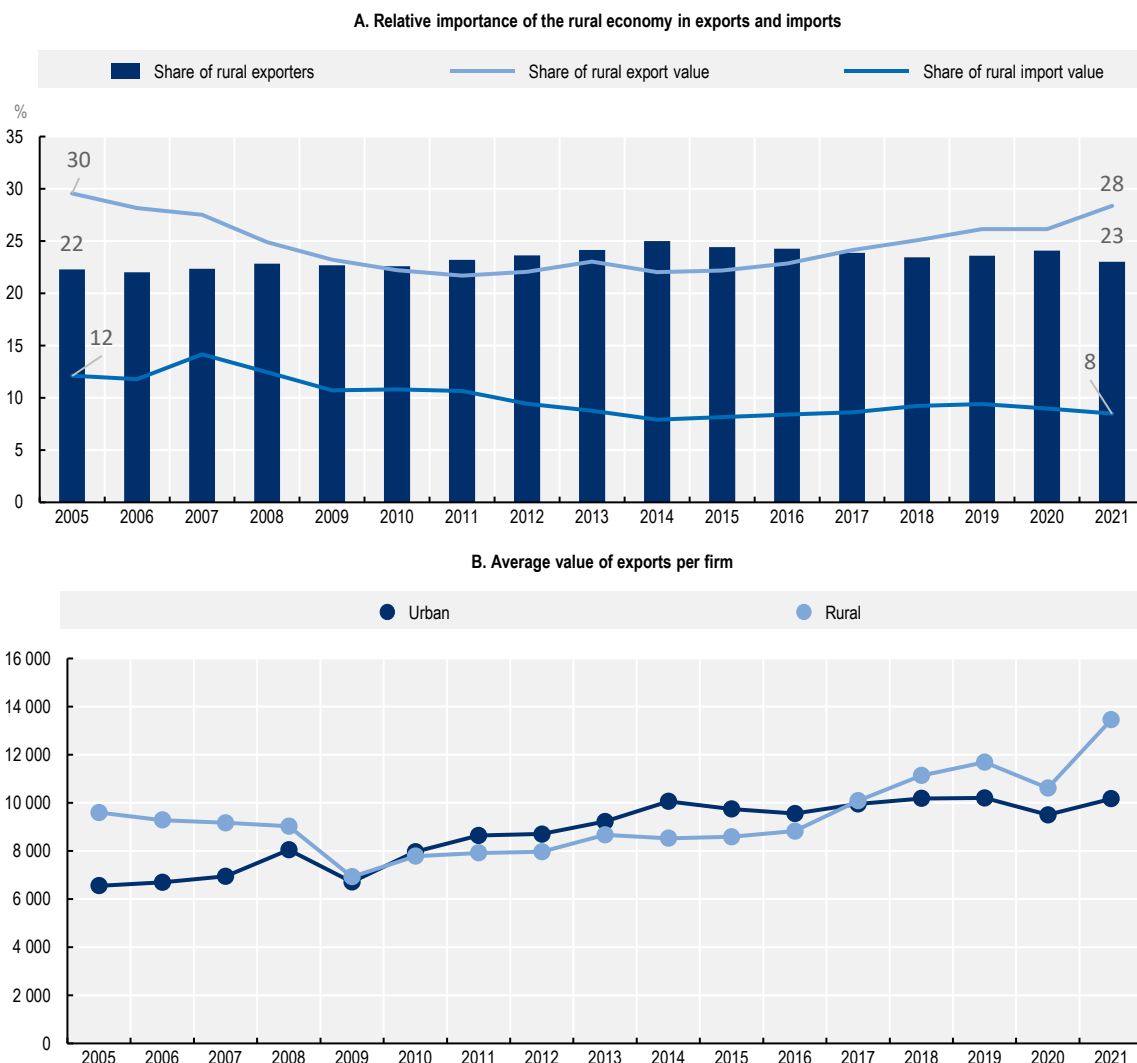
International linkages through trade

Linkage with external firms and markets is a critical factor in overcoming the barriers to distance rural firms perceive for both import and export goods. The possibility of trade can increase incentives for innovation and innovation-induced growth. In a recent report by the OECD, regions that were identified as “catching up” (at least 5 percentage point growth more than the national average over a 14-year period of time) had the highest share of gross value added from the tradeable sector,²⁶ despite the fact that they do not necessarily contribute to an increase of employment (OECD, 2018_[40]). Productivity growth is, in general, positively impacted by foreign market exposure (Melitz, 2003_[41]; Baldwin, 2004_[37]). Baldwin (2004_[37]) found that a reduction of tariffs increased the adoption of new technologies, investment in R&D and the proliferation of innovation in firms.²⁷ Rural firms that can develop supply chain linkages with external customers have larger incentives to innovate and additional avenues to adopt innovation through exchanges within global value chains (Crescenzi and Harman, 2023_[42]). However, strategies for exporting and innovation differ by regional attributes. For example, findings from research in Quebec suggest that exports in the knowledge-intensive business sector differ across space (Doloreux, Shearmur and Van Assche, 2018_[43]).

A remarkable 41% of firms in rural areas that applied for tax incentive programmes related to formal R&D investment participated in global value chains and markets through either imports or exports (Figure 2.10). While this number was higher in urban areas (52%), participating in the global supply chain is a strong characteristic of firms that innovate in Canada. This is surprising as only 5% of rural firms participate in trade compared to 7% of urban firms, which is a smaller gap than observed in the foreign ownership analysis. Furthermore, a larger share of new firms in rural areas (0.71%) participate in global supply chains than in urban areas (0.56%). While comparative data are not available, studies from the United Kingdom also find that there is a marginally higher proportion of firms in urban areas that export than those in rural areas, despite the fact that non-family-owned firms in sparse, dispersed rural areas were more likely to export (Mole et al., 2022_[44]).

Rural firms are increasingly exporting products but insourcing process goods from Canada. In Canada, most of the firms that export are in urban areas. In 2021, only 23% of firms that exported were in rural areas and 77% in urban areas (Figure 2.10). With less than a quarter of all exporting firms in rural areas, the share of value of exports is relatively high, at 28% against 72% in urban areas.²⁸ The value of rural exports has been rising steadily since the beginning of the last decade, while imports fell. At its lowest, rural areas contributed to only 22% of total export value roughly all years from 2010 to 2015, until reaching 28% in 2021. At the same time, rural firms were less connected to international value chains, importing less in terms of value in 2021 than two decades prior. The share of total Canadian imports attributed to rural firms came down from 12% to 8% of total aggregate Canadian import values.

Figure 2.10. Growth in rural exports but not in exporting firms



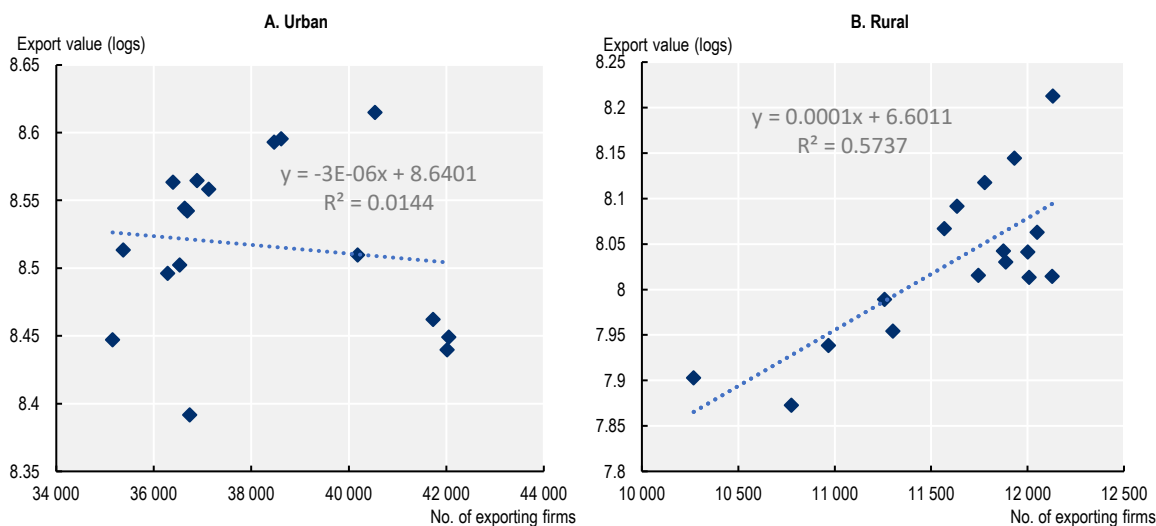
Note: The rural economy is measured as all non-CMAs as a whole. Relative importance measures the rural economy as a share of the total economy in respective activities. Panel B figures are in thousands of CAD.

Source: Statistics Canada Tables 12-10-0137-01 (exports) and 12-10-0131-01 (imports), <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210013701> and <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210013101>.

The monetary returns to export activity are stronger in rural areas than in urban areas (Figure 2.11). Even though most firms that export are in urban areas, the returns to an additional exporting firm are negative and relatively spurious in urban areas. However, one additional exporter in rural areas is associated with a 0.01% increase in export values. As such, the marginal return of supporting one additional firm to enter the export market is more clearly associated with positive and significant gains in export value and, by extension, productivity growth. While it is unclear whether firms that export are already more innovative or if, through exports, firms become more innovative, it is likely that both directions of causation are simultaneously creating benefits for rural areas. Furthermore, more analysis should be carried out to exclude the effect of sectors, such as the oil and gas industry, on the average firm. It gives cause to support a place-based approach to export support programmes.

Figure 2.11. Correlation between export value and number of exporters

Two-way correlations between export values (logs) and the number of exporting firms, by geography, 2005-21



Note: The rural economy is measured as all non-CMAs as a whole. Relative importance measures the rural economy as a share of the total economy in respective activities. Each data point refers to the average shares per year for each year from 2005 to 2021 for urban and rural areas.

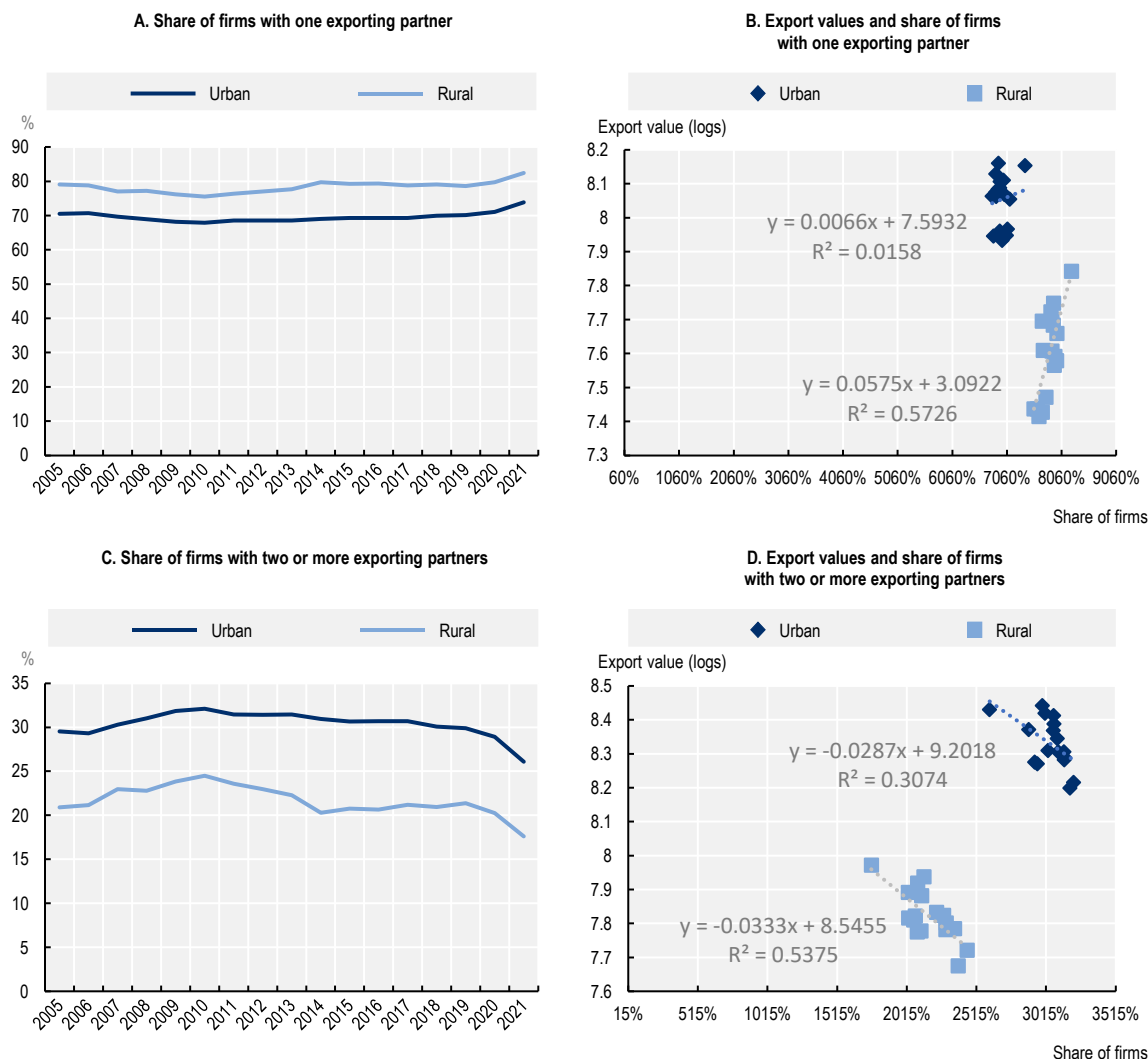
Source: Statistics Canada Tables 12-10-0137-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210013701>.

Export gains are substantial and large for rural firms with only one export partner country (Figure 2.12). In rural Canada, close to 82% of firms have only 1 export partner country, as compared to 74% in urban areas. In urban areas, 26% of firms have more than 1 trading partner, whereas in rural areas, the share is lower, at 18%. Increasing the share of firms exporting by 1% is associated with a close to sixfold increase in export values in rural areas and explains quite a strong share (57% of the variation) of the outcome for export values. As in the previous figure, the non-linear relationship between returns, trade and geography is reinforced, as the relationship is less positive and has a lower explanatory power in urban areas. In addition, there are decreasing returns to gains in export partners in both rural and urban areas. While the decrease is relatively less convincing in urban areas, they are particularly important in rural areas, suggesting that the type of firm that exports to multiple export partners may sell products at lower prices than those that focus their export markets in one country. This is in line with the literature that finds heterogeneous results between firms with different levels of productivity (Shu and Steinwender, 2019^[35]).

Critically, for governments, the analysis provides ample evidence for the importance of helping rural firms reach at least their first export partner. In a recent randomised controlled experiment for small and medium sized enterprises in six Western Balkan countries, live group training and remote counselling were helpful in overcoming constraints in accessing overseas clients (Cusolito, Darova and McKenzie, 2022^[45]). The firms that received the training and counselling services were taught techniques such as search engine optimisation and improved social media content to increase digital presence, with positive and significant impacts on the number of new clients and increased export sales. In part, this was because of a combination of sector-specific advice on market expansion and increased confidence in trying new sales strategies.

Figure 2.12. Marginal returns to exports decrease for rural firms with multiple export partners

Share of firms and export values, by number of exporting partners and geography, 2005-21



Note: The rural economy is measured as all non-CMAs as a whole. Relative importance measures the rural economy as a share of the total economy in respective activities. Each data point refers to the average shares per year for each year from 2005 to 2021 for urban and rural areas.

Source: Statistics Canada Tables 12-10-0137-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210013701>.

Individual characteristics as drivers of innovation

The structure of the labour force in rural areas can have substantial impacts on opportunities for innovation in rural areas. Given that innovation in rural regions is often more user-based (either directly, through solutions, or through partnerships) and incremental, the characteristics of individuals in rural areas become particularly important. For example, chief executive officers who gain general managerial skills are more likely to produce more innovation (patents) in their firms (Custódio, Ferreira and Matos, 2019^[46]), while manufacturing firms that have more technical skills are more likely to produce more R&D collaborations and product or process innovation (Leiponen, 2005^[47]). The incremental nature of most innovations suggests that there is a more substantial role for the development of the broader workforce on innovation and productivity. This can create the “total package” needed for new innovations and new firm activities

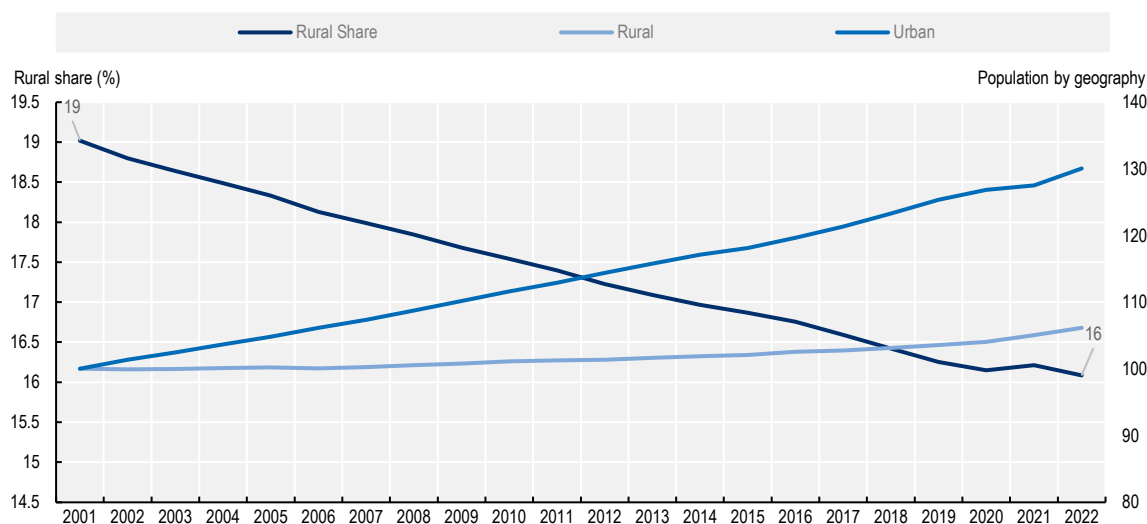
and includes the quality of post-secondary education as well as vocational educational skills (Toner, 2011^[48]).

However, individuals in rural areas of Canada may suffer from challenges in terms of ease of access to quality training and education opportunities, leading to less diversity of skills in rural areas for innovation, as observed in other OECD countries (OECD, 2022^[7]). This challenge is exacerbated by demographic trends in ageing and the decline of populations in rural areas. Results from the 2021 census indicated that populations outside of urban centres are growing slower and ageing faster than in urban areas. Rural areas have a larger portion of people aged 65 and older (23.2%) than urban areas (18.2%); rural areas also have fewer working-age (15-64 year-old) people than urban centres (60.1% compared with 65.7%) (Statistics Canada, 2022^[49]). In Canada, immigration is used as a policy tool to counteract some of this demographic change (Statistics Canada, 2022^[49]). However, immigrants rarely go to rural areas of Canada but are often clustered in major cities (Statistics Canada, 2022^[1]).

Population demographics in rural areas

Fewer than one in five Canadians live in rural areas. Although there is a 5% growth in the number of rural inhabitants in 2021, as compared to 2001 (Figure 2.13), rural population growth is still lagging significantly behind its urban counterparts. This is resulting in a shrinking share of rural populations due to the faster urban population growth. The trend is a continuation of previous trends, where from 1966 to 2006, rural areas lost about 2 million inhabitants (Reimer and Bollman, 2010^[50]), which is reflected in net migration changes between rural and urban areas. The closer a rural community is to a metropolitan agglomeration, the higher the rate of population growth. Within a radius of 25 km, the population grew by a rate of 25%, while within 100 km to 149 km, the population grew by roughly 2% from 1981 to 2001 (Reimer and Bollman, 2010^[50]). The observed population decline can have a multitude of impacts on how communities function and deliver services to support innovation in rural areas.

Figure 2.13. There is a growing gap in population between rural and urban areas



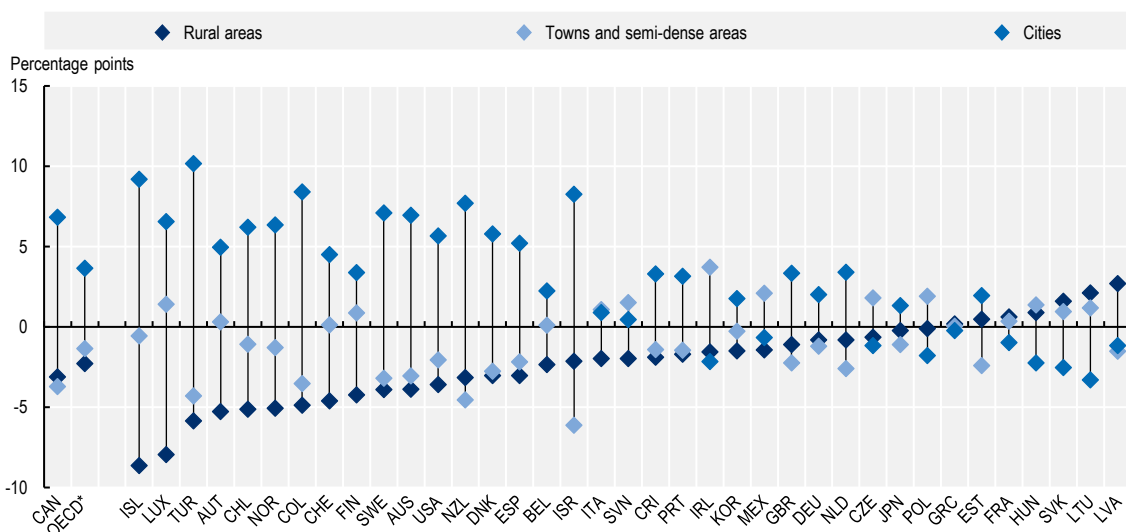
Note: The rural areas are defined as all non-CMAs/CAs, whereas the urban economy measures all CMAs/CAs. Population estimates are based on the Standard Geographical Classification (SGC) 2016 as delineated in the 2016 census. Population estimates as of 1 July are final intercensal up to 2015, final postcensal for 2016 to 2020, updated postcensal for 2021 and preliminary postcensal for 2022.

Source: Statistics Canada (n.d.^[25]), *Population Estimates, July 1, by CMA and CA, 2016 Boundaries*, Table 17-10-0135-01, <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=1710013501>.

The loss of the relative share of the rural population is rather strong in Canada, even though it is not unique among OECD countries. On average, between 2000 and 2020, 31 of 38 OECD member countries demonstrated a demographic decline in rural areas (Figure 2.14). Cities in OECD countries observed a gain of 3.6-point shares of the population, while rural areas saw a 2.3-point share decline. Canada observed a growth of 6.8-point shares in cities, a decline of 3.1-point shares in rural areas and a decline of 3.7-point shares in suburbs and towns. In comparison, 2 other large and substantially rural OECD countries, Australia and the United States, observed gains of 6.9-point shares and 5.6-point shares in cities and reductions in rural areas of around 3.8-point shares and 3.6-point shares respectively. On average, in the OECD, changes in the total share of the population were less stark. In the OECD, on average, there was a slower growth of 3.6 in urban areas and a smaller decline of 2.3 in rural areas from 2000 to 2020 (OECD, 2022^[38]).²⁹

Figure 2.14. Changes in population shares, 2000-20

Change in the share of the population by type of area over the total population



Note: * The reported OECD average is the change in the share of the total OECD population in each of the 3 degree of urbanisation categories from 2000 to 2020. Estimates that were weighted for population in the first year (2000) demonstrated similar changes. The only exception was in cities that grew 0.3 percentage points less when weighted by population in the first year. Estimates in rural areas were the same as the second decimal point.

Source: Based on data from OECD (2022^[38]), *OECD Regions and Cities at a Glance 2022*, <https://doi.org/10.1787/14108660-en>; updates using the most recent Global Human Settlement Layer release (R2023A), https://ghsl.jrc.ec.europa.eu/ghs_smod2023.php.

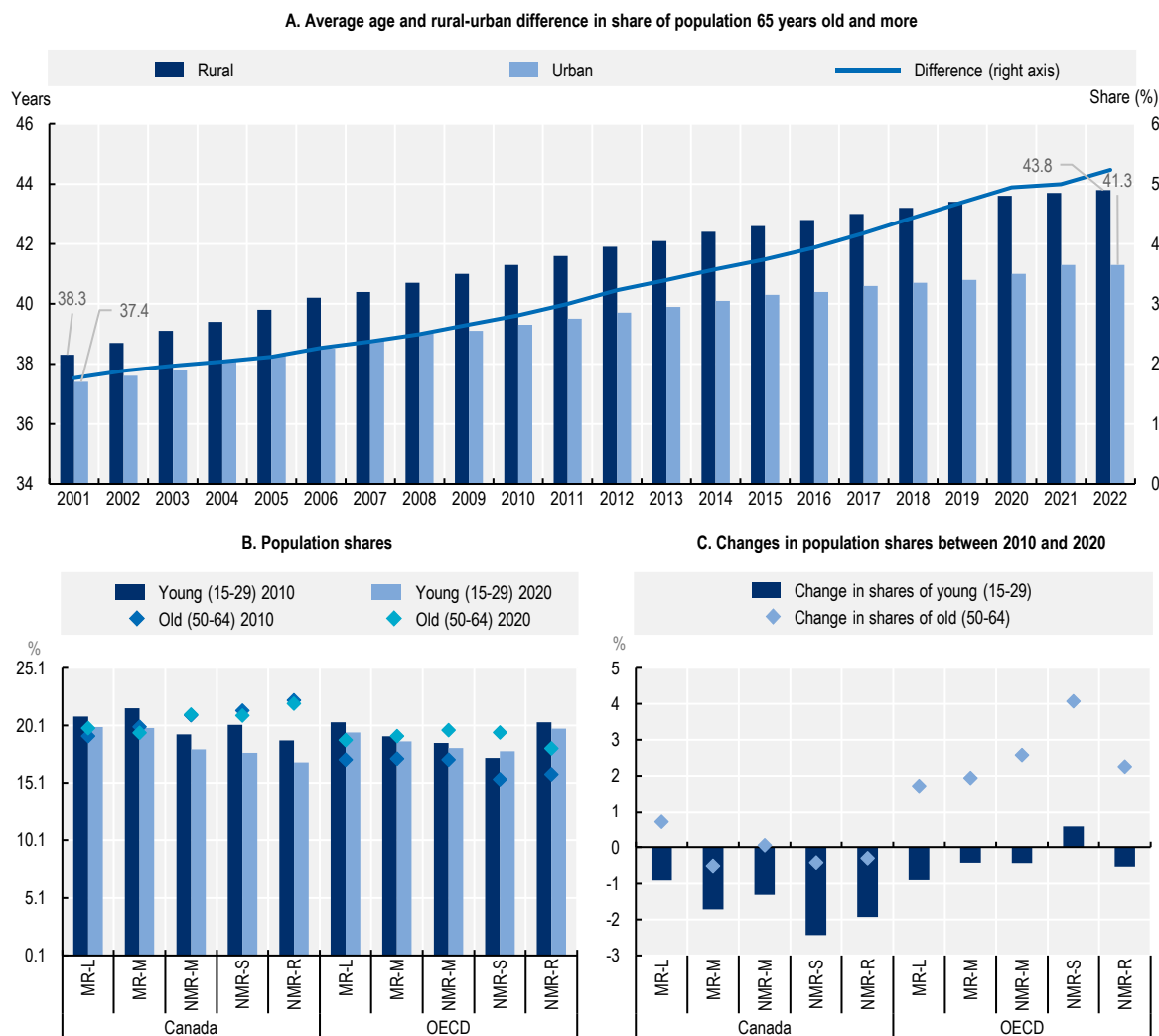
In addition to population decline, rural Canada is ageing. Rural areas of Canada have a higher share of the population over 65 years of age than urban areas. In 2001, the average age in rural areas was 38.3, as compared to 37.4 in urban areas (Figure 2.15, Panel A, left-hand axis). In 2022, the population's average age in rural areas grew to 43.8, while it reached 41.3 in urban areas. Furthermore, at the age of statutory retirement, the older population has also risen. In 2001, there was a 2% difference between the share of individuals over 65 in rural areas compared to urban areas (Figure 2.15, Panel A, right-hand axis). In 2022, the difference in the population over 65 grew to 5%.

However, much of the observed ageing has to do with fewer younger working-age individuals. Age demographics among younger and older working-age populations are also shifting. Using internationally comparative data on small regions, we observe the demographic change that is more strongly determined by changes in the share of young working-age individuals than older working-age individuals. In 2010, the

share of younger individuals (15-29) in all non-metropolitan regions was relatively similar in Canada (19.1%) and the OECD (18.7%) (Figure 2.15, Panel B, left-hand axis).

Figure 2.15. Society is ageing faster in rural areas than in urban areas

Canadian shares in population 65 years old and more and population shares, by young (15-19) and old (50-64) in 2010 and 2020



Note: Panel A: The rural areas are defined as all non-CMAs/CAs, whereas the urban economy measures all CMAs/CAs. Population estimates are based on the SGC 2016 as delineated in the 2016 census. Population estimates as of 1 July are final intercensal up to 2015, final postcensal for 2016 to 2020, updated postcensal for 2021 and preliminary postcensal for 2022. The age is as of 1 July. Panel B: Share of young individuals includes those aged 15-29. The share of old individuals includes those 50 to 64 years of age. Age categories are depicted as a share of the total population. Changes in population shares are depicted as level differences in shares calculated as the last year (2020) minus the first year (2010).

Source: Panel A: Statistics Canada (n.d.^[25]), *Population Estimates, July 1, by CMA and CA, 2016 Boundaries*, Table 17-10-0135-01, <https://www150.statcan.gc.ca/t1/tb1/en/tv.action?pid=1710013501>; Panel B: OECD (n.d.^[51]), *Regional Statistics (database)*, <https://www.oecd.org/regional/regional-statistics/>.

However, the share of young individuals dropped substantially in Canada in 2020 to 17.1%, whereas it remained the same on average in OECD countries (18.6%). The 2-percentage point fall from 2010 to 2020 in Canada's non-metropolitan regions was stronger than the fall in metropolitan regions in Canada (1.1%), as well as on average in OECD metropolitan regions (0.7%) and non-metropolitan regions (0.2%). On the flip side, non-metropolitan regions of Canada are not seeing a substantial increase in the older working-age (50-64 year-old) population. Meanwhile, in OECD countries, the older working-age population in non-metropolitan regions saw an average increase of 3% and metropolitan regions saw an increase of 1.8% from 2010 to 2020. In Canada, non-metropolitan regions saw a small but relative decline of 0.3% and the growth in metropolitan regions was more tempered than on average in OECD countries at 0.4%.

The ageing of the rural population is a considerable change that can have implications for rural innovation. Managing the delivery of programmes and policies for rural innovation will have to increasingly take into consideration the needs of an ageing population by placing additional emphasis on skilling and reskilling programmes to support innovation, as well as finding flexible working conditions that may better suit an older workforce and entrepreneurs.

Around 1 807 250 individuals in Canada self-identify as Indigenous people, corresponding to 5.0% of the total population in 2021. Of all Indigenous people in Canada, 15.7% (284 470) lived in Alberta, the third-largest population behind Ontario (406 585) and British Columbia (290 210) (Government of Alberta, 2021^[52]). First Nations people, Métis and Inuit across Canada have diverse histories and cultures and speak numerous languages. Indigenous entrepreneurship is the creation, management and development of new ventures by Indigenous people for the benefit of Indigenous people. This encompasses both profit-generating activities and those pursued for the benefit of the community and may take the form of sole proprietorship, partnership, corporation or co-operative, including community-led economic development practices that align with diverse Indigenous cultural, spiritual and environmental worldviews.

Understanding age demographics in the rural labour force

Age demographics are bringing change across many OECD countries. They are often compounded in rural areas, where the share of older populations tends to be larger. This also impacts how entrepreneurs innovate because of needs related to the ageing of entrepreneurs and the ageing of the workforce.

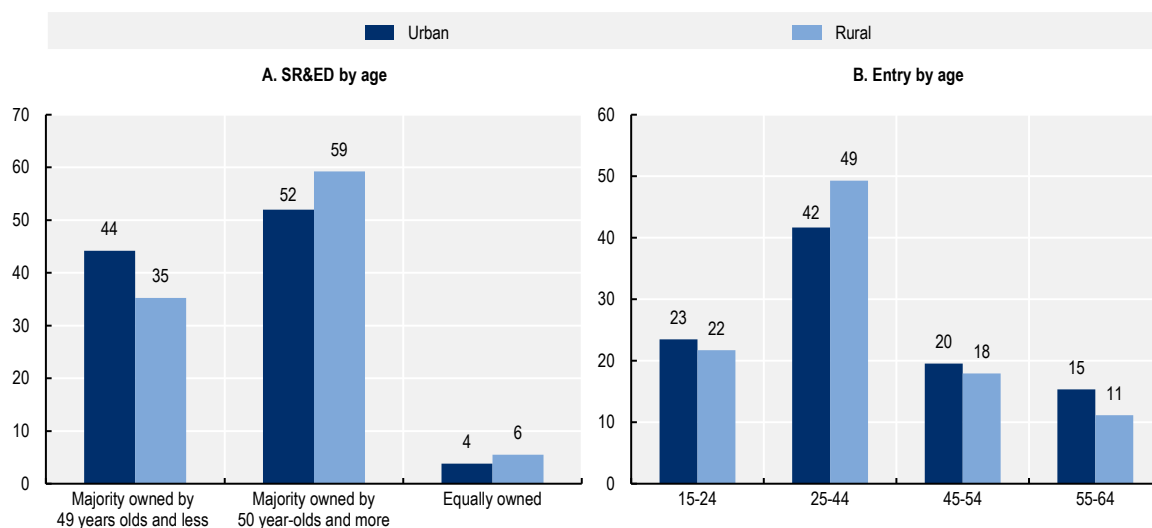
Age of entrepreneurs

In rural areas, nearly half (49%) of new entrepreneurs are 25 to 44 years old and relatively fewer entrepreneurs are in older age categories (Figure 2.16). In comparison, close to 42% of new entrepreneurs are between the ages of 25 and 44. While urban areas have a larger share of younger entrepreneurs (23%) than rural areas (22%), the difference is small. There are larger differences between urban and rural entrepreneurs in the later years of life. In urban areas, 35% of entrepreneurs are older than 45 years of age, while only 29% are older than 45 in rural areas.

The age of entrepreneurs is also relevant for innovation. Over half of firms that apply for innovation tax incentive programmes have the majority of entrepreneurs over the age of 50 in both urban and rural areas. In part, this may suggest a type of asymmetry of information, either about tax relief or the formal innovation process or inversely on access to investment or capital. This trend compounds itself in rural areas, where there is a higher share of older entrepreneurs over the age of 50 who tend to apply for tax incentive programmes for R&D in both rural (49%) and urban areas (42%).

Figure 2.16. Age diversity in new firm formation and innovation

Age distribution of new entrepreneurs and SR&ED applications, by geography, 2010-19



Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Workforce trends

The workforce in rural Canada is older than in urban areas. As such, upskilling the labour force and providing lifelong learning opportunities for older workers is increasingly important in rural areas, in line with the OECD Recommendation on Ageing and Employment (OECD, 2018^[53]). However, providing courses alone is not always enough to encourage more active participation in the labour force, in particular as the labour force approaches retirement age. For example, a study in Germany highlighted that reducing the costs of participating in on-the-job training courses was more effective than providing additional courses (Backhaus, 2023^[54]).

Part of the loss of actively employed individuals identified previously is associated with changes in the age demographics of workers (Figure 2.17, Panel A). In 2022, there is an almost 6% lower prime working-age population (aged 25 to 44) in rural areas than in urban areas and close to 6% more workers over the age of 45. The encouragement and support of younger workers in rural areas is critical for encouraging innovation in rural areas. The relatively low rate of workers in highly productive years is a loss of opportunity for rural areas. Second, the share of workers in pre-retirement age is larger in rural areas by 3%, suggesting an increasingly important role in upskilling the labour force for innovation and entrepreneurship in rural areas in the later years of their careers.

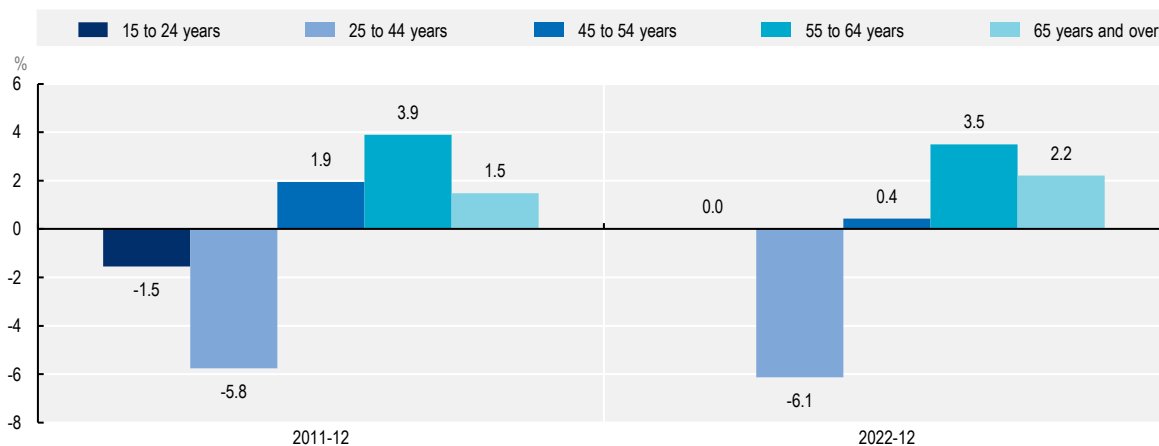
While the average age of rural workers is increasing faster than urban workers, part of the ageing trend in employment is being offset by changes in the relative distribution of employment age groups. Over the past 20 years, the difference between the employment shares in rural and urban areas has narrowed down. However, given the trends in participation rates, those dropping out of the labour force could also mechanically increase the share of the remaining employed individuals in the pool of age-based workers.

In rural Canada, the retention of young workers is relatively difficult during the years of access to higher education institutions. The rate of the youngest age of workers (15 to 24) in rural areas is relatively on par with the rate in urban areas, at 13% of the total workforce (Figure 2.18). However, there is a net loss in workers between the youngest group (cohort) and workers at the beginning of their professional lives (25 to 44). The difference between the shares of workers aged 25 to 44 is 6 percentage points, at 40% in

rural areas and 46% in urban areas. This difference has been relatively stable from 2011 to 2022, reflecting the overall ageing of Canada and the continued disparity between working-age groups across geography.

Figure 2.17. The rural workforce in Canada is ageing

Rural-urban differences in employment shares, by age

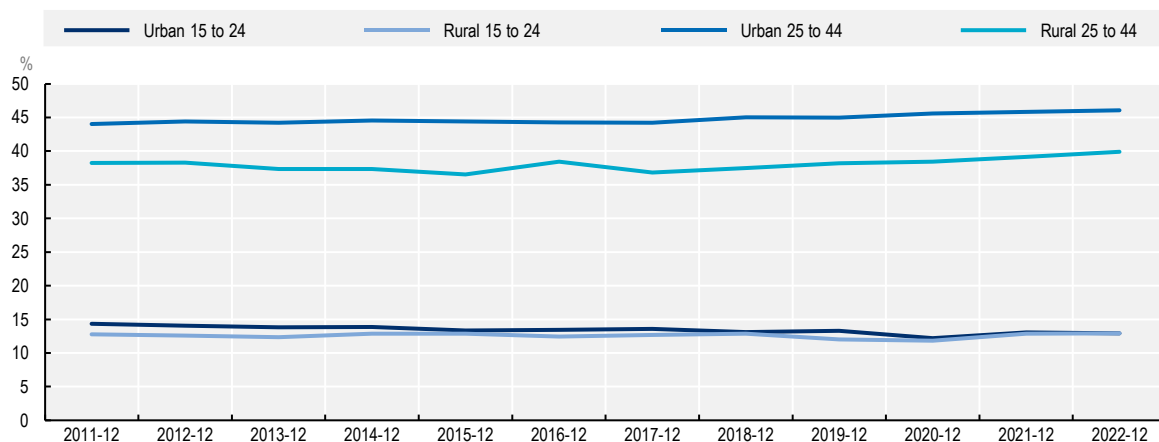


Note: Employment and unemployment series are based on workers aged 15 years and more. Monthly data with only December indicators represented. The rural economy is measured by all non-census metropolitan areas and census agglomerations (non-CMAs/CAs), whereas the urban economy measures all CMAs/CAs. Estimates in thousands, rounded to the nearest hundred. The employment rate refers to the share of employed over the active labour market (excludes discouraged workers, unemployed individuals not looking for work and students). Employed workers refer to the number of persons who, during the reference week, worked for pay or profit, or performed unpaid family work or had a job but were not at work due to their own illness or disability, personal or family responsibilities, labour dispute, vacation or other reasons. Those persons on layoff and those without work but who had a job to start at a definite date are not considered employed. The unemployment rate is the number of unemployed persons expressed as a percentage of the labour force.

Source: Statistics Canada (n.d.^[55]), *Employment and Unemployment Rate, Monthly, Unadjusted for Seasonality*, Table 14-10-0374-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410037401>.

Figure 2.18. Employment shares for 25 to 44-year-old workers are higher in urban areas

Employment shares of younger age cohorts, by geography



Note: Share of total employment of all age groups (15-65 years of age) within each area.

Source: Statistics Canada (n.d.^[55]), *Employment and Unemployment Rate, Monthly, Unadjusted for Seasonality*, Table 14-10-0374-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410037401>.

Engaging with young and older workers promotes diversity of skills, which is an important contributor to innovation and entrepreneurship in rural areas. However, many rural areas suffer from population decline and age-based demographic challenges. As such, efforts to support young inclusion are increasingly a priority in rural areas. Examples of such initiatives from Japan and Norway are elaborated in Box 2.1.

Box 2.1. Measures for youth inclusion

Youth inclusion in Nordland, Norway

The skills strategy for Nordland County Municipality focuses on bringing skills to develop and use natural resources in the county, provide welfare services, give back to the Indigenous Sámi community and create good local communities. The attractiveness of municipalities is considered to be reliant on the quality of the school system, good residential areas and access to private and public services.

At the beginning of 2021, Nordland County Municipality had a population of 240 559 inhabitants. Among these, 7 000 aged between 16 and 30 were not in employment, education or training (NEET). The parliament in Nordland County has adopted a strategy to counter young exclusion in Nordland and work on the associated action programme is underway.

Nordland has room for and needs for everyone. It aims to ensure young people feel a sense of belonging and have the opportunity to participate in society based on their own prerequisites. In the strategy, four sub-goals have been specified:

1. Children and young people in Nordland must grow up in good conditions.
2. Young people in Nordland must be offered comprehensive and co-ordinated local services.
3. Sami young people should be able to participate in society on their own cultural and linguistic terms.
4. Children and young adults with disabilities must have equal education, work and civic participation opportunities.

Activating youth through urban-rural partnerships, Yamagata University, Japan

Yamagata University (YU), which services rural communities in the prefecture of Yamagata, established the Development Centre for Entrepreneurship (YU-DES) by integrating YU's unique entrepreneurship programme and broad academic assets. YU-DES offers a human resource development programme called Development of Innovative Human Resource toward Outcome the Programme for Entrepreneurship (i-HOPE) to encourage personnel to develop innovation through leadership. By introducing Columbia Business School's Venture for All, i-HOPE created an original programme to foster entrepreneurship, offering business mindset training, basic business skillsets and practical exercises. i-HOPE is not exclusively open to university students and working adults: it also provides a special programme for high school students to cultivate an entrepreneurship mindset at an early stage.

Each prefecture has at least one national university in the Japanese university system. Unlike leading universities like the University of Tokyo or Kyoto University, the principal role of local universities like YU is to work for the local prefecture. The focus of the i-HOPE programme is to engage with youth already in the local Yamagata region, regardless of whether they are native or have migrated to Yamagata.

i-HOPE is intended to support entrepreneurs, many of whom are young, to set up new businesses in the region and is supported through the Local Vitalization Cooperator programme (hosted by the Ministry of Internal Affairs and Communication) and hosted at YU.

Encouraging diversity for innovation

Diversity in management and within the labour force can help bring new solutions to old problems. In addition, activating a more diverse group of individuals may help alleviate some of the demographic challenges that rural areas are facing. The academic literature suggests that a small but significant “diversity” bonus for firms in London exists, with impacts on new product innovation and international markets (Nathan and Lee, 2013^[56]), and that women sitting on boards tend to have an impact on increased ethical and social compliance (Isidro and Sobral, 2014^[57]). Diversity is positively associated with productivity in European regions (Bellini et al., 2012^[58]), and there is a positive relationship between gender diversity and the likelihood of introducing innovation (Østergaard, Timmermans and Kristinsson, 2011^[59]). Finally, mobility, as a physical manifestation of building networks, is often positively associated with innovation. However, the direction of the causality is often contested. Mobility is important for innovation; as such, those who migrate often bring new ideas with them. Nevertheless, immigrants are also more mobile initially, suggesting that it is indeed only those who are willing to take on risks associated with mobility that are more likely to make the move and innovate. For example, top “breakthrough” inventions are associated with high spatial mobility of the workforce (Kerr, 2010^[60]).

The following section explores trends and analysis of the Indigenous peoples, women and migrants in rural communities.

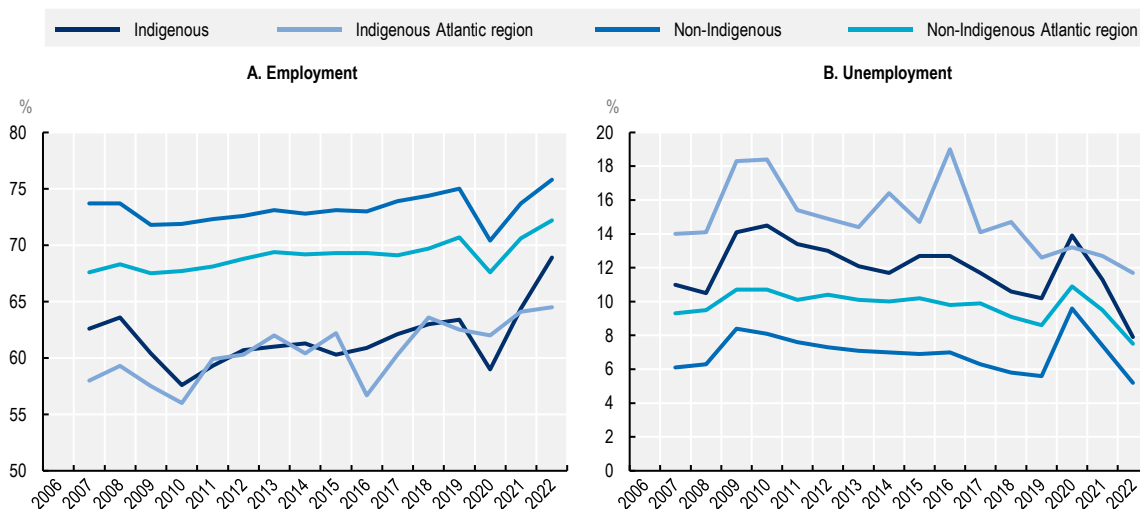
Indigenous workers and entrepreneurs

There is a long history of disadvantages for different communities in Canada. Indigenous peoples and communities are often disadvantaged as compared to non-Indigenous populations. This is compounded for individuals who are off-reserve as compared to those on-reserve.³⁰ In part, this may reflect different value systems but is also substantially impacted by a lack of systematic consultation and partnerships with the Indigenous peoples, as is often the case in many rural areas across Canada (see Chapters 3 and 4 for more details). Indigenous peoples historically experienced economic marginalisation and observed widening socio-economic gaps as compared to non-Indigenous populations. However, this is not the only reason why Indigenous peoples may face a disadvantage. Economic displacement can be attributed to differing value systems and worldviews, as well as the systemic removal of Indigenous peoples from their cultural practices, traditions, lands, resources and relationships.

Roughly 60% of Indigenous peoples lived in predominantly rural/remote areas in 2016; this was 33% more than the share of non-Indigenous peoples living in rural regions. According to the 2011 National Household Survey, around 43 000 First Nations, Inuit and Métis people in Canada own businesses across the country. Understanding how to support Indigenous innovation and entrepreneurs is an opportunity to generate new opportunities in rural areas, as rates of entrepreneurship demonstrate that more support for Indigenous entrepreneurs is needed (OECD, 2020^[61]).

The employment rate among Indigenous peoples is lower than for non-Indigenous populations, while unemployment is higher. Furthermore, those in the Atlantic regions face even more substantial challenges in terms of access to jobs. In 2007, Indigenous peoples off-reserve in the Atlantic region had an employment rate of 58%, increasing to 64.5% in 2022. Indigenous peoples in other areas of Canada, likewise, had relatively low rates of employment as compared to non-Indigenous individuals (68.9% in 2022, as compared to 75.8% for non-Indigenous populations). Unemployment is the highest for the Indigenous peoples in the Atlantic regions, at close to 12% in 2022, down from 14% in 2007, while Indigenous peoples in other regions of Canada have close to an 8% unemployment rate. In comparison, the non-Indigenous population in Canada (outside of the Atlantic region) has close to a 5% unemployment rate. For context, the natural rate of unemployment is usually between 5% and 6%, suggesting that unemployment for Indigenous populations is still a substantial challenge, while it is less challenging for non-Indigenous peoples.

Figure 2.19. Employment and unemployment rates for Indigenous people



Note: Includes persons who reported having an Indigenous identity, that is, First Nations (North American Indian), Métis or Inuk (Inuit), or those who reported more than one identity. Excluded from the survey's coverage are persons living on reserve and other Indigenous settlements in the provinces, as well as those living in the territories. Data on persons reporting being Inuit or having multiple identities are included in the Indigenous total but are not shown separately because of the small sample sizes. Geography excludes the territories. It is noted that when discussing rural areas, omitting on-reserve and territorial populations is problematic. Ideally, additional on-reserve data would be available for such analysis. Estimates include the number of persons of working age, 15 years and over. The unemployment rate is the number of unemployed persons expressed as a percentage of the labour force. Estimates are percentages rounded to the nearest tenth. The employment rate is the number of persons employed expressed as a percentage of the population 15 years of age and over. Estimates are percentages rounded to the nearest tenth.

Source: Statistics Canada (n.d.^[62]), *Labour Force Characteristics by Province, Region and Indigenous Group*, Table 14-10-0364-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410036401>.

In 2019, Indigenous businesses represented 1.3% of all businesses in Canada, with variation across Canadian provinces. For example, in Manitoba, where the share of rural areas is relatively large, Indigenous people owned 3.4% of firms, while in Ontario, a more urbanised province, Indigenous people owned 0.7% of firms. In addition, the business ownership rates (as a share of the population) for Indigenous owners are relatively low and decreasing (Figure 2.20).

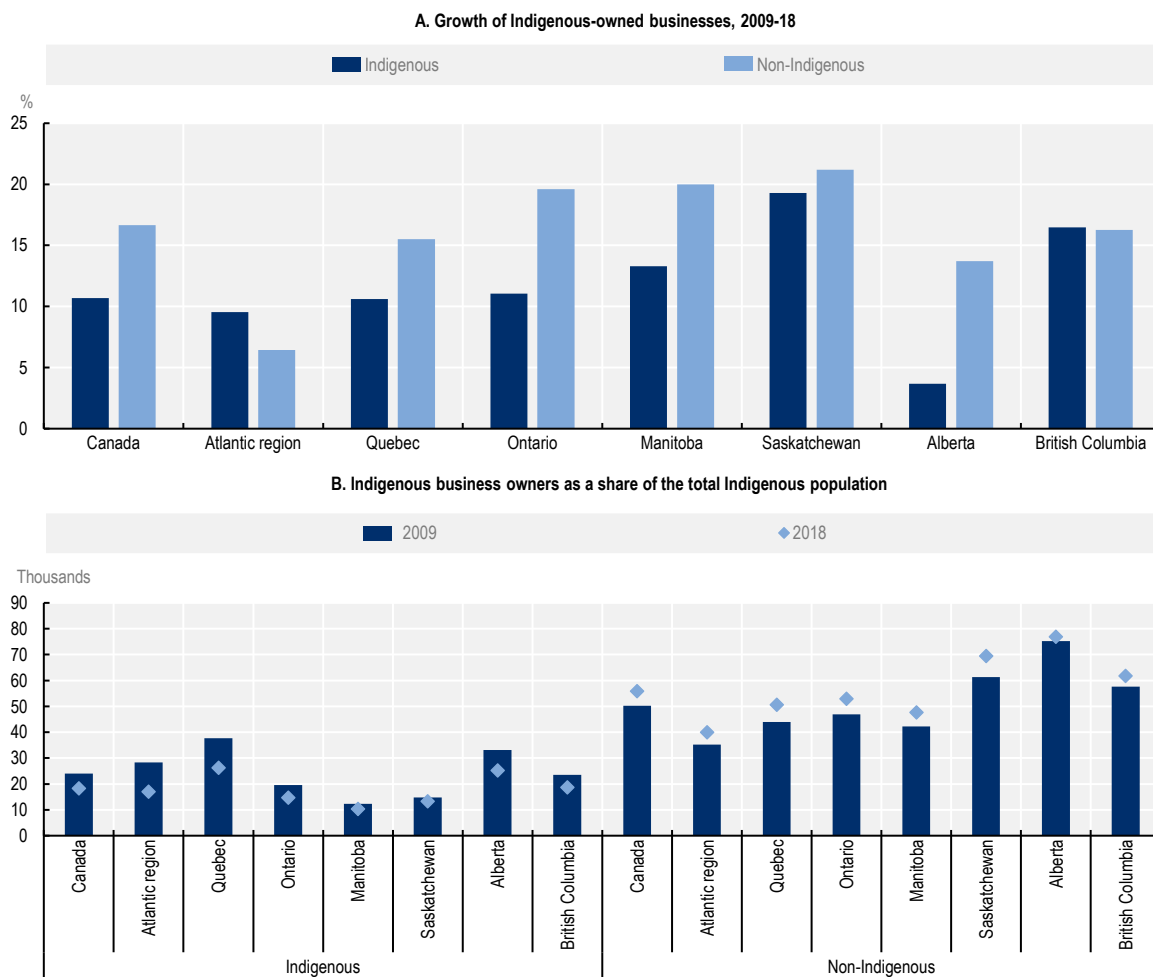
Indigenous businesses have grown by 11% from 2009 to 2018 (Figure 2.20). The growth was highest in Saskatchewan, where there were 19% more Indigenous-owned businesses in 2018 than in 2009. It grew the least in the Alberta region, at 4%. The business ownership rate among Indigenous populations is lower than in the rest of the Canadian population. In 2018, there were 18 Indigenous entrepreneurs per 1 000 Indigenous individuals, whereas there were 56 entrepreneurs per 1 000 individuals among the rest of the Canadian population. In 2009, the difference between the rates of entrepreneurship between Indigenous and non-Indigenous peoples was 26 entrepreneurs per 1 000 individuals. This grew close to 38 entrepreneurs per 1 000 individuals in 2019. In other words, if the rate of entrepreneurship for Indigenous peoples were the same as for non-Indigenous peoples, there would be nearly 38 more entrepreneurs per 1 000 individuals in Indigenous peoples.

The lower share of Indigenous businesses is a missed opportunity for innovation. In a recent report on linking Indigenous communities to local development, using data from the 2016 National Aboriginal Business Survey conducted by the Canadian Council for Aboriginal Business, the OECD (2020^[61]) found that a higher share of Aboriginal businesses introduce new products/services or new production/delivery processes relative to the broader Canadian small business sector. Aboriginal businesses are also reported to be more than twice as likely to have introduced a new product or service over the prior three years and nearly three times more likely to have brought in new ways of doing things than the broader Canadian

business sector. While Aboriginal businesses tend to be small and, like all small businesses, have a relatively lower propensity to export, the report finds that Aboriginal businesses are more than twice as likely as all small businesses to export and send their products to a broader geographic base than other small exporters.

Figure 2.20. Share of Indigenous-owned businesses and business ownership per population

Growth of Indigenous-owned businesses and Indigenous business owners as a share of the total Indigenous population, 2009-18



Note: A business is Indigenous-owned if Indigenous peoples own more than 50% of its shares – individuals who reported being First Nations (North American Indian), Métis or Inuk (Inuit) and/or those who reported Registered or Treaty Indian status registered under the Indian Act of Canada, and/or those who reported membership in a First Nation or Indian band. The total does not represent all businesses in Canada. Businesses in the public administration industry (North American Industry Classification System [NAICS] 91) are not included. Atlantic includes the following four provinces: Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick. Territories include Yukon, Northwest Territories and Nunavut. Total population estimates include persons between the ages of 15 and 64 who reported having an Indigenous identity: First Nations (North American Indian), Métis or Inuk (Inuit), or those who reported more than one identity. Excluded from the survey's coverage are persons living on reserves and other Indigenous settlements in the provinces, as well as those living in the territories. It is noted that when discussing rural areas, omitting on-reserve and territorial populations is problematic. Ideally, additional on-reserve data would be available for such analysis. Data on persons reporting being Inuit or having multiple identities are included in the Indigenous total but are not shown separately because of the small sample sizes.

Source: Statistics Canada, CEEDD; Statistics Canada (2011^[63]), NHS Profile, 2011, <https://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>; Statistics Canada (n.d.^[62]), *Labour Force Characteristics by Province, Region and Indigenous Group*, Table 14-10-0364-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410036401>.

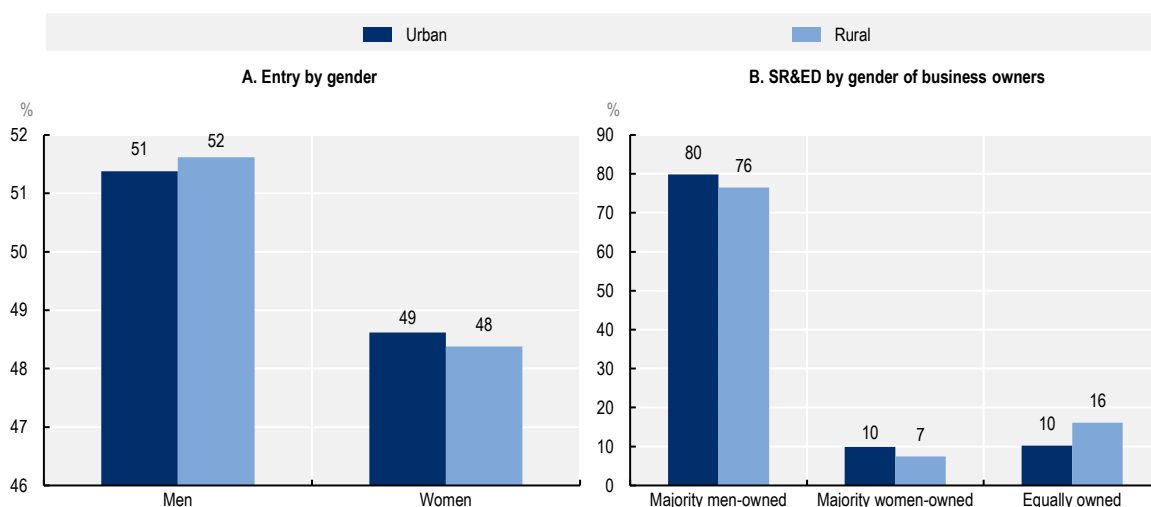
Women in rural Canada

In Canada, 48% of firms in rural areas were started by women (Figure 2.21). In comparison, slightly more firms are started by women in urban areas (49%). The rates in both rural and urban areas are relatively close to parity but we find the largest penalty in terms of rates of entrepreneurship for women in rural areas.

Women who own firms, however, are less likely to participate in formal innovation through investment in R&D, despite only a small difference between men and women entrepreneurs (Figure 2.21). In rural areas, only 7% of all rural firms are majority-owned by women and they are less likely to participate in formal innovation. However, the share of firms in rural areas with parity in ownership that participate in formal innovation processes is higher (16%) than those with primarily women owners (7%) and higher than firms with equal ownership in urban areas (10%). Jointly, this suggests that diversity (or equal representation) in ownership of firms can be a strategy for supporting innovation for women entrepreneurs.

Figure 2.21. Women as entrepreneurs

Share of new firms by gender and share of SR&ED applications by gender of business owner



Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

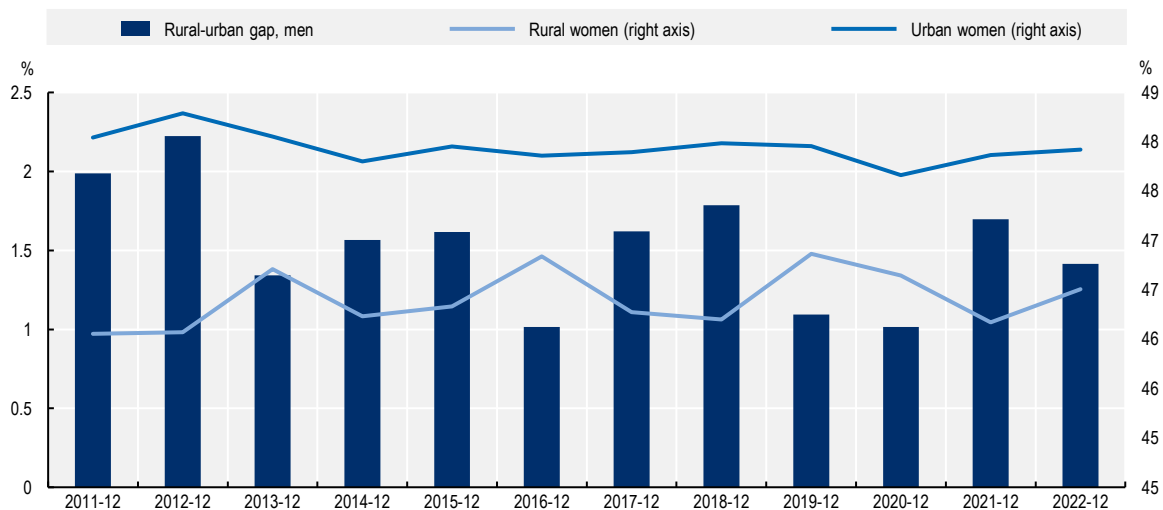
In addition to challenges in starting new firms and participating in formal innovation, the contribution of women to innovation through diversity in the labour force is limited by demographics and employment trends. There is a lower share of women in rural areas and a lower share in employment. The share of women in rural areas in December 2022 was close to 46.5%, while it was 48% in urban areas. This difference has remained relatively stable over time. Likewise, women's employment rates were lower than men's. In 2011, there was a 2-percentage point difference between women's employment share in rural areas compared to those in urban areas. This difference was reduced in 2022 to 1.4% but still remained at a disadvantage for women in rural areas (Figure 2.22).³¹

While there is a lower employment rate for women than men in rural areas, the differences vary substantially within different types of rural areas. In rural areas as a whole, the ratio of employed women to men is 0.87, meaning there are 1.15 men for every woman in employment in rural areas of Canada (Annex Figure 2.A.7). In comparison, this is less than the rate in urban areas (0.92), where there are 1.09 men for every woman. The most remote rural areas (rural areas in non-CMAs) have the lowest rate of female-to-male³² participation, where there are close to 1.19 men for every woman employed in rural

areas, with a male-to-female ratio of 0.84 in 2022. Rural areas with a small population centre tend to follow trends in areas on the fringe of urban areas.

Figure 2.22. Women are less likely to be employed in rural areas than in urban areas

Rural-urban differences in employment shares and percentage of women in rural areas, by geography, 2011-22



Note: The share of women refers to the share of females in the total population. Employment rates are based on workers aged 15 years and more. Monthly data with only December indicators represented. The rural economy is measured by all non-CMAs/CAs, whereas the urban economy measures all CMAs/CAs. Estimates in thousands, rounded to the nearest hundred. The employment rate refers to the share of employed over the active labour market (excludes discouraged workers, unemployed individuals not looking for work and students). Employed workers refer to the number of persons who, during the reference week, worked for pay or profit, performed unpaid family work or had a job but were not at work due to their own illness or disability, personal or family responsibilities, labour dispute, vacation or other reason. Estimates are percentages rounded to the nearest tenth.

Source: Statistics Canada (n.d.^[55]), *Employment and Unemployment Rate, Monthly, Unadjusted for Seasonality*, Table 14-10-0374-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410037401>.

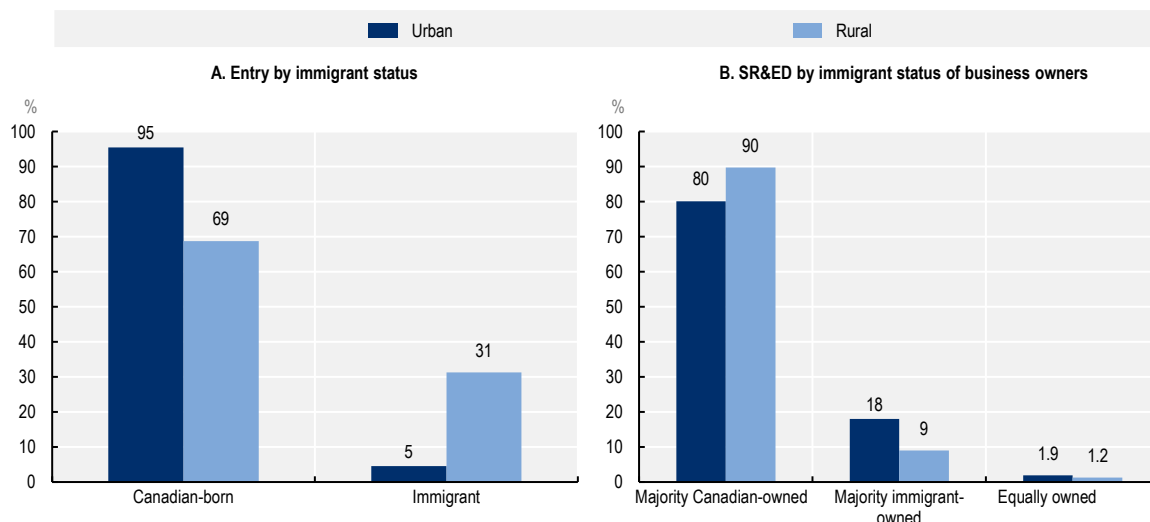
Migrants and inter-regional mobility

Promoting diversity to support innovation and entrepreneurship can also be accomplished through the attraction of skills from outside of Canada. The movement of individuals across spaces can reinforce innovation and the circulation of ideas. As such, the movement of inter-regional and international immigrants could provide an opportunity for rural areas and firms looking for a more diversified labour force. As compared to other OECD countries, inter-regional migration (i.e. movement within Canada), measured as the share of individuals in the total population that move across regions, is relatively high (OECD, 2022^[38]). Nevertheless, inter-regional migration is lower than in other large, federal OECD countries like Australia and the United States.

Immigrant entrepreneurs bring new opportunities to rural areas. In rural areas of Canada, 31% of new firms were established by immigrants, whereas only 5% of new firms were started by immigrants in urban areas of Canada (Figure 2.23). Despite promising figures for the contribution of immigrants to the rural economy, once rural immigrant entrepreneurs establish firms, they may face challenges in attaining tax support for investment in R&D. The share of majority immigrant-owned firms that apply to the SR&ED funding is low, at 9%, in rural areas, as compared to 18% in urban areas.

Figure 2.23. New firm formation and innovation, by immigrant status

New firm formation and application to the SR&ED tax incentive programme, by immigrant status and geography

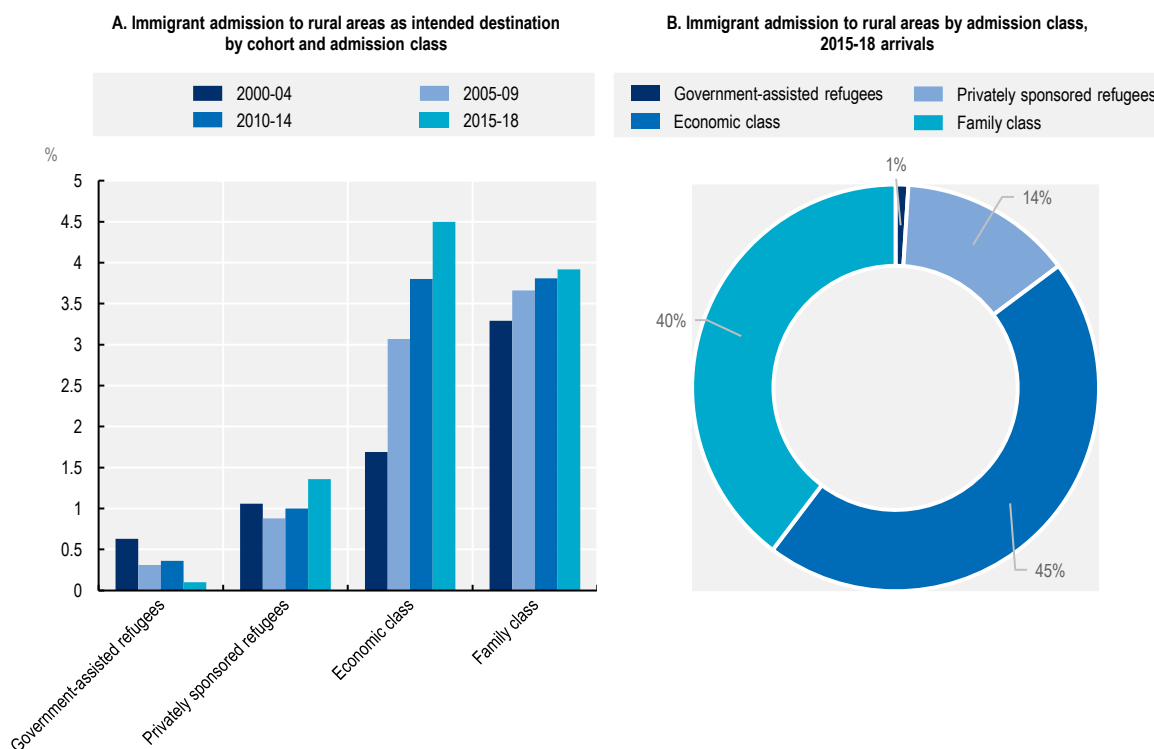


Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

The number and share of migrants entering Canada have increased since 2000 (Figure 2.24). This has also been reflected in an increased share of immigrants to rural areas. Immigrants who came for economic purposes and those who came for family reunification have the highest shares in rural areas at 4.5% and 3.9% as a share of the total (rural and urban) immigrant admissions in the 2015-18 period (Figure 2.24). This amounted to 35% of all admissions in rural areas due to economic reasons and 40% due to family reunification purposes. However, despite an increase in the total shares of immigrants going to rural areas from the early 2000s to the period 2015 to 2018, the intended destination for immigration remained heavily in urban areas due to perceived and real opportunities for employment (Gure and Hou, 2022^[13]).

As compared to other OECD countries, immigrants to Canada tend to have good employment opportunities. The employment rate of foreign workers is close to equal to that of non-foreign workers (OECD, 2022^[38]) and provincial dispersion of labour market opportunities for migrants within Canada is relatively low. In part, this is because immigration³³ policies, including the Canadian refugee resettlement programme, are directly targeted to support provincial governments in getting access to skills and labour that can support provincial priorities (Gure and Hou, 2022^[13]).

Support in resettlement can come in the form of job placement and cultural integration.³⁴ While rural communities may not be able to create perceived economic benefits that urban areas are valued for, supporting efforts to build vibrant immigrant neighbourhoods and providing government support offices to help with resettlement could, in part, support a more stable resettlement into rural areas (Gure and Hou, 2022^[13]), encouraging a sustained level of diversity and labour supply to support the development of new opportunities in rural areas. Literature on immigrant resettlement in other countries suggests that while immigrants who resettle in places with large co-ethnic networks have stronger initial labour market outcomes, they may be inclined to invest less in human capital development (Battisti, Peri and Romiti, 2016^[64]) while, on the other hand, resettlement support with language classes tends to lead to higher labour market outcomes and reinvestment in human capital (Lochmann, Rapoport and Speciale, 2019^[65]; Arendt et al., 2020^[66]; Foged, Hasager and Peri, 2022^[67]).

Figure 2.24. Increasingly, rural areas are gaining migrants interested in economic opportunities

Source: Gure, Y. and F. Hou (2022^[13]), "Retention of government-assisted refugees in designated destinations: Recent trends and the role of destination characteristics", Statistics Canada, <https://doi.org/10.25318/3628000120220700002-eng>.

Determinants of entrepreneurship and innovation in rural areas

Entrepreneurs and innovators are risk takers who find ways to overcome challenges by building knowledge from the market and community. However, not all individuals have the same opportunities. Both individual characteristics, firm characteristics and the market in which individuals create firms and innovation have an impact on the success of risky endeavours. In this final section, the analysis will focus on individual and market characteristics that drive the creation of new firms and the propensity to participate in formal innovation.³⁵ Drawing primarily from analysis through the linked Canadian Employer-Employee Database, which allows for simultaneous individual and firm effects (described in the previous section), this provides the analytical basis on which the following chapters build in terms of policies and programmes within the context of Canada.

New entrepreneurs across geographies

As individuals get older, they are less likely to start a new firm in both urban and rural areas (Table 2.1).³⁶ The finding on age and new firm formation is relatively consistent across rural and urban areas, yet there is nevertheless a higher share of older individuals in rural areas. As such, thinking about how to engage older individuals in entrepreneurship and skill upgrading is critical for rural areas, as is a continued engagement strategy for youth from an early age.

Women are more likely to start firms in rural areas than men. This is not the case in urban areas. Being a woman increases the probability of starting a firm in rural areas by 0.018 but not in urban areas, where being a woman is negatively associated with starting a firm (-0.005) (Table 2.1).³⁷ Despite different reasons

for starting firms, such as flexibility in work-life balance, some research suggests that female-owned firms tend to employ fewer individuals across Canada (Grekou, Li and Liu, 2018^[68]). While further information is needed to draw strong conclusions, fostering programmes specifically to support women-owned firms in rural areas can be useful in overcoming some of the barriers to equal opportunities for women across different geographies of Canada. Beyond direct support mechanisms, ancillary support, such as through quality child care, elderly care and access to education, can make a substantial impact on women's participation in the labour market and as entrepreneurs.

The entrepreneurial drive of immigrants in Canada is more pronounced in urban areas than in rural ones. This is a missed opportunity for rural areas. Immigrants in Canada's urban and rural areas are more likely to start a new firm than non-immigrants (Table 2.1). However, the likelihood of starting a firm in rural areas for immigrants is lower (0.124) than in urban areas (0.162).

Rural entrepreneurs are more likely to take more financial risks to start a firm than urban entrepreneurs. During the first year of firm formation, rural entrepreneurs tend to rely less often on both unemployment insurance income and income from second jobs than urban entrepreneurs (Table 2.1). However, unemployment insurance is a more important source of income for rural entrepreneurs looking to start a new firm than income from a second employment source.

Finally, the characteristics of firms that start new endeavours vary in urban and rural areas. Rural start-ups tend to be smaller than their urban counterparts (Table 2.1) and have more limited linkages with foreign owners (or investors), often being less likely to form part of a foreign partnership. While all new firms are less likely to immediately participate in global supply chains (through exports or imports), rural firms have a marginally better (less negative) association with global supply chains than urban firms (-0.46 in rural areas and -0.56 in urban areas). Lastly, rural and urban firms are unlikely to apply for innovation tax incentives through the formal R&D incentives programmes in their first year. This is likely due to the fact that filing for innovation-related tax incentives may develop over the course of the development of the firm, in particular after the firm's first year. In some countries, taxes are often also already lower in the first years of operation.

Table 2.1. Start-up Analysis, 2010-19

Probability of starting a firm (Dependent Variable: Start-up Status)

	Urban		Rural	
	Coeff.	S.E.	Coeff.	S.E.
Age (relative to 55-64 year-olds)				
15-24	0.278***	(0.002)	0.227***	(0.004)
25-44	0.240***	(0.001)	0.191***	(0.003)
45-54	0.098***	(0.002)	0.086***	(0.003)
Gender (relative to men)				
Women	-0.005***	(0.001)	0.018***	(0.002)
Marital status (relative to married)				
Union: Common-law	0.003*	(0.002)	0.026***	(0.003)
Single: Widowed/divorced/separated	0.038***	(0.002)	0.037***	(0.004)
Single: Never married	0.044***	(0.001)	0.045***	(0.003)
Immigrant status				
Immigrants	0.162***	0.001	0.124***	0.005
Main income source (relative to incorporated business income)				
Employment income	0.064***	0.002	0.047***	0.003
Unemployment insurance	0.132***	(0.003)	0.097***	(0.005)
Provinces (relative to Ontario)				

	Urban		Rural	
	Coeff.	S.E.	Coeff.	S.E.
Atlantic Canada	0.171***	0.002	0.111***	0.003
Quebec	-0.002	(0.001)	-0.051***	(0.003)
Prairies	-0.005***	(0.001)	-0.044***	(0.003)
British Columbia	0.016***	(0.001)	0.041***	(0.004)
Territories	-0.058***	(0.010)	-0.036*	(0.014)
Labour market (LM) condition				
Percentage of youth (15-29) in local LM	0.915***	0.032	-0.950***	0.095
Size class (relative to large 100 or more employees)				
Non-employer	1.001***	0.002	0.762***	0.005
Micro 1-4	0.610***	(0.001)	0.442***	(0.003)
Small 5-19	0.210***	(0.001)	0.091***	(0.003)
Medium 20-99	0.001	(0.001)	-0.126***	(0.003)
Other firm characteristics				
Trade status (exporter and/or importer)	-0.557***	0.001	-0.458***	0.003
SR&ED filing status	-0.381***	(0.002)	-0.381***	(0.005)
Foreign ownership status	-0.029***	(0.002)	-0.099***	(0.005)
No. of observations	135 134 585		24 982 840	
No. of clusters	21 290 400		4 546 016	
Pseudo R2	0.159		0.121	

Note: Coeff. stands for coefficient and S.E. for standard error. Fixed effects for all regressions include industry, year, region, marital status and percentage of youth in the labour market. Errors are clustered on the individual level. The reference groups include corporations, young firms (1 year old), large firms (100 or more employees), and Ontario.

Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Innovation in established firms

Once firms establish themselves, what characteristics of entrepreneurs and their firms help them continue to innovate? The following analysis uses innovation, as measured by applicants filing a tax incentive programme request for R&D expenditure, as a proxy for formal innovation activities. This analysis, therefore, only refers to this type of innovation, which excludes other forms of innovation that significantly improve processes and products without heavy R&D investment.

When firms are majority-owned by men, they are more likely to participate in formal innovation activities than those owned or equally owned by women (Table 2.2). Despite the unfavourable outlook for women, the penalty for majority female-owned firms is reduced in rural areas. The probability of participating in formal innovation in urban areas when the firm is primarily woman-owned or equally owned is 0.13 to 0.12 less than primarily men-owned firms. In comparison, the probability of undertaking innovation when a primarily woman-owned firm is half as big as those in rural areas.

Unlike the trend in urban areas, businesses primarily owned by immigrants contribute positively to formal innovation in rural areas (Table 2.2). In urban areas, firms primarily owned by immigrants have a lower propensity to participate in formal R&D activities but a positive probability in rural areas. In urban areas, most immigrant-owned firms have a 0.20 lower probability of participating in formal innovation than the majority of Canadian-born owners. On the other hand, having immigrants work as a part of the firm is positively associated with formal innovation in urban and rural areas, with a stronger impact in rural areas, particularly if they arrived less than five years ago (Table 2.2).

Size matters for innovation. In the previous analysis, the size composition of rural areas with a larger share of smaller firms and the distribution of innovators were aligned. Rural areas have both more innovators

and smaller firms. However, considering all other characteristics of firms, the regression results find that the largest firms (100 or more employees) tend to innovate more than smaller firms. Furthermore, there is still a penalty for rural firms (Table 2.3). In urban areas, medium-sized firms (20-99) had a 0.305 smaller probability of starting a firm than large firms (100 or more employees) in urban areas. In rural areas, medium-sized firms were 0.434 less likely to participate in formal innovation activities than large firms (100 or more employees) in rural areas.

Table 2.2. Innovation analysis, 2010-19, Part 1

Probability of applying for SR&ED, (Dependant Variable: SR&ED Filing Status)

	Urban		Rural	
	Coeff.	S.E.	Coeff.	S.E.
Business ownership structure				
Gender (relative to men-owned)				
Majority women-owned	-0.131***	(0.012)	-0.066*	(0.030)
Equally owned	-0.120***	(0.012)	-0.068***	(0.023)
Immigrant status (relative to Canadian-born-owned)				
Majority immigrant-owned	-0.200***	(0.015)	0.226***	(0.046)
Equally owned	0.046	(0.028)	0.244**	(0.080)
Previous business experience (relative to. with exp.)				
Majority-owned by persons without pre. bus. exp.	-0.120*	(0.047)	-0.254*	(0.100)
Previous labour market (LM) experience (relative to. with exp.)				
Majority-owned by persons without pre. LM exp.	-0.070***	(0.009)	-0.054**	(0.020)
Age (relative to. owned by 50 year-olds or more)				
Majority-owned by 49 year-olds-	-0.018	(0.013)	-0.074**	(0.029)
Equally owned	-0.048***	(0.017)	-0.095**	(0.032)
Percentage of 29 year-olds or younger	0.163***	(0.020)	0.118*	(0.046)
Percentage of 30-49 year-olds	0.023	(0.012)	0.076**	(0.029)
Foreign ownership status	0.175***	(0.054)	-0.063	(0.181)
Workplace characteristics				
Percentage of women	-0.545***	(0.011)	-0.266***	(0.026)
Percentage of 24 year-olds	-0.045*	(0.021)	-0.304***	(0.034)
Percentage of 25-54 year-olds	0.276***	(0.012)	0.211***	(0.025)
Percentage of immigrants	0.321***	(0.016)	0.440***	(0.060)
Percentage of recent immigrants landed less than 5 years ago	0.290***	(0.018)	0.241***	(0.082)
Percentage of recent immigrants landed 5-9 years ago	-0.023	(0.017)	0.026	(0.090)
Percentage of employees with previous LM experience	-0.253***	(0.009)	-0.105***	(0.021)
No. of observations	5 151 076		1 084 712	
No. of clusters	962 130		191 237	
Pseudo R2	0.316		0.305	

Note: Coeff. stands for coefficient and S.E. for standard error. The reference groups include corporations, young firms (1 year old), large firms (100 or more employees) and Ontario. Fixed effects include industry, year, region, marital status and share of owners over the age of 50. Errors are clustered on the firm level. The results include unreported fixed effects on industry and year. Errors are clustered on the firm level.

Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

The peak age when firms are likely to innovate is older (between 11-30 years of age) in rural areas than in urban areas (Table 2.3). The probability of innovating for a young firm (2-5 years old) is 0.16 in urban areas and null (non-significant) in rural areas, compared to firms over 30 years of age. For firms that are in their intermediate ages (6-10), the probability is 0.219 in urban areas and 0.086 in rural areas. The highest probability for a firm to innovate in rural areas is in its mature age (11-30), when the probability is

0.105. In comparison, firms in urban areas in this same age group have a higher probability than rural firms (0.195) but lower than firms 6 and 10 years of age.

Table 2.3. Innovation Analysis, 2010-19, Part 2

Probability of applying for SR&ED (Dependant Variable: SR&ED Filing Status)

	Coeff.	Urban	Rural	
		S.E.	Coeff.	S.E.
Age class (relative to more than 30 year-olds)				
Young (2-5)	0.163***	(0.019)	-0.001	(0.038)
Intermediate (6-10)	0.219***	(0.019)	0.086***	(0.037)
Mature (11-30)	0.195***	(0.017)	0.105***	(0.032)
Size class (relative to. large 100 or more)				
Micro 1-4	-1.136***	(0.019)	-1.140***	(0.050)
Small 5-19	-0.605***	(0.018)	-0.828***	(0.050)
Medium 20-99	-0.305***	(0.018)	-0.434***	(0.050)
Provinces (relative to Ontario)				
Atlantic Canada	-0.182***	(0.021)	-0.836***	(0.032)
Quebec	0.151***	(0.009)	-0.404***	(0.021)
Prairies	-0.420***	(0.011)	-0.855***	(0.022)
British Columbia	-0.218***	(0.011)	-0.940***	(0.042)
Territories	-0.679***	(0.115)	-1.177***	(0.226)
Other firm characteristics				
Labour productivity	0.141***	(0.004)	-0.026**	(0.009)
Trade status (exporter and/or importer)	0.679***	(0.007)	0.558***	(0.016)
Multiple-location status	-0.039**	(0.014)	-0.036	(0.043)
Multiple-province status	0.055***	(0.018)	0.007	(0.063)
Multiple-activity status	0.043*	(0.020)	0.123*	(0.058)
No. of observations		5 151 076		1 084 712
No. of clusters		962 130		191 237
Pseudo R2		0.316		0.305

Note: Coeff. stands for coefficient and S.E. for standard error. The results include unreported fixed effects on industry and year. Errors are clustered on the firm level.

Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

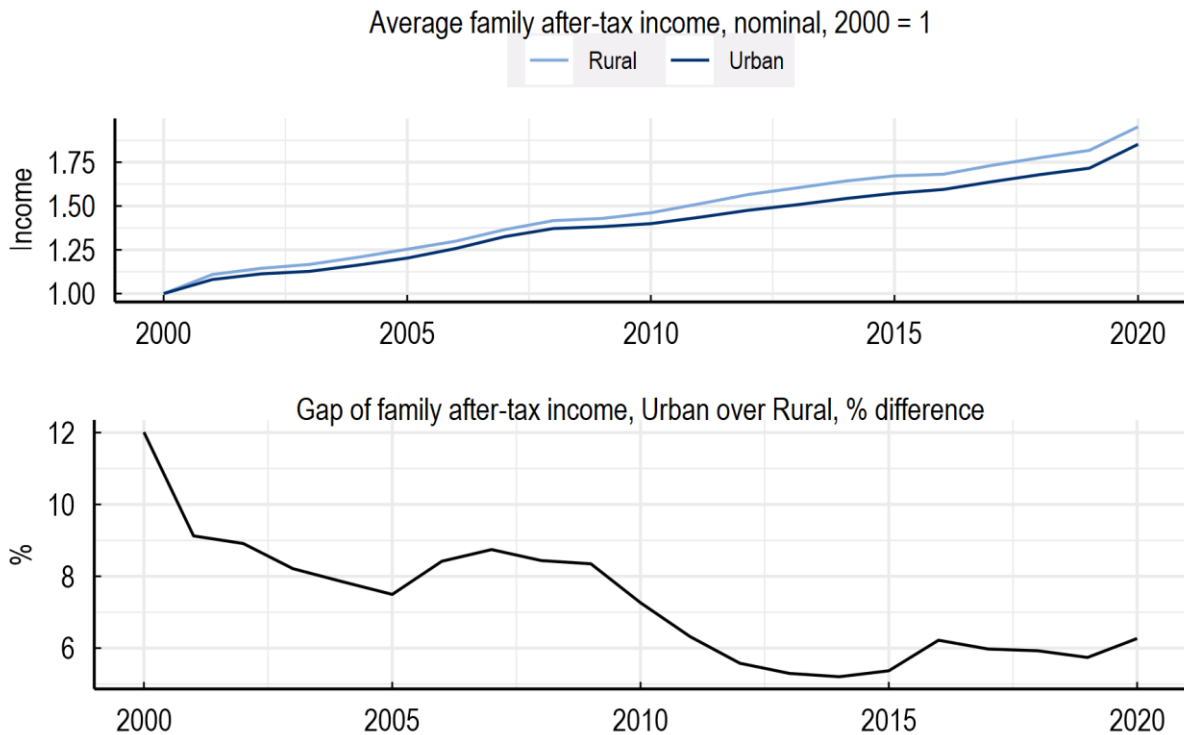
International linkages through trade and foreign ownership tend to have relatively positive impacts on the probability of participating in formal innovation activities. In rural areas, participating in global value chains, either through imports or exports, has a positive effect on formal innovation activity (Table 2.3). However, there is still a penalty for rural areas as compared to urban areas. In urban areas, participating in global value chains is associated with a 0.68 higher probability of participating in formal innovation, while the likelihood decreases to 0.56 for rural firms. On the other hand, international linkages through foreign ownership are less critical to the likelihood of participating in formal innovation (Table 2.3). Having a foreign owner increases the likelihood of participating in formal innovation activities by 0.175 in urban areas, while no perceivable (statistically significant) benefit is observed in rural areas.

Finally, the likelihood of participating in formal innovation is highest in urban areas of Quebec and rural areas of Ontario (Table 2.3). In fact, both Quebec's urban and rural areas are associated with relatively high levels of formal innovation activities compared to most other provinces and geographies, except for rural Ontario. The positive association with formal innovation in the province of Quebec is further explored

in Chapter 3 of the report. In part, this may be due to the strong development of the formal university-firm innovation system and regionally integrated model of community colleges (CCTTs) in Quebec that creates more opportunities for formal innovation linkages between universities and firms in both urban and rural areas. Firms in rural areas within the Territories, where there is a relatively higher proportion of Indigenous entrepreneurs, are least likely to participate in formal innovation activities.

Annex 2.A. Additional resources

Annex Figure 2.A.1. The gap in income between rural and urban households halved between 2000 and 2020

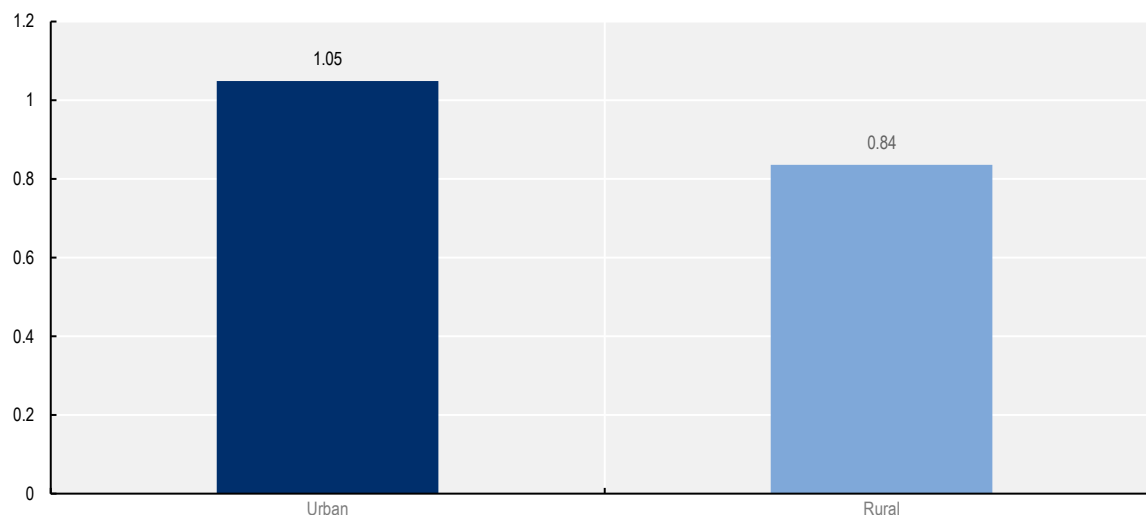


Note: The underlying data are in current CAD. All family units, with or without children, are included in the analysis. Average income refers to the median of all family income. Urban here denotes the explicitly defined areas provided in the data source in the provinces (Alberta, British Columbia, Manitoba, Ontario, New Brunswick, Newfoundland and Labrador, Nova Scotia, Quebec and Saskatchewan) and territories (Northwest Territory and Yukon). Rural denotes the non-CMAs/CAs of each province and territory, as given in the dataset and described in the chapter. Nunavut has no CMA/CA region and so is classified as entirely non-CMA/CA in this analysis.

Source: Analysis based on Statistics Canada (n.d.^[69]), *Census Families by Family Type and Family Composition Including Before and After-tax Median Income of the Family*, Table 11-10-0017-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110001701>.

Annex Figure 2.A.2. There is a higher share of urban firms that report having expenditure on scientific research and experimental development

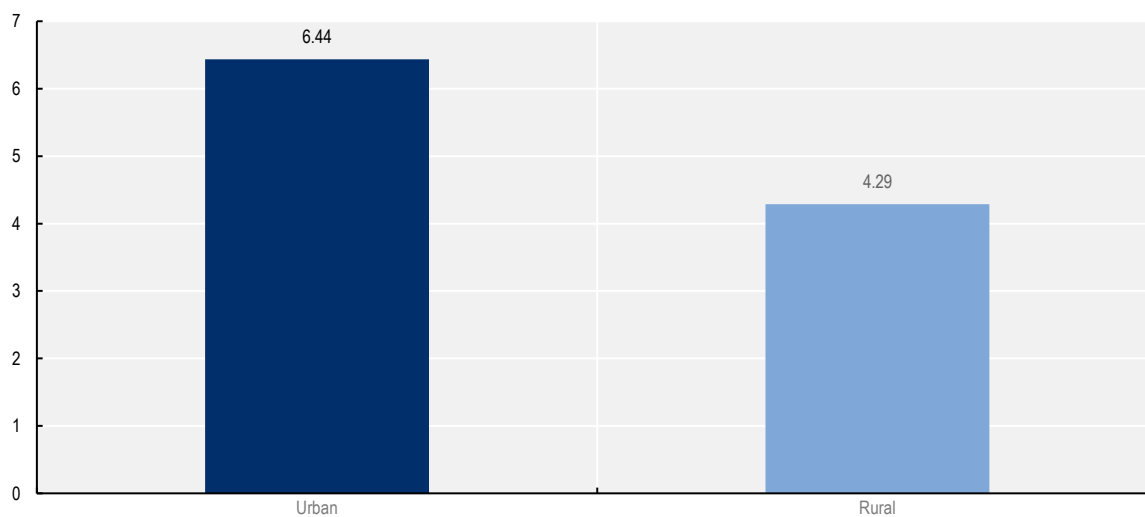
Share of firms having filed tax returns for R&D expenditure, by geography, 2018



Source: OECD analysis based on Statistics Canada (2022_[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Annex Figure 2.A.3. There is a higher share of new firms in urban regions

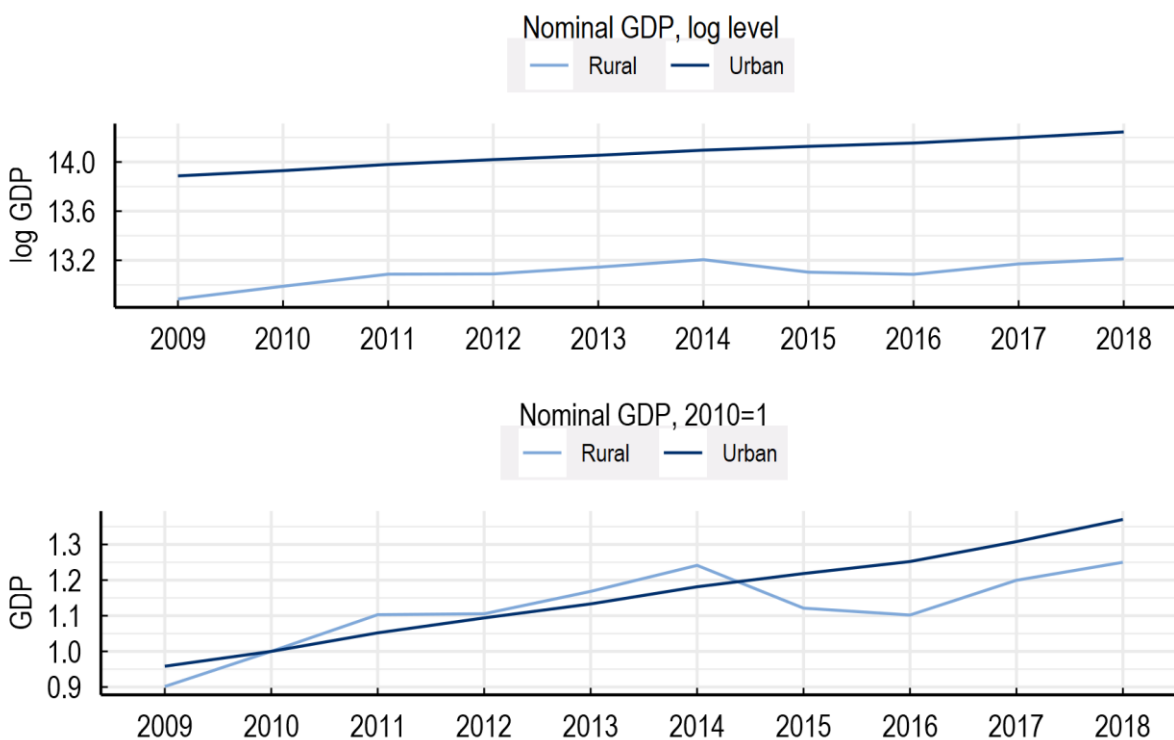
Share of new firms (1 year and younger), by geography, 2018



Source: OECD analysis based on Statistics Canada (2022_[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Annex Figure 2.A.4. GDP is higher in urban areas than in rural areas, however both are showing similar signs of growth

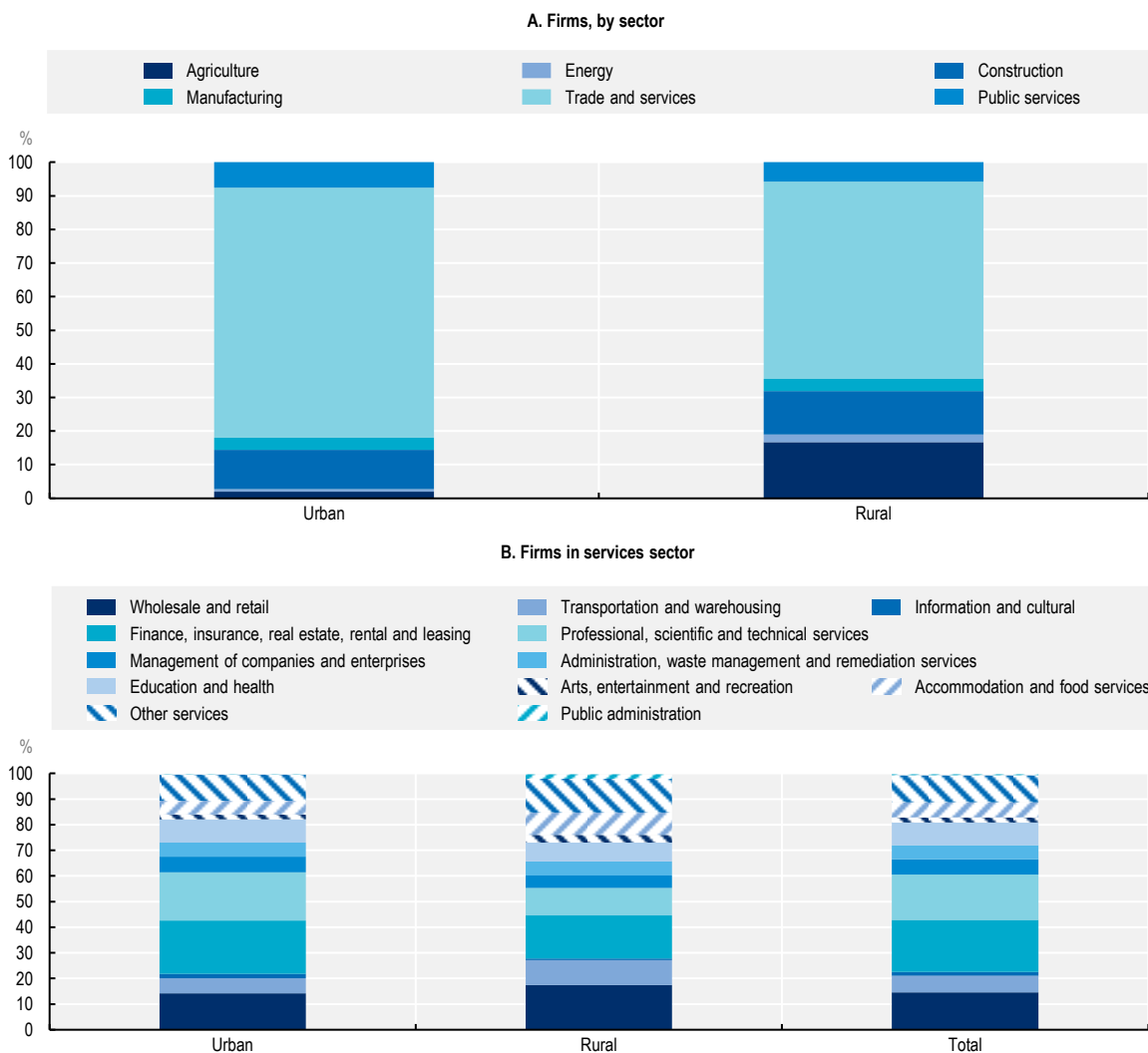
GDP in log levels and nominal growth rates, base 2010



Note: The underlying data are in current CAD. All sectors of the economy are included.

Source: Statistics Canada (n.d.^[24]), *Gross Domestic Product (GDP) at Basic Prices, by Census Metropolitan Area (CMA) (x 1,000,000)*, Table 36-10-0468-01 (GDP), <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610046801>; Statistics Canada (n.d.^[25]), *Population Estimates, July 1, by Census Metropolitan Area and Census Agglomeration, 2016 Boundaries 17-10-0135-01 (worker)*, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710013501>.

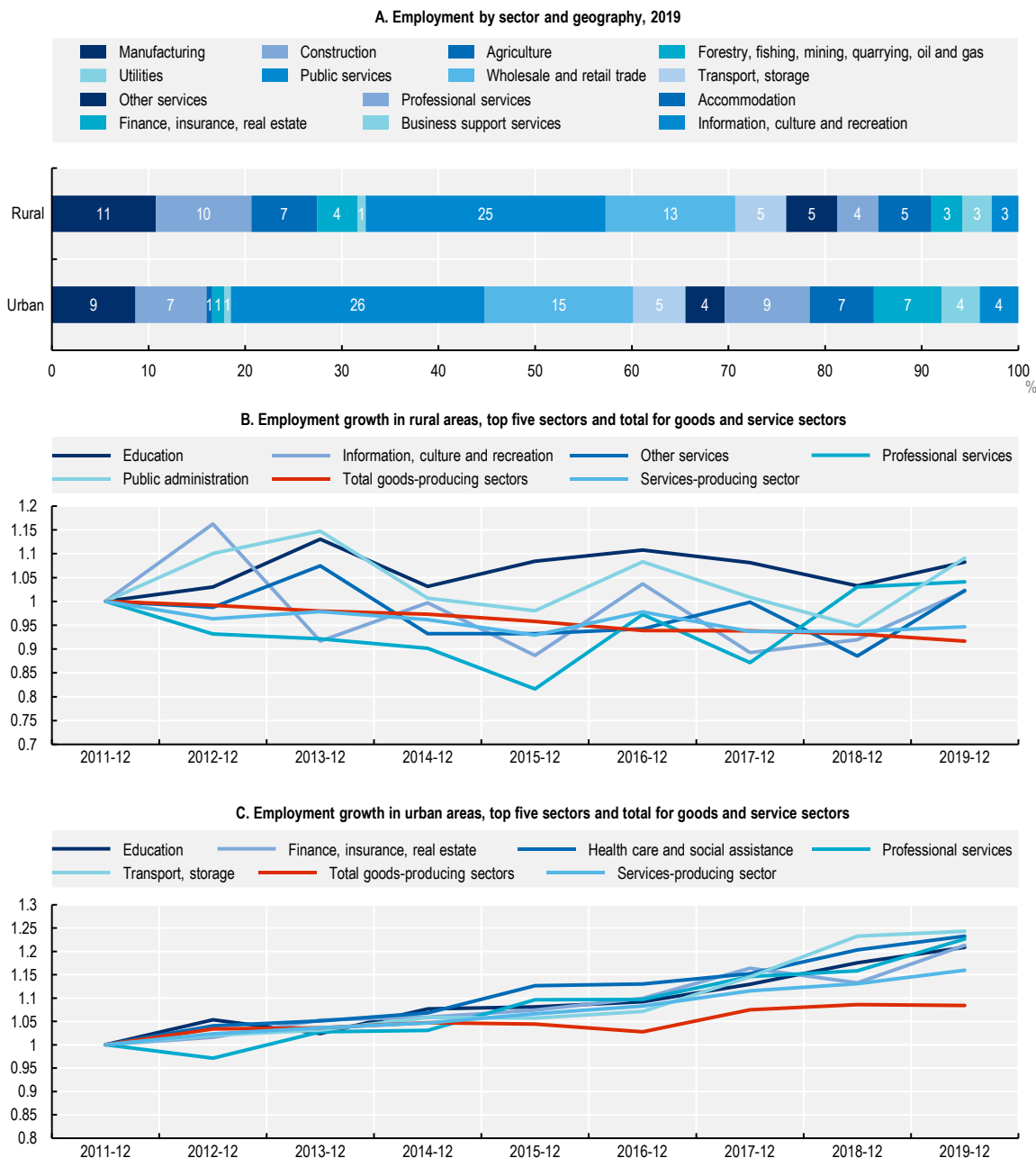
Annex Figure 2.A.5. Number of firms in Canada, by sector, 2005-19



Source: OECD analysis based on Statistics Canada (2022^[31]) *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023).

Annex Figure 2.A.6. Employment by sector

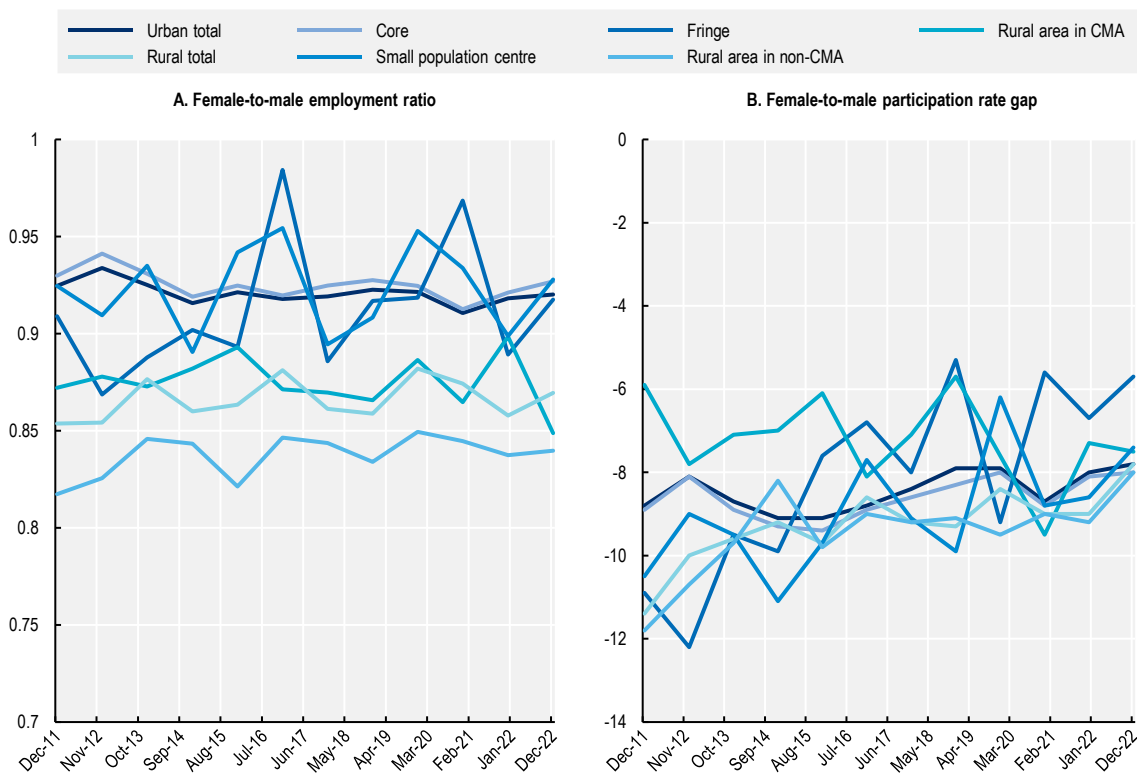
Employment shares by sector in 2019 and employment growth by top five sectors, base =2011



Note: Goods-producing sectors are manufacturing, construction, agriculture, forestry, fishing, mining, quarrying, oil and gas, and utilities. The service-producing sectors are public services, wholesale and retail trade, transport and storage, other services, professional services, accommodation, finance, insurance, real estate, business support services, information, culture and recreation. To ensure respondent confidentiality, estimates below a certain threshold are suppressed. Estimates exclude the Territories. Estimates are taken from December of each year. Industry refers to the general nature of the business carried out by the employer for whom the respondent works (main job only). Industry estimates are based on the 2012 NAICS, rather than the 2017 definitions. Urban areas are defined as a CMA with a population of at least 100 000 inhabitants and a CA with a population of at least 10 000 based on the previous census. Rural areas are defined as non-CMA/CA. Source: Statistics Canada (n.d.^[70]), *Employment by Class of Worker and Industry, Monthly, Unadjusted for Seasonality, Population Centres and Rural Areas, Inactive (x 1,000)*, Table 14-10-0107-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410010701>.

Annex Figure 2.A.7. Low-density and remote rural areas have the strongest challenges for gender parity

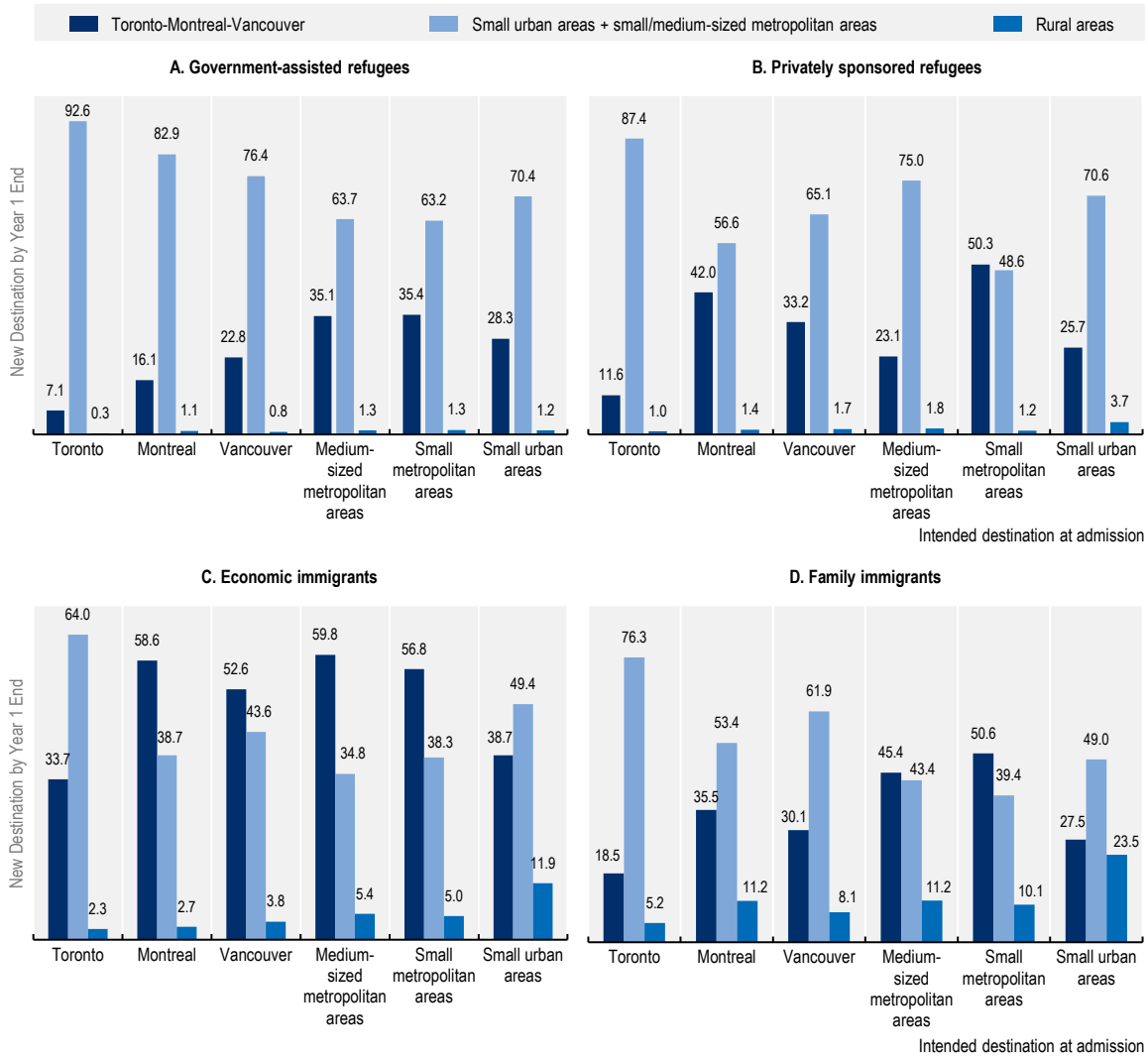
By geography, 2011-22



Note: Employment and unemployment series are based on workers aged 15 and more. Monthly data with only December indicators represented. The rural economy is measured by all non-CMAs/CAs, whereas the urban economy measures all CMAs/CAs. Estimates in thousands, rounded to the nearest hundred. The employment rate refers to the share of employed over the active labour market (excludes discouraged workers, unemployed individuals not looking for work and students). Employed workers refer to the number of persons who, during the reference week, worked for pay or profit, performed unpaid family work or had a job but were not at work due to their own illness or disability, personal or family responsibilities, labour dispute, vacation or other reasons. Those persons on layoff and those without work who had a job to start at a definite date are not considered employed. Estimates in thousands, rounded to the nearest hundred. The unemployment rate is the number of unemployed persons expressed as a percentage of the labour force. The unemployment rate for a particular group (age, gender, marital status, etc.) is the number of unemployed in that group expressed as a percentage of the labour force for that group. Estimates are percentages rounded to the nearest tenth.

Source: Statistics Canada (n.d.^[55]), *Employment and Unemployment Rate, Monthly, Unadjusted for Seasonality*, Table 14-10-0374-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410037401>.

Annex Figure 2.A.8. After arrival, migrants are primarily choosing to resettle in urban and metropolitan areas



Source: Gure, Y. and F. Hou (2022^[13]), "Retention of government-assisted refugees in designated destinations: Recent trends and the role of destination characteristics", Statistics Canada, <https://doi.org/10.25318/36280001202200700002-eng>.

Annex 2.B. OECD typology of geographical units based on accessibility

Rural places are everywhere and exist as a continuum. What we commonly understand as rural is implicitly spatial and relative. In practice, governments delineate typologies of territories but there is no clear cut-off between regions or areas. Rural characteristics can exist within more urbanised regions and rural attributes are apparent across the spectrum of territorial characteristics. This continuum of rurality is delineated within the recent OECD publication on rural well-being (OECD, 2020^[71]).

The term “rural” is often used to describe territories that have relatively low density of human settlement patterns, with relatively large distances to more densely populated areas. Often, rural regions are characterised as regions with activities closely related to natural resource industries such as mining and agriculture. However, this sectoral definition overlooks many of the different varieties of rural territories and what this means for political agenda-setting in rural regions. Indeed, a region being identified as “rural” has implications on government finance and wider regional policy making.

Defining rural regions, by small regions (TL3)

In consultation with OECD national governments, the OECD harmonised guidelines for classifying territorial characteristics across countries avoid the traditional, sometimes harmful, rural-urban dichotomy. While there is no one best definition of geographies, different definitions may suit different purposes. This unified definition of rural provides the basis for analysis across countries within rural economies (OECD, 2020^[71]). The most recent definitions of rural regions have benefitted from a reflection on the combination of physical (“first-nature”) and human (“second-nature”) geographies. Rural regions are defined by economic remoteness, with three distinct features related to the physical distance to major markets, economic connectedness and sector specialisation. Considering these features, rural regions are physically distant to major markets, with specialisation in niche markets and those linked with natural resources such as agriculture and tourism. The degree of economic connectedness with surrounding areas may vary by relative density, infrastructure availability and complementarities between and within rural regions.

Annex Box 2.B.1. OECD territorial classifications

The OECD classifies regions within the 38 member countries into 2 territorial levels that reflect the administrative organisation of countries. The 433 OECD large regions (TL2) represent the first administrative tier of subnational government, for example, the Ontario provinces of Canada. The 2 414 OECD small regions (TL3) correspond to administrative regions, with the exception of Australia, Canada and the United States. These TL3 regions are contained in a TL2 region, with the exception of the United States, for which the economic areas cross the states’ borders. For Costa Rica, Israel and New Zealand, TL2 and TL3 levels are equivalent.

Source: OECD (2022^[72]), *OECD Territorial Grids*, <https://www.oecd.org/cfe/regionaldevelopment/territorial-grid.pdf>.

In 2019, the OECD published a new classification that is based on functional urban areas (FUA) that incorporates density and the driving estimations for the time it takes to access dense metropolitan areas. To the furthest extent possible, rural in OECD comparative classification will be defined based on characteristics of small administrative regions, as described in Annex Box 2.B.1, in order of priority, where:

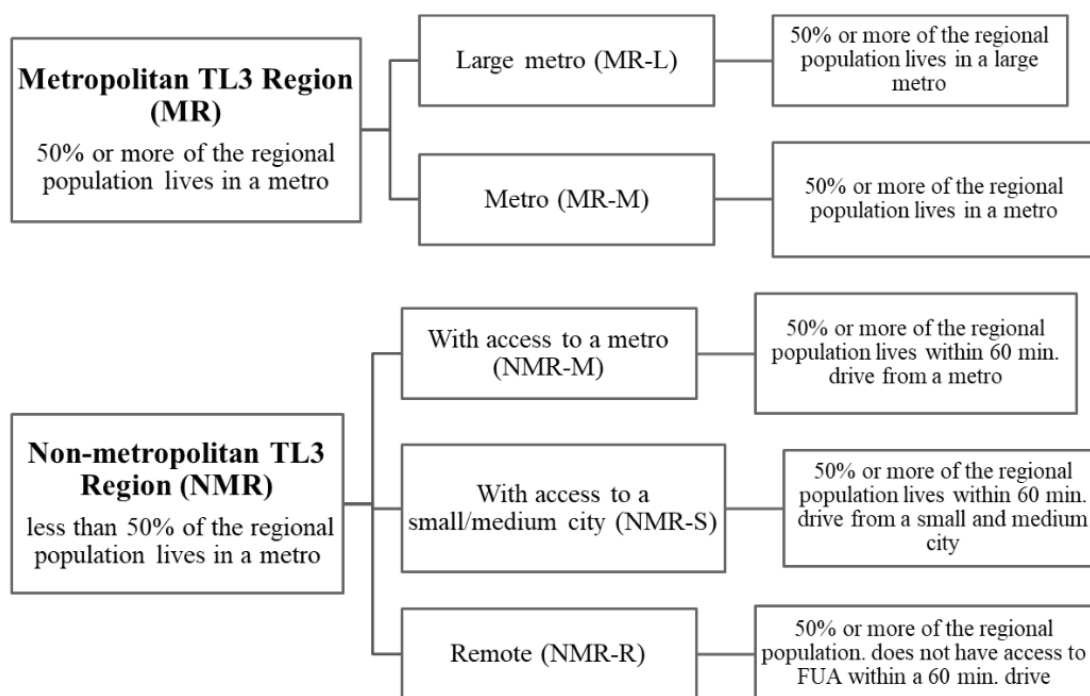
- Data at the Territorial Level 3 (TL3) are available; less than 50% of the regional population live in metropolitan areas. This includes rural regions inside FUAs (where at least 50% of the population is within a 1-hour driving distance away from a dense urban area with a population larger than 250 000 inhabitants), rural regions close to small or medium-sized cities of populations with smaller or equivalent to 250 000 inhabitants, and rural remote areas.
- Data at the Territorial Level 2 (TL2) are available and we calculate the degree of rurality within regions (TL2) for each country. This is based on the share of the population within each TL2 that is outside of FUAs, ranked by share values. Those above the median are considered *relatively rural*, while those below are considered *relatively urban*.

The diverse types of rural regions all have different characteristics and policy needs. Three types of non-metropolitan regions are considered. To various degrees, these share more rural characteristics than urban ones.

- **Non-metropolitan regions** are defined as having less than 50% of the population living in an FUA with a population larger than 250 000 inhabitants (otherwise referred to as a metro region). The three types of non-metropolitan units include regions with access to a metropolitan region, non-metropolitan areas with access to a small or medium-sized city (referred to as a non-metro near region) and a non-metropolitan region in remote areas (referred to as a non-metro far region).
- **Non-metropolitan regions with access to a metropolitan region:** These regions have 50% or more of the regional population that live within a 60-minute drive to a metropolitan area. This is, in part, referring to towns and suburbs surrounding the distant periphery of major metropolitan centres. An example of such regions includes Tyrolean Oberland in Austria (AT334), Montmagny in Quebec, Canada (CA2418), Jura in France (FRC22) and Nagasaki in Japan (JPJ42). The challenges of such regions are often tied to economies of metropolitan areas while focusing on industries such as tourism without some of the infrastructure barriers of less densely populated areas.
- **Non-metropolitan regions with access to small or medium-sized cities:** These regions are regions with 50% or more of the regional population living within a 60-minute drive from a small or medium-sized city. Examples of these types of regions include the administrative district of Neufchâteau in Belgium (BE344), San Antonio in Chile (CL056), South Bohemia in the Czech Republic (CZ031), East Lancashire in the United Kingdom (UKD46) or Springfield in Illinois, United States (US158). These regions have a strong manufacturing base and linkages to neighbouring economies.

The schematic breakdown is available in the figure below.

Annex Figure 2.B.1. OECD typology of TL3 regions with access to cities



Source: Fadic, M. et al. (2019^[73]), “Classifying small (TL3) regions based on metropolitan population, low density and remoteness”, <https://doi.org/10.1787/b902cc00-en>.

Annex 2.C. Defining sectors

The industrial sector classification used in this report follows that provided by the government agencies from which the data originate, which is mainly the North American Industry Classification System (NAICS). Industry refers to the general nature of the business carried out by the employer for whom the respondent works (main job only). Annex Table 2.C.1 reports the industrial groupings used in Canada. This is the basis for the sectoral analysis of this chapter. Abbreviations may be used for parsimony.

Annex Table 2.C.1. Sector classifications

NAICS 2017 classification	Industrial sector	Abbreviation used in the chapter	Goods vs. service-producing sectors	Commonly used aggregations
11*	Agriculture, forestry, fishing and hunting	Agriculture	Goods	Agriculture, fishing and forestry
21*	Mining, quarrying and oil and gas extraction	Mining, oil and gas	Goods	Mining
22	Utilities	Utilities	Goods	Utilities
23	Construction	Construction	Goods	Construction
31-33	Manufacturing	Manufacturing	Goods	Manufacturing
44, 45	Retail trade	Retail trade	Services	Services
48, 49	Transportation and warehousing	Transportation	Services	Services
42	Wholesale trade	Wholesale trade	Services	Services
51	Information	Information	Services	Services
52, 53	Finance and insurance, and real estate and rental and leasing	Finance, insurance and real estate	Services	Services
54, 55, 56	Professional, scientific, and management and administrative and waste management service	Professional services	Services	Services
61, 62	Educational services, and healthcare and social assistance	Education and social services	Services	Public services
71, 72	Arts, entertainment, and recreation and accommodation and food services	Recreation	Services	Services
81	Other services, except public administration	Other services (non-public)	Services	Services
91*	Public administration	Public administration	Services	Public services

Note: When possible, the mining, quarrying and oil and gas extraction sector is excluded from the analysis. In some resources, forestry, fishing and hunting are combined with mining, quarrying and oil and gas extraction sectors. When data are not available, public administration is excluded from the analysis.

Source: Based on United States Census Bureau (2021^[74]) *Introduction to NAICS*, <https://www.census.gov/naics/?58967?yearbck=2017> (accessed on 15 June 2021).

Mining, quarrying and oil and gas extraction industry

Due to supra-national oil and gas price fluctuations and the volatility of output based on global trends rather than firm production processes, the inclusion of oil and gas industries in analysis on drivers of innovation and productivity in rural areas can be misleading. This is because the high-end profits of a few companies may create a distortionary effect on the experience of the average firm or individual. Because of the outlier effects that are exerted by firms in the oil and gas industry and sectoral shocks that impact regions solely because of the sector, such firms are excluded from analysis in summary statistics where feasible. For regression analysis, controls will be placed on the industry to capture this effect.

Goods versus service-producing sectors

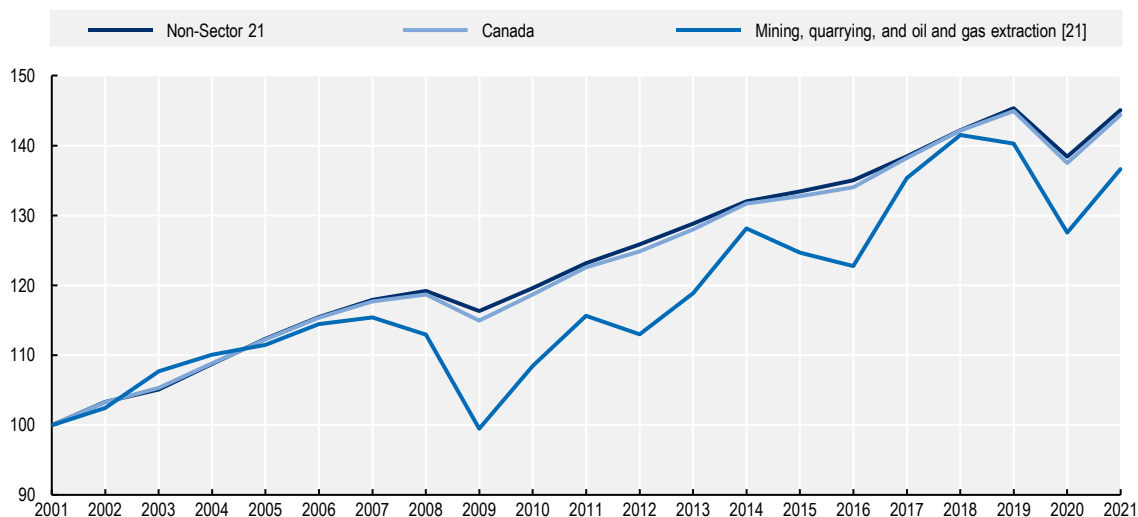
In cases where categorical variables related to sectors have too few units of observation, the chapter aggregates sectors. The aggregation into goods-producing versus service-producing sectors can be a useful categorisation of sectors that provides insights into the types of activities within an economy by the sector. As such, when statistics are presented as goods or service producing, they are categorised as identified in Annex Table 2.C.1. Total employment refers to employment in NAICS codes 11 to 91. Employment in the goods-producing sector refers to the combination of NAICS codes 11 to 33. Employment in the service-producing sector refers to the combination of NAICS codes 41 to 91.

Annex 2.D. The importance of the natural resource sector for rural Canada and the 2014 mini recession in Canada

In Canada, a substantial part of the GDP in rural areas is due to activities in the oil and gas sector. These are often large firms clustered into areas where natural resources are available, such as the province of Alberta. However, because of the dependence of the industry on international prices and exchange rates and its volatility that is determined primarily by causes outside of the Canadian market, economic development analysis that includes the extractive sector with oil and gas can be misleading. In part, this dependency leads to an overestimation of GDP or value-added in industries outside of the oil and gas sector and brings additional volatility that neither federal nor provincial policy makers can address but by international price setting. For example, Annex Figure 2.D.1 demonstrates the extractive sector (mining, quarrying and oil and gas extraction sector, NAICS 21) is relatively volatile. Without this sector, aggregate GDP growth is similar to the national aggregate GDP. However, the extractive sector itself demonstrates a volatility that mirrors that of the rural economy, with peaks and falls in years with overlapping data such as 2014, 2016 and 2018 (Annex Figure 2.D.1).

Annex Figure 2.D.1. GDP in the mining, quarrying and oil and gas extraction sector

GDP index (2012 chained Canadian Dollar, 2001=100)



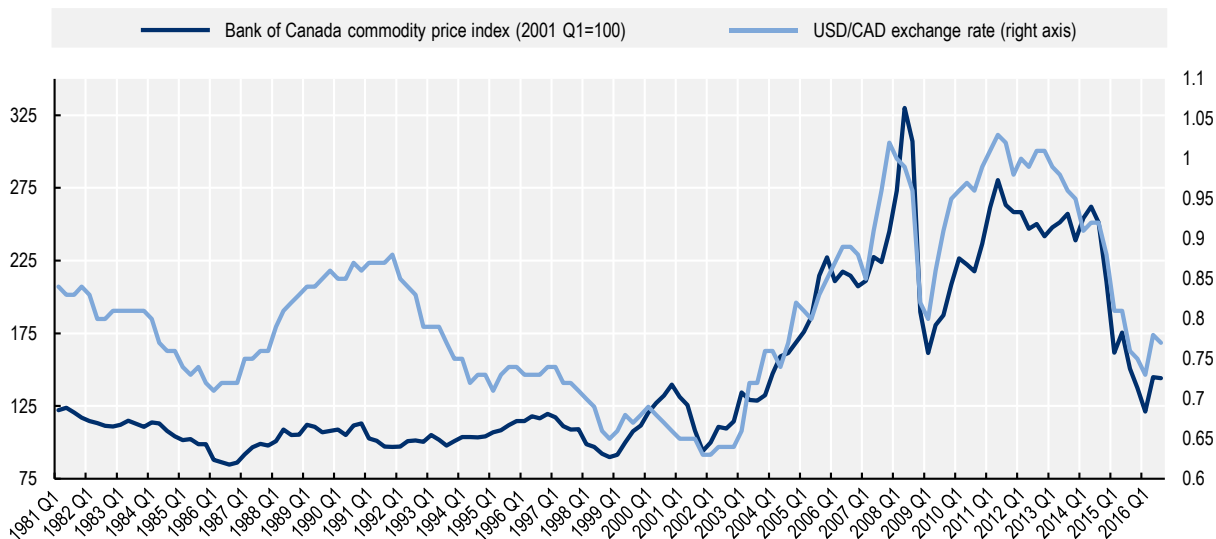
Source: Data provided by Statistics Canada.

Crises in the sector can impact the economic figures substantially. In several of the figures that are not adjusted for the oil and gas industry, the 2014 crisis in commodity prices and its impact on the US-Canadian exchange rate had wider implications for the Canadian economy, including in rural places. In Annex Figure 2.D.2, the decline of global prices for commodities in the middle of 2014 and throughout 2015 and early 2016 amounted to a decline of 53.7% from the second quarter (Q2) of 2014 to 2016 Q1 (Macdonald and Rispoli, 2016^[75]).

This change and the impact on US-Canadian exchange rates has an impact on rural areas with a large share of oil and gas activities, despite not being tied to any progress or recessions in terms of production capacity.

Annex Figure 2.D.2. Commodity price fall in 2014

Bank of Canada commodity price index versus US-Canada exchange rate



Note: Q stands for quarter.

Source: Macdonald, R. and L. Rispoli (2016^[75]), "How big was the effect of falling commodity prices on Canadian real incomes between mid-2014 and mid-2016?", <https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2016066-eng.htm>; Statistics Canada, CANSIM Tables 176-0075 and 176-0064, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1010013201> and <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1010000901>.

References

- Abbes, C., J. Baldwin and D. Leung (2022), “Patenting activity of Canadian-resident businesses”, *Economic and Social Reports*, Vol. 2/3. [76]
- Aghion, P. et al. (2018), “Innovation and top income inequality”, *The Review of Economic Studies*, Vol. 86/1, pp. 1-45, <https://doi.org/10.1093/restud/rdy027>. [14]
- Aghion, P. et al. (2009), “The effects of entry on incumbent innovation and productivity”, *The Review of Economics and Statistics*, Vol. 91/1, pp. 20-32, <https://www.jstor.org/stable/25651315> (accessed on 23 January 2024). [28]
- Arendt, J. et al. (2020), “Language training and refugees’ integration”, National Bureau of Economic Research, Cambridge, MA, <https://doi.org/10.3386/w26834>. [66]
- Backhaus, T. (2023), “Training in late careers: A structural approach”, *IZA Discussion Paper Series*, Institute of Labor Economics, <https://docs.iza.org/dp15875.pdf>. [54]
- Baldwin, J. (2004), “Trade liberalization: Export-market participation, productivity growth, and innovation”, *Oxford Review of Economic Policy*, Vol. 20/3, pp. 372-392, <https://doi.org/10.1093/oxrep/grh022>. [37]
- Battisti, M., G. Peri and A. Romiti (2016), “Dynamic effects of co-ethnic networks on immigrants’ economic success”, *NBER Working Paper Series*, No. 22389, National Bureau of Economic Research, Cambridge, MA, <https://doi.org/10.3386/w22389>. [64]
- Bellini, E. et al. (2012), “Cultural Diversity and Economic Performance: Evidence from European Regions”, in *Geography, Institutions and Regional Economic Performance, Advances in Spatial Science*, Springer Berlin Heidelberg, Berlin, Heidelberg, https://doi.org/10.1007/978-3-642-33395-8_7. [58]
- Chen, W. (2009), “Cross-national differences in income mobility: Evidence from Canada, the United States, Great Britain And Germany”, *Review of Income and Wealth*, Vol. 55/1, pp. 75-100, <https://doi.org/10.1111/j.1475-4991.2008.00307.x>. [80]
- Chen, W. and T. Mehdi (2019), “Assessing job quality in Canada: A multidimensional approach”, *Canadian Public Policy*, Vol. 45/2, pp. 173-191, <https://doi.org/10.3138/cpp.2018-030>. [79]
- Conference Board of Canada (2019), *The Economic Impact of Family Owned Enterprises in Canada*, https://familyenterprise.ca/res/pub/docs/ResearchReports/CBOC_2019_Family_Owned_Enterprises.pdf (accessed on 3 March 2023). [78]
- Crescenzi, R. and O. Harman (2023), *Harnessing Global Value Chains for Regional Development: How to Upgrade through Regional Policy, FDI and Trade*, Routledge, London, <https://doi.org/10.4324/9781003356141>. [42]
- Criscuolo, C. et al. (2023), “Worker skills or firm wage-setting practices? Decomposing wage inequality across 20 OECD countries”, *SSRN Electronic Journal*, <https://doi.org/10.2139/ssrn.4324842>. [15]
- Cusolito, A., O. Darova and D. McKenzie (2022), “Capacity building as a route to export market expansion: A six-country experiment in the Western Balkans”, *Policy Research Working Papers*, World Bank, Washington, DC, <https://doi.org/10.1596/1813-9450-10256>. [45]

- Custódio, C., M. Ferreira and P. Matos (2019), “Do general managerial skills spur innovation?”, *Management Science*, Vol. 65/2, pp. 459-476, <https://doi.org/10.1287/mnsc.2017.2828>. [46]
- Diemer, A. and T. Regan (2022), “No inventor is an island: Social connectedness and the geography of knowledge flows in the US”, *Research Policy*, Vol. 51/2, p. 104416, <https://doi.org/10.1016/j.respol.2021.104416>. [34]
- Doloreux, D., R. Shearmur and A. Van Assche (2018), “Combined innovation and export strategies of KIBS in different regional settings”, *Industry and Innovation*, Vol. 26/6, pp. 715-740, <https://doi.org/10.1080/13662716.2018.1498769>. [43]
- Eurostat (2024), *Degree of Urbanisation: Methodology*, <https://ec.europa.eu/eurostat/web/degree-of-urbanisation/methodology> (accessed on 29 January 2024). [77]
- Fadic, M. et al. (2019), “Classifying small (TL3) regions based on metropolitan population, low density and remoteness”, *OECD Regional Development Working Papers*, No. 2019/06, OECD Publishing, Paris, <https://doi.org/10.1787/b902cc00-en>. [73]
- Feldman, M. and D. Kogler (2010), “Stylized facts in the geography of innovation”, in *Handbook of The Economics of Innovation*, Vol. 1, Elsevier, [https://doi.org/10.1016/s0169-7218\(10\)01008-7](https://doi.org/10.1016/s0169-7218(10)01008-7). [8]
- Foged, M., L. Hasager and G. Peri (2022), “Comparing the effects of policies for the labor market integration of refugees”, *NBER Working Papers*, No. 30534, National Bureau of Economic Research, Cambridge, MA, <https://doi.org/10.3386/w30534>. [67]
- Galindo-Rueda, F., F. Verger and S. Ouellet (2020), “Patterns of innovation, advanced technology use and business practices in Canadian firms”, *OECD Science, Technology and Industry Working Papers*, No. 2020/02, OECD Publishing, Paris, <https://doi.org/10.1787/6856ab8c-en>. [29]
- Government of Alberta (2021), *2021 Census of Canada - Indigenous People*, <https://open.alberta.ca/dataset/487a7294-06ac-481e-80b7-5566692a6b11/resource/257af6d4-902c-4761-8fee-3971a4480678/download/tbf-2021-census-of-canada-indigenous-people.pdf>. [52]
- Grekou, D., J. Li and H. Liu (2018), “The measurement of business ownership by gender in the Canadian Employer-Employee Dynamics Database”, *Analytical Studies: Methods and References*, Statistics Canada, <https://www150.statcan.gc.ca/n1/en/pub/11-633-x/11-633-x2018017-eng.pdf?st=5RWZqfAf>. [68]
- Guadalupe, M., O. Kuzmina and C. Thomas (2012), “Innovation and foreign ownership”, *American Economic Review*, Vol. 102/7, pp. 3594-3627, <https://doi.org/10.1257/aer.102.7.3594>. [36]
- Gure, Y. and F. Hou (2022), “Retention of government-assisted refugees in designated destinations: Recent trends and the role of destination characteristics”, Statistics Canada, <https://doi.org/10.25318/36280001202200700002-eng>. [13]
- Isidro, H. and M. Sobral (2014), “The Effects of Women on Corporate Boards on Firm Value, Financial Performance, and Ethical and Social Compliance”, *Journal of Business Ethics*, Vol. 132/1, pp. 1-19, <https://doi.org/10.1007/s10551-014-2302-9>. [57]

- Kerr, W. (2010), “Breakthrough inventions and migrating clusters of innovation”, *Journal of Urban Economics*, Vol. 67/1, pp. 46-60, <https://doi.org/10.1016/j.jue.2009.09.006>. [60]
- Leiponen, A. (2005), “Skills and innovation”, *International Journal of Industrial Organization*, Vol. 23/5-6, pp. 303-323, <https://doi.org/10.1016/j.ijindorg.2005.03.005>. [47]
- Lochmann, A., H. Rapoport and B. Speciale (2019), “The effect of language training on immigrants’ economic integration: Empirical evidence from France”, *European Economic Review*, Vol. 113, pp. 265-296, <https://doi.org/10.1016/j.euroecorev.2019.01.008>. [65]
- Macdonald, R. and L. Rispoli (2016), “How big was the effect of falling commodity prices on Canadian real incomes between mid-2014 and mid-2016?”, Economic Insights, Statistics Canada, <https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2016066-eng.htm> (accessed on 20 January 2023). [75]
- McMurtry, J. and F. Brouard (2015), “Social enterprises in Canada: An introduction”, *Canadian Journal of Nonprofit and Social Economy Research*, Vol. 6/1, <https://doi.org/10.22230/cjnsr.2015v6n1a199>. [12]
- Melitz, M. (2003), “The impact of trade on intra-industry reallocations and aggregate industry productivity”, *Econometrica*, Vol. 71/6, pp. 1695-1725. [41]
- Mole, K. et al. (2022), *Rural Family Business and Exporting Behaviour*, <https://doi.org/10.13140/RG.2.2.30788.91523>. [44]
- Moretti, E. (2010), “Local multipliers”, *American Economic Review*, pp. 373–377. [81]
- Nathan, M. and N. Lee (2013), “Cultural diversity, innovation, and entrepreneurship: Firm-level evidence from London”, *Economic Geography*, Vol. 89/4, pp. 367-394, <https://doi.org/10.1111/ecge.12016>. [56]
- OECD (2023), *Enhancing Rural Innovation in Scotland, United Kingdom*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/33b8c803-en>. [30]
- OECD (2023), *Enhancing Rural Innovation in the United States*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/22a8261b-en>. [18]
- OECD (2023), “Income inequality (indicator)”, <https://doi.org/10.1787/459aa7f1-en> (accessed on 30 November 2023). [17]
- OECD (2023), *OECD Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption*, OECD Publishing, Paris, <https://doi.org/10.1787/0b55736e-en>. [22]
- OECD (2023), “Regional innovation”, *OECD Regional Statistics (database)*, <https://doi.org/10.1787/1c89e05a-en> (accessed on 18 July 2023). [23]
- OECD (2023), *The Geography of Higher Education in Québec, Canada*, OECD Skills Studies, OECD Publishing, Paris, <https://doi.org/10.1787/becf3c60-en>. [27]
- OECD (2022), *Education at a Glance 2022: OECD Indicators*, OECD Publishing, Paris, <https://doi.org/10.1787/3197152b-en>. [19]
- OECD (2022), *Education Policy Outlook 2022: Transforming Pathways for Lifelong Learners*, OECD Publishing, Paris, <https://doi.org/10.1787/c77c7a97-en>. [20]

- OECD (2022), *Enhancing Innovation in Rural Regions of Switzerland*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/307886ff-en>. [33]
- OECD (2022), *International Migration Outlook 2022*, OECD Publishing, Paris, <https://doi.org/10.1787/30fe16d2-en>. [21]
- OECD (2022), “Measuring the capacity to engage with social innovation in rural areas”, OECD, Paris. [11]
- OECD (2022), *OECD Regions and Cities at a Glance 2022*, OECD Publishing, Paris, <https://doi.org/10.1787/14108660-en>. [38]
- OECD (2022), *OECD Territorial Grids*, OECD, Paris, <https://www.oecd.org/cfe/regionaldevelopment/territorial-grid.pdf>. [72]
- OECD (2022), *Unlocking Rural Innovation*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/9044a961-en>. [7]
- OECD (2021), *Bridging Digital Divides in G20 Countries*, OECD Publishing, Paris, <https://doi.org/10.1787/35c1d850-en>. [39]
- OECD (2021), *Government at a Glance 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/1c258f55-en>. [32]
- OECD (2020), *Delineating Functional Areas in All Territories*, OECD Territorial Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/07970966-en>. [6]
- OECD (2020), *Linking Indigenous Communities with Regional Development in Canada*, OECD Rural Policy Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/fa0f60c6-en>. [61]
- OECD (2020), *Rural Well-being: Geography of Opportunities*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/d25cef80-en>. [71]
- OECD (2018), *Council Recommendation on Ageing and Employment Policies*, OECD, Paris, <https://legalinstruments.oecd.org/public/doc/333/333.en.pdf>. [53]
- OECD (2018), *Productivity and Jobs in a Globalised World: (How) Can All Regions Benefit?*, OECD Regional Development Studies, OECD Publishing, Paris, <https://doi.org/10.1787/9789264293137-en>. [40]
- OECD (2016), *OECD Regional Outlook 2016: Productive Regions for Inclusive Societies*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264260245-en>. [10]
- OECD (2015), *In It Together: Why Less Inequality Benefits All*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264235120-en>. [16]
- OECD (n.d.), *Regional Statistics (database)*, <https://www.oecd.org/regional/regional-statistics/>. [51]
- OECD/Eurostat (2021), *Manuel d’Oslo 2018: Lignes directrices pour le recueil, la communication et l’utilisation des données sur l’innovation, 4ème édition*, Mesurer les activités scientifiques, technologiques et d’innovation, OECD Publishing, Paris, <https://doi.org/10.1787/c76f1c7b-fr>. [26]
- Østergaard, C., B. Timmermans and K. Kristinsson (2011), “Does a different view create something new? The effect of employee diversity on innovation”, *Research Policy*, Vol. 40/3, pp. 500-509, <https://doi.org/10.1016/j.respol.2010.11.004>. [59]

- Reimer, B. and R. Bollman (2010), “Understanding rural Canada: Implications for rural development policy and rural planning policy”, in David, J. (ed.), *Rural Planning and Development in Canada*. [50]
- Shearmur, R. (2012), “Are cities the font of innovation? A critical review of the literature on cities and innovation”, *Cities*, Vol. 29, pp. S9-S18, <https://doi.org/10.1016/j.cities.2012.06.008>. [9]
- Shu, P. and C. Steinwender (2019), “The impact of trade liberalization on firm productivity and innovation”, *Innovation Policy and the Economy*, Vol. 19, pp. 39-68, <https://doi.org/10.1086/699932>. [35]
- Statistics Canada (2023), “Opportunities of working remotely in rural labour markets: Small area estimation from the Canadian Survey on Business Conditions 2022”, <https://www.statcan.gc.ca/o1/en/node/2903> (accessed on 22 February 2023). [5]
- Statistics Canada (2022), *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023). [31]
- Statistics Canada (2022), *Census Metropolitan Area (CMA) and Census Agglomeration (CA)*, <https://www12.statcan.gc.ca/census-recensement/2021/ref/dict/az/Definition-eng.cfm?ID=geo009> (accessed on 19 January 2023). [2]
- Statistics Canada (2022), *Census of Population*, https://www12.statcan.gc.ca/census-recensement/alternative_alternatif.cfm?l=eng&dispext=zip&teng=lcma000b21a_e.zip&k=%20%20%2013083&loc=/www12.statcan.gc.ca/census-recensement/2021/geo/sip-pis/boundary-limit/les-fichiers/lcma000b21a_e.zip (accessed on 9 February 2024). [4]
- Statistics Canada (2022), *Illustrated Glossary - Core, Fringe and Rural Area*, <https://www150.statcan.gc.ca/n1/pub/92-195-x/2021001/geo/rur/rur-eng.htm> (accessed on 31 May 2023). [3]
- Statistics Canada (2022), “In the midst of high job vacancies and historically low unemployment, Canada faces record retirements from an aging workforce”, <https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.pdf> (accessed on 20 January 2023). [49]
- Statistics Canada (2022), *Population Growth in Canada’s Rural Areas, 2016 to 2021*, <https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-x/2021002/98-200-x2021002-eng.pdf> (accessed on 20 January 2023). [1]
- Statistics Canada (2011), *NHS Profile, 2011*, <https://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E>. [63]
- Statistics Canada (n.d.), *Census Families by Family Type and Family Composition Including Before and After-tax Median Income of the Family*, Table 11-10-0017-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110001701>. [69]
- Statistics Canada (n.d.), *Employment and Unemployment Rate, Monthly, Unadjusted for Seasonality*, Table 14-10-0374-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410037401>. [55]

- Statistics Canada (n.d.), *Employment by Class of Worker and Industry, Monthly, Unadjusted for Seasonality, Population Centres and Rural Areas, Inactive (x 1,000)*, Table 14-10-0107-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410010701>. [70]
- Statistics Canada (n.d.), *Gross Domestic Product (GDP) at Basic Prices, by Census Metropolitan Area (CMA) (x 1,000,000)*, Tables 36-10-0468-01 (GDP), <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610046801>. [24]
- Statistics Canada (n.d.), *Labour Force Characteristics by Province, Region and Indigenous Group*, Table 14-10-0364-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410036401>. [62]
- Statistics Canada (n.d.), *Population Estimates, July 1, by Census Metropolitan Area and Census Agglomeration, 2016 Boundaries 17-10-0135-01 (worker)*, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710013501>. [25]
- Toner, P. (2011), "Workforce Skills and Innovation: An Overview of Major Themes in the Literature", *OECD Science, Technology and Industry Working Papers*, No. 2011/1, OECD Publishing, Paris, <https://doi.org/10.1787/5kgkdqdkc8tl-en>. [48]
- United States Census Bureau (2021), *Introduction to NAICS*, <https://www.census.gov/naics/?58967?yearbck=2017> (accessed on 15 June 2021). [74]

Notes

¹ For more information on the methods used to delineate SLAs, see OECD (2020_[6]).

² This refers to innovations that occur by using low-technology solutions or solutions that may be less resource intensive but still suit the same purpose.

³ Rural economies in the far north (whether Indigenous or not) have unique attributes such as the impact of high costs of goods, shipping costs, etc.

⁴ It is often reported that essential activities and services, such as access to water, basic infrastructure and basic health and education services, are sometimes not sufficiently funded in rural areas.

⁵ Nevertheless, there are examples of universities located throughout the north of Canada (e.g. in Prince George, Thunder Bay and Sudbury) and Yukon (e.g. Whitehorse).

⁶ For example, when the Fogo Island Fish Co-operative needed better machinery for processing first crab, then sea cucumber, they turned to the Fisheries and Marine Institute of Memorial University of Newfoundland and a metal fabricator in Bay Bulls to provide the solution. Notably, the co-operative initiated an innovation process that would otherwise not have occurred.

⁷ While volunteer fire brigades are common in many rural communities, it is unusual to find a marketing co-operative created by local artists to jointly sell their products or a community store operated by a local social enterprise to ensure that basic foods are available in a small remote community.

⁸ Because of challenges in computing power, the summary statistics are pooled across years.

⁹ There are 17 million clusters in the analysis, representing individual entrepreneurs.

¹⁰ This includes both firms with employees.

¹¹ Clusters refer to statistical units that share the same identifying characteristics in regression analysis. In these cases, this refers to observations for 1 million unique establishments in several different points in time.

¹² It has been argued that, in Canada, the relatively low levels of inequality are primarily because of a system of taxes and benefits that increases income for those in lower income brackets (Chen, 2009_[80]).

¹³ Nevertheless, well-being is still challenged by harsh working conditions, related to both the sector and type of employment that rural workers engage in. This can include non-standard hours (for example, part-time) or atypical contracts. For example, in Canada, those in hospitality and personal services, a strong component of rural economies, were found to have a lower dimension of job quality, related to job security, career prospects, quantitative demands, atypical work schedules or employment benefits, among other indicators (Chen and Mehdi, 2019_[79]).

¹⁴ While the trend growth of GDP in metropolitan areas of Canada were persistent, rural regions exhibited more variability. In the aftermath of the 2008 global financial crisis and up until 2014, rural Canada's growth outpaced that of metropolitan regions. But from 2014 onward, it was more volatile and grew at a relatively depressed rate. This is likely due to the commodity exchange crisis observed in 2014/15 that impacted the heavily present oil and gas industry, as described in Annex Figure 2.D.2.

¹⁵ However, this is in part due to large value-added sectors such as the resource extraction sectors that are primarily located in rural areas.

¹⁶ Patent applicants refer to fractional counts of total applicants for each patent associated with the region in each applicant's address. This is out of 37 OECD countries with available data.

¹⁷ Furthermore, because patenting activities can vary from year to year, taking a five-year average avoids excluding regions with no patents in a particular year and can demonstrate more stable patterns of high-technology innovation activity.

¹⁸ Further descriptions of the regional classifications are in Annex 2.B. In some countries, data could not be regionalised. The analysis only includes patent data that can be allocated to a TL3 region.

¹⁹ There are no statistics for non-metropolitan rural remote regions in Japan.

²⁰ A large share of firm employment in rural areas of Canada are focused on producing goods. As compared to urban firms, rural firms have a disproportionately higher share of employment that produce tangible goods than those in urban areas. In 2019, a third (33%) of employment in firms in rural areas produced goods, as compared to only 19% of firms in urban areas (Source: OECD analysis based on Statistics Canada *Canadian Employer Employee Dynamics Database (CEEDD)*, https://www.statcan.gc.ca/en/statistical-programs/document/5228_D1_V1 (accessed on 15 July 2023)).

Annex Figure 2.A.6, Panel A).

²¹ The public sector category consists of health, education and general government services.

²² Given the importance of access to public services in rural areas, a relatively substantial share of public sector employment suggests better provision of government services; however, in many cases, the quality of public services and physical access to public services may still be limited due to challenges of distance and scale. Further discussion of the provision of government services for entrepreneurship and innovation, this issue will be covered in Chapter 3.

²³ This is the sum of all sectors that produce goods. Goods-producing sectors include manufacturing; construction, agriculture, forestry and fishing, mining and quarrying, oil and gas, and utilities. The service-producing sectors includes public services, wholesale and retail trade, transport and storage, other services, professional services, accommodation, finance, insurance and real estate, business support services, and information, culture and recreation.

²⁴ Manufacturing is particularly important for rural areas as it helps create employment spillovers in other non-tradeable sectors (Moretti, 2010^[81]) and contributes to innovation. For example, manufacturing accounted in 2015 for the largest share of all patent application by Canadian firms within and outside Canada (36.7% CIPO; 30.7% USPTO; 37.7% EPO). Unfortunately, this share has been declining from about 50% across all patent offices in 2001 (Abbes, Baldwin and Leung, 2022^[76]).

²⁵ As firms get older, entrepreneurs tend to also age, in particular when they are family-owned. In places with older firms, succession planning becomes increasingly important. In Canada, nearly two-thirds of all private sector firms are family-owned and generate half of Canada's GDP (Conference Board of Canada, 2019^[78]). Family firms are more prominent in the agricultural sector and tend to be small and medium-sized enterprises. In rural areas, with relatively higher shares of agricultural firms, the challenges of family firms are therefore more pronounced. Older firms that are family-owned face substantial challenges in succession planning and may have different challenges to adopting innovations, such as a more digitalised workflow or services.

²⁶ Due to lack of regional data over the period, only 22 countries are included in the averages. Tradeable sectors are defined by a selection of the ten industries defined in the System of National Accounts 2008. They include: agriculture (A), industry (BCDE), information and communication (J), financial and insurance activities (K) and other services (RSTU). Non-tradeable sectors include construction, distributive trade, repairs, transport, accommodation, food services activities (GHI), real estate activities (L), business services (MN) and public administration (OPQ).

²⁷ Yet, not all countries have the same experience. For the most part, countries that are in the development phase tend to innovate through trade, while those that are less developed may also face some challenges from external competition in the import markets. In addition, some studies show that innovation through international trade is more positively associated with firms that were already more productive than with those that were initially less productive (Shu and Steinwender, 2019^[35]).

²⁸ Unfortunately, this share includes the value of high value-added exports in the extractive sector and therefore may be overestimating exports by the average firm in rural areas.

²⁹ The statistics reported here are updated from the OECD report (2022_[38]) using the most updated Global Human Settlement Layer release (R2023A). The update now includes the 2020 estimates. The definition of the degree of urbanisation can be found in Eurostat (2024_[77]).

³⁰ On-reserve refers to individuals who live in one of eight census sub-division types legally affiliated with First Nations or Indian bands. Further information on this classification can be found at <https://www23.statcan.gc.ca/imdb/p3Var.pl?Function=DEC&Id=205332>.

³¹ The analysis was drawn from statistics reported in December of each year. While consistency in monthly data is needed, it is evident that seasonality is also a factor to consider in understanding the gender dynamics in employment statistics. In particular, if women are overrepresented in manual labour in the agricultural sector as compared to men, then these statistics would be a lower bound estimate for average employment rates as December is low season for many high-value crops.

³² Female refers to women and male refers to men. Female-to-male is used as a conventional term when referring to ratios between women and men.

³³ Immigration in Canada is characterised in four distinct categories of legal immigrants. This includes government-assisted refugees, privately sponsored refugees, economic migrants and family reunification migrants.

³⁴ In Gure and Hou (2022_[13]), the reported determinants of relocation for migrants were the existence of ethnic enclaves (cluster of similar immigrant country origin) and the longevity of refugee support offices in intended destinations.

³⁵ The regression estimates used are simple probability models. Where the probability for an entrepreneur to start-up a new firm is the following:

$$E[Y_{it} | X_{Location}] = a_0 + a_1X_{1it} + a_2X_{2it} + a_3X_{3it} + a_4X_{4it} + E_{it} \quad (1)$$

where Y_{it} denotes whether a person i starts a new firm in year t ; *Location* refers to urban or rural; X_1 , X_2 , X_3 and X_4 denote characteristics of demography, place, ownership structure and firm respectively. Other controls include year fixed effects, industry fixed effects and their interactions. Robust standard errors are clustered at the person level.

Second, the estimates referring to the probability of applying for tax incentive programme associated with research and development expenditure is proxied for participation in formal innovation processes. It is elaborated in the following way:

$$E[Y_{jt} | Z_{Location}] = \beta_0 + \beta_1Z_{1jt} + \beta_2Z_{2jt} + \beta_3Z_{3jt} + \beta_4Z_{4jt} + E_{jt} \quad (2)$$

where Y_{jt} denotes whether an established firm j files SR&ED in year t ; *Location* refers to urban or rural; Z_1 , Z_2 , Z_3 and Z_4 denote characteristics of ownership structure, firm, workplace and place respectively. Other controls include year fixed effects, industry fixed effects and their interactions. Robust standard errors are clustered at the firm level.

³⁶ Estimates in both rural and urban areas find that the probability of starting a firm increases with age; however, it increases at a diminishing rate. Additional specifications that individually capture the age

cohorts of 16-24, 25-44, 45-54 and 55-64 year-olds demonstrated a similar trend. The probability of starting a firm increases but with a diminishing tendency for older age cohorts.

³⁷ Standard errors of the estimates of the start-up likelihood for women entrepreneurs in urban and rural lie outside of each other, suggesting that there is little chance that the difference between entrepreneurship rates for women in urban and rural areas are different from each other due to spurious effects.

3

Policies and programmes for innovation and entrepreneurship in Canada

This chapter explores the evolution of major federal, provincial and territorial policies supporting innovation and entrepreneurship in rural areas of Canada.

Key messages

Like some other federal countries, Canada has national and provincial/territorial level policies to support innovation and entrepreneurship. Canadian provinces and territories play a particularly important role in most aspects of economic, environmental and social development policy, including policies that affect innovation. As such, entrepreneurs in Canada navigate this multi-level governance landscape when they search for support for innovation and business development that includes federal government line agency programmes, federal regional development agency (RDA) support, provincial and territorial programmes and, in some instances, local government support. There are also many diverse Indigenous governments, Indigenous Development Corporations, Tribal Associations and Indigenous organisations with policies and services for innovation and entrepreneurship. Municipal/provincial/territorial and federal governments, in many cases, devolve responsibility for the deployment of funding programmes to non-profit community entities, further complicating the Canadian funding context. For rural entrepreneurs, core national and provincial/territorial support mechanisms may overlook the types of innovation that are more common to rural areas, such as those that focus on user-based or solution-based challenges and those that may be suitable for accessible rural versus remote rural areas, because of the heavy focus on science, technology and innovation (STI). On the other hand, federal regional innovation programmes tend to be more adapted to the needs of both rural and urban entrepreneurs.

In Canada, there are ample examples of innovative entrepreneurship in rural and remote regions. For example, the case studies conducted for this report reveal multiple innovative examples of Indigenous entrepreneurs and communities playing leading economic development roles in their rural areas. And yet, challenges related to accessing finance persist for underserved populations, including Indigenous communities. Federal and provincial/territorial innovation strategies could offer better support. In many rural areas, legacy institutions from the Community Futures Program (CFP), as well as local civil society organisations, serve critical roles by providing technical support and acting as brokers with local financial intermediaries to overcome such challenges. They help to link rural entrepreneurs to the full array of resources supporting innovation.

Canada has strong performance in basic research and development largely due to strong federal and provincial/territorial financial support for post-secondary-based research. While post-secondary-firm linkages are a catalyst to support the upgrading and upskilling of rural individuals and firms that contribute to “user-driven” innovation, they are not as strong in: i) facilitating “demand-driven” innovations;¹ ii) taking innovative ideas to commercialisation; or iii) providing tailored upskilling and reskilling opportunities for rural areas. Nevertheless, there is an opportunity to learn from at least one province, Quebec, that has a more defined and integrated approach to promoting university-firm linkages through research institutions that serve priorities in rural areas, Indigenous communities and climate change while encouraging research and innovation.

Canada has the largest rural and remote land mass of all OECD countries. The 9.2 million square kilometres (km²) of rural and remote land mass in Canada outsizes that of other large OECD countries such as the United States (8.9 million km²), Brazil (8.3 million km²) and Australia (7.6 million km²), according to satellite mapping and settlement patterns (CIESIN, 2013^[1]).

Based on population grid estimates, one in five people live in rural and remote areas of Canada. According to the OECD (2020^[2]), close to 60% of Indigenous peoples live in predominantly rural regions (60%), whereas 27% of non-Indigenous populations live in predominantly rural regions. Rural and remote areas comprise 98% of the total landmass and approximately 18% of the population. Rural and remote communities produce approximately 30% of Canada's gross domestic product (GDP), with 220 000 rural businesses representing nearly 17% of Canada's employers in 2021 (Government of Canada, 2022^[3]). Additionally, many census metropolitan areas (CMAs) have strong rural characteristics such as agricultural lands, making rural areas within urban metropolitan areas substantial. According to the 2021 census, 87% of the land within urban areas (CMAs/CAs) are rural, with only 13% capturing population centres. The average land mass of rural areas within urban CMAs is 76.8%. Similarly, in the United States, about 90% of the land mass within metropolitan areas was considered rural (non-urban) (Cox, 2022^[4]).

As identified in Chapter 2, the way we measure innovation matters for the geography of innovation. In particular, rural and remote areas have different forms of innovative creation that address local opportunities and challenges.

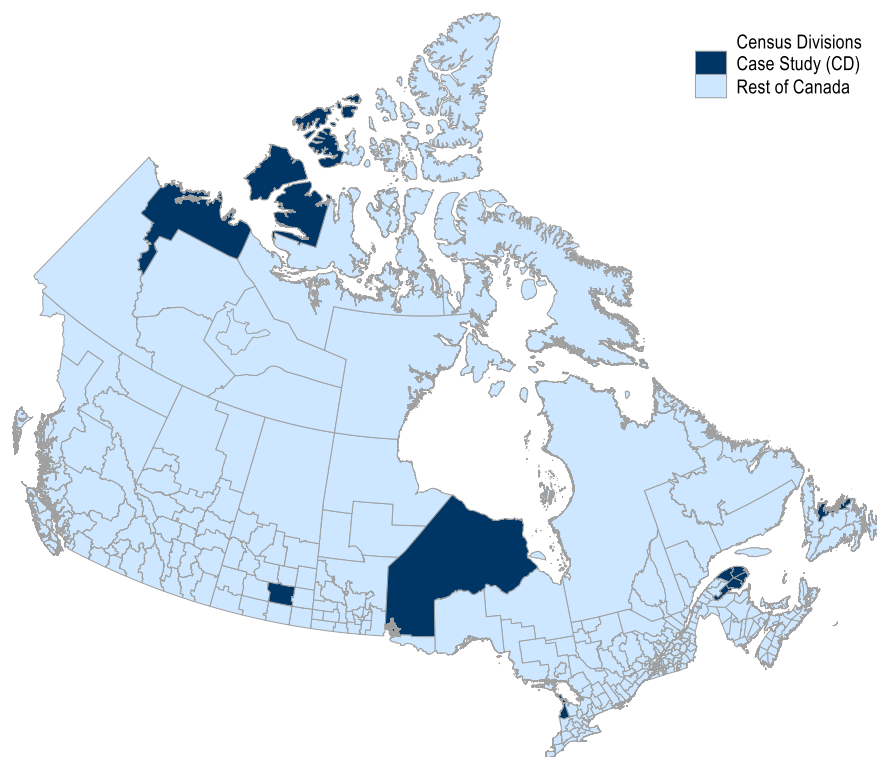
Building on desk research, insights from an OECD government survey on drivers of innovation in rural areas, six case study missions and consultation with various local, federal and national public and private sector experts, this chapter provides an overview of the findings related to current policies and programmes focused on supporting rural innovation and rural entrepreneurs at the federal, provincial and territorial levels. While it focuses more heavily on federal programmes and lessons learned from the different types of rural areas in the study, it also provides guidance to provincial and territorial policy makers. The case study areas were Fogo Island (Newfoundland and Labrador), the Gaspé Peninsula (Quebec), Inuvik (Northwest Territories), Kenora (Ontario), Kincardine (Ontario) and Regina (Saskatchewan). Further details on each of the case studies are available in Annex 3.A, highlighting the diversity of the challenges facing a selection of rural areas. These case study areas are mapped within their relevant census subdivision in Figure 3.1.

This chapter on policies and programmes for rural innovation in Canada is constructed in three parts. It builds on the context containing a description of the various forms that innovation can take in rural areas, including in the North,² which presents a substantially different challenge to public service access, which cannot be adequately captured by the standard definition in Chapter 2. It is also important to note that the Government of Canada has adopted an Inuit Nunangat definition that recognises all Inuit regions regardless of provincial/territorial boundaries. In the first section, there is a description of federal innovation policy and the role of RDAs in supporting innovation and entrepreneurship. This is followed by a review of provincial and territorial innovation policy in the four provinces and one territory visited for the case studies. The second section of the chapter identifies ways that innovation policy in Canada can be adapted to rural areas, highlighting that the current focus on cluster-based development, driven by a science-based regional innovation system (RIS) approach fails to adequately support rural innovation. The final part of the chapter provides overarching conclusions from the chapter and findings from the case studies. The annex to this chapter includes a description of the six case studies and the innovations seen in each.

Rural innovation is occurring in Canada in a variety of contexts. However, few are suited to the RIS approach. Rural areas within a metropolitan region often offer examples of applicable traditional RIS approaches to innovation, despite some instances of urban research and development (R&D) supporting rural innovations in several of the case studies. The set of rural innovations taking place outside the RIS model confirms the need for a parallel approach to fostering innovation that complements the current urban-focused RIS approach. As in Chapter 2, the following chapter looks at some of the framework

conditions needed for innovation through the lens of scale and accessibility, as elaborated in Figure 3.1 below. It broadly covers challenges in delivering government services related to innovation and entrepreneurship and some of the services often associated with innovation, such as university-firm linkages, finance and access to digital and physical infrastructure. While the chapter identifies these areas as key challenges, they are only some of the conditions that are relevant for rural innovation. Beyond these conditions, conditions for rural access to housing, healthcare, education and social services are standard building blocks of building prosperous communities for harbouring an innovation ecosystem.

Figure 3.1. Map of case study areas, by census division



Source: Author's own elaboration.

Evolution of federal, provincial and territorial policies and programmes to promote innovation in Canada

In the last 50 years, rural Canadians have created and commercialised a number of disruptive innovations. Chronologically, these include the axial flow combine harvester developed by Massey Ferguson, advanced telephone switching systems produced by Nortel, Corel's WordPerfect, Bombardier's Canadair regional jets and the BlackBerry smartphone that initially dominated the global smartphone market. Strikingly, the companies that produced these products either no longer exist or are now minor players in their industry.

Canada's innovation record suggests that while the country is strong in basic research and generating new ideas, it remains relatively weak in the successful commercialisation of these innovations (Nicholson, 2016^[5]; Schwanen, 2017^[6]; Edler, 2019^[7]; Phillips and Castle, 2022^[8]). Since the 1970s, both the federal and provincial/territorial governments have made major public funding commitments to research and development, both in post-secondary institutions and, to a lesser extent, private firms. Nevertheless, there is a strong sense that public funding in the absence of a comprehensive innovation strategy and culture of innovation is not enough (Nicholson, 2018^[9]). In particular, a greater focus is needed on strengthening

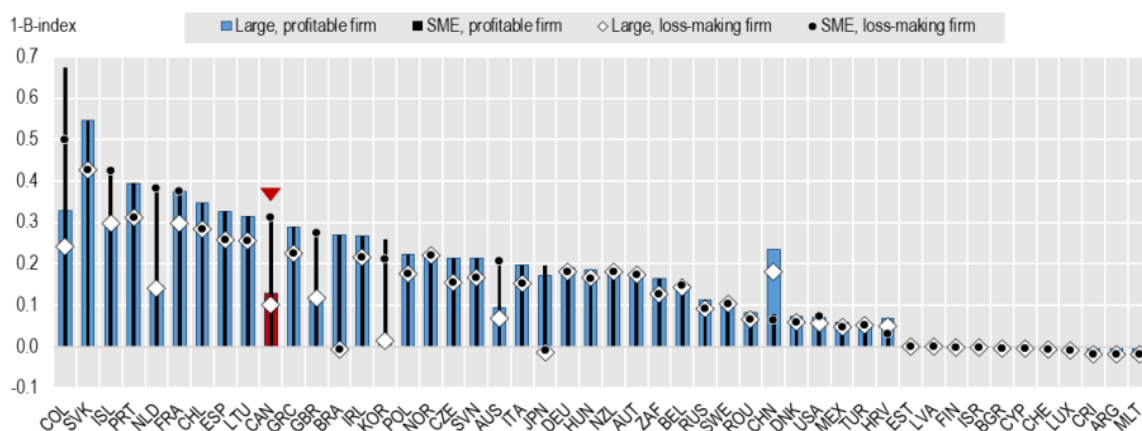
regional innovation policy in a country as diverse as Canada, particularly given the primacy of provincial and territorial governments in innovation and entrepreneurship support.

Innovation policy in Canada

The Government of Canada has had a relatively long commitment to science and innovation policy. The federal government provides generous tax credit support programmes, in particular for small and medium-sized enterprises (SMEs). Canada has a federal Scientific Research and Experimental Development (SR&ED) tax credit that is used across Canada to support innovation investment. In comparison, while information on the rural or urban distribution of tax credits is not modelled comparatively across OECD countries, Canada's federal tax credit programme largely benefits SMEs, which represent a larger share in rural areas than large corporations (Figure 3.2), suggesting that the subsidy and tax incentives on R&D are not directly disfavoured rural firms due to size characteristics. Canada is relatively generous in its tax subsidy programme, providing a marginal tax subsidy rate for SMEs in Canada of 0.31 for both profit-making and loss-making firms, which is well above the OECD median of 0.20 for profit-making and 0.18 for loss-making firms. Furthermore, the rate is relatively stronger for SMEs than larger corporations, whose implied tax subsidy rate is 0.13 (0.10) in the profit(loss)-making scenario, below the OECD median of 0.17 (0.15).

Figure 3.2. Implied tax subsidy rates on R&D expenditures: Canada, 2021

1-B-Index, by firm size and profit scenario



Note: Implied marginal tax subsidy rates, presented for different firm size and profitability scenarios, are calculated based on headline tax credit/allowance rates, providing an upper bound value of the generosity of R&D tax support, not reflecting the effect of thresholds and ceilings that may limit the amount of qualifying R&D expenditure or value of tax relief. For the purpose of modelling Canada's R&D tax subsidy rates, SMEs are defined as eligible Canadian-controlled private corporations that benefit from a refundable R&D tax credit at an enhanced rate.

Source: OECD (n.d._[10]), *R&D Tax Incentives and Innovation (database)*, <http://oe.cd/rdtax> (accessed 15 December 2021); OECD (2021_[11]), *R&D Tax Incentives: Canada, 2021*, Directorate for Science, Technology and Innovation, OECD, Paris.

Beyond the federal R&D tax subsidy programme, most innovation policies are driven through post-secondary or public research centres and cluster development initiatives under the mandate of provincial and territorial governments. There are hundreds of different federal support programmes to support entrepreneurs and innovation. In recent work by Statistics Canada, in partnership with the Treasury Board Secretariat, 123 federal programmes via the Business Innovation and Growth Support (BIGS) initiative were recorded in a database of support programmes (Statistics Canada, 2023_[12]). In 2020, SMEs accounted for 95.8% of the initiative's recipients of federal support programmes. In particular, SMEs with

fewer than 100 employees accounted for 87.9% of total recipients and 61.4% of the total amount given. Over two-thirds of BIGS recipients were in the services sector, while the largest share in the goods-producing sector were in manufacturing, followed by agriculture.

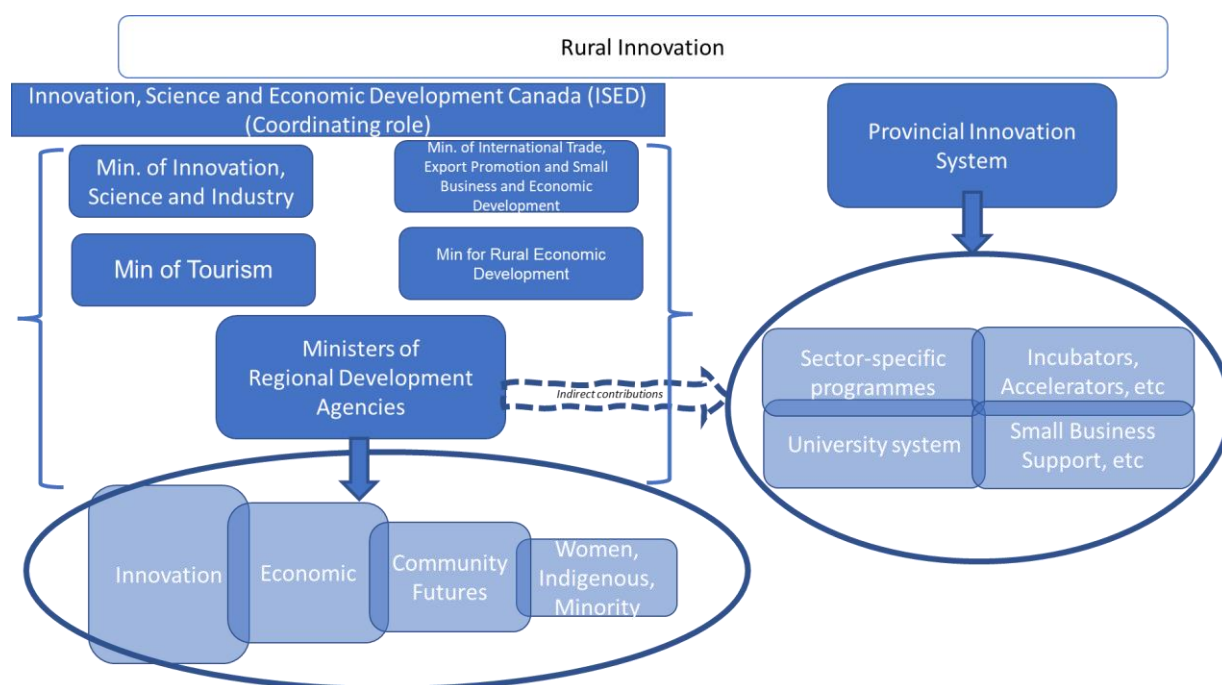
Canada's natural resources and energy sector is undergoing a period of transformation towards clean and renewable practices at the federal, provincial, territorial and municipal levels. This includes innovation initiatives such as the Mining Innovation Commercialization Accelerator, with an investment of CAD 40 million through the Government of Canada's Strategic Innovation Fund (MICA, 2021^[13]) and Canada's Oil Sands Innovation Alliance (COSIA, 2012^[14]). These initiatives bring together stakeholders from industry, government and academia to deliver innovative and more sustainable practices in the natural resources and energy sector.

Innovation, Science and Economic Development Canada (ISED) is the federal department in charge of co-ordinating programmes and policies focused on helping Canadian businesses grow and expand. It serves several ministers, including the Minister of Innovation, Science and Industry, the Minister of Export Promotion, International Trade and Economic Development, the Minister of Rural Economic Development and the Minister responsible for the Atlantic Canada Opportunities Agency, the Minister of Tourism and Minister of the Economic Development Agency of Canada for the Regions of Quebec and the Minister of Small Business.

ISED leads the federal government's innovation agenda and collaborates across 18 federal departments and agencies, including the 7 federal RDAs, namely the Atlantic Canada Opportunities Agency (ACOA), Canada Economic Development for Quebec Regions (CED), the Canadian Northern Economic Development Agency (CanNor), the Federal Economic Development Agency for Northern Ontario (FedNor), the Federal Economic Development Agency for Southern Ontario (FedDev Ontario), Pacific Economic Development Canada (PacifiCan) and Prairies Economic Development Canada (PrairiesCan). It also bears noting that the federal RDAs share interlocking responsibilities for rural regions with the Ministry for Rural Economic Development (a cabinet portfolio established in 2019). The ministry includes a Centre for Rural Economic Development, which is tasked with co-ordinating a whole-of-government approach to help improve federal policy and programme relevance and access and provide rural communities with advice and guidance to help them access federal support to meet their needs.³

As the department in-charge of co-ordination for programmes on innovation, ISED also co-ordinates the Rural Economic Development Strategy, which is a bottom-up strategy supported by the newly built Centre for Rural Economic Development (Government of Canada, 2023^[15]). The strategy is built around improving rural communities, supporting rural Canadians and building partnerships. It aims to improve rural places and communities by expanding broadband and mobile connectivity, renewing infrastructure and building climate resilience, strengthening local economies and supporting businesses impacted by the pandemic. It focuses on supporting people in rural Canada by helping newcomers in rural communities, building affordable housing and investing in public transit, helping women re-enter the workforce and investing in early learning and childcare. It builds partnerships by integrating rural perspectives into federal policies and decisions, working horizontally to improve access to federal programmes and services, and ensuring that federal investments benefit communities (Government of Canada, 2021^[16]). To address some of the objectives of strategy, additional funding was provided for programmes like Connect to Innovate, the Universal Broadband Fund and the low Earth orbit satellite capacity, which complement other broader initiatives. Other examples of initiatives undertaken by the strategy include increased support to various tourism initiatives, leveraging opportunities for rural social enterprise, Smart City challenges (in rural areas), renewable energy sector programmes, modernising the Youth Employment and Skills Strategy, extending the Canadian Training Benefit programme and Student Work Placement Program, while planning to actively work on bringing the rural voice to the Apprenticeship Strategy. Among other initiatives, the strategy also supports housing initiatives through the Housing Supply Challenge and is piloting several immigration schemes for rural Canada, including the Atlantic Immigration Pilot and the Rural and Northern Immigration Pilot.

Figure 3.3. Institutions working on building innovation capacity in rural areas



Note: ISED serves a co-ordinating role and is not an umbrella organisation for other ministries. Every RDA has its own ministry.

The mandate to co-ordinate programmes and policies for innovation in Canada under one roof facilitates challenges in conflicting institutional mandates. In addition, in some cases, there is an active partnership with local governments, as observed in the accessible rural area of Bruce County (Ontario) and in the remote rural area of Fogo Island (Newfoundland and Labrador). Active participation of local governments in such organisations can increase how responsive such initiatives are to local needs. For example, the joint responsibilities of tourism, small business development and trade under the same department as innovation is also observed in Norway, where, in addition, local governments have ownership – meaning direct funding and programme management implications – of part of the national innovation agency as described in Box 3.1.

Box 3.1. Innovation Norway: An integrated innovation agency

Innovation Norway is the Norwegian government's national instrument for innovation and development of Norwegian enterprises and industry. They support companies in developing their competitive advantage and enhancing innovation.

Innovation Norway has ownership of over 51% of the Ministry of Trade, Industry and Fisheries and 49% of county municipalities, meaning that it finances the majority of activities in both ministries. It also manages funds from the Ministry of Local Government and Modernisation, the Ministry of Agriculture and Food, the Ministry of Foreign Affairs and the county governors.

Innovation Norway covers four main service areas to facilitate innovation in all of Norway, where there are large areas of sparsely populated rural areas that aim to support an ecosystem of entrepreneurs for innovation that seek to develop new services, new markets or new products:

- **Start-ups:** Advisory and financial services, courses and competency training.

- **Export and international markets:** Advice on export and international markets, financing for international ventures, courses and competency training.
- **Innovation and development:** Advice in and funding for innovation and development, courses and competency, clusters and networks, and services for the shipping and fish industry.
- **Tourism and agriculture:** Services linked to the agriculture and tourism sectors

Norwegian enterprises have access to a broad business support system as well as financial means. Innovation Norway provides competency, advisory, promotional and networking services. The marketing of Norway as a tourist destination is also considered one of the organisation's important tasks.

This institutional arrangement combines municipalities and international networks' knowledge of local industry with business ideas and entrepreneurship while being the Norwegian government's official trade representative abroad.

Source: Based on Innovation Norway (n.d.^[17]), *Our Services*, <https://en.innovasjon Norge.no/article/our-services>.

Early in its existence, the former Science Council of Canada,⁴ an advisory board of up to 40 scientists and civil servants active from 1966 to 1993, published 2 reports that remain relevant today. *Innovation in a Cold Climate* (1971^[18]) and *Technology Transfer Government Laboratories to Manufacturing Industry* (1975^[19]). These two publications found that the decline of advanced manufacturing products by Canadian firms in the 1960s was associated with limited investment in applied research despite measures of technological progress and a high share of skilled engineers. Second, they found that there was an opportunity to use government resources (physical laboratories) to support innovation in manufacturing, using the resources of government laboratories and harnessing the commercialisation mandate of rural firms. However, most firms that could use new technologies lacked the capacity to connect with a potential source to complete the transfer process. In part, it was argued that this is because they often lacked the corresponding resources to turn a concept into reality or move it towards commercialisation.

Much of what the council recommended to address these needs is still relevant. Core recommendations include:

- A greater focus by research organisations on technology transfer.
- Fostering greater interaction between basic research and industry scientists.
- Creating a pathway for firms to explain their needs to researchers.
- More contracting out of government research to private firms to increase capacity and contacts.
- Greater use of procurement processes to encourage the domestic production of new technologies (Science Council of Canada, 1975, pp. 46-48^[19]).

Since the Science Council of Canada was abolished, Canada's science and innovation policy has been articulated through a number of specific policy initiatives put forward by various governments over the last decades, most recently with Canada's Innovation and Skills Plan as part of the 2017 budget. The plan provided both new support for skills development to meet employment needs of the future and a set of supports meant to increase the rate of innovation. Most funding is made available through existing entities, including the Business Development Bank of Canada, Export Development Canada and other funding agencies.

Federal innovation policy in Canada remains aligned with the mainstream understanding of how policy can induce innovation by stimulating R&D efforts by universities, government research facilities and firms through direct funding and tax incentives, providing tax and funding incentives for firm investment in new technologies, and by encouraging the growth of clusters that facilitate greater collaboration among firms in related industries. Inevitably, most of the resources provided by the Government of Canada end up in large metropolitan areas because they provide the urbanisation economies that are most attractive to this STI model (Isaksen and Karlsen, 2016^[20]). On the other hand, in peripheral areas, Isaksen and Karlsen (2016^[20]) argue a different user-driven approach, or similarly a doing-using-interacting (DUI) approach (where innovation is driven by “demand-pull” forces that induce efforts to find specific solutions to current problems), drives innovation (see Chapter 2) (Isaksen and Karlsen, 2016^[20]). Because the DUI process tends to result in incremental innovations that largely benefit small firms and in innovations that do not involve formal R&D and are seldom patented, it is not surprising that rural areas are often seen as having low levels of innovation (Freshwater, 2012^[21]; French, 2022^[22]; OECD, 2014^[23]; 2022^[24]).

In sum, innovation in science and technology is observed to a larger extent in large cities that do not face similar challenges in access to services and markets, whereas innovation in a DUI approach is relevant to a relatively larger extent in peripheral areas. As noted in the introduction to this section of the chapter, in Canada, there is an ongoing concern that strong national performance in the research part of the STI model is not associated with high rates of adoption of resulting innovations by firms. As such, the STI innovation model is disconnected from the realities of rural firms. Instead, more support for overcoming common challenges related to a lack of connectivity that engenders barriers in access to markets and services, as well as bolstering appropriate framework conditions, such as additional support for access to funding, should be prioritised for innovation in rural areas (Marshalian, Chan and Bournisien de Valmont, 2023^[25]).

Federal regional development agencies

The federal RDAs provide services to communities and entrepreneurs on a broad range of issues ranging from innovation and business support services to community programmes and Indigenous or women-specific funding programmes. Today, the federal government provides services to support innovation and entrepreneurship through seven RDAs covering all provinces, as depicted in Figure 3.4. PrairiesCan has three provinces; ACOA has four and CanNor covers three territories; there are two province-specific agencies, CED and PacificCan; and one province, Ontario, has two agencies, FedNor and FedDev. Other than Ontario, a single agency deals with each province, while smaller provinces/territories with similar conditions are grouped within a single agency. It is important for the Government of Canada to co-operate with both provincial and territorial governments to support regional development, including in rural areas.

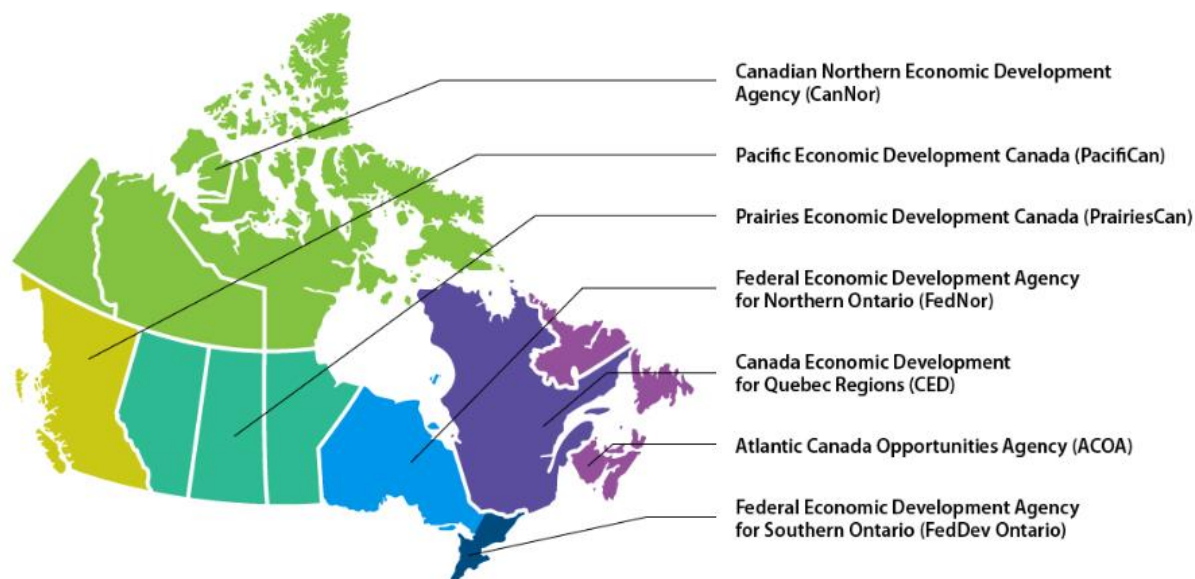
Notably, in the territories of Canada’s North, the Government of Canada plays a larger role. This is because territorial governments’ powers are delegated to them by the parliament of Canada, unlike provinces which have inherent sovereignty in their constitutional domain (see Figure 3.4 for CanNor administrative boundaries). This is reflected in a larger per capita budget for the RDA covering the territories (Figure 3.5).

Inuit Nunangat is a concept distinct from the territories. This term refers to the areas in which Inuit people have historically resided. It is comprised of four regions – the territory of Nunavut, the Inuvialuit Settlement Region of the Northwest Territories, the Nunavik region of Quebec and the Nunatsiavut region of Newfoundland and Labrador. Inuit in Nunatsiavut have established their own regional government, while the other three regions have “public governments” in which participation is open to all residents. These other three Inuit regions could potentially pursue self-government agreements in the future if they desired to do so. Each comprehensive land claim agreement or modern treaty includes specific arrangements for funding and delivery of social services, land management and other governance functions. Among Canadian RDAs, CanNor is unique in that it is required to meet federal obligations established under Article 23 of the Nunavut Land Claims Agreement. This article specifies a level of Inuit representation to

be reached in government employment within Nunavut. CanNor also serves as the central co-ordinating office in the implementation of the Pilimmaksaivik initiative, which is the Federal Centre of Excellence for Inuit Employment in Nunavut.⁵

Figure 3.4. Map of RDAs

Administrative borders of RDAs, 2023

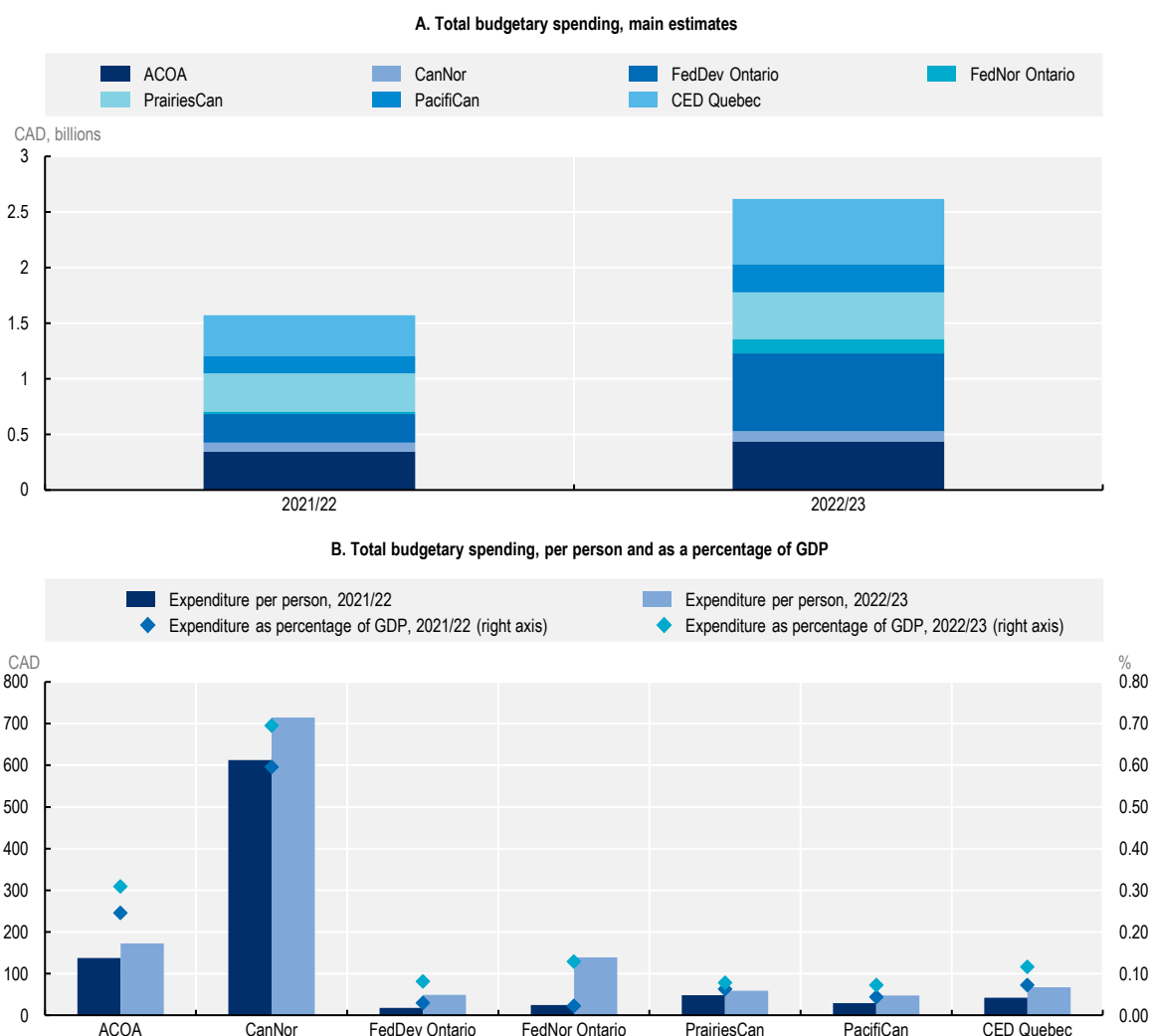


Source: Provided by FedDev.

Financially, the seven RDAs are gaining in budgetary size. With the split of PrairiesCan and PacificCan, the 2021/22 total budgetary estimates jumped by 70% to CAD 1.6 billion (current prices) from the previous year (Figure 3.5, Panel A). The total budgetary estimate was CAD 2.6 billion (current prices) the following year, a 67% growth from the previous year. Total expenditures were estimated to be at CAD 40.4 per person; in the next year, they rose to CAD 67.3 per person. In part, the cost increase in the two periods also reflects emergency COVID-19 support aid delivered through the agencies. Both ACOA and CanNor have larger expenditures per person than other agencies, reflecting those regions' higher costs of doing business and difficulties in access to services (Figure 3.5, Panel B).⁶ Despite the fact that some agencies have substantially higher levels of expenditure than others, in all cases, the expenditure relative to GDP is lower than 1% for all RDAs, with the highest level in the 2022/23 period, being 0.7% of GDP in CanNor and the lowest level at 0.07% of GDP in PacifiCan.

RDAs in Canada have broad mandates and are able to function in both an urban and rural context by providing differentiated support. In rural areas, the focus is on supporting entrepreneurship and business expansion and on building local capacity in civil society. Since 2018, the agencies have delivered Regional Economic Growth through Innovation – a nationally co-ordinated, regionally tailored programme to support the growth of Canadian businesses, their expansion into new markets and their adoption of new technologies and processes, which will help fuel the economy.

Figure 3.5. Spending by RDAs has increased over time



Note: All estimates refer to total budgetary spending reported. In 2021/22, estimates to date were used instead of main estimates for FedNor and PacifiCan. FedNor, PrairiesCan and PacifiCan did not exist in 2020/21.

Source: Government of Canada (n.d.^[26]), *Canada's Regional Development Agencies*, <https://ised-isde.canada.ca/site/ised/en/canadas-regional-development-agencies>; Government of Canada (n.d.^[27]), *Government Expenditure Plan and Main Estimates - 2022–23 Estimates*, <https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates/2022-23-estimates/main-estimates.html>.

In rural areas, the legacy organisations of the Community Futures Program (CFP) play an important role in supporting rural innovators. The CFP was an innovative rural economic development programme created by Employment and Immigration Canada in the 1980s (Box 3.2). The organisations now operate under a variety of names across the country, typically business development centres (BDCs) or Community Futures Organizations (CFOs). Currently, 267 CFO groups are located in rural areas (CFNC, 2024^[28]). Today, the main function of BDCs or CFOs is to support small businesses, including new entrepreneurs. Each BDC has a legacy revolving loan fund that it can use to leverage other lenders' funds by taking a less-secured position in a loan package. Equally important, BDC/CFOs provide business advice to firms, including help with business planning. They typically act as intermediaries for the local financial community to meet, assess lending opportunities and develop financing packages. In many rural areas, the BDC/CFO is a “keystone” organisation that plays a much larger role than the size of its loan portfolio.

CFOs take a bottom-up approach to local development. The idea of bottom-up approaches encouraging association between rural places in view of accessing government funding is not new. It is often used to facilitate associations between functional areas that may be outside of administrative boundaries. For example:

- In Switzerland, RDAs are formed through a free association of a group of municipalities, sometimes dividing parts of cantons (comparable to provinces). These entities form together one of the six current regional innovation system entities within the federal RIS programme (OECD, 2022^[29]). In Switzerland, the RIS serves areas outside of the large metropolitan agglomerations and provides some partnership incentives with firms in urban places. Some areas may not be included in the federal RIS programme because of a lack of active application to form an RIS.
- The United States Economic Development Administration is experimenting with bottom-up associations for applying to regional development funding in the USD 1 Billion Build Back Better Regional Challenge as described in Box 3.7 (EDA, n.d.^[30]).

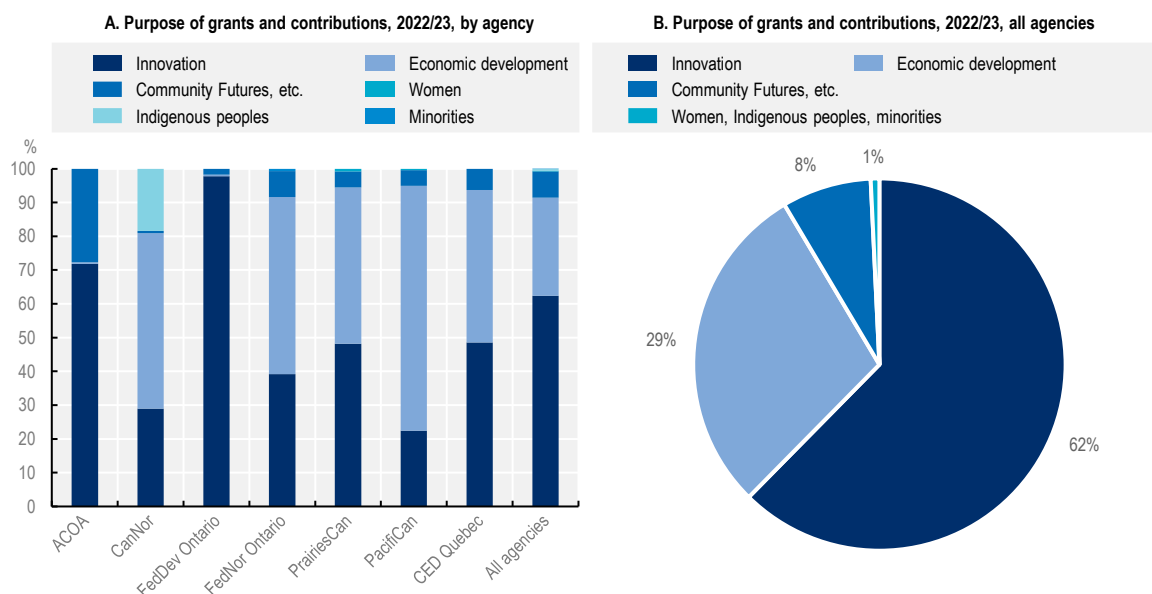
RDAs allocate the majority of their programme funding to support initiatives for innovation, 62% (Figure 3.6). However, there are differences between RDAs: the quasi-totality of FedDev funding is allocated specifically to innovation, while less than a quarter of funding is allocated to innovation in PacifiCan. Notably, much of the innovation funding (62%) and economic development funding (29%) overlap and many programmes may resemble each other within the groups despite having different labels.

Given the important role of the CFP in Canada, the funding allocation is relatively low (Figure 3.6) and particularly so when one considers the size of rural areas (98% of the land), the share of the rural population (18% of the total population) and the fact that delivering to areas with low density and further distances to urban areas is increasingly expensive. CFP initiatives with a larger rural mandate for supporting innovation and economic development account for only 8% of total expenditures from RDAs. Most agencies spend less than 8% of total funding on community economic development, with the exception of ACOA, which spends 28%⁷ of total expenditures on community economic development. Excluding ACOA, the average spending on the CFP is only 4% of total expenditure. While spending on Community Futures is lowest in CanNor (1% of total programme expenditures), the agency officially reports Indigenous-specific funding⁸ (18%) that delivers similar programmes as a CFP⁹ through an Indigenous development angle. Keeping in mind that the share of rural individuals in Canada is close to one-fifth of the population and that costs for providing assistance to rural areas are high, the allocated resources to rural-specific development programmes are relatively low. These funding allocations are particularly important for Indigenous peoples who comprise the largest proportion of the population in Nunavut (86%), the Northwest Territories (51%) and Yukon (23%), followed by Manitoba (18%) and Saskatchewan (16%) (Government of Canada, 2020^[31]).

Furthermore, despite the important role of the CFP in supporting entrepreneurs in rural and remote areas, it is unclear if measures are put into place to support public sector innovation that can help deliver services in a more innovative way. This is particularly relevant when considering that the public sector is the largest sector of activity in rural areas (see Chapter 3). Public sector innovation can be reinforced through programmes that enable engagement with community stakeholders and support social and public sector innovation (Box 3.2). An example of such a programme is found in rural Japan, which is likewise characterised by strong subnational governments (prefectures) and faces the challenge of low population density and ageing demographics.

Figure 3.6. The largest share of expenditure is in innovation-related programmes

Share of programme expenditure on grants and contributions, by purpose and agency



Note: Graphs contain grants and contribution funding, which are the major components of the total budgetary spending. They exclude operating expenses. Innovation funds include all funding that has innovation as an explicit purpose or mechanisms, or funds for entrepreneurship and business development, notably in ACOA. In most places, the Community category refers to Community Futures grants and contributions. The only exceptions are in ACOA, which also includes contributions for the Innovative Communities Fund, and CanNor, which also includes investments made under the Northern Isolated Community Initiatives Fund. The equivalent of CanNor's Indigenous programming is delivered by Indigenous Services Canada in the provinces.

Source: Government of Canada (n.d.^[27]), *Government Expenditure Plan and Main Estimates – 2022-23 Estimates*, <https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates/2022-23-estimates/main-estimates.html>.

Box 3.2. Initiatives for innovation at the community level

The use of bottom-up initiatives to provide opportunities and encourage innovation is observed in several countries. In the case of Canada and Japan, specific programmes that enable bottom-up solutions are a hallmark of rural development.

Community Futures, Canada

The Canadian national government created the Community Futures Program (CFP) in 1985 as a new initiative to address chronic levels of unemployment and underemployment in rural parts of the country. Because the CFP focused on strengthening economic development, it used local labour markets to identify a “community” and this meant that smaller places had to apply jointly, while larger places could apply individually. The programme required applicants to demonstrate that all parts of the community (local governments, business organisations and civil society) were involved in developing an economic strategy that would guide how support provided by the federal government would be used. If successful, applicants would receive support for five years, with the potential for renewal. To implement the strategy, each successful applicant had to create a local Community Futures Development Corporation

(CFDC). While a rigid evaluation process was not established, each recipient was assigned a civil service case officer who provided technical support and monitored progress.

Five support mechanisms were established that applicants could choose among depending on their specific strategy (Andison, 1990, p. 59^[32]):

1. Assistance for workers to become self-employed, providing income support for new establishments.
2. Funding for a BDC that operates as a subsidiary of the CFDC. The centre receives money for operations, including providing technical support to local businesses and CAD 1 million to establish a revolving loan fund to support local businesses.
3. Funding to provide relocation assistance for people to leave the community and seek employment elsewhere.
4. Support for a Community Initiative Fund (CIF) to invest in a single project intended to have a major impact on the community. Up to CAD 1 million is provided to the CIF through cost-sharing by the community is required.
5. Funding to offer training to increase local people's skills and improve their employment prospects.

Most funded communities chose support from BDCs and CIFs since these provided the greatest medium-term support and had the greatest local impact (Freshwater and Ehrensaft, 1993^[33]). But these two options also placed greater requirements on members of the community to come together around a single agreed-upon investment project in the case of a CIF and to make a long-term commitment to creating and operating a local financial intermediary in the case of a BDC. While the CFP is described as an economic development programme, it initially encouraged the formation of a strong core of local capacity. It enhanced local cohesion by ensuring a broad spectrum of community interests was involved, starting with the initial application, and that government, businesses and civil society were all represented in the CFDC (Ehrensaft and Freshwater, 1992^[34]). The way the CFP was designed required participants to work collaboratively through all stages of the process, from first applying for support to creating and implementing their strategy. Communities had to choose to apply and make a significant commitment of residents' time and resources. This process only took place in communities prepared to build local social capital as a precursor to receiving support for local economic development.

The CFP continues to operate in most rural areas of Canada but in a significantly different way: its main function today is to support business development (Larsson, Fuller and Pletsch, 2012^[35]). Over time, the majority of the revolving loan funds have expanded the size of their investment portfolio by making profitable loans, which has increased the availability of support for local businesses.

Community revitalisers, Yamagata Prefecture, Japan

Over the course of the past decade, Yamagata Prefecture began developing a bottom-up approach to rural development. Spearheaded by Yamagata and dedicated public servants from rural regions, the prefecture established a programme that: i) identifies community stakeholders; ii) conducts several focus groups together; and iii) supports communities in accomplishing their own new ideas for solving challenges to public service delivery and innovation.

Yamagata Prefecture's Rural Community Vitaliser brings changes to rural communities by supporting community actors in making decisions and providing the resources and network to accomplish these challenges. It is not intended to bring changes exogenously but to encourage a community to take action by itself. Individuals ("planners") from the prefectures are designated as "vitalisers". Vitalisers' role is to accompany communities and assist local residents in sharing their future vision of the community and taking action on their own. This process is considered to be a fundamental step in helping the community and encouraging self-transformation.

Vitaliser skills have been developed via the implementation of land-based projects to improve agricultural productivity.¹ Development of agricultural infrastructure requires community consensus as land and water are managed through the community's collective action. Thus, the public sector has been supporting local communities in their future planning discussions. These achievements has brought about greater community planning know-how for the public sector and resulted in the formation of a group of rural community vitalisers.

In 2009, Yamagata Prefecture set up a registering system to award vitalisers having completing the four-step training course official certification. The course is funded by Yamagata Prefecture government and trainees (prefecture government staff) can take the course during their office hours. The course comprises both classroom lectures and field training so that trainees can gain basic skills as well as practical experience of working with local communities.

The case of the marine community of the city of Tsuruoka, where various local groups acted individually and organised events separately, offers a good example of vitaliser activities. The local group first consulted the vitaliser about the marine development project and the vitaliser proposed to hold a workshop to share and exchange local issues. Thanks to this discussion platform, local groups have joined forces to form a single and unified committee, functioning as an umbrella body for various groups. At the committee's initiative, several programmes to mobilise marine resources, such as a coastal café and leisure fishing spots, were launched. This initiative gained recognition at the national level and was given an award by the Minister of Agriculture, Forestry and Fisheries.

1. This is because rural areas are administratively aligned with areas with a relatively high share of the agriculture industry.

Source: Andison, M. (1990^[32]), "Community futures: An evaluation of a top-down approach to community economic development", <https://doi.org/10.14288/1.0098506>; Freshwater, D. and P. Ehrensaft (1993^[33]), "Initial results from the implementation of Canada's Community Futures Program", Agricultural Experiment Station, College of Agriculture, University of Kentucky; Ehrensaft, P. and D. Freshwater (1992^[34]), "Rural development strategies that work (working title)", Nelson-Hall; Larsson, L., T. Fuller and C. Pletsch (2012^[35]), "Business and community approaches to rural development: Comparing government-to-local approaches", *Journal of Rural and Community Development*, Vol. 7/2.

The current approach of RDAs is to offer flexibility that fits the highly variable conditions across Canada and the ability to provide a set of support programmes that meet local needs (Bradford, 2017, pp. 14-16^[36]). The OECD also sees these agencies as a key element of Canadian innovation policy, playing a central role in bringing national innovation policy to the sub-provincial and sub-territorial level by supporting the formulation of regional growth strategies (OECD, 2019^[37]).

Simplification of access to government resources is one important solution to the challenges of rural entrepreneurs. In Canada, the use of the Business Benefits Finder or similar efforts such as the Switchboard Business Support Hub,¹⁰ funded in part by FedDev in partnership with St. Lawrence College, Southern Ontario Angel Network, Queens' University, Launch Lab (Innovation Centre) and Kingston Economic Development Corporation, could be reinforced as a tool for simplification (Box 3.3). For example, in the United Kingdom, initiatives to support simplification were a high-level priority and the development of resources such as Business Gateway, described in Box 3.3, has been an important aspect of facilitating access to national resources for entrepreneurs.

Complementing physical presence with online services can allow for easier navigation of business services according to the particular needs of entrepreneurs. This can reduce complexity and help direct people to the “right” offer in their geographic location without having to relocate. In Scotland, United Kingdom, for instance, the main RDAs, Scottish Enterprise, Highlands and Islands Enterprise and the newest South of Scotland Enterprise work with Business Gateway and 32 local authority councils to deliver support to SMEs through a shared national website.¹¹ The aim of the initiative is to help SMEs find business support wherever they may be, in a single location. Behind this website is Business Support Partnership where all the agencies meet and share information to avoid confusion and duplication. In addition, the enterprise agencies and Business Gateway share a customer relationship management system for all businesses engaging in the public sector to give an overview of previous and current engagements.

Box 3.3. Encouraging co-ordination and simplification for the delivery of entrepreneurship and innovation support in rural areas

Business Pathfinder Tools, Canada

The Canadian federal government has set up a Business Benefits Finder, which aims to provide businesses with a list of tailored supports. The tool is designed on the basis of questions and answers that help filter through hundreds of federal, provincial and territorial programmes. A key objective of the tool was to develop a fun, interactive and user-friendly site while providing the best results. It also aims to reach people who might not know what they are looking for and equip them with information on what the government can do for them. Importantly, the process does not collect or track individual information. The more questions are answered, the more customised and accurate the results will be. Behind the tool sits a team of four people working on keeping information up to date, summarising programmes and creating the right tags for them. While the page was largely oriented towards business growth in the beginning, it was expanded towards resilience to economic shocks due to the COVID-19 pandemic. As of 3 October 2023, the tool provided information on 1 600 programme streams (some programmes have multiple sub-services) and is advertised through sustained marketing efforts.

Canada Business App

The Canada Business App, released by Innovation, Science and Economic Development Canada in 2019, provides access to an umbrella of programmes and services that are directly relevant to SMEs in Canada. It is an all-in-one resource to connect people to over 15 000 government programmes and services in a simple, accessible and easy-to-understand way.

Switchboard: Entrepreneurial support available wherever you live, Canada

Relative to rural areas in other parts of Canada, rural areas in Southern Ontario are relatively close to cities and well connected by road, rail and broadband services. However, rural entrepreneurs have not had access to support from their counterparts in the country’s major cities. Recognising this issue, the Federal Economic Development Agency for Southern Ontario, which provides funding to the three major business accelerators, included a provision in recent funding negotiations to develop rural-urban linkages between the three major business accelerators and innovation centres serving smaller communities and rural areas across the region. The resulting Southern Ontario Scale-Up Platform brings together each major city’s business accelerator organisation into a new partnership. A goal of the new platform is to make the programming, advisory services and other support offered by these organisations in their urban locations available to entrepreneurs and SMEs located outside the major cities by partnering with local innovation centres.

Invest Ottawa has partnered with local vocational college St. Lawrence College, with its three campuses across Eastern Ontario, to develop a business ecosystem pathfinding tool to assist start-ups and scale-ups in connecting with available resources. The tool called Switchboard provides navigation support and visibility to all relevant public support activities in the area of Kingston. Results are clustered and displayed according to which stage of the business circle entrepreneurs are in, based on qualitative analysis. In case entrepreneurs are unsure of their best fit, the tool also provides assessment help and lets people research for support directed at specific needs, including for women and Indigenous people. The page is constantly updated through support providers, making it easily saleable to other regions and allowing for reporting on the most-searched-for support. This way it can also be used to locate needs and whether demands are currently met.

By helping rural residents fulfil business ambitions in their own communities without having to commute or move into the cities to find the help they need, the benefits of their efforts may be captured locally, supporting the development of rural communities. Linkages forged via the Scale-Up Platform are also expanding the capacity of smaller innovation centres outside the major cities while fostering a stronger network between these centres and the major platform members, creating new opportunities for knowledge sharing and idea development across a wider area.

Rural Partners Network, United States

Set up by the Biden-Harris Administration, the Rural Partners Network is an alliance of federal agencies and civic partners working to expand rural prosperity through job creation, infrastructure development and community improvement. The network brings “boots to the ground” by designating community liaisons to work to simplify access to information for rural communities. It is established as a collaboration of 27 agencies and the White House in an effort to improve access to government resources, staffing and tools, build awareness of rural issues and focus on building rural strategies. It is currently going through the second pilot programme in 14 counties and 10 states.

Business Support Simplification Programme, United Kingdom

The Business Support Simplification Programme was initiated by the Department for Business Enterprise and Regulatory Reform (now the Department for Business, Innovation and Skills) for English regions. It aims to make it easier for companies and entrepreneurs to understand and access government-funded grants, subsidies and advice on how to start and grow their businesses. It was estimated over 3 000 publicly funded business support schemes existed. Businesses reported that they were confused by the number of schemes, which discouraged them from applying. Streamlining helps save them time and money when looking for support. Better targeted schemes have more impact on businesses and provide the public sector with greater value for money from a leaner system. The 3 000 schemes were reduced to 100 or less by 2010 and made available through the nationally sponsored and regionally administered Business Link Gateway. With the new United Kingdom government in 2010, this process was consolidated into Solutions for Business.

Business Gateway, Scotland, United Kingdom

In addition to the national and regional enterprise agencies that work on regional development, the Business Gateway network, operated at the level of the 32 local authorities in the United Kingdom, offers a range of professional resources, support and tools to help entrepreneurs learn new skills, create new opportunities and develop sustainable strategies for growth. Business Gateway supports start-ups and businesses seeking to develop or solve issues (e.g. digitalisation) but not necessarily grow beyond the local area/scale. For the latter, Business Gateway is expected to signpost the company towards the enterprise agencies, Skills Development Scotland, Interface and other innovation partners.

Note: For more information, see <http://www.myswitchboard.ca>.

Source: Government of Canada (2023^[38]), *Business Benefits Finder*, https://innovation.ised-isde.canada.ca/innovation/s/list-liste?language=en_CA&token=a0BOG00000WfhZ2AS; OECD (2012^[39]), *OECD Reviews of Regional Innovation: Central and Southern Denmark 2012*, <https://doi.org/10.1787/9789264178748-en>; UK Government (n.d.^[40]), *Department for Business, Innovation & Skills*, <https://www.gov.uk/government/organisations/department-for-business-innovation-skills>; Scottish Government (n.d.^[41]), *Find Business Support*, <https://findbusinesssupport.gov.scot/> (accessed on 15 June 2023); US Government (n.d.^[42]), *Rural Partners Network*, <https://www.rural.gov/> (accessed on 15 June 2023); Community Futures Canada (n.d.^[43]), *Supporting Canada's 267 Community Futures Organizations*, <https://communityfuturescanada.ca/> (accessed on 15 June 2023); EDC (2021^[44]), "Powered by innovation: The new Canada Business App", <https://www.edc.ca/en/article/ised-releases-canada-business-app.html>.

Lastly, the federal approach to innovation policy is particularly relevant for Indigenous peoples but federal agreements alone may be challenging, as incorporating Indigenous organisations in the policy cycle requires a multi-level approach building on local and national dialogues (OECD, 2020^[2]). In May 2016, Canada announced its full support, without qualification, of the United Nations Declaration on the Rights of Indigenous Peoples (hereafter the UN Declaration). In 2021, Canada adopted the United Nations Declaration on the Rights of Indigenous Peoples Act (hereafter the UN Declaration Act), which requires the Government of Canada to work in consultation and co-operation with Indigenous peoples to co-develop an action plan to achieve the objectives of the United Nations Declaration and to take measures to ensure that federal laws are consistent with the declaration and to report annually on progress. While six provinces officially opposed the legislation, citing concerns that it would impact provincial laws and jurisdiction, others have moved forward with their own implementation. British Columbia was the first province to release an action plan dedicated to implementing the United Nations Declaration on the Rights of Indigenous People (UN Declaration). The federal government also officially released its 2023-2028 Action Plan in June 2023 to work towards achieving the objectives of the UN Declaration and UN Declaration Act (Government of Canada, 2023^[45])

Territorial governments are at the forefront of Indigenous Reconciliation. For example, since its establishment, the Government of Nunavut has adopted Inuit societal values. Despite guidelines in some provinces for improving co-ordination between the First Nations, local, provincial and territorial governments, such as the Political Accord between First Nations and the Government of Ontario¹² and *Local People, Local Solutions: A Guide to First Nation Co-operative Development in Saskatchewan*,¹³ made by the Saskatchewan First Nations Economic Development Network and the Saskatchewan Co-operative Association, Indigenous communities are not systematically integrated in policies that impact their livelihoods. According to the International Work Group for Indigenous Affairs, the Indigenous peoples and Canadian allies are challenged by the slowness of substantive action on the implementation of the Declaration of the Rights of Indigenous Peoples of the United Nations. The causes of this include pressures from the corporate sector and disputes within the government about how the implementation could move forward. For example, in the tourism and economic development strategy for the city of Kenora, Indigenous peoples are mentioned¹⁴ but it is unclear if there has been systematic dialogue and engagement between Indigenous peoples and the municipality in this work. Strategies to engage Indigenous peoples as partners in economic development are facilitated by local commitments. For example, city-pacts in Norway described in Box 3.4 demonstrate the important role of local capacity for engagement between cities and Indigenous communities.

Box 3.4. Indigenous participation in rural economic development in Norway

Norwegian context for Indigenous engagement in rural economic development

In Norway, the Indigenous Peoples Act is referred to as the Sami Act. The Sami Act contains an obligation for the state, county municipalities and municipalities to consult *Sámediggi* (Sami Parliament) and other Sami interests in matters affecting them. The rules state, among other things, that the consultations must be carried out with mutual loyalty and respect for the parties' interests, values and needs.

The agreement on procedures for consultations¹ between the central government authorities and *Sámediggi* sets out detailed procedures for how consultations with *Sámediggi* shall take place. For example, regular half-yearly meetings have to be held between the minister responsible for Sami affairs and the president of *Sámediggi*.

Municipalities and county municipalities can adapt the implementation of consultations to the conditions in their municipality and the individual case. The Ministry of Local Government and Regional Development, in consultation with the Norwegian Association of Local and Regional Authorities and with *Sámediggi* and the Norwegian Reindeer Husbandry Sami National Association, has prepared a guide for municipalities and county municipalities.² The purpose of the guide is to provide municipalities and county municipalities with practical aid in carrying out the consultation obligation under the Sami Act.

Sámediggi has co-operation agreements with some county municipalities. The agreements will, among other things, contribute to strengthening co-operation in areas such as the Sami language, culture and industry. *Sámediggi* also has several co-operation agreements with urban municipalities that have a larger Sami population. The goal of the city agreements is an active and targeted collaboration with regional and local authorities to strengthen and develop Sami culture, language and community life.

1. See <https://www.regjeringen.no/en/topics/indigenous-peoples-and-minorities/Sami-people/midtspalte/consultation-duty-in-sami-matters/id86931/>.

2. See <https://www.regjeringen.no/contentassets/0b26bd9f4fd043d29edbc5ae070e6f03/veileder-for-kommuner-og-fylkeskommuner-om-konsultasjoner-med-samiske-interesser-2.pdf>.

Provincial and territorial innovation policy in case study areas

In a federal system of government where provinces and territories control large parts of the policy arena, the ability of the national government to shape actions at the regional or local level is limited. Every province and territory in Canada has a distinct set of science and innovation policies (Phillips and Castle, 2022^[8]), even if innovation policy rarely includes rural priorities or opportunities (Krawchenko et al., 2022^[46]).

This chapter focuses only on the policies of Newfoundland and Labrador, the Northwest Territory, Ontario, Quebec and Saskatchewan,¹⁵ the locations of the six case studies that were selected for this review. While innovation policies and programmes in provincial and territorial governments are substantial, it is important to note that Indigenous governments and organisations are important economic development actors that support business development and innovation.¹⁶ A more detailed analysis of the provincial and territorial innovation policies is outlined in Annex 3.A.

Provincial and territorial innovation policy seems to largely respond to federal priorities and approaches, largely because federal funding for innovation is a major component of all funding in every province. This means that provincial and territorial innovation policy is largely cluster-focused and relies mainly on university-conducted R&D to generate innovations. Smaller provinces tend to have a more specialised set

of innovation priorities that reflect their current and perceived future opportunities, with Saskatchewan focusing on agriculture and mining and Newfoundland and Labrador on fisheries and ocean opportunities. The two larger provinces, Ontario and Quebec, both have a more comprehensive innovation policy that covers multiple sectors but, in both instances, the bulk of the outlays are for university research on topics that have a more urban focus. Their policies also aim to improve commercialisation by encouraging firm and university collaboration but with limited success. Both provinces have developed a regional approach to encouraging innovation but with a different structure. Quebec, which has a centralised university and college system, relies on specialised programmes within the higher education campuses to provide applied research and technical assistance to innovative local firms. Ontario has created a system of free-standing regional innovation centres across the province, which only have a limited presence in Northern Ontario.

In particular, the provinces of Ontario and Quebec have established an important goal of increasing linkages between universities, research institutes and entrepreneurs. The system of innovation interactions between entrepreneurs and other knowledge partners such as universities, research centres and other firms is an important aspect of building systematic-level innovation opportunities. For example, the International Institute for Sustainable Development Experimental Lakes Area (IISD-ELA) was initially a public sector-funded research initiative that led to several international collaborations and the longest record of an ecosystem-wide study of the impacts of climate change and various toxic substances that impact natural environments, bringing knowledge spillovers to young people and researchers working collaboratively on issues related to climate change. The IISD-ELA is located in a sparsely populated region of Northwestern Ontario where the lakes are not affected by human impacts.

There are several examples of initiatives that link research initiatives and firms together. In Quebec, the *Centres Collégiaux de transfert de technologies* (CCTT) system actively involves local actors in elaborating training courses and supports research institutes that actively work in the research fields that impact local communities. Likewise, the Marine Institute of Memorial University of Newfoundland has a research model closely tied to rural needs. Rarer are cases where local firms are able to host university-based researchers for opportunities outside of the firm's model. Nevertheless, these can still exist, especially if firms are able to build a business model around allowing university researchers to use their resources. An example of this comes from rural Japan, where an initial public subsidy for a public good related to marine life created decades of spillover effects. Kamo Aquarium, a local jellyfish aquarium, initially received funding from the local municipality and the prefecture to help navigate some of the challenges associated with a decline in the population visiting the aquarium. Following this initial level of support, the private company linked up with university researchers and local schools in an effort to reconnect with the local community and build interest in their services. The initiative eventually created benefits for the company (increased tourism) and the larger society, including through research that was granted a Nobel Prize for the discovery of cancer biomarkers that use jellyfish luminescent properties.

Box 3.5. Firm-research partnership example from rural Yamagata, Japan

Kamo Aquarium is a well-known tourist destination for its large collection of jellyfish and wildlife. Originally a tourism company, the aquarium gained fame when it started opening its resources for collaboration with university researchers. One notable researcher, Osamu Shimomura, received a Nobel Prize in Chemistry in 2008 for using the green fluorescent protein properties of jellyfish to create cancer biomarkers. Today, a rotating residency exists for doctoral and post-doctoral students conducting research within its laboratories.

In addition, the aquarium has a local community outreach strategy to educate local youth on jellyfish and marine life, collaborating with Yamagata University to organise the Jellyfish Meister training course. The Jellyfish Meister is a local leader whose aim is to interest school children in science by teaching

them about the unique ecosystem of jellyfish and biology more broadly. The aquarium also provides its facilities for field training courses linked to Yamagata University as well as local high schools. The aquarium is very motivated to be a leader in the field and therefore has as a mission to deepen its jellyfish expertise. Partnerships with external research institutes help develop the aquarium's research level and create good publicity for the aquarium.

Source: Murakami, T. (2016^[47]), "History and introduction of the Kamo Aquarium", *Der Zoologische Garten*, 85(1-2), pp.64-73.

In places where access to university or rural extension programmes may be limited, entrepreneurs in rural areas still benefit from knowledge spillovers resulting from "learning while doing". For example, the Mitiigoog Trust in Ontario provided knowledge on sustainable forest management as part of public procurement contracts requiring consultation and partnership with local Indigenous representatives. In Saskatchewan, Durmur Industries, a firm operating in the defence industry, built local knowledge and spillovers through public procurement contracts that required local participation.

For university-firm linkages to be fruitful, the firms must be motivated to innovate and conduct experiments. Evidence from a recent study in Norway found that many successful initiatives are often determined by the characteristics of firms rather than initiatives from university researchers (Atta-Owusu, Fitjar and Rodríguez-Pose, 2021^[48]). When firms are open to collaboration, they are more likely to collaborate with local universities. However, incentives for universities are not always aligned and universities may not necessarily gain as much from collaboration. In Canada, provincial arrangements in Quebec, where universities and research institutes are active in rural communities, demonstrate a strong opportunity for rural innovation. In Scotland, an initiative entitled Interface was established over 16 years ago to formalise engagement between entrepreneurs and research or university institutes. The initiative is used to connect firms to researchers despite the fact that it is often more successful in areas that have close linkages to universities (Box 3.6). In part, the challenge for rural entrepreneurs in accessing such services is a mismatch between researchers and firms. However, initiatives that tend to be tethered to traditional rural universities seem to better support innovation in rural areas.

Box 3.6. Mechanisms to encourage university-firm linkages for innovation in Scotland

Interface, Scotland, United Kingdom

Established in 2005, Interface is a central hub connecting organisations from a wide variety of national and international industries to all of Scotland's universities, research institutes and colleges. Based regionally throughout Scotland, Interface works with businesses of all sizes in all sectors to match them to Scotland's academic expertise to help them grow. Interface has established efficient processes that will help save time and money in finding and accessing academic expertise, research, technologies, specialist facilities and funding. It also seeks to facilitate clusters of businesses and academics working together to tackle industry sector challenges leading to transformational outcomes and impacts.

In addition to the proactive matchmaking advice provided by the Interface team (with regionally located specialists across Scotland), Interface is able to provide funding through 3 types of innovation vouchers: Standard Innovation Vouchers of up to GBP 5 000 of funding aimed at encouraging first-time partnerships between a company and a university or further education college; Student Placement Innovation Vouchers, up to GBP 5 000 to fund a PhD or Masters student to work within a business on a clearly defined project and continue the development of a Standard Innovation Voucher award; and Advanced Innovation Vouchers of up to GBP 20 000 of match funding to either encourage sustained relationships with academia and enable existing partnerships to continue the development of a project

or for those companies who are beginning their collaborative journey with a higher education institutions (HEI)/further education (FE) college partner. The company must provide a mix of in-kind and cash contributions.

Now in its seventeenth year of operating, Interface's success story is reflected in 6 261 business-led expertise searches sent to academic partners and facilitated 3 399 business-academic discussions. A 2020 evaluation estimated that Interface's contribution to the Scottish economy from R&D projects between businesses and academics enabled was GBP88.9 million gross value added (GVA), which supported 1 595 jobs, with expectations to reach GBP222.3 million GVA and 3 193 jobs. The Interface website presents a set of case studies from across Scotland, including rural areas, of how this support has helped transform businesses.

Source: Interface (2022_[49]), *Interface Online*, <https://interface-online.org.uk/> (accessed on 15 June 2023).

One particularly unique arrangement of university structures that has been fruitful for regional and rural innovation is the system of community colleges and universities in Quebec. As the only public university network in Quebec, the Université du Québec (UQ) includes ten institutions (universities, research institutes and HEIs). UQ's specific mission is to: i) promote access to university education; ii) contribute to Quebec's scientific development and critically participate in developing its regions. The network spanned over 10 institutions in 54 cities in Quebec province alone. In addition, the university system has college-level (pre-university) educational institutions called *Collèges d'enseignement général et professionnel* (CEGEPs) that support applied research and provide technical support to businesses and training. These institutions are tied to CCTTs that specialise in sectors with a strong link to local community ecosystems. In fact, close to 50% of CCTT clients are located within 100 km of their CCTT (OECD, 2023_[50]).

These Quebec HEIs are critical for the province's entrepreneurial system. In responses received from these HEIs, a rising entrepreneurial education trend is emerging in the province. The OECD (2023_[50]) found that 57% of CEGEPs and 29% of universities reported providing entrepreneurial education to students. The CCTTs gather teams of researchers focused on sectors and work on thousands of projects annually while simultaneously contributing to the development of a targeted skilled workforce (Synchronex, 2021_[51]). While CCTTs are important actors in the innovation ecosystem, they also face challenges related to scale and distance. In part, they overcome this challenge by working closely with provincial actors. However, there is still more that CCTTs can do in the community, especially in terms of developing skills and strategies with local actors. Because of their ease of access to rural communities through their system of colleges, they are a critical player in the rural ecosystem of entrepreneurs and other government institutions such as Investissement Québec. One particularity of why Quebec institutions may have a stronger connection to rural entrepreneurs is the set of incentives put in place at the university and college levels to encourage academics and researchers to collaborate with external stakeholders. These incentives are either financial or career progression-related.

In the case of the Northwest Territories, promoting formal innovation is challenging at both the federal and territorial government levels. Few opportunities for cluster-based development and no research-intensive universities make science-based innovation policy implausible. There were, however, clear examples of innovation to be found, with some being technologically based. Importantly, many of these were driven by Indigenous communities and regional Indigenous governments (Akaitcho Territory Government, Dehcho First Nations, Gwich'in Tribal Council, Inuvialuit Regional Corporation, Northwest Territory Métis Nation, Sahtu Secretariat Incorporated, Tłı̨chǫ Government). The Government of Northwest Territories is currently in the process of transforming Aurora College into a polytechnic university and the Aurora Research Centre in Inuvik makes important contributions.

While provincial and territorial innovation policies do not conflict with federal policy, neither do they reinforce it. This can be seen as a problem or a reality. If federal policies and priorities were applied equally well in all provinces, the lack of co-ordination would not be problematic.

Expanding federal regional support for rural entrepreneurs

This section discusses ways to expand the focus of federal Canadian innovation policy beyond its current structure. It argues for a broader approach that adds policies that support rural innovation, underlying a context that expands the concept of how an RIS works to restore a larger role for entrepreneurs, particularly “system entrepreneurs” who create a local business and social environment in which innovation is encouraged.

Broadening the concept of an RIS includes the support of “system entrepreneurs”

Understanding rural innovation from the point of view of entrepreneurs can broaden the RIS into a system that works for rural areas. For example, one can distinguish between standard perspectives on innovation systems that minimise the role of entrepreneurs and those that keep entrepreneurs as a key element (Isaksen et al., 2018^[52]). In this line of reasoning, two types of entrepreneurs are identified; the first is the individual actor that creates a new product or process, while the other they term “system entrepreneurs”, who create an improved local institutional context that in turn acts as a catalyst to increase the likelihood of successful individual creative actions by individual entrepreneurs (p. 36^[52]). The regional element of their model comes from significant differences in the capacity of the RIS in which entrepreneurs are situated.

From the perspective of the entrepreneurs, one can consider three types of RIS – thick/diversified, thin/specialised and thin, with each type having a different capacity to support innovation (Isaksen et al., 2018, p. 39^[52]). Importantly, as the capability of the RIS declines, the importance of the system entrepreneur increases because it becomes the main way that local support for the creative entrepreneur occurs. In essence, in a region with a thin RIS, an alternative actor is required to improve the local milieu in which individual entrepreneurs operate (p. 39^[52]). Importantly, these three types can be thought of as roughly corresponding to metropolitan RIS, RIS in regions with a small to medium-sized city and RIS in rural regions, as outlined in Table 3.1.

In Table 3.1, the regional differences in innovation systems are described. The table suggests that as the capacity of the local RIS declines, the importance of system-level entrepreneurs increases as a substitute for a formal actor that supports innovation. In addition, as the capacity of the RIS decreases, it tends to become more focused on supporting existing core activities in the region and on diffusing technologies from elsewhere into the region. Finally, the last column of the table suggests differences in how a region’s industrial path (core specialisations) will evolve, with thick/diversified RIS regions having the best opportunity to identify and implement new activities and diversify and with thin regions being most likely to extend existing specialisations.

For example, in the context of the six Canadian case studies, Regina/Edenwald is located within a thick/diversified RIS, Kincardine is located within a thin/specialised RIS, while the Gaspé Peninsula and Kenora are located within thin RIS (see more descriptions of each case study area in Annex 3.A). Arguably, the remaining two case studies, Fogo and Inuvik, are situated in regions without an RIS, which implicitly creates one more regional category than is identified by the Indigenous Knowledge Research System (IKRS). Since innovation occurs in all six case studies, the IKRS model provides a way to reframe the role of the standard RIS approach to incorporate rural innovation in a systematic way, rather than it being seen as an anomaly, with system entrepreneurs acting as a substitute for a thick/diversified RIS.

Table 3.1. Linking of different types of RIS, entrepreneurial discoveries and regional industrial path development

Type of RIS	Characteristics of spontaneous entrepreneurial discovery processes		Possible regional industrial path development
	Key entrepreneurs	RIS changes	
Thick/diversified	Increasing importance of system-level entrepreneurs	Increasing importance of new and adapted knowledge-creating and diffusion organisations	Path creation and diversification
Thin/specialised			Path extension and diversification
Thin			Path extension
None			Path identification and extension

Source: Based on Isaksen, A. et al. (Isaksen et al., 2018^[52]), “Differentiated regional entrepreneurial discovery processes. A conceptual discussion and empirical illustration from three emergent clusters”, <https://doi.org/10.1080/09654313.2018.1530143>.

Clearly, for regions completely lacking an RIS, the importance of system-level innovators is critical. In the case of Fogo, both the Shorefast Foundation and the Fogo Island Co-operative Society Limited can be seen as system-level entrepreneurs¹⁷ because they are both social enterprises that see strengthening and improving their community as a key role. Similarly, in Inuvik, the Inuvialuit Regional Corporation and the Gwich'in Tribal Council play the same system entrepreneur role by providing both economic and social capacity through various for-profit and non-profit subsidiaries. This suggests that it is possible to construct a parallel innovation support system in small, isolated rural regions that can systematically enhance entrepreneurial activity and local innovation.¹⁸ It is important to note that Indigenous rights holders' organisations are responsible for implementing their modern treaties, of which economic development is a goal.

An important extension of the systems entrepreneurial approach is innovation in Indigenous communities. Indigenous entrepreneurship matters because vibrant Indigenous businesses and economies are fundamental to self-determination. Rebuilding Canada's relations with Indigenous peoples – First Nations, Métis and Inuit – requires rebalancing political and economic power.¹⁹ Hence the emergence of the term “economic reconciliation”. Indigenous entrepreneurship supports self-determination by reducing dependency relationships and by increasing decision-making autonomy. As noted by the Royal Commission on Aboriginal Peoples, “self-government without a significant economic base would be an exercise in illusion and futility” (Government of Canada, 1996^[53]).

Active consultation and partnership with Indigenous communities at the RIS development stage can be important to ensure that development plans for entrepreneurship and innovation are inclusive and targeted towards the communities they serve. McDonald makes the case that this autonomy, when coupled with sufficient resources, provides Indigenous groups with the opportunity to create a development strategy based on traditional values that is coupled with market opportunities (2019^[54]). In a case study on Indigenous First Nations communities in British Columbia, where there are few historical or modern treaties, Kobzik and Krawchenko (2022^[55]) demonstrate that when comprehensive community development plans are administered, they tend to prioritise infrastructure, social and economic development. In addition, of the 70 First Nations included in the analysis of the paper, 40% have some kind of First Nations-municipal-regional agreement and methods of community engagement are included in the majority of strategic plans.

For Indigenous people in Canada's North, there is little chance that an RIS approach to innovation will directly provide solutions to either their development challenges or to adapting to climate change. Incentives to participate in high-technology innovation are also low for Indigenous communities. The OECD (2020^[2]) found that intellectual property protection rights and certification systems were not well suited to address the appropriation and commercialisation of Indigenous knowledge and cultural expression; this includes Canada's Copyright Act, which does not currently integrate the protection of Indigenous

knowledge and languages. While some of the innovations from RIS activities carried out at universities in the south have value in the north, new approaches may be needed in order to integrate these into a very different context, necessitating another innovation. There are strong linkages between southern universities and northern communities and a desire to increase the research sector within the North so that more researchers live there. A good example is the ArcticNet initiative, a network of Canadian centres of excellence that brings together scientists, engineers and other professionals in the human health, natural and social sciences with partners from Inuit organisations, northern communities, federal, provincial and territorial agencies and the private sector to study the impacts of climate and socio-economic change in the Canadian North.

In rural remote regions, the presence of “system entrepreneurs” provides vital support to an entrepreneurial innovation process powered largely by either user or customer-driven innovation. The idea is compatible with Isaksen and Karlsen’s suggestion (2016^[20]) that the innovation process in rural areas follows a doing-using-interacting approach instead of the common RIS model. More effective innovation policy in rural areas should thus focus on finding ways to encourage both local government and local civil society to engage in activities that support local firm entrepreneurs, including system entrepreneurship as well as providing more traditional business support.

Providing policy support for rural innovation through a “user-driven” approach has two streams:

- The first is instituting a form of local capacity building that encourages individuals and communities to search for local solutions to their problems. In a sense, this is a process of creating “system entrepreneurs” who alter local institutions to make them more amenable to new ideas.
- The second stream is providing resources to self-identified local innovation leaders, whether firms or from civil society.

Systems entrepreneurs and self-identified local innovation leaders often benefit from being able to participate in networking initiatives where they meet like-minded individuals. Such initiatives can be observed in other contexts outside the OECD, such as through the rural leaders programmes described in Box 3.10.

Building equitable opportunities for rural innovation

Most of the Government of Canada’s departments and agencies have a mandate to support diverse and inclusive economic growth across the country. Like some other federal OECD countries, the Canadian constitution has an equalisation clause that requires the Government of Canada to provide financial assistance to provinces with relatively weak levels of per capita fiscal. Due to economic weakness, provinces with low fiscal capacity are seen to be unable to provide citizens in their jurisdiction with appropriate levels of public services. As a result, the provision of basic public services among the provinces of Canada is relatively uniform, although major gaps in accessing services exist between rural and urban regions in all provinces.

To address geographical inequalities, Canada provides specific programmes to address underlying disadvantages. Targeted initiatives, departments and agencies invest in and prioritise projects that are led by and benefit underrepresented groups through much of their ongoing generic programming. A few examples include projects that prioritise supporting women, black and Indigenous entrepreneurs and language minority communities. Similar initiatives are also observed in the United States, as described in Box 3.7. Successful First Nations in Canada provide an example of the possibilities for governments, industry and Indigenous communities to work together to empower Indigenous economic participation. Fort McKay, Osoyoos, Tsawwassen and West Bank First Nations are leading the way in wholly owned and joint-venture businesses that have markedly improved the living standards of their members. For instance, Fort McKay First Nation’s portfolio includes joint ventures across building and construction, tourism and

hospitality sectors, which have raised its average after-tax income to more than CAD 73 000 (approximately CAD 10 000 higher than the 2018 national average) (Municipal World, 2018^[56]).

Box 3.7. Encouraging equity and supporting rural access to finance in the United States

The **United States Department of Commerce Economic Development Administration (EDA)** has taken many steps towards integrating diversity and equity in their programme delivery that span from specific programmes and placing priority on populations and geographies considered traditionally underserved, including minorities, rural areas, tribal lands and those considered in persistent poverty, to directly addressing equity.

Specific EDA programmes are required to set aside 10% of its Public Works and Build to Scale programme funds for investments in priority areas that have been identified as persistently poor, meaning counties with a poverty level of at least 20% for the last 30 years. The requirement, also known as the 10-20-30 rule, streamlines a focus on providing fair and impartial opportunities by ensuring support is reaching systematically disadvantaged areas across all investment opportunities.

The **United States Department for Agriculture (USDA)** has engaged in a comprehensive review of its policies, processes and programmes to determine how it can advance equity throughout the department. Along with this review, the department has taken steps to be intentional about advancing equity in their programmes. For example, applications in the rural development mission area can receive priority points if their projects are located in socially vulnerable communities that score 0.75 or above on the Social Vulnerability (developed by the Center for Disease Control).

Having recognised the opportunity to do more in this area, the USDA established the Equity Action Plan in light of an executive order to advance racial equity and underserved communities by:

- Partnering with trusted technical assistance providers to expand access for underserved communities.
- Reducing barriers that prevent underserved producers from accessing USDA farm programmes.
- Expand equitable assistance to USDA nutrition programmes.
- Increase the share of overall USDA infrastructure investments that benefit underserved rural and Tribal communities.
- Increase fair and equitable opportunities for small, disadvantaged businesses.
- Uphold federal trust and treaty responsibilities to Indian Tribes.
- Institutionalise civil rights and equity as part of the essence and culture of USDA.

In addition to EDA and USDA initiatives, banking institutions play an important role in small communities in the United States. The **Community Reinvestment Act**, which became law in 1977, promotes financial inclusion and community engagement by incentivising banks that have branches in small communities to reinvest in the community by meeting the credit needs of communities, including low-income and moderate-income areas. It does so by enabling the Federal Reserve and other financial institutions to evaluate bank performance in communities. The act incentivises the use of smaller-value loans and investments that can have a high impact and be more responsive to the needs of communities.

Among different ways to reinvest in the community, these rural banks offer finance options for rural entrepreneurs that may be more lenient regarding collateral requirements and risk assessment. Banks are at the forefront of reinvestment in the communities, work with local entrepreneurs and develop initiatives to encourage community revitalisation. In some cases, banks that are actively participating in

community revitalisation: i) hire locals to develop community reinvestment opportunities; and ii) provide business support opportunities or networks for rural entrepreneurs.

Source: ATSDR (2022^[57]), *CDC/ATSDR Social Vulnerability Index*, <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html> (accessed on 15 June 2023); EDA (n.d.^[58]), *Economic Development Districts*, <https://eda.gov/edd/> (accessed on 15 July 2023); EDA (n.d.^[30]), *Research and National Technical Assistance (RNTA) Program*, <https://eda.gov/programs/rnta/> (accessed on 15 November 2022); Federal Reserve (2022^[59]), *Community Reinvestment Act (CRA)*, https://www.federalreserve.gov/consumerscommunities/cra_about.htm.

ISED estimates that by ensuring the full and equal participation of women in the economy, Canada could add up to CAD 150 billion in GDP (Government of Canada, 2023^[60]). With only 17% of Canadian SMEs owned by women, the Government of Canada developed a Women Entrepreneurship Strategy (WES) with CAD 6 billion in investments and commitments to encourage access to finance, talent, networks and expertise. It includes an Inclusive Women Venture Capital Initiative, a Women Entrepreneurship Loan Fund, an Ecosystem Fund and the Women Entrepreneurship Knowledge Hub. Other similar programmes exist: a Women Entrepreneur Program administered by Farm Credit Canada, a Women in Technology Venture Fund, a Women Entrepreneur programme administered by the Business Development Bank of Canada and a Women in Trade programme administered by Export Development Canada. RDAs in Canada, such as ACOA, FedDev Ontario, PrairiesCan, PacifiCan, CED and provinces across Canada, provide specific support, consulting and advisory services to women.

The Women's Enterprise Initiative is an example of a distinct Canadian regional programme addressing women entrepreneurs' challenges. The initiative, in partnership with PrairiesCan and PacifiCan, helps women entrepreneurs start, scale up and grow their businesses. There is a Women's Enterprise Initiative organisation in each of the four Canadian western provinces (Alberta, British Columbia, Manitoba, Saskatchewan). These non-profit organisations provide a variety of unique products for women entrepreneurs, including business advisory services, training, networking opportunities, loans and referrals to complementary services (Government of Canada, 2021^[61]; 2021^[62]). CED in Quebec offered a similar initiative that provided over CAD 10 million in support to 38 projects led by women entrepreneurs for 2 years starting in 2020 (Government of Canada, 2020^[63]). The project supported included seven associations and organisations already benefitting from the WES Ecosystem Fund.

The Black Entrepreneurship Program, a partnership between the Government of Canada's ISED, Black-led business organisations and financial institutions, provides opportunities targeted towards supporting Black Canadian entrepreneurs. The programme has an investment of up to CAD 265 million over 4 years to help Black Canadian business owners and entrepreneurs build and grow their businesses. It has three main components, including a Black entrepreneurship loan fund, a National Ecosystem Fund and a Knowledge Sharing Hub that conducts research on the challenges for Black entrepreneurship in Canada, led by Carleton University's School of Business and the Dream Legacy Foundation (Government of Canada, 2021^[64]; Prime Minister of Canada, 2020^[65]).

The Economic Development Initiative is an initiative under the responsibility of ISED that supports the development of official language minority communities. It is a partnership between federal agencies, including ACOA, CED, CanNor, Western Economic Diversification Canada, FedDev Ontario and FedNor. It provides financial support to projects that encourage economic diversification, business development, innovation, partnerships and increased support for SMEs in official language minority communities. Through the Economic Development Initiative, agencies can invest in projects focused on the economic development of businesses and communities with diversified linguistic heritages that help develop capacity, expertise and partnerships (Government of Canada, 2013^[66]).

In addition, the Government of Canada is providing up to CAD 306.8 million in interest-free loans and non-repayable contributions for First Nations, Inuit and Métis businesses. The initiative is administered by the Aboriginal Entrepreneurship Program and Métis Capital Corporations and provides access to capital

and business opportunities to Indigenous entrepreneurs and business owners in Canada, including in rural areas (Government of Canada, 2021^[67]).

Improving access to finance

Financial services and national development banks can support rural access to finance by understanding how rural entrepreneurs assess and manage risk and the opportunities that come with them. For example, in ACOA, the Community Business Development Corporation (CBDC), funded under the CFP, acts as a financial broker for rural entrepreneurs. The CBDC, funded by the ACOA, provides financial help in the form of loans, loan guarantees and equity financing, as well as business mentoring and advice, entrepreneurship development and training in access to skills, and technical help (coaching) (Government of Canada, 2022^[68]). The four distinct CBDCs have rural action centres that focus specifically on providing services to rural communities, working as facilitators to find resources for rural entrepreneurs and providing loans and grants through the centres themselves (CBDC, n.d.^[69]). In rural places where banks no longer serve rural communities, credit unions and national initiatives need to play a stronger role in assessing risks and providing financial services. However, loans from CBDCs alone may limit rural entrepreneurs' financial options. Other institutions, such as the Business Development Bank, could consider better assessing risks and opportunities in rural areas that do not inadvertently disadvantage rural entrepreneurs, for example, with higher interest rates than commercial lenders in rural areas. They can instead consider the relative risk markets of rural entrepreneurs and work with entrepreneurs on establishing better conditions related to collateral, bankruptcy and credit limits. In the cases of rural finance, financial institutions with the mandate to support rural entrepreneurs need to consider how banking regulations fit within the context of rural opportunities and entrepreneurs.

In rural Canada, commercial banks are important financial intermediaries but are typically minor players in funding business innovation. Other lenders, such as credit unions, can be more flexible in their lending approaches but cannot provide the crucial equity investments that make loans viable. In Quebec, the two largest unions (CSN and FTQ) have put in place an economic development fund to support economic development and create jobs. They are non-profit organisations that use workers' collective retirement savings to finance socially responsible and environmentally friendly projects, including investment in rural SMEs.

Because rural markets are thinner and collateral may be more challenging in some types of rural areas, it is hard for entrepreneurs of any type to come up with enough owner equity. Recent research by ISED on rural entrepreneurship has found that opportunity-based nascent entrepreneurship (as opposed to necessity-based) is more prevalent in rural regions. Their analysis suggests that entrepreneurs in rural regions seem to be able to recognise market opportunities and take advantage of them but they need a supportive environment to grow their businesses (Government of Canada, 2021^[70]).

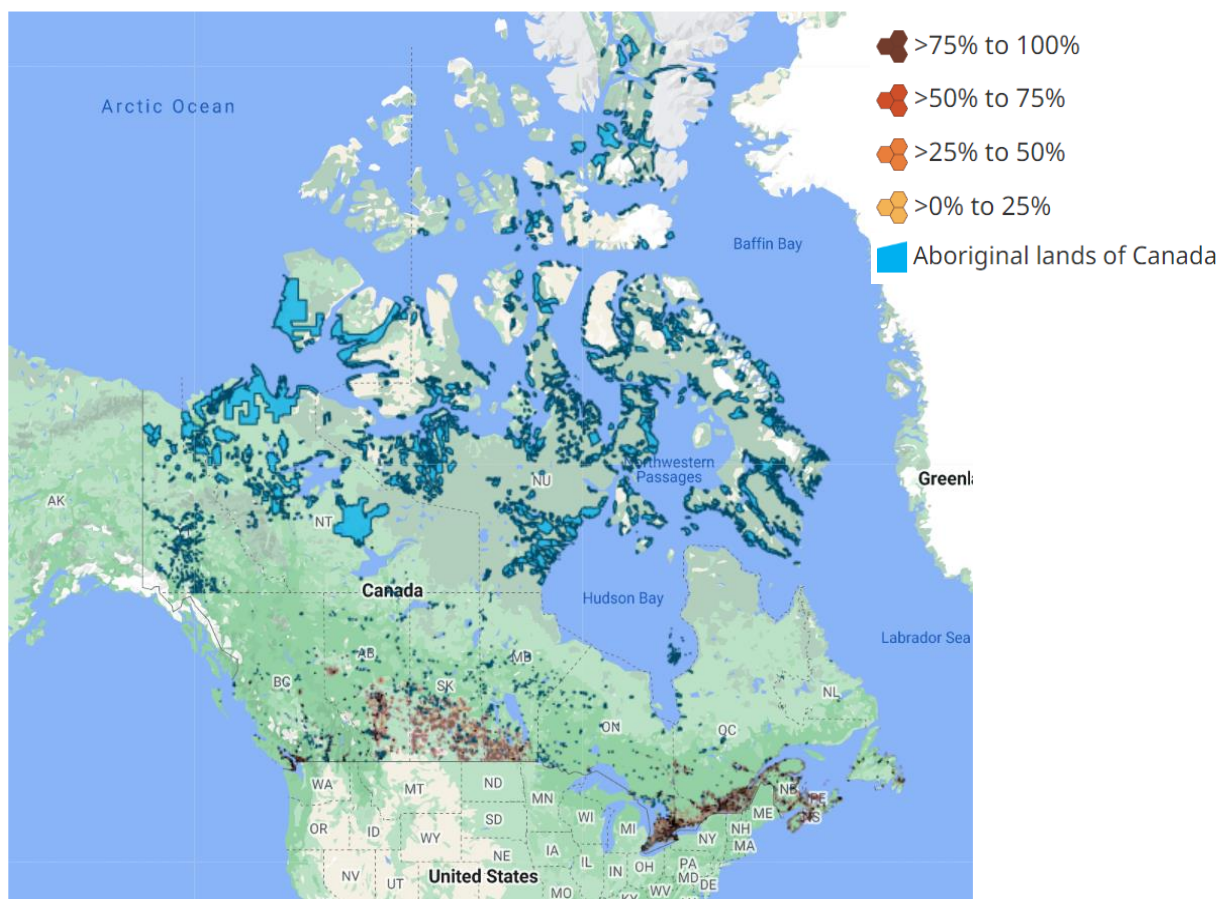
There are similar challenges for rural finance across many provinces in Canada and abroad, where peer learning may provide the impetus for local solutions. One promising practice to support equity in access to finance is voluntary contribution funding roundtables or "pitches", practised in rural Quebec by CED, that place the entrepreneur at the centre of the process by gathering various public and private financial institutions to have direct contact with the rural entrepreneurs. Furthermore, the co-ordination with the province investment authority, Investissement Québec, actively works with the RDA CED to address challenges in accessing finance. Other initiatives that can support easier access to finance in rural areas include initiatives that specifically target women or Indigenous entrepreneurs. For example, similar challenges are observed in the United States, where incentives are created for community banks to reinvest in the community, such as the Community Reinvestment Act highlighted in Box 3.7.

Access to digital infrastructure

Many of the challenges of rural innovators exist because of the physical attributes of the location where they are operating. Creating physical and, increasingly, digital linkages is increasingly important (Marshalian, Chan and Bournisien de Valmont, 2023^[25]). Access to quality digital infrastructure is a challenge in Canada, as in many OECD countries. In Canada, there is a close to 40-percentage-point slower average fixed download speeds for rural areas compared to national averages, based on user-tested data in the last quarter of 2020 (Figure 3.8).²⁰ Compared to urban areas, the difference increased to close to 53 percentage points in 2020. Furthermore, when moving to the northernmost hemispheres, the lack of both digital and physical infrastructure results in access to satellite services only (Government of Canada, 2023^[71]). A recent study has found that this digital divide limits access to online government services for those in rural areas, women and those in lower social-economic backgrounds (Singh and Chobotaru, 2022^[72]).

Figure 3.7. National broadband internet service availability map

Current 50/10 megabits per second (Mbps) areas



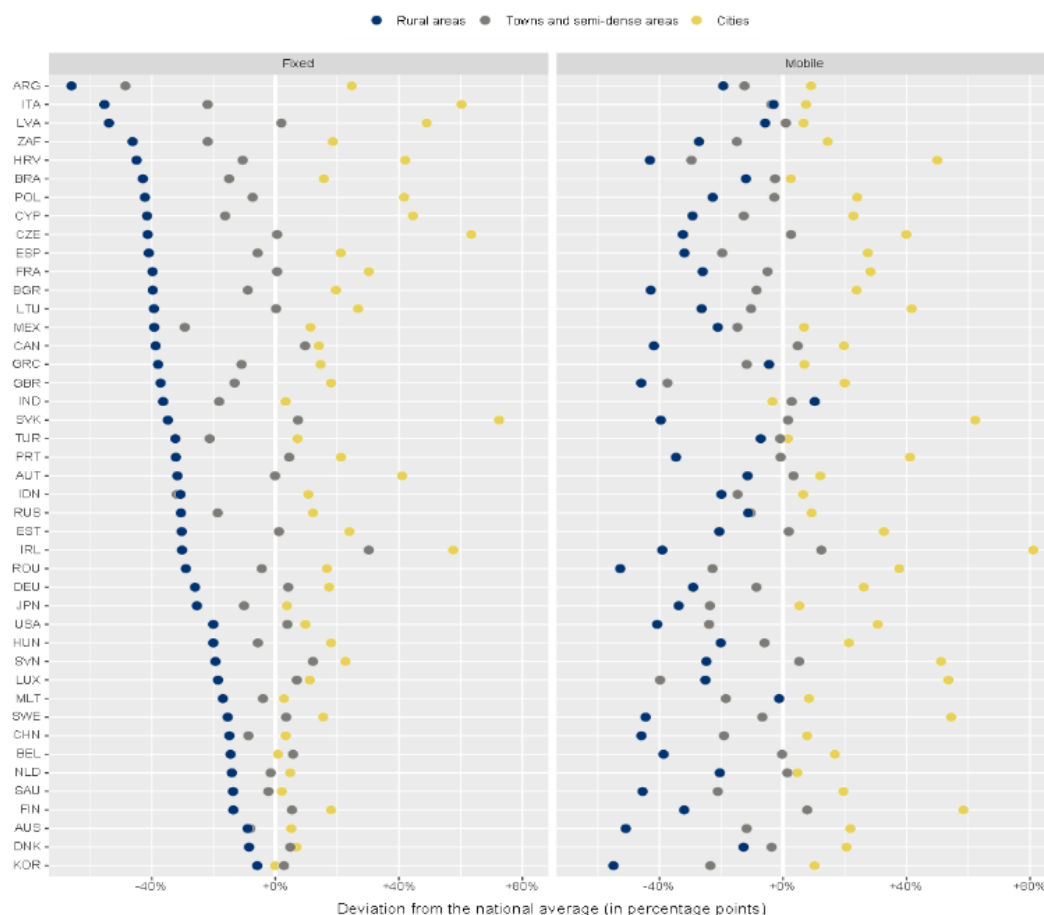
Note: Coverage within an area will depend on the network design, local topography and other factors. In some instances, Internet service providers will not be able to provide service to 100% of households within an area shown as serviced. Data were modified 13 April 2023 and the map was updated 3 May 2023.

Source: Government of Canada (2023^[71]), *National Broadband Internet Service Availability Map*, <https://www.ic.gc.ca/app/scr/sittibc/web/bbmap?lang=eng#/map> (accessed on 7 June 2023).

Broadband connectivity has an important role in rural areas to boost rural innovation for both digital entrepreneurs as well as traditional firms embracing digitalisation (OECD, 2023^[73]). For firms in rural areas, a recent paper found causal evidence of positive effects of universal broadband policies that may lead to economic benefits for firms in rural areas, in particular, in knowledge-intensive sectors, by exploiting geographical discontinuities in broadband availability across the United Kingdom (DeStefano, Kneller and Timmis, 2022^[74]). Other academic work has investigated the relationship between broadband availability, the use of cloud computing and various types of innovation for firms in the United States and the enabling effect of cloud computing on firm innovation in the United States that provides concrete evidence of the adverse effects of the geographical digital divide on businesses (Wohan, forthcoming^[75]).²¹

Figure 3.8. Geographic variation in download speeds in OECD and G20 countries

Gaps estimated as percentage deviation from national averages, 2020 Q4



Note: Speedtest data corresponds to 2020 Q4. The data for average fixed and mobile broadband download Speedtests reported by Ookla measure the sustained peak throughput achieved by users of the network. Measurements are based on self-administered tests by users, carried over iOS and mobile devices. Aggregation according to the degree of urbanisation was based on the Global Human Settlement Model (GHS-SMOD) layer grids. The figure presents average peak speed tests, weighted by the number of tests. For further information on the degree of urbanisation, the definition and treatment of the Speedtest data, see OECD (2021^[76]).

Source: Calculations based on Speedtest® by Ookla® Global Fixed and Mobile Network Performance Maps. Based on analysis by Ookla of Speedtest Intelligence® data for 2020 Q4. Provided by Ookla and accessed 2021-01-27. Ookla trademarks used under license and reprinted with permission.

Through the High-Speed Access for All strategy (2019^[77]), the Government of Canada has committed to connecting 98% of Canadians to high-speed Internet by 2026 and 100% of Canadians by 2030 and has established a high-speed Internet access dashboard to monitor its implementation. In support of these objectives, the federal government has established a Universal Broadband Fund of CAD 3.225 billion to support high-speed Internet projects (50/10 Mbps) in rural and remote communities. It has also established a Connecting Families Initiative to help low-income Canadians access the Internet (Government of Canada, 2023^[78]). As of 2022, 93.5% of Canadian households nationally have access to minimum Internet speeds of 50/10 Mbps in Canada. However, there are major regional differences: for example, only 67.3% of households in the Northwest Territories meet those targets (Government of Canada, 2023^[79]).

While policies to promote competition and private investment, as well as independent and evidence-based regulation, have extended broadband coverage (including in rural and remote areas), some gaps may remain. In an assessment of Canada's broadband approach, Weeden and Kelly (2021^[80]) note that it has primarily focused on market stimuli to deliver solutions to address the rural-urban digital divide. They argue that this approach has been ineffective at building hard and soft digital infrastructure and that Canada's digital rural policy should invest in connectivity, capacity and culture of use through a place-based approach. In areas where market forces have not been proven to be able to fulfil policy objectives (i.e. in terms of broadband coverage or service quality), additional interventions by governments may be necessary. In a report to Group of Twenty (G20) governments (OECD, 2021^[76]), the following approaches were encouraged to tailor initiatives to bridge connectivity divides in rural and/or remote areas, in addition to promoting market forces and reducing deployment costs:

- Demand aggregation models to ensure the financial viability of projects.
- Public-private partnership initiatives.
- Public funding to expand connectivity in rural/remote areas, often making use of market mechanisms, such as reverse auctions, to provide funding to market players to deploy their networks in rural and remote areas.
- Bottom-up approaches: open access municipal and community-led networks.
- Addressing particular “last mile” challenges in rural and remote areas.
- Coverage obligations in spectrum auctions (for wireless networks).

Building room for experimentation in programmes and public service delivery

Encouraging innovation for entrepreneurs is a practice of allowing for trial and error. Many entrepreneurs operate on the basis of creating new solutions to old problems, particularly rural entrepreneurs, and on the basis of innovating for solutions to lack of resources (OECD, 2022^[24]). Building this culture of experimentation and providing resources to support such entrepreneurs has become the target of several innovation-focused initiatives across OECD countries, as described in Box 3.9. Among other initiatives, federal innovation policies may build experimentation in support mechanisms for public service delivery through:

- Direct support for experimentation.
- Challenge-based initiatives.
- Regulation sandboxes (temporary regulatory waivers for testing business ideas).
- Engaging with open consultation and collaboration with third-party actors.

Box 3.8. Innosuisse Innovation Booster

The Innovation Booster programme powered by Innosuisse is designed to specifically support radical ideas in a culture of open innovation. Supporting the primary stage of an open innovation process, they provide the impulse for innovative ideas and help them get off the ground into the market.

The main mission of the programme includes:

- Bringing together all interested players from research, business and society on various innovation topics.
- Promoting knowledge transfer and encouraging co-operation with partners along the entire value chain of a topic. Each booster has its own organisation and leading house.
- Using design thinking methods and other user-centred methods, the Innovation boosters support companies, start-ups and other organisations to identify and explore problems in interdisciplinary teams and develop new and radical solutions from scratch.
- Providing an apt funding amount to finance and support the testing and verification of promising ideas and assisting teams in getting follow-up support to further develop or implement their idea.
- Fostering a culture of open innovation to create sustainable competitive advantages for innovative Swiss organisations and SMEs.

Innosuisse selects Innovation Boosters with regular calls for proposals for a four-year period. The selection is based on a range of criteria, which include:

- The current and future importance of the innovation topic.
- The likelihood that it will give rise to future innovation projects.
- The appropriateness of the methods and mechanisms used to promote the transfer of knowledge and technology.
- The competency to address the innovation topic and to involve the relevant actors on a national scale.
- The plausibility of the budget and cost-benefit ratio, the degree of own-funding and the contribution of third-party funds.
- The contribution to the sustainable development of society, the economy and the environment.
- Measures to ensure appropriate gender representation in the organisation and at activities.

Key performance indicators on gender are supposed to motivate initiatives to proactively increase the percentage of women on their boards as well as among their speakers and participants. This is especially interesting in some fields which are historically unbalanced with respect to the participation of men and women.

Innovation Boosters are selected under a complementarity principle: Innosuisse supports initiatives that would not easily be supported by the private sector only because of inherent risk, lack of resources or private investments, or unclear economic return. They should all have the potential to involve actors from all over the national territory.

The above criteria should allow Innosuisse to select Innovation Boosters that will create an impact in Switzerland. This includes societal impacts such as an increase in quality of life, addressing major societal challenges, better population health, or economic impacts such as job creation, increase in revenues, etc.

Source: Innosuisse (2022^[81]), "Innovation boosters", Presentation.

An increasing opportunity in many rural areas, physical spaces of experimentation such as Living Labs are gaining ground. These mini laboratories often provide free to low-cost opportunities for entrepreneurs (young or older) to test ideas and join a community of like-minded entrepreneurs. In some cases, such labs allow access to heavy and expensive equipment, such as three-dimensional printers or industrial equipment used to build products.

As one example, a Living Lab in Gaspésie-Îles-de-la-Madeleine was established in 2018-20 to support start-ups within three cultural and tourism organisations in the territory: the *Corporation de gestion et de mise en valeur du mont-Saint-Joseph*, Exploramer and the *Festival Musique du Bout du Monde*. The initiative set up a prototyping process of tourist and cultural experiences enriched by technology. One of the objectives was to formalise the deployment of a sustainable techno-cultural community to support the development of the digital economy of Gaspésie and the Magdalen Islands and, ultimately, the retention and attractiveness of the workforce as well as the economic and social development of the region. As another example, Switzerland's challenge-based programmes are implemented by the national innovation agency, Innosuisse, and is increasingly working on regional collaborations (OECD, 2022^[29]) within the context of Innovation Boosters as described by the OECD (2022^[29]). Likewise, the Japanese Ministry of Agriculture, Forestry and Fishing supports initiatives from community organisations and universities that look for new and disruptive ideas through challenge-based initiatives in rural areas (OECD, forthcoming^[82]).

Experimentation may be further supported by providing temporary relief from regulatory burdens for the purpose of testing the benefits and specific contexts in which programmes can support rural innovation and welfare. For example, in Switzerland, local public-private or public-civil society partnerships temporarily reduce historically protected places for responsible tourism (OECD, 2022^[29]).

In terms of public service delivery, open consultation on the policy-making cycle with a wider audience that includes community members and civil society organisations can bring new insight into how to improve public delivery. In rural areas, third-party actors such as civil society organisations can help support the delivery of programmes where government entities may not have enough resources. This strategy is currently used for supporting rural innovation in Scotland and the United States (OECD, 2023^[73]; 2023^[83]). As Indigenous community development organisations, such as Saskatchewan's FHQ Developments organisation, engaging with civil society actors and entities tied to local community development can help deliver public services with a bottom-up approach.

Box 3.9. Innovation sandboxes and Living Labs

Regulatory innovation sandboxes

In 2016, the first regulatory innovation sandbox allowed experimentation in the financial technology (fintech) industry. According to a recent study, since then, 73 fintech sandboxes have been established in 57 countries, with more than half between 2018 and 2019 (World Bank, 2020^[84]). An innovation sandbox is a type of regulatory sandbox that encourages innovation, holding several regulatory requirements on pause while innovators experiment on whether outcomes of innovations may develop useful innovations that may solve greater issues or prove whether regulations may be needed. Regulators across the globe are using regulatory sandboxes to provide a safe environment for emerging technologies to test regulatory boundaries.

A recent report showed that they tended to serve as a base to test the necessity of regulations, facilitate firm start-up entrepreneurship and foster new partnerships. A few examples include a fintech sandbox in Australia and a digital sandbox in the United Kingdom. Additionally, initiatives in the agri-tourism sector of the Jura region of Switzerland fit a similar definition.

Regulatory exemptions in tourism in the Jura region, Switzerland

While not directly marketed as such, two examples of regulatory sandboxes with the specific target of developing the tourism sector are found in the mountainous region of the Jura in Switzerland.

A first example was built in collaboration with TalentisLab, which requested an exemption from environmental protection legislation limiting ecotourism activities. After an application for exemption and a call for proposals, a new initiative to encourage eco-responsible tourism in the provision of campsite accommodation is being put in place.

A second example involves temporarily lowering prohibition from visiting publicly protected places while visiting local towns. The initiative provides access to a “secret route”¹ to groups of tourists who have acquired digital keys. The community of Porrentruy, in collaboration with the RIS agency services, worked on reducing regulations on access to public places that may be of interest to areas with an increase in tourism. This has allowed the town of Porrentruy, whose business was strongly impacted by the COVID-19 pandemic, to gain visibility and attractiveness.

Innovation labs

Another increasingly popular way to encourage innovation are Living Labs, “fab labs” and similar initiatives to bring previously inaccessible tools to budding innovators. The Interreg Europe Policy Learning Platform² is one of the agencies supporting the increased use of such tools that create a place to learn, experiment and enjoy the process of innovation. While the different labs vary, they generally provide a mix of services such as skills, materials and advanced tools to participants that can include university-industry collaborations and provide prototyping services for SMEs.

e-Health Living Lab and smart energy grids, Eindhoven, the Netherlands

As part of the Brainport Development Cluster, the city of Eindhoven also houses an example of a Living Lab that focuses on the development of time-limited trial runs for new products and services. Brainport works with local stakeholders, HEIs, the government and a consortium of private sector parties to experiment with new solutions to pre-existing issues. Through Living Labs, individuals are given a license to test out a new initiative in a short time frame to get quick feedback and determine the feasibility, benefit and scalability of such a project. For example, e-Health Living Lab provides elderly people with the opportunity to try out new medical and healthcare services and a smart energy grids project provides new energy solutions for social housing.

Experimenting in the public sector

The use of “serious games” to support governments and make various options for courses of action visible through systems thinking and futurism has been increasing in the policy arena. This can be a good option to replace conventional brainstorming sessions with sticky notes and drawings on a board.

The European Commission Joint Research Centre (JRC) has worked with experts in these types of games at the Hawaii Research Center for Futures Studies to create the Scenario Exploration System (SES). Participants explore their long-term objectives against scenarios and consider various stakeholders. By creating a realistic journey towards the future, the SES generates a safe space to uncover perspectives and thinking, with a view to simulating possible responses linked to issues of interest to the participants.

The SES is available under a Creative Commons licence, which allows anyone to freely use and modify the game as long as they share the results of their adaptation under the same conditions. The OECD has made details, instructions and templates freely downloadable and available at <https://oe.cd/ses>.

1. See <https://porrentruy.ch/tourisme-economie/visite-de-la-ville/circuit-secret/>.

Source: OECD (2022^[29]), *Enhancing Innovation in Rural Regions: Switzerland*, <https://doi.org/10.1787/307886ff-en>; OECD (2021^[85]), *Embracing Innovation in Government*, OECD, Paris, <https://trends.oecd-opsi.org/> (accessed on 15 June 2023); Smart Rural Areas (2021^[86]), *Penela*, https://www.smartrural21.eu/villages/penela_pt/ (accessed on 15 June 2023); Farmreal (2016^[87]), *Homepage*, <https://farmreal.pt/en> (accessed on 15 June 2023); Deutscher Bundestag (2018^[88]), *Reallabore, Living Labs und Citizen Science-Projekte in Europa*, <https://www.bundestag.de/resource/blob/563290/9d6da7676c82fe6777e6df85c7a7d573/wd-8-020-18-pdf-data.pdf>.

Enhancing the role of the RDAs

The seven RDAs are one of the vehicles by which the Government of Canada can play a direct role in supporting rural innovation. The agencies already provide both technical support and funding to local governments, organisations and firms in both rural and urban areas. Their programmes already support innovation but the focus on innovation in rural areas has not been as strong as in urban areas. This largely reflects the broader focus on innovation policy in Canada on university R&D as the driver of innovation. At present Community Futures-type organisations are central support mechanisms for new and expanding small businesses in the rural regions where they exist.

Based on the insights and analysis presented in this chapter and the rest of the report, a few ways in which the RDAs can advance the agenda for rural innovation could be summarised as follows.

Policy design

Based on the realities of innovators in rural and remote areas, ensure that policies and programmes for innovation reflect the local economic, labour and social structures. This largely means ensuring that policies and programmes focus on supporting smaller and older firms, initiatives to encourage entrepreneurship (new firm formation) and support mechanisms for getting rural firms to start exporting and scaling up. In addition, there needs to be more high-level support for system entrepreneurs, rural leaders, social entrepreneurs and public sector innovation while focusing less on science and technology innovation. Likewise, all policies for (demand-side) innovation will be challenged by (supply-side) labour shortages. Therefore, all programmes need to consider the relatively stronger challenges for youth entrepreneurs, older workers, Indigenous people and women.

Co-ordination and peer learning

There are many challenges that rural entrepreneurs face that go beyond the scope of work for RDAs. The agencies could address these challenges by establishing regular consultative occasions and co-ordination units that provide vital insight for rural-proofing federal, provincial and territorial governments focused on creating the conditions for rural innovation. These include educational programmes for young entrepreneurs, lifelong learning upskilling programmes, social services (such as child care and elderly care) and programmes to encourage partnerships in skills training among Indigenous populations. In addition, RDAs could provide insight into critical infrastructure projects such as broadband and physical infrastructure like roads, ferries and airports, which are rural entrepreneurs' critical lifelines. For on-reserve populations, the federal department Indigenous Services Canada is responsible for improved service delivery and eventual transfer of service delivery to self-governing Indigenous authorities.

Many ideas for rural innovation are already available in Canada. They can be enhanced by creating a platform for peer learning between federal, provincial and territorial agencies and enabling rural leaders and system-level entrepreneurs to demonstrate and network across different rural areas. These individuals are also great resources for providing insight into public sector initiatives.

Simplification of government support services for innovation

RDAs provide a large share of the operating budget of many of these organisations but the business Community Futures organisation's ability to directly fund loans to local firms is limited by the size of its existing revolving loan fund and is unable to provide equity finance, although it can provide subordinated loans.

There are few venture capital funds in rural areas and rural-focused angel investors are rare. Nevertheless, they do exist in some places such as Kenora and Regina and some Indigenous groups play a similar role by taking equity stakes in rural enterprises. But a new venture-type entity is needed for higher rates of commercialisation of innovation in rural areas. The entity could be structured as a social enterprise to support commercialisation but keep the benefits in the community, just as the Business Development Associations created through Community Futures now do. RDAs could operate a new programme that provided seed funding to a "venture-type" rural entity that made equity investments in its region. The long-term success of the BDC revolving loan funds offers the assurance that such a policy could have limited risk and would fill a missing gap that current equity investment firms are not interested in filling.

Overcoming challenges of scale through linkages and networks

In Canada, RDAs operate across provinces and territories and, in doing so, create a macro area functional approach, while at the same time, the legacy institutions of the CFP provide a co-ordination mechanism that creates a level of support that opens avenues and access to financial and in-kind resources in view of supporting innovation and entrepreneurship.

For policy and programme design in rural areas, the scale of interventions for innovation is often more important to consider than in urban areas, particularly in countries with large, sparsely populated areas. In its Northern Sparsely Populated Areas report (2017^[89]), the OECD identifies growth in opportunities for sparsely populated regions as intrinsically linked to immobile assets such as resource endowments, coastal topography or national parks. The challenge for these areas is to focus on how to add value around these factors through skills, innovation, infrastructure and the development of a business environment. In many European countries, building on regional comparative advantages is often supported through what is referred to as a "smart specialisation strategy". This type of strategy is a co-ordinated territorial approach that engages with major stakeholders in building on local comparative advantages. It can provide a platform in which regional development can take a place-based functional approach, engaging relevant stakeholders to support regional development and diversification.

In some cases, local efforts to build scale can be in the form of support for entrepreneurs in overcoming challenges related to distance and access to services. RDAs can easily support these initiatives through networks linking rural entrepreneurs together. One example is the Scottish Rural Leaders Programme, which brings young entrepreneurs from rural regions together to support each other, build business networks and work on solutions. A second example comes from rural Japan, where peer-to-peer partnerships in the sake industry help circulate knowledge, create linkages in supply chains, build firm-to-firm collaborations and promote regional branding. A third example is the European Union's LEADER programme, which focuses on a bottom-up, area-based approach to supporting rural development and innovation. These initiatives are further described in Box 3.10. Lastly, building scale is also enabled through the use of university systems, such as the Quebec CCTTs and university-firm partnerships that can overcome the challenge of scale through the building of a network.

Building an ecosystem of experimentation

RDAs can have a substantial impact on reinforcing innovation by engaging in programmes that build experimentation as part of regular solutions for new challenges. In the spirit of a changing environment, RDAs can incorporate funds for public sector experimentation in service delivery, as well as encourage regular challenge-based programmes to engage with local innovators on finding solutions to service delivery challenges. In addition, working with the local governments, it may also be possible to create opportunities for rural entrepreneurs by discussing regulatory sandboxes in a testing environment while supporting the proliferation of “fab labs”, incubators, accelerators and similar initiatives that build on local skills and ideas for solutions to local challenges.

Re-enforcing Indigenous values in RDA innovation

While many Indigenous businesses are like any other, they can also have unique features such as an emphasis on communal goals, strong links to the land and alignment with Indigenous culture, values and worldviews (Peredo et al., 2004^[90]; Croce, 2017^[91]; Hindle and Lansdowne, 2005^[92]). Recognition of these oft-present characteristics is important in order to design relevant and culturally-acceptable policies and partnerships. Moreover, diverse Indigenous peoples in Canada have specific rights to lands, resources and self-determination, impacting individual and community-led business activities.

All RDAs across Canada also have a mandate to support Indigenous entrepreneurship through the Government of Canada’s inclusive growth agenda and, more specifically, its Innovation and Skills Plan and Investing in Regional Innovation and Development framework. As well as serving non-Indigenous communities, CanNor is unique as it was mandated to support Indigenous economic development at the time of its creation and it operates targeted Indigenous programmes, including the Northern Indigenous Economic Opportunities Program, which includes two streams: community and opportunities planning, and entrepreneurship and business development. A third stream is under development, which would establish a research agenda and target research proposals that can contribute to the territorial Indigenous business ecosystem, major economic sectors or broader regional priorities.

For Canada’s RDAs to be successful in meeting their priorities for Indigenous economic development, they will need to develop strong relations with Indigenous communities and leaders, and adopt a flexible approach to programme delivery. As one positive example, CED introduced flexibilities to its regular programming (i.e. Regional Economic Growth through Innovation and Quebec Economic Development Program for Indigenous-controlled Non-profit Organisations and SMEs). The design of these more flexible intervention parameters resulted from engagement sessions with various Indigenous representatives and are aligned with government priorities. They allow for an intervention with Indigenous communities and beneficiaries that is more tailored to their needs.

Box 3.10. Building linkages to overcome challenges of scale

Scottish Rural Leadership Programme, Scottish Enterprise, Scotland

Since 2006, Scottish Enterprise, an RDA in Scotland, has been running an annual Rural Leadership Programme that engages with business leaders and owners from rural Scotland. The participants come from a wide range of sectors in Scotland, including agriculture, tourism and hospitality, goods and drink, energy, horticulture and the services sector. The programme was developed in partnership with Highlands and Islands Enterprise and the South of Scotland Enterprise. The programme has over 700 leaders that have gone through it as of 2022 and it is expected to grow to close to 900 by 2025.

The programme provides a core 6-month session that builds the capacity of individuals as leaders through workshops, one-on-one coaching to support a growth mindset, building industry and parliamentary connections, and widening personal networks. The rural team at Scottish Enterprise hosted two Global Connection events during the pandemic, connecting rural leaders in Scotland with counterparts in Australia, Canada and the United States.

Peer-to-peer partnerships in the sake industry, Yamagata, Japan

Led by the private sector, in rural Yamagata, business leaders set up a strategy to simultaneously promote linkages between rural sake producers, regional branding and an export strategy that can promote the regional products. Through a local (prefectural) branding initiative, the Yamagata sake industry was given Geographical Indicator (GI) status, which is an indicator of the producer's quality of land, resources and processes. This was a first for the industry (sake, a branch of food and drink). The uniqueness of the Yamagata sake GI is that, although GI protection is normally given to limited local areas, sake GI is given over the whole area of Yamagata prefecture.

As a part of the strategy to attain branded status, the Yamagata Sake Brewery Union association initiated a study that involved focus groups of breweries to help them learn and improve each other's skills. This peer-to-peer partnership is rarely seen in the sake industry as they are competitors for the local market and brewery skills are kept as family secrets. However, in the case of Yamagata, with a shrinking domestic sake market, they changed their market strategy to a collaborative one, now intending to grow international export markets. This export-driven strategy has changed the mindset of the Yamagata sake industry and resulted in a lasting peer-to-peer partnership study group.

European Union's LEADER programme

The acronym LEADER derives from the French phrase "*Liaison entre actions de développement de l'économie rurale*" which means "Links between activities for the development of rural economy". It was introduced in 1991 by the European Commission in response to the failure of traditional, top-down policies to address problems faced by many rural areas in Europe. The idea was to engage the energy and resources of people and local organisations as development actors rather than beneficiaries, empowering them to contribute to the future development of their rural areas by forming area-based local action group partnerships between the public, private and civil sectors. From 2007, LEADER was extended to fisheries policy and made a mandatory component of the European Union's rural development policy. From 2014, the applicability of the LEADER approach was further extended to community-led local development in rural, fisheries and urban areas.

The LEADER approach or method is based on seven specific features: i) a bottom-up approach; ii) an area-based approach; iii) local partnerships with public, private and civil society; iv) an integrated and multi-sectoral strategy; v) networking, including with non-rural areas; vi) innovation in how services are delivered; and vii) co-operation between territories and internationally.

Source: Based on Skills Development Scotland (n.d.^[93]), *Rural Leadership Programme*, <https://www.skillsdevelopmentscotland.co.uk/what-we-do/skills-planning/skills-action-plan-for-rural-scotland/rural-scotland-blogs-and-newsletters/rural-leadership-programme/>; OECD (2022^[94]), *Adapting Regional Policy in Korea: Preparing Regions for Demographic Change*, <https://doi.org/10.1787/6108b2a1-en>.

Implicit in the Northern Sparsely Populated Areas report (OECD, 2017^[89]) is the consideration of a functional area approach to smart specialisation strategies (Box 3.11). Whereas smart specialisation strategies build on local comparative and absolute advantages through consultations and co-ordination with local experts, elected offices, the public sector, businesses and academics, a functional area approach builds on approaches that focus on access to labour and incorporate access to services such as education, health and social services. This approach contributes to a strategy that places rural mobility patterns at the

centre of the policy discussion. It encourages thinking outside of administrative boundaries to areas that are in use and accessible to local communities.

Box 3.11. Smart specialisation in Norway

In the European Union, smart specialisation¹ is an innovative approach that aims to boost growth and jobs in Europe by enabling each region to identify and develop its own competitive advantages. This is a partnership and bottom-up approach and smart specialisation brings together local authorities, academia, business spheres and civil society.

Nordland County Municipality has a smart specialisation strategy (2014-20)² adopted in 2014. This is still valid in anticipation of a new strategy. The focus businesses were:

- **Seafood:** fisheries, fish processing, aquaculture, the food and feed industry.
- **Industry:** process industry which produces metals, minerals, chemicals, metallurgical products and machines, with the mining industry and the hydroelectric power industry as the main suppliers.
- **Experience-based tourism** based on a strong tourism industry with nature as the important framework, and the Lofoten Islands as the cutting edge in the national tourism industry.

In an evaluation of the strategy by SINTEF and Nordland Research Institute (n.d.^[95]), the researchers found that the development policy focuses on place-based strengths, diversifying industrial structure and increasing business research interactions and co-operation. In a co-ordinated place-based approach, the strategy developed and encouraged policy and public support to co-ordinate on a regional level above only local co-ordination efforts. Among other outcomes, the initiative increased the region's capacity for research and innovation offerings and the use of innovation hubs to drive company collaboration.

Similarly, in the Helgeland region of Norway, an initiative to mobilise research-driven innovation in industry focused on enhancing the use of research knowledge in innovation processes in enterprises and clusters as part of a broader smart specialisation strategy, which included a focus on industry, tourism and seafood. The main mechanism was through a tool referred to as knowledge brokering. Knowledge brokering is designed to introduce SMEs to opportunities in collaboration with R&D institutions and to do R&D internally. Not surprisingly, there was a strong synergy between knowledge brokering and another low-level instrument SkatteFunn, which is a tax-deductible R&D relief programme.

1. See <https://s3platform.jrc.ec.europa.eu/about-us>.

2. See <https://s3platform-legacy.jrc.ec.europa.eu/documents/20182/91578/fh.ashx.pdf/3e6d55ab-78f7-499e-8a63-8084676ed787>.

Source: SINTEF/NRI (n.d.^[95]), *First among Smart Regions in Norway. Evaluation of Nordland's Innovation Strategy for Smart Specialisation 2014-2020*, <https://nforsk.brage.unit.no/nforsk-xmlui/handle/11250/2724399>.

Conclusions and findings from case studies

While they are not comprehensive in scope, the study benefitted from six case study visits and research based on qualitative interviews. As such, much of the findings of this report reflect priorities captured through these case studies. The analysis provides an initial glimpse of challenges perceived in different types of rural areas such as those in the remote North, coastal or island communities, highly agriculture-

intense areas, those accessible to urban areas and finally, communities that identify as rural within the boundaries of an urban city. Further information on each of the case studies can be found in Annex 3.A.

While some innovation in rural areas follows the common research-driven approach to creating a solution described in the RIS, a large amount does not. The RIS approach works where there is already a technology that is appropriate to the problem, the presence of sufficient individuals with the skills to follow a science-driven approach, an existing set of supportive institutions, such as university laboratories, adequate levels of funding to carry out a multi-year effort and most importantly a problem amenable to the RIS approach. DoT Technologies, Prairie Lithium and LM Wind Power are clear examples of science-based rural innovation.

In each of the sites visited there was clear evidence of innovation, both by firms, civil society and local governments. Most of these innovations were developed to deal with problems facing the community for which there was no available solution to be purchased or transferred elsewhere. While most innovations were locally focused, several innovations had clear potential to have an impact far beyond the regions. Some of these innovations had an external market focus from their inception, including DoT Technologies in Edenwald, Saskatchewan, LM Wind Power in the Gaspé Peninsula, Quebec, Taalrumiq's high fashion clothing from Tuktoyaktuk, Northwest Territories, and the Shorefast Hotel in Fogo, Newfoundland and Labrador. Others were more locally focused initially but their approach has potential for other places, including the Miisun collaborative forest management strategy in Kenora, Ontario, Bruce Power's support for locally based suppliers in Kincardine, Ontario, or the agri-focused venture capital fund in Regina, Saskatchewan.

Accessible rural areas such as Kincardine and Regina provide interesting examples of growth-oriented rural development and policy discussions where the objective is for rural areas to emulate the innovation processes of dynamic urban areas. In contrast, remote rural areas such as Fogo Island, the Gaspé Peninsula, Inuvik and Kenora provide interesting examples of innovation and development that are instead grounded in an authenticity of rural identity that is in many ways not focused on the same values as urban areas. A summary of the analysis of approaches to rural innovation is provided in Table 3.2.

Table 3.2. Understanding approaches to rural innovation, by typology of regions

Typology	Accessible rural	Remote rural
Case study areas examples	Kincardine (Ontario), Regina (Saskatchewan) Trifecta Model of Dynamic Rural Growth	Fogo Island (Newfoundland and Labrador), Gaspé Peninsula (Quebec), Inuvik (Northwest Territories), Kenora (Ontario) Slow Innovation Rural Flourishing
Type of innovation policy	Cluster development, extension of urban innovation policies: entrepreneurial fostering in school, contextual creative problem-solving, physical spaces for exploring entrepreneurial ideas, etc.	Building collaborative models, refocusing urban innovation policies for remote rural economies: entrepreneurial fostering in school, contextual creative problem-solving, physical spaces for exploring entrepreneurial ideas, often as a multi-purpose facility or shared between communities, etc.
Framework conditions	Easier access to labour, finance, government resources	Significant challenges in access to labour, finance models not well adapted, access to government services are limited
Overcoming challenges of scale	Solutions available through the extension of urban infrastructure and local labour market areas	Infrastructure and interregional/national migration incentives
Assets	Creative class, natural amenities, entrepreneurial context	Artisanal tinkering, natural amenities, cultural attachment to place, strong tourism industry

Typology	Accessible rural	Remote rural
Innovation processes	<ul style="list-style-type: none"> • Division of innovative labour • Creative class spillovers • Slow innovation processors relevant to traditional rural sectors 	<ul style="list-style-type: none"> • Slow innovation • External technological inputs • Experimenting as a requirement for survival • Design integration/appropriateness
Innovation outputs	<ul style="list-style-type: none"> • Productivity • Intellectual property • New products • Spin-offs or start-ups 	<ul style="list-style-type: none"> • Meaningfulness • Aesthetic experience • Productivity or mobilising underutilised assets

In each of these cases, there are areas that seem to have more of a dynamic and developed innovation ecosystem. In Kincardine, the existence of a stable, long-term large employer with a long-term government contract means stable income and demand for jobs. In consultation with the local elected governments, this model for development also benefitted from a co-ordinated approach that was encouraged by reinvestment in the community. The model relevant to Kincardine is easier to describe, explain and discuss with respect to development policy as employment and income growth objectives are accepted without debate. While the success of the Kincardine model is evident, it is not easily reproducible. Nevertheless, places like Regina, which is technically a rural area within a metropolitan area that benefits from accessibility to metropolitan skills, services and opportunities, can be more easily supported by policy interventions that build on the importance of promoting circulation and access to skills and firm-to-firm interactions.

The model relevant to Fogo Island, the Gaspé Peninsula and Inuvik is much more difficult to describe, explain and discuss because it deals with objectives that are less easily quantified and are less commonly included in debates of rural development policy. However, the focus on innovation does provide concrete examples of how this alternative model can contribute to development objectives in resource-constrained environments. While the Kincardine model is not applicable or translatable to places like Fogo Island, the Gaspé Peninsula or Inuvik, dynamic rural growth models may benefit from some of the “slow innovation” processes that characterise remote rural areas.

Far more firm-based rural innovation follows the doing-using-interacting approach described by Isaksen and Karlsen (2016^[20]). This does not mean it is not a purposeful process but involves a different approach. For example, the Fogo Island fishing co-operative knew that to be competitive in both the crab and the sea cucumber global markets, it needed a processing technology that lowered costs, improved quality and allowed increased production volumes. Working collaboratively with the Fisheries and Marine Institute of Memorial University and another university partner, both new machines and a new processing line were designed in an iterative process focused on satisfying the co-op’s requirements. At a smaller scale, Innovate in Inuvik works with artists to determine what part of their production process can be automated and how new technologies can allow them to extend their artistic capacity in new ways. The goal is to make them more successful in the market and allow them to operate a viable business.

Social innovation is particularly important in rural areas because it fills in the gaps caused by a truncated market economy that provides only a limited number of goods and services and local governments that have to few resources to deliver any more than essential services. In rural and remote regions, high levels of social capital may be more important for economic and social development because it can increase social innovation. In Canadian rural regions where there are significant numbers of Indigenous people, especially both the provincial and territorial North, social innovation is especially important as a way to expand economic opportunities in societies that have different social and economic norms and as a bridge between Indigenous and non-Indigenous firms and governments, as is the case in Kenora where there is a joint effort to construct a shared hospital and where Miisunn provides a model of shared forest management.

The current federal innovation policy has an inherent urban bias because of its strong focus on the RIS approach and because a very large share of federal funds flows through universities. In every place, the innovations observed were supported by a significant infusion of external funds that provided firms, civil society and governments with the additional resources they needed and the time to create a new product, process or way of delivering services. While rural areas may have adequate access to credit for conventional purposes – buying a car or home, or starting a conventional small business – rural financial intermediaries are largely limited to standardised consumer and business debt instruments. There is a definite lack of equity capital and also a limited capacity to evaluate the unconventional investment opportunities that are the hallmark of innovations. Support from the federal government, especially from the RDAs, was especially important for improving economic conditions and constructing essential infrastructure. While evidence of federal support for innovation in rural areas was available, it did not appear to be provided in a systematic way and there was considerable variability among the RDAs in how that supported innovation. Other agencies supporting research, such as the Natural Sciences and Engineering Research Council of Canada and the three core research funding councils, had some presence in rural areas that had a higher education institution but were not actors in most places that did not have one.

In most cases, provincial and territorial innovation policies follow the national government approach as doing so increases their access to federal funds. Quebec and Saskatchewan are more strategic in their approach, allowing them to better support innovation in rural areas. In both these cases, there has been considerable reliance on crown corporations to either attract external support for innovation through procurement policy or use the corporations to bring innovative production to rural regions, especially in Saskatchewan. Social innovation is now part of the 2022-27 Quebec Research and Investment in Innovation Strategy. To support research and investment in innovation, Employment and Social Development Canada established a Social Innovation and Social Finance (SI/SF) Strategy with CAD 755 million from the Social Finance Fund to support charities, non-profits, social enterprises, co-operatives and other social purpose organisations in accessing flexible financing opportunities. Greater access to social finance through the Social Finance Fund will help them grow, innovate and enhance their social and environmental impacts.

Annex 3.A. A review of provincial and territorial innovation and further information on case study areas

This part of the report provides a brief overview of each of the communities visited and a description of innovations observed. These innovations are, for the most part, locally developed solutions to a significant problem or are responses to a perceived local opportunity. Few evolved from standard regional innovation system (RIS) approaches and many were brought about by local civil society. Communities are discussed in visiting order, from first to last.

Provincial and territorial innovation system

Newfoundland and Labrador

In Newfoundland and Labrador, responsibility for rural development resides with the Ministry of Industry and Economic Development. This body is also responsible for the broadband portfolio of the province. Several regional development officers support regions in their ability to access a portfolio of community and economic development programmes, such as loan assessments and community development initiatives. Other departments contributing to economic development activities cover immigration, population growth and skills education, advanced education, skills and labour, and municipal and provincial affairs.

In Newfoundland and Labrador, the provincial innovation system largely follows the standard science-based, technology-focused approach based on formal research and development (Phillips and Castle, 2022, pp. 119-125^[8]). This innovation architecture is focused on the St John's metropolitan area, with the Memorial University of Newfoundland as the central hub that connects federal and provincial support with a variety of technology firms operating primarily but not exclusively in key natural resource sectors. The Atlantic Canada Opportunities Agency (ACOA) is identified as a key player in this process, providing support both to the university and innovative technology-oriented businesses (Phillips and Castle, 2022, p. 120^[8]). The oil and gas industry has also been a major source of support for innovation efforts partly driven by the need to adapt technologies for the specific drilling environment and partly due to provincial requirements for ancillary investments, such as in Indigenous communities, as specified in drilling leases. The Newfoundland and Labrador Oil and Gas Innovation and Business Development Fund²² is a 10-year, CAD 60 million fund with an annual budget of CAD 6 million to facilitate collaboration, investment and industry growth required to position the province globally as a preferred location for oil and gas development. The needs of rural communities are neither articulated nor prioritised in this fund (Krawchenko et al., 2022^[46]).

Currently, the province uses the Department of Tourism, Culture, Industry and Innovation as the lead agency supporting innovation. While responsibility for innovation policy has been located in a number of departments over time, the core programmes have remained relatively stable since 2000, although the level of funding has varied with provincial royalties from oil and gas extraction (Phillips and Castle, 2022, pp. 119-120^[8]). Because the province is geographically large, with a small highly dispersed population, only one metropolitan area and highly dependent on resource industries, innovation is challenging,

especially outside the St. John's area. This includes all phases, from conceiving a potential opportunity to acting on creating the concept and bringing it to commercial fruition.

In sum, the province has developed an innovation architecture that largely follows the national science-based, technology-oriented approach, which has worked well in St John's because it has the implementation capacity. Certainly, benefits from St John's-based innovations have spun off to other areas of the province in the form of technology transfer and higher provincial tax revenue that funds public services. In addition, parts of Memorial University, particularly the Marine Institute, play an important role in supporting customer-driven innovation in the fisheries sector, as observed in Fogo Island. Similarly, ACOA provides essential financial and technical support to both rural firms and new entrepreneurs through its direct lending programmes and ongoing support for Community Futures organisations. Crucially, rural areas in the province are facing a critical workforce shortage, which can only be addressed by innovations in processing to reduce labour requirements and increase productivity. The province has recently introduced regional innovation pilot projects in a number of rural areas (Phillips and Castle, 2022, p. 129^[8]), which may provide a path to a more geographically balanced innovation policy.

Northwest Territories

The Northwest Territories (NWT) have their own challenges based on geography and human settlement patterns. Compared to the provinces, the territorial North lacks the population, research capacity, investment capital and consistent commercial interest needed to create and sustain an innovation ecosystem (Coates and McPhee-Knowles, 2022, p. 342^[96]). With devolution, territorial governments have gained authority; however, they are heavily reliant on federal transfers compared to the provinces, which impacts their capacity. The majority of the NWT are covered by modern treaty lands and Indigenous peoples in the NWT have established co-management regulatory regimes. In addition, there are only a couple of reserves and the majority of Indigenous peoples live in hamlets. The need for innovation in the North is particularly high because of the combination of climate, small dispersed populations, high transport costs and the need for infrastructure adapted to permafrost conditions. Climate change has exacerbated the need for new solutions as permafrost thawing alters transport and building conditions.

The lead department for rural development in the NWT is the Department of Industry, Tourism and Investment. The region's primary rural economic development strategy, the Sustainable Livelihoods Action Plan²³ is the responsibility of a different unit, the Department of Environment and Natural Resources. The government has made efforts to articulate its respect for local knowledge. A policy²⁴ was made to this effect in 2005 and the NWT has a higher relative proportion of approaches addressing the needs of rural communities than other regions in Canada (Krawchenko et al., 2022^[46]).

While the government of the Northwest Territories does not have a formal innovation policy embedded in a department, it is developing an Action Plan on the Knowledge Economy. In a recent legislative address, the minister responsible for the action plan identified important innovations in the NWT that are part of the knowledge economy, including the Inuvik satellite stations (one public and one private) that manage uploads and downloads for a large share of polar-orbiting satellites, the expanding Arctic research programme at the three campuses of Aurora College and the Innovate Centre for Arts, Crafts and Technology in Inuvik that focuses on helping Indigenous craft producers use modern technologies to increase their productivity to allow them to move to full commercial scale. Financial support from CanNor, the Natural Sciences and Engineering Research Council of Canada and other federal agencies played important roles in these activities.

The standard innovation policy approach faces substantial challenges in the territories (Coates and McPhee-Knowles, 2022^[96]). In part, this is because the opportunities for scale do not exist and there are insufficient scientific or financial resources; a simple technology transfer from the south will not be enough (Coates and McPhee-Knowles, 2022, p. 345^[96]). Innovation will be crucial in the NWT if it is to advance environmentally, socially and economically. A clear opportunity lies in innovation by Indigenous people.

“Indigenous economic development corporations and Indigenous-owned companies speak of taking the long-term view of economic transition that is important to many forms of innovation” (p. 345^[96]). The Inuvialuit Regional Corporation is a clear example of this with its mix of profit-oriented and social enterprise programmes. The corporation was established to manage the Inuvialuit Final Agreement. It has subsidiary bodies such as the Inuvialuit Development Corporation (for-profit arm) and the Inuvialuit Community Economic Development Organization, which runs the “country food” programme. Construction companies and forestry companies may not be inherently innovative, but they can be managed in ways that increase employment and skill development opportunities for Indigenous people while still generating a profit, as observed in field research. The “country food” project is an innovative social enterprise that provides free high-quality game to Inuvialuit settlements by buying carcasses from Inuvialuit hunters, processing them in a modern central facility that uses solar energy to power container-size freezers and distributing boxes of family-sized portions to the six Inuvialuit communities.

Ontario

Ontario has a strong innovation policy that operates both at the provincial and regional levels. While innovation policy has evolved as provincial governments change, it has largely focused on manufacturing and is cluster-focused (Mastroeni, 2022, p. 224^[97]). There has also been a clear focus on supporting applied research centres, typically located at universities, and on skill development programmes and supporting start-ups (p. 224^[97]). Mastroeni suggests that while Ontario’s innovation policy has always recognised the value of federal innovation funding support, there has been little effort to align provincial programmes with federal priorities (p. 242^[97]). In part, differences in the political orientation of provinces and the federal government impact the lack of co-ordination.

Ontario does not have a rural development strategy but has a ministry with rural in its name, the Ministry of Agriculture, Food and Rural Affairs. As a concept within Ontario, rural appears to be associated with a more traditional lens of agriculture and food, similar to Alberta. Rural is not integrated into sector approaches, although a few broad rural programmes are delivered by a variety of ministries, including a broadband strategy (Krawchenko et al., 2022^[46]).

Ontario has the majority of the research-intensive universities in Canada and the provincial university and college system is large and well-distributed across the southern part of the province, particularly along the Highway 401 corridor between Windsor and the provincial border with Quebec. However, in Northern Ontario, there is a limited presence of both universities and colleges, limiting the effectiveness of a provincial innovation ecosystem built around higher education institutions (HEIs).

The Ministry of Research and Innovation currently directs the provinces’ innovation policy and programmes; some version of this ministry has been in place since 2005. A central element of the province’s innovation approach is the Ontario Centres of Excellence, established in 1987 and renamed the Ontario Centre of Innovation (OCI) in 2021. The main function of the OCI remains trying to better connect university research to industry needs while providing financial support for innovative R&D conducted at provincial universities, colleges and hospitals. A unique element of the support is the Voucher for Innovation and Productivity, which is provided to for-profit firms to facilitate their collaboration with academic researchers. The cost-sharing voucher (maximum of 50% of project costs) can only be used for R&D purposes but because the firm has greater control over the specific R&D activity, it increases the likelihood of the research leading to commercialisation. The OCI also currently has funding programmes for pre-commercial development of fifth-generation technology standard for cellular networks (5G) technologies and autonomous vehicle development focused on winter driving conditions.

The province operates 17 regional innovation centres (RICs) that support entrepreneurs and early-growth innovation and technology companies in developing marketing strategies, preparing financial plans to attract investment funding, and developing staffing strategies. Most of these are in Southern Ontario. Individual RICs emphasise different approaches to how they deliver support that best fit the needs of the

region but all can provide basic support to new and growing firms and help them identify sources of government support from different federal and provincial agencies, as well as potential private sources of debt and equity finance.

Ontario has both a core set of provincial programmes that support innovation and a distinct set of regional institutions that provide more focused support to specific regions. In general, the innovation ecosystem is designed to take advantage of provincial strengths in university, college and hospital institutions and build on Ontario's strong manufacturing industries and proximity to key United States markets. Very limited attention seems to be paid to the possibility of rural innovation in the more remote rural parts of the province, particularly the provincial north. Of the two case studies, the provincial ecosystem most clearly benefits the town of Kincardine, which is near several major research universities, even though it does not have one, while Kenora receives more limited support, even though it hosts a branch office of one of the RICs.

Kenora, Ontario

The main manufacturing sector in the city of Kenora remains forest and wood products and, while it is considerably smaller than at its peak several decades ago, it has modernised both in terms of forest management and production technologies. Federal resources, mainly through FedNor, have supported the process, as have Natural Resources Canada and other departments. But, because natural resources are a provincial responsibility and, in particular, because most of the land in Northern Ontario is Crown land under the direct control of the province, provincial policy through the Ontario Ministry of Natural Resources and Forestry has the dominant role.

However, the innovation ecosystem in Ontario has a largely urban orientation that relies on collaboration between higher education and firms as the main way to drive innovation. While Kenora has branch facilities of Confederation College, they offer limited courses and have only a small local staff. Lakehead in Thunder Bay is the closest medium-sized Ontario university to Kenora, which is over 480 kilometres away. Kenora is much closer to the major metropolitan area of Winnipeg, which is in a different province, making Kenora ineligible for Manitoba's provincial support systems, even though it is only a little over two hours to Winnipeg while the provincial border is less than an hour's drive away.

Kincardine, Ontario

Kincardine fits clearly into the focus of Ontario's innovation policy. The Bruce Nuclear Generating Station (Bruce Power) and its surrounding cluster of nuclear-related support firms create a technology cluster that can easily link to major proximate universities in Hamilton, London, Waterloo and even Toronto. Each of these cities also has RICs and this provides opportunities for firms to take advantage of access to both higher education and provincial government support mechanisms. The large number of science, technology, engineering and mathematics (STEM) employment opportunities in Kincardine attracts a highly skilled labour force that also has the opportunity for entrepreneurship and there are examples of new firms initially formed in Kincardine by individuals who moved there to take advantage of opportunities to serve Bruce Power.

Critically, one of the challenges of the model of innovation latent in Kincardine, as well as several other small communities including Fogo Island, is innovation in the face of one or two dominant employers. In the case of Kincardine, Bruce Power conducts some research activities within its nuclear reactors when going through a cleaning period (for example, to make isotopes used in the treatment of cancer patients) and critically provides ample opportunity for engagement with local actors and reinvestment into the community to encourage a dynamic innovation ecosystem. However, it does so under the unique condition of low to no competition and a long-term contract for the provision of public services. This stable condition, while not replicable in most other industries, limits competition and innovation within the same industry. However, given the nuclear industry's large fixed costs and regulatory limitations, such a condition is nearly inevitable. Given this context, innovation is still possible despite the dominance of few employers. In part,

this has been facilitated by open and clear partnerships with local elected and public sector officials, the active reinvestment of the large firm into developing a mutually beneficial ecosystem of support industries for the nuclear firm (for example, through the use of robotics for nuclear testing and validation) and a high-level commitment for local sourcing of supply chain materials (such as packaging for nuclear equipment exports).

Quebec

Quebec arguably has the most coherent provincial innovation policy. It has a provincial overlay that establishes a broad strategy across multiple sectors and a regional layer that focuses on specific local opportunities. While Quebec's innovation policies are not the same as those of the federal government, it has constructed the structure of its provincial organisation to closely align with that of the federal government to facilitate access to funding (Gingras, 2022, p. 205^[98]). As a result, Quebec seems to capture a larger share of federal R&D outlays to universities than its share of the national population would suggest (p. 212^[98]). Quebec's support for innovation came from the recognition in the 1980s that it had few firms that were significantly engaged in R&D and that its competitiveness was declining as a result (p. 209^[98]). The policy response was to use the existing provincial system of universities and colleges as a way to stimulate applied public R&D by higher education units on key sectors through co-ordinated team research that linked individuals at more than one institution on a single topic (pp. 209-210^[98]). The Quebec Research and Innovation Strategy (*Stratégie québécoise de la recherche et de l'innovation*)²⁵ focusses on skills, research and commercialisation but makes no mention of rural opportunities or priorities (Krawchenko et al., 2022^[46]). Quebec does, however, integrate innovation to a degree into its regional planning through the use of "signature innovation"²⁶ projects. This is regional/territorial development framing and includes smaller, rural communities by default. Quebec also has a Quebec Energy Transition, Innovation and Efficiency Master Plan,²⁷ which makes no mention of rural priorities (Krawchenko et al., 2022^[46]).

Compared to Ontario, the only other province with a somewhat similar size population, Quebec has a more integrated system of universities and colleges that are more broadly distributed across the settled territory. Regional universities have developed specialised programmes that reflect local opportunities, for example the Université de Québec à Rimouski specialises in fisheries and is one of the networks of Universities of Quebec specially designed to connect with territories (OECD, 2023^[50]). Similarly, community colleges (CEGEPs) have core academic programmes but have one or more *Centres collegiaux de transfert technologique* or technology transfer centres (CCTTs) that combine applied research with industry support and workforce training. Programmes at CCTTs are also specific to regional economic development opportunities and support the integration of entrepreneurship. For example, the CEGEP in the Gaspé Peninsula has 3 CCTTs wind power, fisheries and social innovation that co-ordinate their activities with other CEGEPs with similar interests.

Within the provincial government of Quebec, there is the will and the ability to co-ordinate the actions of various departments and agencies to work toward induced innovation. The federal-provincial dynamic is well co-ordinated. Innovation policies in the province are not only different from federal ones; the provincial government supports federal initiatives (Phillips and Castle, 2022^[8]). In the Gaspé Peninsula, the wind turbine cluster was driven initially by the creation of procurement requirements in a large tender request by Hydro Quebec for wind turbines that specified turbine blades and towers would have to be manufactured in the peninsula. The wind power CCTT was created in parallel to support the development of a new cluster that could strengthen the regional economy. Financial support was provided by the province and by the federal regional development office CED. More than a decade later, the turbine blade facility has expanded to be the largest local employer and a number of small firms specialising in turbine installation and repair have emerged in the community as well as few turbine component manufacturers. In a small rural labour market that is largely dependent on seasonal employment, the cluster offers high-paying stable jobs.

In Quebec, while federal funds play the largest role in funding R&D, it is clear that the provincial government determines innovation policy and federal policies are used to support provincial goals. As in most provinces, there is a tension between urban-focused clusters that rely on a strong integration among firms, government and universities and fostering innovation in more peripheral rural areas. However, in Quebec, only Montreal has the capacity to support this approach to innovation, which has allowed a broader perspective on innovation policy. Possibly because of the unique cultural conditions in Quebec, the provincial government has developed an effective innovation policy that can be implemented across much of the province in small and medium-sized communities. It, too, relies on interaction among government, firms and higher education but at a lower level of capacity and complexity. The result is still cluster-based development but at a smaller scale and lower level of technology that is appropriate for conditions in rural localities.

Saskatchewan

Saskatchewan provides a powerful example of how conventional science-based innovation policy can not only co-exist with but also be reinforced by innovative actions driven by the actions of firms, civil society and local governments. Phillips and Ballantyne observe that Saskatchewan would seem to be an unlikely place to find innovation; yet there has been a long history of significant innovations occurring across the province (2022, p. 265^[99]). They attribute this to the province being both reliant on global export markets for much of its output and being far from these markets, so transport costs are significant. This has forced firms in the province to continuously innovate to increase productivity to remain competitive. In addition, the province has relied on both government and civil society to support economic development in creative ways through the extensive use of crown corporations and co-operatives (Phillips and Ballantyne, 2022, p. 266^[99]).

Saskatchewan's lead ministry for rural development is the Ministry of Trade and Export Development. There is no specific rural development document or strategy. Saskatchewan's Growth Plan²⁸ is the primary economic development document outlining priorities for all families and communities in the province. This document identifies that the Ministry of Government Relations, Municipal Infrastructure and Finance will support CAD 2.5 billion in revenue sharing and CAD 30 billion in infrastructure for Saskatchewan communities over the next decade.

A large share of the innovations in the province are in resource industries (agriculture, forestry, mining and energy) and in first-stage processing since these are the strengths of the provincial economy. In addition, the province has been a leader in developing credit unions as a core part of the financial intermediation process and in expanding their role beyond consumer finance. Farmer co-operatives continue to play a key role in rural areas and are an important mechanism for producers to directly fund R&D that is directed to their needs. In the 20th century, the provincial government played a central role in the economy through direct ownership of major firms. Even now, public ownership of utilities remains common and while many crown corporations have been privatised, this was after they reached a point where it was clear they could be viable commercial firms.

Conventional university-focused innovation policy is mainly found in Regina and Saskatoon, both of which have research-oriented universities and colleges. However, to a great extent, the formal R&D undertaken in these cities is geared toward application in rural areas. The University of Saskatchewan has a strong strength in agricultural research and the University of Regina has developed an incubator/accelerator programme with a strong focus on agriculture as well as an agriculture technology-focused venture capital fund. Outside the cities, there is a strong tradition of farm-based user innovation where individuals experiment to develop better methods for producing crops or create new types of machinery to increase their productivity. The Humboldt area has a strong farm machinery cluster based largely on SMEs that had their origins in farmer innovations (Phillips and Ballantyne, 2022, p. 275^[99]). The most recent example is

the autonomous DoT Industries tractor CNH Industrial, a multinational farm equipment manufacturer, has recently acquired.

Formal provincial support for innovation is relatively modest when compared to other provinces but it is more focused and highly reliant on federal and provincial funding (Phillips and Ballantyne, 2022, p. 270^[99]). Biosciences, particularly agriculture, is the main focus, but there is emerging competency in mining and energy in uranium, potash and heavy oils, with most of these companies having their origins as crown corporations (2022, pp. 270-271^[99]). With limited resources and a small local market, the focus on core competencies in Saskatchewan has led to innovations developed both by formal R&D and by firms and individuals that complement each other. Federal support has been central to this process, with the core federal R&D funding agencies supporting science-based innovation and PrairiesCan and other agencies supporting smaller-scale innovations outside the two major cities.

Case 1: Kenora, Ontario

City of Kenora

The city of Kenora is located on the shore of Lake of the Woods in the Northwestern corner of Ontario, close to the Manitoba border. The city is also the administrative seat for the Kenora District and census division, which encompasses 37% of Ontario, with an area of 407 000 km². The city hosts the administrative offices of three First Nations communities located in the district. The city has a population of about 15 000 inhabitants, while the district has a population of about 65 000. Local government exists in the organised settlements in the district, including reserves, but the district itself provides no government functions.

Kenora is located on the Trans-Canada Highway, with a by-pass around the city and on the Canadian Pacific Railway East-West main line, which passes through the city. It is about a 2.5-hour drive from Winnipeg, Manitoba, the closest major urban centre and the source of most people with seasonal homes in the region. Since Kenora is the largest city in Northwestern Ontario, it has both federal and provincial government offices and is a regional healthcare centre. The local Northwestern Ontario Innovation Centre branch office is located in Kenora. In addition, the city hosts administrative offices for a number of First Nations bands. First Nations and Métis people each make up about 10% of the city population but are a larger share of the region's population. Kenora has a branch campus of Thunder Bay-based Confederation College that provides access to some academic and technical post-secondary courses. It also hosts a provincially funded Contact North site that allows online access to a large variety of programmes and services offered by universities and colleges across Ontario.

In the 20th century, the economy of the city was dominated by the forest sector, including a large pulp and paper mill that was the largest private sector employer in Kenora before it closed in 2006. As the second-largest community in Northwestern Ontario, Kenora also provides important retail and public service functions for the local population and communities in the larger region. Lake of the Woods has historically been a major tourist destination. As Winnipeg has grown, the importance of both seasonal cottage owners and shorter-term visitors has increased in Kenora and nearby lakes. In the summer, the population of the area around Kenora and the city roughly doubles due to visitors and the need for short-term labour to serve visitors.

Peak employment in the mill was about 1 200 employees but, when it closed in 2006, it employed about 320 people. The mill's capacity had been reduced over the years as demand for its paper fell. When the mill closed, it provided the city with about CAD 2 million in property tax revenue and was estimated to have a total local economic impact of CAD 26 million. Despite the closure, the forest sector remains important. Weyerhaeuser opened a new engineered lumber mill in 2002 that makes laminated strand construction

components and there are several existing sawmills. Further plans are in place to relocate and reopen the Kenora Forest Products sawmill that closed in 2019.

Closure ultimately led to a new effort to redevelop Kenora to increase tourism's contribution and attract new types of businesses looking for a high-amenity environment. Major efforts to improve both the waterfront and Main Street have been undertaken but with only limited impact. Notably, the effort brought together city leaders and leaders of the local First Nations bands to try to find common opportunities across their shared geography. There is a recognition that future joint activity remains necessary and better mechanisms for collaboration are required. In particular, better integration of the local labour force is needed both to meet employers' needs and ensure adequate employment opportunities for First Nations members. This includes improving skill development opportunities that are connected to actual employment opportunities.

Kenora has clear geographic advantages but also geographic challenges. Lake of the Woods is a major visitor attraction in the summer, both for conventional tourism and seasonal homeowners. The forest products industry and mining both provide additional development opportunities. However, the community and region are isolated from the core economic and political power centres of Ontario, which can cause problems in ensuring that provincial policy is compatible with the development needs of the region. Proximity to Winnipeg, a major population centre, can offset some of this distance penalty, especially for seasonal visitors and access to higher education, but only the provincial government of Ontario can address the infrastructure and social programme needs in Kenora.

Currently, the economy is highly seasonal, with a clear drop in economic activity and population in winter months as summer home residents leave. A large seasonal population has several consequences. First, they create competition for a small stock of housing and typically can afford to pay more than permanent residents, exacerbating the housing shortage. The second is that summer residents can lead to a summer spike in demand for some public and private services, which can lead to excess capacity being created that is underutilised in other months. In turn, this leads to less efficiency and lower productivity in the local economy. In addition, summer residents are often not very engaged with the local society, as their main focus is on the community where their main residence is located.

Examples of innovative activities

FSET

FSET is a small digital service provider specialising in supporting telecommunications services in isolated communities with a particular focus on law enforcement information technology, particularly “real-time” access to records, digital evidence management and systems integration. It also supports small hospitals, remote school systems and local governments with similar products. Their particular niche is providing institutions in very small remote communities with access to current technology so their procedures and records comply with the large province-wide regulatory and data systems they are part of.

Notably, FSET worked directly with Starlink (and SpaceX) in 2020 to enable the isolated reserve of the Pikangikum First Nation to become the first community in Canada to have Starlink services. Pikangikum is located 250 km north of Kenora on Turtle Island and has about 2 000 residents. Before installing the Starlink system, the entire community shared a single 1-gigabyte connection.²⁹ Since then, FSET has helped install 4 289 Starlink kits in 109 remote communities in northern Canada.

All Nations Hospital

The city of Kenora began working with local First Nations and Métis governments in 2017 to build a single hospital that will serve all residents in the regions. Typically, through the Ministry of Health, the provincial government builds hospitals in non-Indigenous communities, while the federal government builds specific healthcare facilities and hospitals for Indigenous people. With this process, the region would wind up with

two smaller hospitals that would each be sized for one portion of the total population. Building a single hospital would be both more cost-effective and allow a larger set of services to be provided locally. Planning for the new All Nations Hospital has already reached the point of submitting the main proposal to the Ontario Ministry of Health in 2021 for its analysis. Since both the city and First Nations endorse the process and the plan accommodates the needs of both groups, the remaining hurdle is securing provincial and federal support to allow the hospital to open in 2027.

Sustainable forest management

The province of Ontario controls the vast majority of the land in Northern Ontario as Crown land but can make it available for specific uses, such as timber harvest. First Nations in the north still have unresolved land claims on some of this land and have long objected to previous forest management practices. Ontario now requires all proposals for forest management to meet sustainability objectives. Three distinct entities were developed 14 years ago to put in place an innovative forest management approach in the Kenora District of Northwestern Ontario. The approach combines the interests of a number of First Nation bands in having forests on their traditional lands managed to achieve a better balance of harvested wood and non-wood benefits in the form of wildlife, other plant species and environmental and cultural sustainability with the needs of local wood processors to have a stable supply of wood for their mills.

The three entities are:

- The Miitigoog Trust is a not-for-profit organisation that is jointly held by eight First Nations bands with land claims stretching over significant portions of the Kenora Forest and Whiskey Jack Forest in Northwestern Ontario.
- The Miitigoog Limited Partnership is the entity that links the forest management interests of the Miitigoog Trust with the timber needs of the local mills. The Miitigoog Limited Partnership holds the license to manage forests that the Ontario Government issues. It consists of two categories of members: a general partner and limited partners. The Miitigoog General Partner LLC is the specific entity that brings together the First Nations members with the local timber processing industry. It has 2 types of shareholders, with each group holding 50% ownership. The first is the Miitigoog Trust, which provides four directors drawn from the bands that are current members of the trust. The second is made up of local wood processors that also have four directors chosen from their members.
- Miisun, a wholly owned subsidiary of the Miitigoog Trust, provides actual day-to-day management of the forests and has a road construction arm that develops and maintains logging roads as needed. The objective of Miisun is to generate revenue for the trust while respecting traditional First Nations values for forest use and its practices are certified by the Sustainable Forestry Institute, an international organisation that accredits forest management firms.

Miisun conducts annual timber harvests on the land according to the terms of each management plan and market conditions and makes this wood available at prevailing market prices to firms that participate through the Miitigoog General Partner function. The firms have first right of refusal; if they do not purchase all the wood, the balance is sold through other markets. Profits earned by Miisun are transferred to the Miitigoog Trust for distribution to member bands or other purposes. While timber processors pay market prices for wood, they can benefit in other ways. The first is they have a stable relationship with the forest managers, which can facilitate a more predictable supply of wood and more consistent quality since the general partner is directly engaged in setting the terms of the management contract. In addition, they can use the connection to Miitigoog to certify the sustainability of the wood they supply and may find it beneficial to highlight their engagement with First Nations in timber management when marketing their products.

The success of the model, which was first introduced in 2010 in the Kenora Forest, is shown by: the stable participation of the forest products companies; the increasing number of First Nations who are participating as limited partners, with five new members joining between 2012 and 2021; the ability of Miitigoog General

Partner to obtain management rights to the Whiskey Jack Forest in 2012; the introduction of a successful road construction enterprise in 2014; renewal of the Whiskey Jack Forest Management license in 2020; and renewal of certification as complying with the principles of the Sustainable Forestry Institute in 2021.

IISD Experimental Lakes Area (IISD-ELA)

Located in Northwestern Ontario, the IISD-ELA is a laboratory established in a rural, remote area, initially through public funding and increasingly through collaborations with the private sector and international research initiatives. Since 1968, IISD-ELA's scientists have collected the most comprehensive datasets on freshwater lakes in the world, used for regional and global climate modelling, and its effects on freshwater lakes and the plants and animals that depend on them.

The work focuses on understanding the impacts of climate change, agricultural runoff, water management and contaminants such as mercury, organic pollutants and other chemical substances. It is a natural laboratory with 58 small lakes and watersheds set aside for scientific resources. More recent collaborations have been on the impact of algal blooms, oil spills, pharmaceuticals in water and mercury pollution. The centre serves jointly as a research laboratory and a policy platform to help provide evidence for policy making in Ontario, Canada, and internationally.

Case 2: Regina, Saskatchewan

The rural municipality of Edenwald and the city of Regina, Saskatchewan

This case study has two distinct elements since Edenwald is located within the metropolitan area of Regina, making it rural within a metropolitan region. Consequently, it benefits from the city of Regina's strong support of agriculture and its own actions. Within the rural municipalities (RMs), the site visits took place in the town of White City and the unincorporated community of Emerald Park.

In 2021, the Regina metropolitan area had a population of about 250 000 people, making it the 18th largest census metropolitan area (CMA) in Canada. Within the CMA, the city of Regina had a population of 226 000, with the balance residing in 6 RMs, including the RM of Sherwood that contains Regina, while the others are adjacent to Sherwood. In Saskatchewan, RMs are self-governing entities that have local administrative and taxing powers devolved from the provincial government. The review focuses on the adjacent RM of Edenwald, which had a population in 2021 of just over 5 000 people. The RM is an example of a rural region within the boundaries of a metropolitan area. Its location has provided it the opportunity to link to urban services available within the city of Regina and take advantage of close links to the core agricultural industry of the province.

The economy of Saskatchewan remains highly resource-dependent, with mining and energy accounting for 26% of GDP and agriculture contributing about 10% in 2020. The agricultural sector currently provides over 7% of employment in Saskatchewan and in 2020 agri-food exports of CAD 16.9 billion accounted for 23% of Canada's total agri-food exports and over 55% of Saskatchewan's total exports. Saskatchewan has 40% of the arable land in Canada but is also the province most distant from global markets and is landlocked. Because of climatic conditions, farms have a limited range of crop options, most of which are commodities where prices are set globally. With high transport costs for Saskatchewan producers, the profitability of farming in the province hinges on maintaining high productivity rates driven by creating and adopting new technologies. This high dependence on farming has led both major cities in the province, Regina and Saskatoon, to see supporting farming as vital to their economic growth.

The Greater Regina Area (GRA) extends beyond the metropolitan area. Regina is located in Treaty 4 territory, the ancestral lands of the Cree, Dakota, Lakota, Nakoda, Saukteaux and homeland of the Métis. Individual bands reside on reserves mainly distributed across rural territory in southern Saskatchewan. Increasingly, First Nations in Canada are embarking on self-directed development initiatives that adopt

innovative modern investment approaches to build band wealth and improve economic and social opportunities for members.

The historic importance of agriculture to the GRA was identified in the city's economic growth plan for 2020-30, which was released in 2019. While the GRA already had core strengths in traditional areas of grain marketing, agricultural finance and fertiliser production, opportunities were identified in bringing new technologies to farming and new opportunities for adding value to major commodities. In addition, Regina hosts two major agricultural trade shows each year that attract international exhibitors and visitors. Facilities already exist for hosting other events, especially if Regina can be identified as a leader in fostering agricultural innovation. Thus, while Regina is a medium-sized metropolitan region in OECD terms, it is a source of innovation that is specifically designed to be used in rural areas.

In 2021, Economic Development Regina worked with key industry stakeholders to develop Regina's Agriculture and Food Innovation Strategy, which recognises opportunities both within the city and across the GRA. The strategy identifies several key objectives, including: providing new locally developed and manufactured technologies to primary producers to improve productivity; expanding first-stage processing, which can increase local value-added; capitalising on the city's world-class transportation and logistics infrastructure; stimulating agricultural-related innovations; and working with Regina's post-secondary education institutions (including the University of Regina and First Nations University of Canada plus the Regina campus of Saskatchewan Polytechnic) to prepare the local workforce for employment opportunities generated by the agriculture and food sector.

Regina hopes to expand its rail and road transport infrastructure to allow an increased volume of shipments and better logistics management. Stimulating agricultural-related innovations is a central task for the strategy. With its existing agricultural trade shows, significant potential exists to host other agriculture-focused events as Regina establishes itself as a leader in agriculture and agrotechnology. Thus, while Regina is a medium-sized metropolitan region in OECD terms, the innovation it generates is specifically designed to be used in a much broader area.

Examples of innovative activities

Cultivator

Conexus, the Saskatchewan Credit Union central agency, founded Cultivator in 2019 as a technology innovation hub with a particular interest in agriculture. The facility, located on the University of Regina campus, provides three levels of support for founders in any sector: "start", for emerging businesses trying to validate their concept, "grow", for firms that have an initial product on the market but are in early production stages and "scale", for firms with about CAD 1 million in sales that are trying to expand. In addition, it hosts the Agtech Accelerator, which is jointly funded by Conexus and Emmertech, a United Kingdom venture capital fund. The accelerator is affiliated with all three Saskatchewan universities, Innovate Saskatchewan, Innovate UK and has a variety of farmers as advisors, with the objective of bringing new innovations to farming and related industries.

The explicit focus on innovative agricultural technology targets global solutions, even though it is located in Regina rather than one of the major cities of Canada. The accelerator hosted its first cohort of 16 entrepreneurs in 2021 with 11 Canadian and 5 British firms. Each participant received a CAD 100 000 equity investment and participated in a 14-week programme, with the first and last week taking place in Regina and the rest virtual meetings. Each firm made a final presentation on the main stage of Canada's Farm Show, one of the largest farm exhibitions in North America, to test farmer interest.

Precision AI

Precision AI is a robotics-based precision agriculture firm founded in Regina Saskatchewan in 2017. It is prototyping drone-based precision spraying of herbicide in fields using artificial intelligence. Only targeting weeds reduces the amount of herbicide used, providing cost savings and better environmental quality with equivalent weed control. The technology advanced quickly enough to receive an initial round of funding from government programmes and local investors in 2020, while in 2021, the company raised CAD 20 million in an initial seed round from venture capital investors. The company's precision-spraying autonomous drone system, the first generation of commercial production drones, was released in July 2022, which allows the firm to start developing the data to meet pesticide use regulations in Canada and the United States.

Agtech Growth Fund

Innovation Saskatchewan operates the Agtech Growth Fund (AGF) to accelerate the commercialisation of innovative technologies that support farming in Saskatchewan, including supply chain activities. The provincial government introduced the fund in 2020 to provide up to CAD 1 million annually with a clear focus on the farming sector that had not been as present in prior provincial R&D programmes. Funding is restricted to firms with a Saskatchewan presence that have innovative technology that addresses a significant agricultural challenge in the province. AGF will provide up to 30% of the proposed development and commercialisation budget, with investors providing at least 50%. By 2021, the AGF and a related fund, the Saskatchewan Advantage Innovation Fund that supports commercialisation, had committed about CAD 1.2 million to 6 firms. In 2021, the state of South Australia created a similar fund with AUD 800 000 of annual funding and similar investment objectives.

File Hills Qu'Appelle Tribal Council and FHQ Developments

FHQ Developments is the Regina-based for-profit investment arm of the File Hills Qu'Appelle Tribal Council (FHQTC) made up of 11 First Nations bands in southern Saskatchewan. The FHQTC has over 16 000 citizens and 435 000 acres of reserve land within Treaty 4 Territory. In addition to FHQ Developments, which focuses on various equity investments, including partnerships and acquisitions, the FHQTC has two other main arms: Keseewiwan Holdings, which manages its casino investments, and FHQ eCommerce, which develops and sells online payment platforms, data management systems and digital solutions for firms and governments. The FHQTC is also involved in a range of non-profit activities that provide band members with housing, healthcare, labour force training and other social services.

FHQ Developments was founded in 2010 to expand economic development opportunities for member bands by using government procurement requirements to develop business relationships with federal and provincial contractors. Initially, this consisted of "fee-based income" from satisfying government requirements for Indigenous participation along with some employment opportunities for band members. Because FHQ Developments retains all of the revenue it generates, it became able to move to an "equity partner" relationship and develop its own companies that could subcontract with partners over time. This provided an improved revenue stream, better employment and training opportunities for Indigenous staff, increased capacity development and a sustainable business model that can demonstrate significant impact beyond the bottom line.

FHQ Developments' investment strategy has three elements: building Indigenous workforce capacity, sustainability and maximising impact for its beneficiaries and customers. The result is a three-pronged Indigenous economic development model. The first part is a portfolio of 11 companies, mainly in construction, that generate income, build capacity and employ Indigenous talent for FHQ Developments. The second is reinforcing First Nations' economic development activity by supporting entrepreneurs and building an Indigenous ecosystem for greater success and participation. The third and newest part is a subsidiary, Tokata HR Solutions, which recruits, trains and coaches Indigenous talent for in-demand industries. A significant part of the approach is identifying emerging career opportunities in Saskatchewan

through investors and partners of the strategy, then with Indigenous talent from elementary, high school, post-secondary and active career seekers to establish appropriate career paths.

Rural municipality of Edenwald, Emerald Park and White City

Most of the land in the RM remains in farming but there are several small settlements that are integrated into the Regina CMA labour market, with Balgonie, Pilot Butte and the town of White City, with a population of about 3 700 inhabitants, being the largest. Notably, Emerald Park's population of about 5 000 is a mixed-use unincorporated area adjacent to White City. While these communities are mainly residential in nature, they have a significant manufacturing presence that hosts firms requiring some combination of a large amount of inexpensive space and easy road access for bulky shipments, limited infrastructure or that are engaged in manufacturing processes that are not suitable for more urbanised areas. Both communities are about 15 km from Regina. Emerald Park hosts two large industrial parks both with good access to the Trans-Canada Highway and provincial roads, while in White City, commercial activity is mainly distributed along the Trans-Canada Highway and Saskatchewan Highway 48. Both communities host manufacturing firms but their presence is larger in Emerald Park, in part because the industrial parks provide a more suitable location.

Innovative manufacturing occurs in both communities and examples of various forms of innovation can be found, including science-based research that led to an innovative manufacturing process, innovation by a farmer who was seeking better solutions to his farm equipment needs and who turned into a serial entrepreneur and innovation that was first developed in a large urban area and transferred to a rural firm that acts as a contract manufacturer, but which in turn had to adapt available production processes and in turn train other companies that act as secondary contractors.

Examples of innovative activities

Prairie Lithium

The firm was founded by Zach Maurer, a former oil field worker from the conventional oil production area near Estevan in southeastern Saskatchewan. His initial career objective was to work in the Canadian oil industry but, when prices collapsed in 2014, he reconsidered his options. While he found work as an environmental consultant working on oil field remediation, his background in geology and his knowledge of the Williston Basin led him to consider the possibility of extracting lithium from some of the brine layers in the basin and then reinjecting the residual brine back into other strata that had been depleted of oil and gas. Since this was a relatively novel idea, there was little scientific analysis to assess the concept's potential or identify an appropriate technology. In 2017, he enrolled in a Master's programme in hydrogeology at the University of Regina to investigate the potential for extracting lithium from brine without relying on evaporation. His research suggested that if a deposit with a high enough concentration of lithium could be identified, the process should be feasible.

In 2019, he formed Prairie Lithium and raised sufficient funds to hire a chemist with expertise in separating chemicals from brine and start the process of identifying locations and strata most likely to have high concentrations of lithium. The business is located in the industrial park in Emerald Park as it provides easy access to scientific resources in Regina and is suitable for handling relatively large shipments of brine from test wells for separation. In 2020, it began acquiring drilling rights in areas thought to be potential sources of lithium-rich brine. For the business to be viable, deposits with high lithium concentrations and a chemical separation technology were essential. In 2021, Prairie Lithium identified a scalable technology for separating lithium that was independently verified and resulted in a patent. In 2021, it also drilled its first test well in an area it believed had high potential for hitting a stratum with a high concentration of lithium in the brine. Once the well was successful, work started on scaling up the separation technology in a form that can be located at a well site instead of in an industrial park.

SeedMaster/DoT Technology

In 1991, farmer/entrepreneur Norbert Beaujot developed a new approach to seeding grain that was suitable in a prairie environment for farmers interested in adopting no-till cultivation. Over time, he refined the seeder and added new technologies as he gained experience in its use. In 2002, he established his firm, SeedMaster, in Emerald Park to fully commercialise his evolved air seeder. Full production began in 2004 and the plant was expanded in 2005 to increase capacity. Over time, as electronic control technology improved, SeedMaster drills were improved and their size and capacity increased. SeedMaster products are now sold in the three prairie provinces of Canada, in several northern states in the United States and in most states of Australia.

By 2010, Beaujot was working on a new concept: an autonomous power platform that could be coupled with a number of crop cultivation devices, such as a seeder, herbicide sprayer or grain cart. This would replace or supplement a tractor and remove the operator from the field, allowing greater precision in placing seed, fertiliser or sprays. An additional benefit would be that a single operator could control multiple pieces of machinery, reducing labour requirements and increasing planting speed. In 2014, DoT Technology Corp. was created and shared space with SeedMaster to produce a prototype autonomous diesel power platform. By 2017, the unit was coupled to a SeedMaster air seeder and was capable of planting fields; other manufacturers had also created a compatible sprayer and granular nutrient applicator. This placed DoT Technology as a leader in achieving a viable autonomous tractor.

In 2020, DoT Technology was acquired by Raven Industries, a South Dakota-based precision agriculture components and systems manufacturer. While Raven already had a kit that would convert an existing tractor to autonomous operation, DoT Technology offered a more integrated approach. Raven established a new office and production facility in Emerald Park, enhanced and refreshed the DoT Technology platform and began marketing it as ONMiPOWER. There are now about 20 units in operation on farms in North America. In 2021, CNH Industrial, one of a small number of global farm equipment manufacturers, acquired Raven, largely because of its leading role in autonomy and precision agriculture.

Durmur Industries

Durmur Industries is located in White City and began operations in 1987 as a sheet metal fabricator specialising in cabinets for the food preparation industry. Over time, its focus shifted to metal fabrication for the defence industry as a component supplier for major prime contractors. This involved a major upskilling of the workforce, investments in International Organization for Standardization (ISO) quality assurance processes and continuous adoption of new technologies. In its defence-related work, Durmur typically partners with a foreign defence contractor to satisfy Canadian content requirements in the request for proposals. The prime contractor provides requirements and specifications. Sometimes, this means bringing in new technologies with the support of the prime contractor. Durmur has to determine how to implement these new technologies within the context of their production systems. It may have to either custom-build or modify machinery to meet product specifications using its inhouse engineering capability. Increasingly, the work involves robots and advanced programming and simulation processes to achieve better robot performance. The resulting process innovation can lead to quality improvements as well as cost savings, making Durmur more profitable and a more attractive partner for future contracts.

Case 3: Inuvik, Northwest Territories

Inuvik

With a 2022 population of 3 500 inhabitants, Inuvik is the second-largest city in the Northwest Territories and the largest city in Canada north of the Arctic Circle. It is the regional centre for the much larger but sparsely populated Western Arctic region that is the traditional home of the Inuvialuit people. The municipality of Inuvik itself is also within the traditional homeland of the Gwich'in First Nation. Until 2018,

Inuvik was the most northern settlement in North America that could be reached by road. Now, the Inuvik-Tuktoyaktuk Highway, completed in 2017, extends the road to the Arctic Ocean.

The Canadian government established the town of Inuvik on previously unsettled land in 1953. Inuvik is the largest settlement in Canada north of the Arctic Circle and is situated on the Mackenzie River 97 km south of the Beaufort Sea. It had a population of 3 137 in 2021, with the majority (63.7%) being Indigenous and relative population shares of Inuvialuit (63%), First Nations (31%) and Métis (6%). Inuvik was initially developed as a Canadian Forces base and administrative centre for the larger region. While the base was closed in 1986, the current increase in tensions with Russia has led to a new interest in restoring the military presence.

The area around Inuvik has significant oil and gas reserves, both onshore and offshore, and these were partially developed in the 1980s. However, production was largely discontinued for economic, political and environmental reasons in the early 1990s. Currently, the local economy largely depends on tourism and government functions, including a regional hospital, Aurora College, regional offices for the territorial and national government, and the main administrative functions of the Inuvialuit and Gwich'in people. Inuvik is also a major logistics hub that supplies smaller, more remote communities with goods and, to a lesser extent, services. It is the site of a major satellite telecommunications complex that focuses on downloads of data from circumpolar satellites, which is then sent for processing in Europe and North America.

Energy is expensive, especially since local gas wells are no longer being developed. Most electricity is produced by diesel generators. The harsh winter climate makes heating expensive and any loss of power can be catastrophic. In the summer, solar power is used to reduce the amount of diesel imported since long days provide high levels of panel output. In addition, housing is a critical constraint with very little market rent housing and a large share of the population living in public housing with subsidised rents. Since access to public housing is restricted to low-income households, there are disincentives to work since it can lead to eviction from public housing.

While Inuvik is a small town, it is the main service provider for a larger region. Road access is along the Dempster Highway to Whitehorse, Yukon, a distance of 814 km. Internal access within the region is challenging. For example, the Inuvialuit people are located across six settlements, with only two having all-season road access. This means that four can only be reached by air or barge during the summer or, in some cases, along winter roads when rivers and lakes freeze. Climate change is causing major infrastructure problems for roads, housing and utilities designed in an era when the permafrost was more stable. While the existing infrastructure design was innovative when it was put in place, it is no longer fit for purpose and new innovations will be required.

Examples of innovative activities

Increasing penetration of solar power

There are multiple applications of solar arrays in Inuvik. In the summer, solar power is a viable source of electricity, especially in periods when the sun never sets. Solar provides sufficient energy for many summer demands and this allows lower diesel imports and a longer operating life for diesel generators. However, solar has little value in the winter when hours of daylight are limited or non-existent.

Community greenhouse

A community greenhouse in Inuvik provides opportunities for households to grow seasonal vegetables for their own consumption. The greenhouse also provides surplus produce to two local food banks. It recently installed a portable hydroponics unit powered by a solar array to cool and light the facility in the summer. This model will help them investigate the potential for a larger, more permanent unit that could provide supplemental sources of fresh produce in winter months.

“Country meat” processing facility

The Inuvialuit Regional Corporation has established a small game processing facility employing five full-time workers. It gathers a variety of game from Inuvialuit hunters and processes it for distribution to beneficiary households across the six member communities. In the summer, solar power provides electricity to run container-size freezers that hold unprocessed game and packaged meat. In most other Inuvialuit communities, another container-size freezer holds the meat transferred from Inuvik to the community. The processing facility currently employs six full-time employees. Plans exist to expand the processing capacity to allow for the retail sale of fish and reindeer meat, which would be sourced from a herd owned by the Inuvialuit. The facility already improves the well-being of members because the donated meat improves their food security and preserves traditional diets. Because the facility buys game from beneficiaries, it also provides hunters with a modest supplemental income.

Indigenous self-government

Both the Inuvialuit and the Gwich'in have signed “final agreements” with the Government of Canada and have achieved a high level of autonomy in terms of economic activity. The Inuvialuit Final Agreement, signed in 1984, was the first modern treaty signed by the Government of Canada and became a template for subsequent settlement agreements, including that of the Gwich'in. This has allowed them to build both wealth and relatively high levels of employment for beneficiaries, partially through a combination of direct investment and federal procurement regulations that help them partner with private sector companies on government contracts. As their wealth and capacity increase, they are able to play a larger role in the business sector and gain a bigger share of the revenue.

The Innovate Centre for Arts, Culture and Technology

The Innovate Centre focuses on allowing makers of arts and crafts to adopt modern production techniques, which can help them produce traditional products in new ways – a form of innovation. Automating and mechanising production elements allow for faster and cheaper manufacture, which improves market opportunities and can help increase sales to a point where volumes are high enough to make a business viable. The centre was established by Aurora College with CanNor and territorial government support. It provides a “maker space” with a variety of new production technologies, including lasers, three-dimensional (3D) printers and other computer-controlled equipment. The centre’s main goal is to support people engaged in craft production to a point where they can establish a commercial enterprise. As of 2022, it already had ten participants who had reached this stage and about 50 more casual users, some of whom were working toward commercialisation. The centre buys a large variety of the products its users need to carry out their work in bulk and resells them at cost. This reduces users’ cost of production, improves their potential profit margins while allowing artists to sell at a lower price and helps to ensure there is a timely supply of inputs.

Taalrumiq (Christina King)

Taalrumiq, also known as Christina King, is an Inuvialuit and Gwich'in textile artist and fashion designer from Tuktoyaktuk, Inuvialuit Settlement Region, Northwest Territories. She creates high fashion clothing and fine art based on traditional materials and designs. She relies heavily on Instagram and other social media outlets to market her products directly and also participates in fashion shows and markets in major southern cities, including Ottawa, Toronto and Winnipeg. While her enterprise is successful, her attempt to establish a local business in Tuktoyaktuk was limited by the high cost and slow speed of local Internet, the high cost of transport for input materials and finished products, and the lack of support for small businesses and entrepreneurs.

Case 4: Kincardine, Ontario

Kincardine

The municipality of Kincardine was created in 1969 by the amalgamation of the former town of Kincardine and two townships, Bruce and Kincardine. In 2021, the population of the municipality was about 11 400 inhabitants, with the largest settlement being the former town of Kincardine. The community is located on the shore of Lake Huron at the foot of the Bruce Peninsula. It originally had an economy based on agriculture and, since the 1930s, on seasonal tourism, particularly cottage owners. Kincardine does not host a local university nor offer any significant post-secondary educational training. It is about a three-hour drive from central Toronto and about a two-hour drive to either the Kitchener-Waterloo or London metropolitan areas. This places it at the limit of a rural adjacent region. Both the London and particularly the Kitchener-Waterloo regions have strong universities and technical colleges that can support skill development and research needs but are too far away for daily commutes.

In 1970, Ontario Hydro, at that time the Crown corporation that supplied most of the province's electricity, began constructing the first of eight nuclear reactors in the former Bruce Township. Currently, six of the eight units are producing power. Construction was completed in 1987 and a major reactor refurbishment process began in 2012 that will not be completed until 2060. The Bruce complex now provides about 30% of all electricity produced in Ontario. The facility employs about 4 000 permanent workers and, during refurbishment construction, employment is typically 3 500 but can reach 6 500, making it by far the largest employer in the region.

The reactor complex is now operated by Bruce Power, a private corporate partnership that leases the facility and sells power back to the provincially owned electricity provider. There is work underway to establish an Indigenous relations supplier network: membership is shaped around the Canadian Council for Aboriginal Business Progressive Aboriginal Relations programme (Bruce Power, 2023_[100]). Also, the Saugeen Ojibway Nation and Bruce Power have developed a collaboration agreement to jointly market new isotopes in support of the global fight against cancer (Bruce Power, 2023_[101]).

The Bruce Power refurbishment fundamentally altered the dynamics of Kincardine. An existing housing shortage driven by the large share of homes owned by summer residents has been exacerbated by the influx of construction workers at the plant. In addition, Bruce Power has implemented a policy that requires supplier firms to have a physical presence near the site. This has led to an influx of not only skilled trades workers but also a variety of professional service firms that contract with Bruce Power to provide management engineering, environmental and other consultant services. The influx of new residents has greatly increased the share of skilled workers and professionals in the community and increased average household incomes. However, there has not been a significant increase in the housing stock to date. In addition to contributing to the tax and employment base, the diversification of the local economy has also increased the innovative capacity of the area.

Kincardine is similar to the common “company town” or “single-industry town” found across Canada and other OECD countries. A single large firm dominates the local labour market, typically a mining or forest products company, but first-stage food processors are also common. Economic growth in the community is conditional on the firm's prospects. The firm can play a large role in shaping local government policies and influencing housing availability and the local education system. For Kincardine, Bruce Power is offering a long period of economic stability; the province has thus decided to support the long process of refurbishing the reactors rather than shutting the plant down. However, the powerful presence of the facility can also limit other development opportunities. Moreover, the current level of employment will decline sharply once new construction ends, albeit several decades from now.

Examples of innovative activities

Catapult

Catapult is an incubator and accelerator that works with local universities and businesses to help entrepreneurs with a foundation to build their companies. With a strong share of young entrepreneurs and partnerships with universities and training centres, the initiative provides a locale for establishing a business, training and coaching services and access to resources, including training and upskilling to the local community. Examples of incubated and accelerated entrepreneurial innovations and business ideas include rural medical supply delivery services, local and organic farm-to-table services and nuclear packaging services.

Georgian College

Georgian College is the only full-service college in the region. It specialises in allied healthcare, trades and technology and the marine sector. With a high demand for upskilling from employers, Georgian College, often partners with the nearby Catapult, working with Tarumi businesses to help upskill, primarily in trade industries. Some programmes are now in business, in addition to the many resources already available online. The college also provide training for fire services and has expanded training in the trades over the past few years. The new training services offer options for individuals and companies looking to train workers without going to the metropolitan south. Georgian College also supports entrepreneurs in partnering up with R&D universities.

Nuclear Promise X (NPX)

NPX began operating in Kincardine in 2018 with a staff of 10 that has now grown to 30. Its main client is Bruce Power, where it provides support for ongoing digital technology modernisation of power control systems and operations. In 2019, it also began a similar collaboration with the Nuclear Innovation Institute. NPX also offers technology that provides real-time performance monitoring of a variety of industrial equipment other than nuclear. It will provide plant modernisation services to industrial facilities that want to upgrade their process monitoring technology. Beyond its core activity, NPX also produced face shields for community workers during the early stages of the COVID crisis and is using its 3D printers to supply user-friendly pill bottles to local people with Parkinson's disease.

The Nuclear Innovation Institute (NII)

The NII was created as a non-profit subsidiary of Bruce Power to investigate innovative opportunities for the use of the technologies associated with nuclear power. Its main current activity involves efforts to use reactors to produce medical isotopes by irradiating cobalt and lutetium-177 for use in cancer treatment and other medical purposes. The work is undertaken with partners Kinetrics and Framatone, two German firms that are conducting medical trials with the products. In addition, the municipal innovation group at the NII that investigates and supports innovative approaches in the region's public sector has created the Smart Beach system that uses sensors, smart buoys and cameras to provide real-time information on rip tides. The large number of drowning deaths on Lake Huron provided the impetus for the activity and a pilot system is deployed in Kincardine with plans for eventual deployment to recreational areas throughout the Great Lakes.

Case 5: The Gaspé Peninsula, Quebec

The Gaspé Peninsula

The city of Gaspé is part of the regional county municipality (RCM) of La Cote-de-Gaspé and is the largest community in the Gaspésie-Îles-de-la-Madeleine region of Quebec. In 2021, the city had a population of 15 063 inhabitants, which was a 3.4% increase from the 2016 census number. However, in the 1970-91

period, the city had a population of over 17 000, while the larger region had a stronger economy and birth rates were considerably higher. The local economy is driven by a mix of resource-based industries (fishing, forestry, agriculture), public services (health and education), tourism and manufacturing. The regional hospital is the largest employer, followed by the school system, while the largest private sector employer in the city and region is LM Wind Power, a wind turbine blade manufacturer.

The Gaspé Peninsula, part of the region, contains 5 RCMs that are lined by Route 132, which runs along the north coast of the peninsula east from Sainte-Flavie to Gaspé and then south along the coast to Matapédia where it turns north to return to Sainte-Flavie, completing the loop. Almost all settlements in the region are located along Route 132 and generally, less than a 20-minute drive separates communities. While the labour force in any specific community is small, its local labour market is considerably bigger because it includes communities roughly a one-hour drive in either direction along Route 132.

The closest university is the Université du Québec à Rimouski, which offers courses from the Gaspé Campus in regional and territorial development, social work, health, business management and education. Additionally, the CEGEP de la Gaspésie et des Îles serves the region as a source of higher education for students pursuing a university degree and as a source of technical skills for students oriented to skilled trades. Currently, it has an enrolment of about 3 000 students across all programmes and locations. In addition to the main campus in Gaspé, the CEGEP has satellite campuses in three other communities in the region and Montreal. Importantly, the school strongly supports economic and community development in the region. It hosts three College Centres for the Transfer of Technology (CCTTs), in the areas of wind power, fisheries and social innovation. The Quebec government supports the CCTT programme to diffuse advanced technologies and innovation into communities by creating applied research facilities across the province that are connected to higher education providers, each with a specific mission important to their region.

Economic development in the region is challenged by a number of factors beyond the declining workforce. Because the peninsula is far from a major urban centre, it faces high transport costs for moving goods in and out and difficulty in attracting and retaining skilled workers. Both the natural resource and tourism sectors are seasonal, with a relatively short peak tourism season in mid-summer and shoulder seasons in early summer and early fall. This results in a high proportion of jobs being both seasonal and part-time, as well as offering low wages. Consequently, both labour force participation and employment rates are lower than the provincial and Canadian averages. Employers have faced worker shortages that have limited their expansion in recent years, even as a large share of the potential workforce is unemployed. A combination of skill mismatches, wages that are below reservation wage levels, the preponderance of seasonal work, and other barriers, including housing shortages that limit relocations, contribute to this phenomenon.

Tourism is expanding, both in the variety of opportunities being offered and in terms of efforts to expand the season. Most of the hospitality and tourism businesses are family-owned and have limited capacity. Expansions are difficult to justify since external sources of finance are scarce and the risk of insufficient demand is real. While the region is experiencing more tourism in terms of visitor days, this does not necessarily translate into a significant revenue increase at specific establishments. Small operators cannot easily keep clients for more than a day or two since they have a limited offer. In addition, most people travel by personal transportation means on one-to-two-week family vacations and, inherently, are not large spenders at any single location. Currently, few towns have a large enough number of tourism opportunities to hold people for longer stays. On the other hand, the entire Gaspésie region benefits from renown as a destination, particularly within Quebec, and the Route 132 loop offers a distinct opportunity for a stronger regional tourism marketing project.

Examples of innovative activities

LM Wind Power

LM Wind Power originated from a decision by the government of Quebec in 2001 to diversify its electricity production base beyond hydro into another form of renewable energy. In 2003, Hydro Quebec, the provincially owned electricity company, released the largest single tender for wind turbines to that date for bids. A requirement for proposals was that they include a blade factory and a tower fabrication facility in Gaspé. The Danish company LM Wind Power was part of the winning bid and opened the turbine blade factory in Gaspé in 2005. LM Wind Power was bought by General Electric (GE) in 2017. With this purchase by GE, Gaspé planned to produce for the United States markets. The ambition of the provincial government was to use procurement policy to establish a major wind power cluster in the Gaspé Peninsula. While smaller than initially hoped, the current cluster has generated new innovative firms that make wind power components and provide services to turbine operators, despite the location in the Gaspé Peninsula being a long way from the major North American markets for onshore wind turbines. In 2016, the government of Quebec had decided not to launch any new bids for wind power energy. Since then, the entire blade production is exported.

Since opening, the facility has continually invested in process innovations to allow it to produce larger blades on a faster production cycle. As a result, despite its remote location, it has maintained a customer base and is currently the only surviving wind blade manufacturer in Canada. Support from the province was instrumental in the early years but a change in government in 2014 led to reduced support for wind power, causing the company to become more focused on remaining competitive by engaging in a series of process innovations that allowed it to reduce costs while gaining the capacity to make larger size blades. As of now, there are also new plans with the local government to improve physical access conditions for the large turbines' access to a nearby seaport, ensuring easier access to global markets. The CCTT provides additional support for these innovations and for the cluster at the Gaspé CEGEP, which is focused on wind power. Employment has been of around 200 workers for over a decade but a major expansion of the plant is underway that will increase employment to about 500 and shift the focus to producing 107-meter blades for offshore wind farms. This expansion reflects GE's purchase of LM Wind Power in 2017, which allowed the company to be more fully integrated into GE's wind enterprise and gave it access to investment capital and GE technical expertise that facilitated innovation.

Kuma Brakes

Kuma Brakes opened in Gaspé in 2015 to produce brake pads for new and replacement brakes for wind turbines, for which GE certification was critical. The process of creating brake pad material that was effective and durable took the company founder Christian Babin, a former technical educator, over ten years. His research was supported by small grants from CED and other government agencies and by partnering with Laval University faculty, specialists at the National Research Council Canada and industry experts. The firm employs 12 people and uses a highly automated production process to improve quality and increase productivity.

CCTT System of Research and Innovation Centres

While many countries and states/provinces have invested in centres to support applied research and innovation, the 57 sites distributed across all parts of Quebec appear to be particularly well thought out. Each site focuses on a specific topic/area that is important to the region in which it is located. The centre conducts applied research in its mission area and works with businesses on how to implement new initiatives that can increase their competitiveness. Further, because each CCTT is hosted by a CEGEP, there is a strong connection between innovations in products and processes and efforts to ensure that the local workforce can acquire the skills needed to bring production to market. Further, because the individual centres are in a network, there is the opportunity to collaborate on particular projects that are important to

multiple regions or to investigate projects that span multiple research areas jointly. Project-specific research grants and the support of local governments complement core funding from the province.

Mount-Saint-Joseph Regional Park

This regional park has been used by residents of the small community of Carleton-sur-Mer on the Baie-des-Chaleurs on the south coast of the Gaspé Peninsula to be the focal point for an expanded tourism programme. The town has had a stable population of about 4 000 people for the last 20 years but the core industries of agriculture, forestry and fishing are declining in sales and no longer providing the same level of employment. The regional park at Mont-Saint-Joseph provided a location to add multiple features, including new biking and hiking trails, a number of geodomes located at the peak that can be used for overnight stays, rock-climbing areas and new interpretation guides to provide education about local flora and fauna as well as guided tours. In addition, winter activities have been expanded, including snowshoe and snowmobile trails, to lengthen the tourism season. In addition, businesses in Carleton-sur-Mer invested in improving their facilities and providing new town-based activities to further enhance the local offer, such as concerts and festivals.

Mont-Saint-Joseph Regional Park is an accredited site of the *Association des parcs régionaux du Québec*. The corporation shares the values this association promotes: inclusion, solidarity, quality and innovation. From a sustainable development perspective, the investments made in recent years also considered local population needs in terms of infrastructure.

Case 6: Fogo Island, Newfoundland and Labrador

Fogo Island

Fogo Island is located off the northeast corner of the island of Newfoundland and is accessible by a 45-minute ferry from the main island. It has a total area of 238 km² and, in 2021, had a population of about 2 200 inhabitants. The main economic activity is fishing and related first-stage processing. Before the “cod moratorium” imposed by the Government of Canada in 1992, the dominant species was cod, which was processed in local fish plants before export. Since then, the fishing industry has diversified into crab, shrimp and, more recently, sea cucumber harvesting as well as minor amounts of other local fish species. As with most resource industries there has been a steady substitution of capital for labour, both on fishing boats and in the fish plants, which increased the size of investment needed for boats and processing equipment and reduced the need for labour. Financing these investments is challenging, given the small size of the local economy and the limited absence of commercial lenders. While government programmes can bridge some of the funding gap a major problem for local businesses is the difficulty in assembling equity capital.

Examples of innovative activities

Fogo Island Co-operative Society, Shorefast Foundation and Fogo Island Inn

Fogo Island has a long history of collective action that dates back to the 1960s when the local population was organised to resist efforts by the provincial government to relocate the population to the island of Newfoundland in response to a decline in the inshore fishery. With support from Memorial University of Newfoundland and a series of National Film Board films featuring life in Fogo Island, the community developed the Fogo Process as a way to channel community interests into strategic behaviour. The Fogo Process led to the creation of the Fogo Island Co-operative Society, which was created by local fishers to collectively bargain for better prices. The co-op started by creating a shipyard to build bigger boats so that fishers could fish for species farther offshore following the collapse of inshore cod stocks. Fish plants were subsequently built to process these new species (crab and shrimp). This vertical integration into a single social enterprise reduced the inherent conflict between boat owners and plant operators and provided a

foundation for future innovations. Decades later, Zita Cobb, who grew up on Fogo Island, recalled the Fogo Process when she decided to create the Shorefast Foundation in 2004 as a non-profit entity to stimulate economic recovery on Fogo Island. Shorefast is an operation of the Fogo Island Inn but it has several other programmes to support community activity.

Fogo's growing tourism industry received a major boost when the Fogo Island Inn opened in 2013 and immediately attracted attention and visits from people living in major cities in Europe and North America. The resulting exposure, in turn, stimulated visitors who came to see the island and view the inn but did not stay there. Currently, the tourism sector is characterised by Fogo Island Inn, offering a small number of visitors a very "high-end" curated experience where inn staff provide for virtually all guest needs and manage local exposure and a more traditional tourism offer that is based on small entrepreneurs who operate independent enterprises (e.g. camping, rooms in bed and breakfasts, apartments). In particular, there are several heritage-renovated rental houses that fill a middle market. This latter form of tourism is challenged by a relatively short tourism season, a limited tourism offer that can only keep people on the island for a few days and too few resources to upgrade accommodations and restaurants to current hospitality standards. The Fogo Island Inn hires community hosts to orient guests on the island; hosts are paid but unscripted. When tourism is done well, it is a key activator for other sectors; the inn's prioritisation of local purchasing has supported such a model. For example, it has been an activator of local agriculture and its associated business, Fogo Island Workshops, has activated local craft purchasing, commissioning makers to knit goods, make quilts, etc.

The Fogo Inn and the three fish plants operated by the Fogo Island Co-operative Society are the major employers on the island, accounting for between 250 and 300 jobs each and over 60% of the value of Fogo output. Interestingly, both are not-for-profit entities that have as objectives improving economic and social conditions on Fogo. Both face the challenge of relying on distant places for their customers and face international competition, in addition to common problems from a limited local labour supply, high cost of housing facing new workers and an essentially seasonal business where wages are limited by difficulties in increasing productivity.

A shrinking population and a workforce that is both ageing and that has low formal skills are an increasing challenge. Over time, the fishing industry has greatly reduced its labour requirements by adopting more sophisticated processing machinery that requires a greater level of formal education to operate and also more technical skills to maintain. An ageing workforce has also required investments in reorganising workflow to reduce the amount of lifting and other more strenuous activities to retain older workers. Similarly, the Fogo Island Inn faces challenges in recruiting local workers both for more skilled management and technical occupations. Attracting workers from within the province or the rest of Canada is made difficult by the seasonal nature of operations, a shortage of affordable housing, limited public and private services, transportation infrastructure challenges and the fact that the rural/remote lifestyle appeals to a select subset of the population. As an example of the local workforce challenge, in 2020, Fogo no longer had a doctor resident on the Island for the first time in 200 years.

Fogo Island is an amalgamated municipality: the Town of Fogo Island, which contains ten cultural communities/settlements. The island has ten small communities, with the municipality of Fogo being the largest. Prior to 2011, when all of the local governments merged into the island-wide single Town of Fogo Island, there were four municipal governments in the larger towns and a regional council for the remainder of the island. This is a rare example of municipal amalgamation in the province and was brought about by the provincial government agreeing to take over a significant amount of local municipal debt upon merger and the growing local recognition that the combination of falling incomes, decaying infrastructure and declining population was challenging small municipal governments.

Modernising fish processing technology

The co-op now operates three fish plants on Fogo and has carried out a series of process innovations to introduce new technologies as the market for fish evolved. Notably, in 1992, when the cod moratorium ended the main product the island produced, there was a switch to crab production and processing. However, the hand processing of crabs led to high costs and poor quality, which triggered a search for a way to mechanise the process, which is a classic case of user-driven innovation (Norden, 2006^[102]). The co-op worked with the Fisheries and Marine Institute of Memorial University of Newfoundland and a metal fabrication firm on the Avalon Peninsula to produce the first version of a machine that could break open a crab and split it into halves to make further processing easier. This was the first commercial crab deshelling machine, allowing the co-op to become a leading supplier of high-quality crab to international buyers. Most recently, a new species, sea cucumber, has become marketable and the same three partners have developed a sea cucumber processing machine that has already been upgraded once and has the potential for further improvements as the international market grows.

Economic Nutrition labelling

Shorefast has developed a way for local people to better understand how specific firms provide benefits to the local economy. It has reinterpreted the standard nutrition information label found on packaged food to show that any purchase in one of their businesses can be broken down into two parts: what the money is used for – labour, supplies, administration and profits – and where that money goes – local, provincial, rest of Canada and international. They are currently piloting it to expand to other places and businesses.³⁰ Economic Nutrition labels are developed for all of Shorefast's activities and are also made available for consumers to view at the point of purchase. An example of the Economic Nutrition labels is provided for one of Shorefast's subsidiaries, Growler's Ice Cream in Annex Figure 3.A.1.

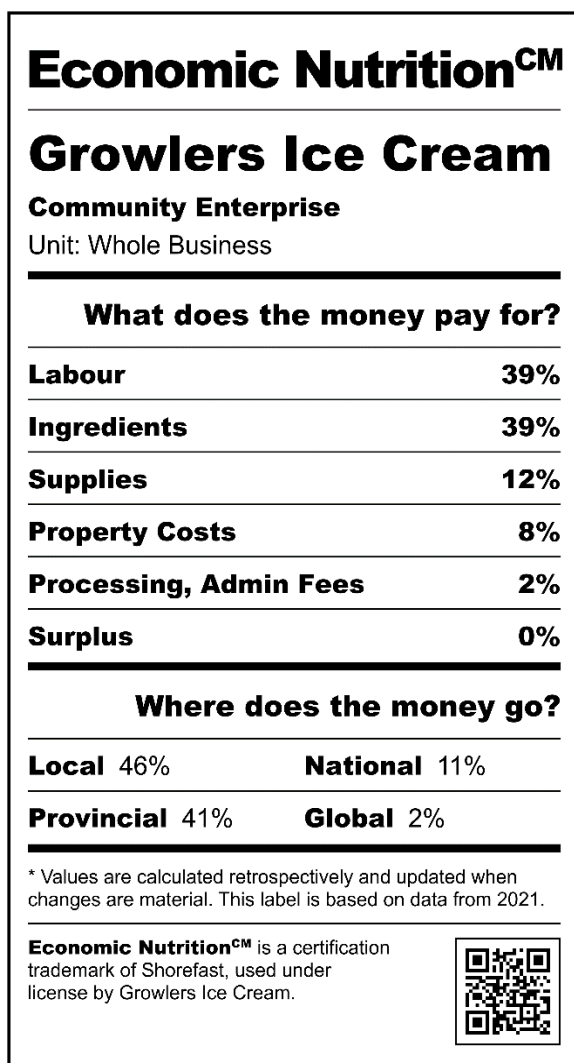
Cod pots

Cod is typically caught using gill nets, which can cause damage to the fish or the ocean bottom and result in bycatch. An innovative alternative is the cod pot developed in 2007 with joint support from Shorefast, the Fogo Island Co-operative Society Ltd. and the Marine Institute. The pot is a variation on a lobster trap that allows the cod to swim in but not swim out. The result is a live, undamaged fish at harvest that can be sold at a premium price. The pots used on Fogo are made locally by individuals who make and repair nets, creating an additional economic impact. More recently, Shorefast spearheaded the social business Fogo Island Fish, which prioritises handline fishing for cod, one by one, in the traditional way (single line and hook off the side of a small boat). Fish are flash frozen at peak freshness and sold to discerning restaurants on mainland Canada. The premium handline fish fetches a high price, allowing Fogo Island Fish to pay fishers well above market rates for their catch.

Municipal merger

Typically, merging municipalities might not be considered an innovative approach to government. The merger on Fogo Island has two innovative aspects however that may offer lessons for other places. The first is the necessity to have some pre-existing trust among the merger candidates. On Fogo, much of this came from the Fogo Process and the reality of a single high school that served all communities, including those from protestant and catholic areas, and allowed students to mingle with people from other settlements, which reshaped beliefs on cohesion. However, the willingness of the provincial government to absorb a portion of outstanding debt provided another incentive that allowed people to commit to merging despite an inherent desire to maintain independence by communities that had a long history of independence.

Annex Figure 3.A.1. Economic Nutrition Label, Shorefast (Fogro Island, NL, Canada)



Source: Shorefast.

References

- Andison, M. (1990), “Community futures: An evaluation of a top-down approach to community economic development”, <https://doi.org/10.14288/1.0098506>. [32]
- ATSDR (2022), *CDC/ATSDR Social Vulnerability Index*, Agency for Toxic Substances and Disease Registry, <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html> (accessed on 15 June 2023). [57]
- Atta-Owusu, K., R. Fitjar and A. Rodríguez-Pose (2021), “What drives university-industry collaboration? Research excellence or firm collaboration strategy?”, *Technological Forecasting and Social Change*, Vol. 173, p. 121084, <https://doi.org/10.1016/j.techfore.2021.121084>. [48]
- Bradford, N. (2017), *Canadian regional development policy: Flexible governance and adaptive implementation*. [36]
- Bruce Power (2023), *Gamzook’aamin Aakoziwin (Fighting Cancer Together)*, <https://www.fightingcancertogether.ca/> (accessed on 30 May 2023). [101]
- Bruce Power (2023), *Indigenous Relations Supplier Network*, <https://www.brucepower.com/indigenous-relations-supplier-network/> (accessed on 30 May 2023). [100]
- Caldas, M., M. Marshalian and P. Veneri (2023), “Assessing spatial disparities in Internet quality using speed tests”, *OECD Regional Development Papers*, No. 47, OECD Publishing, Paris, <https://doi.org/10.1787/77c42f5e-en>. [106]
- CBDC (n.d.), *Rural Action Centres*, Community Business Development Corporation, <https://www.cbdc.ca/en/resources/rural-action-centres> (accessed on 16 February 2023). [69]
- CFNC (2024), *Community Futures Canada*, Community Futures Network of Canada, <https://communityfuturescanada.ca/> (accessed on 15 January 2024). [28]
- CIESIN (2013), *Urban-Rural Population and Land Area Estimates, v2 (1990, 2000, 2010, 2100)*, Center for International Earth Science Information Network, Columbia University, NASA Socioeconomic Data and Applications Center (SEDAC), <http://sedac.ciesin.columbia.edu/data/set/lec2-urban-rural-population-land-area-estimates-v2>. [1]
- Coates, K. and S. McPhee-Knowles (2022), “The territories: Inverting innovation for Canada’s North”, in *Ideas, Institutions, and Interests: The Drivers of Canadian Provincial*, University of Toronto Press, <https://doi.org/10.3138/9781487534806>. [96]
- Community Futures Canada (n.d.), *Supporting Canada’s 267 Community Futures Organizations*, <https://communityfuturescanada.ca/> (accessed on 15 June 2023). [43]
- COSIA (2012), *About*, Canadian Oil Sands Innovation Alliance, <https://cosia.ca/about>. [14]
- Cox, W. (2022), “The rural character of Canada’s metropolitan areas (CMAs)”, <https://www.newgeography.com/content/007665-the-rural-character-canadas-metropolitan-areas-cmas> (accessed on 3 February 2023). [4]

- Croce, F. (2017), “Contextualized indigenous entrepreneurial models: A systematic review of indigenous entrepreneurship literature”, *Journal of Management & Organization*, Vol. 23, pp. 886-906, <https://doi.org/10.1017/jmo.2017.69>. [91]
- DeStefano, T., R. Kneller and J. Timmis (2022), “The (fuzzy) digital divide: The effect of universal broadband on firm performance”, *Journal of Economic Geography*, Vol. 23/1, pp. 139-177, <https://academic.oup.com/joeg/advance-article/doi/10.1093/jeg/lbac006/6573380>. [74]
- Deutscher Bundestag (2018), *Reallabore, Living Labs und Citizen Science-Projekte in Europa*, <https://www.bundestag.de/resource/blob/563290/9d6da7676c82fe6777e6df85c7a7d573/wd-8-020-18-pdf-data.pdf> (accessed on 15 June 2023). [88]
- EDA (n.d.), *Economic Development Districts*, United States Economic Development Administration, <https://eda.gov/edd/> (accessed on 15 July 2023). [58]
- EDA (n.d.), *Research and National Technical Assistance (RNTA) Program*, United States Economic Development Administration, <https://eda.gov/programs/rnta/> (accessed on 15 November 2022). [30]
- EDC (2021), “Powered by innovation: The new Canada Business App”, Export Development Canada, <https://www.edc.ca/en/article/ised-releases-canada-business-app.html> (accessed on 4 October 2023). [44]
- Edler, J. (2019), “A costly gap: The neglect of the demand side in Canadian innovation policy”, *IRPP Insight*, No. 28, <https://irpp.org/wp-content/uploads/2019/05/A-Costly-Gap-The-Neglect-of-the-Demand-Side-in-Canadian-Innovation-Policy.pdf>. [7]
- Ehrensaft, P. and D. Freshwater (1992), “Rural development strategies that work (working title)”, Nelson-Hall. [34]
- Farmreal (2016), *Homepage*, <https://farmreal.pt/en> (accessed on 15 June 2023). [87]
- Federal Reserve (2022), *Community Reinvestment Act (CRA)*, [https://www.federalreserve.gov/consumerscommunities/cra_about.htm#:~:text=The%20Community%20Reinvestment%20Act%20\(CRA\)%2C%20enacted%20in%201977%2C,%2Dincome%20\(LMI\)%20neighborhoods](https://www.federalreserve.gov/consumerscommunities/cra_about.htm#:~:text=The%20Community%20Reinvestment%20Act%20(CRA)%2C%20enacted%20in%201977%2C,%2Dincome%20(LMI)%20neighborhoods). (accessed on 16 February 2023). [59]
- French, C. (ed.) (2022), *Building Rural Community Resilience Through Innovation and Entrepreneurship*, Routledge, <https://doi.org/10.4324/9781003178552>. [22]
- Freshwater, D. (2012), *Rural Innovation - Crucial, But Rarely Systematic*, Agricultural Economics Research Reports, <https://doi.org/10.22004/ag.econ.139829>. [21]
- Freshwater, D. and P. Ehrensaft (1993), “Initial results from the implementation of Canada’s Community Futures Program”, Agricultural Experiment Station, College of Agriculture, University of Kentucky. [33]
- Gingras, Y. (2022), “Quebec: The National Research and Innovation System”, in *Ideas, Institutions, and Interests: The Drivers of Canadian Provincial Science, Technology, and Innovation Policy*, University of Toronto Press, <https://doi.org/10.3138/9781487534806>. [98]
- Government of Canada (2023), *Business Benefits Finder*, https://innovation.ised-isde.canada.ca/innovation/s/list-liste?language=en_CA&token=a0BOG000000WfhZ2AS (accessed on 4 October 2023). [38]

- Government of Canada (2023), *Connecting Families Initiative*, <https://ised-isde.canada.ca/site/connecting-families/en> (accessed on 30 May 2023). [78]
- Government of Canada (2023), *High-Speed Internet Access Dashboard*, <https://www.ic.gc.ca/app/scr/stsidcr/web/high-speed-internet-canada/en/universal-access/broadband-dashboard.html>. [79]
- Government of Canada (2023), *National Broadband Internet Service Availability Map*, <https://www.ic.gc.ca/app/scr/sittibc/web/bbmap?lang=eng#!map> (accessed on 7 June 2023). [71]
- Government of Canada (2023), *Regional Economic Growth through Innovation*, <https://www.canada.ca/en/atlantic-canada-opportunities/services/regional-economic-growth-through-innovation.html> (accessed on 7 June 2023). [104]
- Government of Canada (2023), *Rural Opportunity, National Prosperity: An Economic Development Strategy for Rural Canada*, <https://ised-isde.canada.ca/site/rural/en/rural-opportunity-national-prosperity-economic-development-strategy-rural-canada> (accessed on 22 Jan 2024). [15]
- Government of Canada (2023), *The Action Plan*, <https://www.justice.gc.ca/eng/declaration/ap-pa/index.html>. [45]
- Government of Canada (2023), *Women Entrepreneurship Strategy*, <https://ised-isde.canada.ca/site/women-entrepreneurship-strategy/en> (accessed on May 26 2023). [60]
- Government of Canada (2022), *Canada's Rural Economic Development Strategy: Progress Report August 2021*, <https://ised-isde.canada.ca/site/rural/en/canadas-rural-economic-development-strategy-progress-report-august-2021> (accessed on 3 February 2023). [3]
- Government of Canada (2022), *Community Futures*, <https://www.canada.ca/en/atlantic-canada-opportunities/services/community-futures.html> (accessed on 16 Feb 2023). [68]
- Government of Canada (2021), *Black Entrepreneurship Program*, <https://ised-isde.canada.ca/site/black-entrepreneurship-program/en> (accessed on 15 June 2023). [64]
- Government of Canada (2021), *Canada's Rural Economic Development Strategy: Progress Report*, <https://ised-isde.canada.ca/site/rural/sites/default/files/documents/2022-03/rural-strat-august-2021-aout-eng.pdf> (accessed on 22 January 2024). [16]
- Government of Canada (2021), *Entrepreneurship in Rural Canada: Necessity or Opportunity Driven?*, <https://ised-isde.canada.ca/site/sme-research-statistics/en/research-reports/entrepreneurship-rural-canada-necessity-or-opportunity-driven#results>. [70]
- Government of Canada (2021), *Indigenous Businesses Initiative*, <https://www.isc-sac.gc.ca/eng/1100100032796/1610546385227>. [67]
- Government of Canada (2021), *Women's Enterprise Initiative in British Columbia*, <https://www.canada.ca/en/pacific-economic-development/services/support/womens-enterprise.html> (accessed on 15 June 2023). [61]
- Government of Canada (2021), *Women's Enterprise Initiative in the Prairie Provinces*, <https://www.canada.ca/en/prairies-economic-development/services/support/womens-enterprise.html> (accessed on 15 June 2023). [62]

- Government of Canada (2020), *Annual Report to Parliament 2020*, Indigenous Services Canada, [31]
<https://www.sac-isc.gc.ca/eng/1602010609492/1602010631711> (accessed on 20 March 2023).
- Government of Canada (2020), “Encouraging women entrepreneurship in Quebec for a stronger economy”, [63]
<https://www.canada.ca/en/economic-development-quebec-regions/news/2020/08/ced-investments-to-support-womens-entrepreneurship.html> (accessed on 4 October 2023).
- Government of Canada (2019), *High-Speed Access for All: Canada’s Connectivity Strategy*, [77]
<https://ised-isde.canada.ca/site/high-speed-internet-canada/en/canadas-connectivity-strategy/high-speed-access-all-canadas-connectivity-strategy>.
- Government of Canada (2013), *Economic Development Initiative (EDI)*, [66]
[https://ised-isde-isde.canada.ca/site/communaction/en/economic-development-initiative](https://ised-isde.canada.ca/site/communaction/en/economic-development-initiative) (accessed on 15 June 2023).
- Government of Canada (1996), *Royal Commission on Aboriginal Peoples*, [53]
<https://www.bac-lac.gc.ca/eng/discover/aboriginal-heritage/royal-commission-aboriginal-peoples/Pages/introduction.aspx> (accessed on 11 October 2018).
- Government of Canada (n.d.), *Canada’s Regional Development Agencies*, [26]
[https://ised-isde-isde.canada.ca/site/ised/en/canadas-regional-development-agencies](https://ised-isde.canada.ca/site/ised/en/canadas-regional-development-agencies).
- Government of Canada (n.d.), *Government Expenditure Plan and Main Estimates - 2022–23 Estimates*, [27]
<https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates/2022-23-estimates/main-estimates>.
- Hindle, K. and M. Lansdowne (2005), “Brave spirits on new paths: Toward a globally relevant paradigm of indigenous entrepreneurship research”, *Journal of Small Business & Entrepreneurship*, Vol. 18/2, pp. 131-141, [92]
<https://doi.org/10.1080/08276331.2005.10593335>.
- Innosuisse (2022), “Innovation boosters”, Presentation. [81]
- Innovation Norway (n.d.), *Our Services*, [17]
<https://en.innovasjon Norge.no/article/our-services>.
- Interface (2022), *Interface Online*, [49]
<https://interface-online.org.uk/> (accessed on 15 June 2023).
- Isaksen, A. and J. Karlsen (2016), “Innovation in peripheral regions”, in *Handbook on the Geographics of Innovation*, Edward Elgar Publishing, [20]
<https://doi.org/10.4337/9781784710774.00030>.
- Isaksen, A. et al. (2018), “Differentiated regional entrepreneurial discovery processes. A conceptual discussion and empirical illustration from three emergent clusters”, *European Planning Studies*, Vol. 26/11, pp. 2200-2215, [52]
<https://doi.org/10.1080/09654313.2018.1530143>.
- Kobzik, J. and T. Krawchenko (2022), ““What do we want and how do we get there”: A comparative content analysis of First Nations Comprehensive Community Plans in British Columbia”, Canadian Public Administration, Wiley, [55]
<https://doi.org/10.1111/capa.12507>.

- Krawchenko, T. et al. (2022), *What is Rural Policy Today? A Pan-Canadian Scan of Policies for Rural Places*, Canadian Rural Revitalisation Foundation, <https://crrf.ca/wp-content/uploads/2022/05/Rural-Policies-CRRF-2022.pdf>. [46]
- Larsson, L., T. Fuller and C. Pletsch (2012), "Business and community approaches to rural development: Comparing government-to-local approaches", *Journal of Rural and Community Development*, Vol. 7/2. [35]
- Marshallian, M., P. Chan and M. Bournisien de Valmont (2023), "Networks and rural-urban linkages for rural innovation", *OECD Regional Development Papers*, No. 53, OECD Publishing, Paris, <https://doi.org/10.1787/4928f26b-en>. [25]
- Mastroeni, M. (2022), "Ontario: Heartland Canada", in *Ideas, Institutions, and Interests: The Drivers of Canadian Provincial*, University of Toronto Press, <https://doi.org/10.3138/9781487534806>. [97]
- McDonald, C. (2019), "Promoting Indigenous community economic development, entrepreneurship and SMEs in a rural context", *OECD Regional Development Working Papers*, No. 2019/03, OECD Publishing, Paris, <https://doi.org/10.1787/57b8c6e5-en>. [54]
- MICA (2021), *Homepage*, Mining Innovation Commercialisation Accelerator Network, <https://micanetwork.ca/>. [13]
- Municipal World (2018), "Embracing business opportunities raises living standards and incomes for Fort McKay First Nation members", <https://www.municipalworld.com/feature-story/embracing-business-opportunities-raises-living-standards-and-incomes-for-fort-mckay-first-nation-members/>. [56]
- Murakami, T. (2016), "History and introduction of the Kamo Aquarium", *Der Zoologische Garten*, Vol. 85/1-2, pp. 64-73. [47]
- Nicholson, P. (2018), "Facing the facts: Reconsidering business innovation policy in Canada", *IRPP Insights*, No. 22, <http://irpp.org/wp-content/uploads/2018/10/Facing-the-Facts-Reconsidering-Business-Innovation-Policy-in-Canada.pdf>. [9]
- Nicholson, P. (2016), "Canada's low-innovation equilibrium: Why it has been sustained and how it will be disrupted", *Canadian Public Policy*, Vol. 42/S1, pp. S39-S45, <https://doi.org/10.3138/cpp.2015-019>. [5]
- Norden (2006), *Understanding User-Driven Innovation*, Nordic Council of Ministers, <http://norden.diva-portal.org/smash/get/diva2:701139/FULLTEXT01.pdf> (accessed on 15 June 2023). [102]
- OECD (2023), *Enhancing Rural Innovation in Scotland, United Kingdom*, OECD Publishing, Paris, <https://doi.org/10.1787/33b8c803-en>. [83]
- OECD (2023), *Enhancing Rural Innovation in the United States*, OECD Publishing, Paris, <https://doi.org/10.1787/22a8261b-en>. [73]
- OECD (2023), *The Geography of Higher Education in Québec, Canada*, OECD Skills Studies, OECD Publishing, Paris, <https://doi.org/10.1787/becf3c60-en>. [50]
- OECD (2022), *Adapting Regional Policy in Korea : Preparing Regions for Demographic Change*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/6108b2a1-en>. [94]

- OECD (2022), *Enhancing Innovation in Rural Regions: Switzerland*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/307886ff-en>. [29]
- OECD (2022), *Unlocking Rural Innovation*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/9044a961-en>. [24]
- OECD (2021), *Bridging Digital Divides in G20 Countries*, OECD Publishing, Paris, <https://doi.org/10.1787/35c1d850-en>. [76]
- OECD (2021), *Embracing Innovation in Government*, OECD, Paris, <https://trends.oecd-opsi.org/> (accessed on 15 June 2023). [85]
- OECD (2021), *R&D Tax Incentives: Canada, 2021*, Directorate for Science, Technology and Innovation, OECD, Paris. [11]
- OECD (2020), *Linking Indigenous Communities with Regional Development in Canada*, OECD Rural Policy Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/fa0f60c6-en>. [2]
- OECD (2019), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264312838-en>. [37]
- OECD (2017), *OECD Territorial Reviews: Northern Sparsely Populated Areas*, OECD Territorial Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/9789264268234-en>. [89]
- OECD (2014), *OECD Science, Technology and Industry Outlook 2014*, OECD Publishing, Paris, https://doi.org/10.1787/sti_outlook-2014-en. [23]
- OECD (2012), *OECD Reviews of Regional Innovation: Central and Southern Denmark 2012*, OECD Reviews of Regional Innovation, OECD Publishing, Paris, <https://doi.org/10.1787/9789264178748-en>. [39]
- OECD (forthcoming), *Enhancing Innovation in Rural Regions: Japan*, OECD Publishing, Paris. [82]
- OECD (n.d.), *R&D Tax Incentives and Innovation (database)*, <http://oe.cd/rdtax> (accessed on 15 December 2021). [10]
- Peredo, A. et al. (2004), "Towards a theory of indigenous entrepreneurship", *International Journal of Entrepreneurship and Small Business*, Vol. 1/1/2, p. 1, <https://doi.org/10.1504/IJESB.2004.005374>. [90]
- Phillips, P. and A. Ballantyne (2022), "Saskatchewan: Where innovation is a contact sport", in *Ideas, Institutions, and Interests: The Drivers of Canadian Provincial Science, Technology, and Innovation Policy*, University of Toronto Press, <https://doi.org/10.3138/9781487534806>. [99]
- Phillips, P. and D. Castle (2022), *Ideas, Institutions, and Interests: The Drivers of Canadian Provincial Science, Technology, and Innovation Policy*, University of Toronto Press, <https://doi.org/10.3138/9781487534806>. [8]
- Prime Minister of Canada (2020), "Prime Minister announces support for Black entrepreneurs and business owners", <https://pm.gc.ca/en/news/news-releases/2020/09/09/prime-minister-announces-support-black-entrepreneurs-and-business> (accessed on 15 June 2023). [65]
- Schlaile, M. et al. (2020), "Systems entrepreneurship: A conceptual substantiation of a novel entrepreneurial "species"", *Sustainability Science*, Vol. 16/3, pp. 781-794, <https://doi.org/10.1007/s11625-020-00850-6>. [105]

- Schwanen, D. (2017), "Innovation policy in Canada: A holistic approach", *CD Howe Institute Commentary*, No. 497, <https://doi.org/10.2139/ssrn.3088156>. [6]
- Science Council of Canada (1975), *Technology Transfer Government Laboratories to Manufacturing Industry*. [19]
- Science Council of Canada (1971), *Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing*, <https://www.uottawa.ca/research-innovation/sites/g/files/bhrsksd326/files/2022-08/report-no.-15-innovation-in-a-cold-climate.pdf>. [18]
- Scottish Government (n.d.), *Find Business Support*, <https://findbusinesssupport.gov.scot/> (accessed on 15 June 2023). [41]
- Singh, V. and J. Chobotaru (2022), "Digital divide: Barriers to accessing online government services in Canada", *Administrative Sciences*, Vol. 12/3, p. 112, <https://doi.org/10.3390/admsci12030112>. [72]
- SINTEF/NRI (n.d.), *First among Smart Regions in Norway. Evaluation of Nordland's Innovation Strategy for Smart Specialisation 2014-2020*, <https://nforsk.brage.unit.no/nforsk-xmlui/handle/11250/2724399>. [95]
- Skills Development Scotland (n.d.), *Rural Leadership Programme*, <https://www.skillsdevelopmentscotland.co.uk/what-we-do/skills-planning/skills-action-plan-for-rural-scotland/rural-scotland-blogs-and-newsletters/rural-leadership-programme/>. [93]
- Smart Rural Areas (2021), *Penela*, https://www.smartrural21.eu/villages/penela_pt/ (accessed on 15 June 2023). [86]
- Statistics Canada (2023), "Business innovation and growth support, 2020", <https://www150.statcan.gc.ca/n1/en/daily-quotidien/230112/dq230112b-eng.pdf?st=jV9aBZzr> (accessed on 2023 June 07). [12]
- Synchronex (2021), "Mot du président du CA et de la présidente-directrice générale". [51]
- UK Government (n.d.), *Department for Business, Innovation & Skills*, Government of the United Kingdom, <https://www.gov.uk/government/organisations/department-for-business-innovation-skills>. [40]
- US Government (n.d.), *Rural Partners Network*, United States Government, <https://www.rural.gov/> (accessed on 15 June 2023). [42]
- USDA (n.d.), *Equity Commission: Shaping Change at USDA*, United States Department of Agriculture, <https://www.usda.gov/equity-commission> (accessed on 15 June 2023). [103]
- Weeden, A. and W. Kelly (2021), "Canada's (dis)connected rural broadband policies: Dealing with the digital divide and building 'digital capitals' to address the impacts of COVID-19 in rural Canada", *Journal of Rural and Community Development*, Vol. 16/4. [80]
- Wohan, T. (forthcoming), "Experimenting in the cloud: The digital divide's impact on innovation", Working paper submitted to Telecommunications Policy, National Science Foundation. [75]
- World Bank (2020), *Global Experiences from Regulatory Sandboxes*, World Bank, Washington, DC, <https://documents1.worldbank.org/curated/en/912001605241080935/pdf/Global-Experiences-from-Regulatory-Sandboxes.pdf> (accessed on 23 January 2024). [84]

Notes

¹ User-driven innovation refers to innovation initiated as a solution to an underlying challenge of entrepreneurs within the process of delivering a product or service. Demand-driven innovation refers to more general market demand from customers and clients that can include the creation of new services or products to satisfy customer demands.

² “The North” in Canada has a particular meaning and can be usefully partitioned into the provincial north and the territorial north, with both categories being distinct from rural southern Canada where the OECD typology and other typologies usually apply.

³ Other federal agencies important for the innovation agenda include: the Business Development Bank of Canada, the Canadian Space Agency, the Competition Tribunal, the Copyright Board of Canada, Destination Canada (formerly known as the Canadian Tourism Commission), the National Research Council Canada, the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council of Canada, the Standards Council of Canada and Statistics Canada. In 2023, Canada also created the Canada Innovation Corporation to strengthen business R&D support and commercialisation.

⁴ This is similar to the Office of Technology Assessment operating around the same time in the United States.

⁵ First Nations citizens who are governed under the Indian Act fall under federal jurisdiction for healthcare, education and all forms of social provision that are for the rest of the population a matter of provincial and territorial responsibility. Their reserve lands and collective wealth are under federal control, managed “in trust”, unless they participate in certain federal programmes that provide for a degree of independent economic management and funding arrangements. Despite the dominant role of the federal government, Section 88 of the Indian Act provides that provincial and territorial laws of general application apply to individuals who are governed under the act. Some First Nations and a smaller number of Métis are also parties to modern treaties and have created governing institutions pursuant to those treaties. In other places, First Nations governed by the Indian Act are building alternative institutions with the long run goal of removing themselves from Indian Act jurisdiction. This has resulted in a wide range of evolving forms of self-government.

⁶ In ACOA, like in other RDAs, this includes a relatively large programmes such as the Regional Economic Growth through Innovation, which works on building framework conditions to help to start and grow businesses and non-profits in Atlantic Canada (Government of Canada, 2023^[104]).

⁷ In part, this large deviation is due to COVID relief funds being delivered by Community Futures.

⁸ Only CanNor official reports spending on Indigenous-specific programmes. However, this does not exclude the fact that Indigenous communities may still benefit from other programme spending.

⁹ CanNor does not fund any CFPs.

¹⁰ Further information available at myswitchboard.ca.

¹¹ For more information, see <https://findbusinesssupport.gov.scot/>.

¹² For more information, see <https://www.ontario.ca/page/aboriginal-peoples-relationships>.

¹³ For more information, see <https://ccednet-rcdec.ca/en/toolbox/local-people-local-solutions-guide-first-nation-co-operative>.

¹⁴ The strategy says: “The City of Kenora and this 5-Year Tourism and Economic Development Strategy recognize the historic connection of Indigenous peoples to this place as original inhabitants of the area. It is also recognized the importance Indigenous peoples and communities have in the current and future growth and development of Kenora’s tourism sector and local economy”.

¹⁵ The six studies covered as case studies included a considerable share of rural conditions in Canada. All are small population settlements, with populations between 15 000 and 2 000 inhabitants. In terms of OECD rural typology, one is rural within a metropolitan region, two are adjacent rural and the other three are rural remote, but the degree of remoteness exceeds the norms used for constructing the OECD typology. In several locations Indigenous people are a considerable share of the population and their presence provides another dimension for innovation to occur, both in terms of a distinct society that seeks its own development path within the larger economy and through innovative collaborations between Indigenous people and their non-Indigenous neighbours.

¹⁶ For example, Indigenous governments that have been established consequent to the negotiation of a comprehensive land claim agreement (a modern treaty), such as the Tłı̨ch̨ Government in the Northwest Territories and the Nunatsiavut Government in Labrador; both have economic development officers and are networked to business development contacts in other organisations, financial institutions and government departments and agencies. It is also important to note that the pan-Canadian network of Aboriginal Financial Institutions (AFIs) fills an incredibly important role in providing access to finance for Indigenous businesses and other business support services. There are three types of AFIs across Canada: i) the Aboriginal Capital Corporations; ii) Aboriginal Community Futures Development Corporations (ACFDC); and iii) Aboriginal Developmental Lenders. Each serve a slightly different purpose. Community Futures (of which the ACFDC are a part) are a network of 267 offices across Canada focused on rural development that provide business financing to small local businesses (e.g. small business loans, tools, training and events for people wanting to start, expand, franchise or sell a business). They work in partnership with other business lenders, educational institutions, not-for-profits and community governments. Only a few of the CFPs are Aboriginal-exclusive. Unlike most AFIs, CFPs can also deliver economic development strategies. See the OECD’s work on *Linking Indigenous Communities with Regional Development in Canada* (2020^[2]) for a comprehensive overview of AFIs and related Indigenous business development and financial services.

¹⁷ A systems entrepreneur can be described as an entrepreneur or community actor that works on a systems (network) base, often engaging with an ecosystem of actors in a community or place that can include public, private and non-profit sectors to solve challenges that are engrained in the system. These challenges are often rooted in relationships that involve social, economic and environmental factors rather than one-issue challenges that can be reduced to cause-effect relationships (Schlaile et al., 2020^[105]).

¹⁸ Isaksen et al. (2018^[52]) provide three case studies of regions in Norway to illustrate their model. In each model, they identify the role of the local RIS and provide examples of an entrepreneurial discovery process that is partially driven by the actions of the RIS but also by entrepreneurial behaviour both by firms or individuals and by civil society organisations, including social enterprise. Their focus is on the behaviour of local clusters, which they use as a proxy for local comparative advantage. In each case, the clusters they examine were strongly supported by Innovation Norway, the national agency supporting innovation, and there was at least one active higher education institution supporting the main clusters in each region as well as several producer organisations. They also note ways in which systems entrepreneurs better support emerging firms (p. 43^[52]). Importantly, in the smallest region with only a “thin” RIS, firms have longstanding relationships with distant universities and organisations that provide technical expertise (p. 41^[52]). This clearly parallels the ongoing relationship between the Fogo Island Co-operative Society and the Fisheries and Marine Institute of Memorial University of Newfoundland.

¹⁹ This sentiment was expressed, for example in Canada’s *Royal Commission on Aboriginal Peoples* (1996^[53]); it was viewed as the core element underpinning the hundreds of recommendations contained in the report.

²⁰ For more information on how the figure was calculated, please refer to Caldas, Marshallian and Veneri (2023^[106]).

²¹ The authors consider propensity score matching and endogenous treatment effect models to control for innovation orientation and find evidence of cloud adoption enable various types of innovation using the 2018 Annual Business Survey of the United States.

²² For more information, see <https://www.gov.nl.ca/iet/funding/innovation-and-business-development-fund/>.

²³ For more information, see https://www.ntassembly.ca/sites/assembly/files/td_498-183_0.pdf.

²⁴ For more information, see https://www.enr.gov.nt.ca/sites/enr/files/documents/53_03_traditional_knowledge_policy.pdf.

²⁵ For more information, see https://www.economie.gouv.qc.ca/fileadmin/contenu/documents_soutien/strategies/recherche_innovation/SQRI/sqri_complet_fr.pdf.

²⁶ For more information, see <https://www.quebec.ca/habitation-territoire/amenagement-developpement-territoires/developpement/fonds-programmes/fonds-regions-ruralite>.

²⁷ For more information, see https://transitionenergetique.gouv.qc.ca/fileadmin/medias/pdf/plan-directeur/TEQ_PlanDirecteur_web.pdf.

²⁸ For more information, see <https://publications.saskatchewan.ca/api/v1/products/103260/formats/114516/download>.

²⁹ For more information, see <https://www.fset.inc/pikangikum/>.

³⁰ For more information, see <https://shorefast.org/economicnutrition/#:~:text=Economic%20Nutrition%20is%20an%20initiative,piloted%20for%20more%20widespread%20use> and <https://fogoislandinn.ca/contact-us/economic-nutrition/>.

4 Green innovation in rural Canada

This chapter focuses on green innovation in Canada's rural areas. It starts by analysing the current climate implications across different Canadian geographies and then investigates if the existing business support ecosystem for green innovation sufficiently addresses rural regions. It identifies potential gaps for support and barriers to enhance green innovation. The chapter then proposes a set of different policy actions that can enhance green innovation in rural Canada, including clear market signals, clear definitions of and work towards rural opportunities, better policy co-ordination, green support streamlined into general programmes and the need for more granular data.

Key messages

Rural regions in Canada are pivotal to the fight against climate change. Contrary to most OECD countries, in Canada, rural remote regions contribute more to production-based greenhouse gas (GHG) emissions in total than any other regional type. The same is true for estimates of per capita emissions. Canadian regions are not in line with the United Nations (UN) goal of reducing the per capita carbon footprint to around 2 to 2.5 tonnes of carbon dioxide (CO₂) by 2030; most large regions (TL2) are also above the OECD average of 11.5 tonnes of CO₂.

Emissions are highly concentrated within provinces and territories, with some small regions (TL3) emitting several times above the provincial mean. This is in part because of Canada's industrial structure, which includes energy, heavy industry and transport components. This suggests that targeted actions to reduce emissions in small regions with specific sectors can have significant mitigation impacts but will also require substantive transition action.

The most remote regions in Canada's arctic and coastal areas are particularly vulnerable to climate change. Some are warming at more than double the global rate. These places, in particular, are in need of quick, adaptive actions, including the rising risk of early thawing of permafrost that will cause arctic communities to face relocation, looking for new transport solutions, managing health risks and adapting their economies.

Canada's rural places have a range of assets and opportunities that are underutilised in addressing climate challenges and where green innovation can play an important role in activating them. These include the utilisation and generation of renewable energy, production and application of emissions-free vehicles, carbon capture and carbon sequestration, including payments for ecosystem services, green hydrogen generation and more general applications of the bio- and circular economy and nature-based solutions.

Green innovation (defined as innovations that benefit the environment through product, service, process or business innovation) will not be sufficient to solve all of Canada's climate challenges, yet it is necessary to enable the transition to a climate-friendly economy and address adaptation challenges. Green innovation is also a source of competitive advantage in the fast-growing environmental goods and services industry. Still, policy intervention for green innovation is needed because market mechanisms do not allow for enough green innovation.

Canada's Indigenous peoples are essential to realising green innovation in rural regions. Not only are they more concentrated in rural places compared to Canada's non-Indigenous population but they also govern significant amounts of land (modern treaties alone provide Indigenous ownership of over 600 000 square kilometres [km²] of land), hold constitutionally protected Aboriginal and Treaty Rights and participate in co-management regimes for natural resources, energy and transportation infrastructure projects. Recognising this, Canada has made firm commitments in plans and legislation to advance and support self-determined Indigenous climate action and climate leadership.

Some of Canada's rural small and medium-sized enterprises (SMEs) face a range of general challenges in adopting green business approaches and engaging in green innovations. These include a lack of awareness, information and knowledge on changing environmental requirements, limited availability of resources for greening, such as skills, finance and technology and uncertainties in markets and policies. In addition, the COVID-19 pandemic and the recent price spikes in energy left some SMEs with limited resources. This makes them vulnerable and further reduces their capacity to engage in greening activities requiring investments. Some RDAs have made important advancements to address these challenges in their programmes.

The Canadian government has significantly increased its support and ambitions with regard to green innovation. Over the past 5 years, clean technology (in short cleantech) spending has more than doubled, reaching CAD 786.8 million. Key policy documents defining the country's net zero pathway were released in 2022, including a focus on clean procurement, a positive signal for innovation. Despite these advancements, Canada is lagging behind other major OECD economies in terms of classical green research and development (R&D) spending and patent generation. The federal budget in 2023 earmarked further funding for a number of clean economy initiatives that included programming, financing and investment tax credits, as well as planned investment from the Canada Infrastructure Bank in major clean energy and infrastructure projects. Despite pressures on rural regions and existing rural opportunities, conventional green innovation support and strategies are largely space-blind and are likely to contribute more to urban economies. Many do not grasp the specific needs, opportunities and challenges existing in different geographies. At the same time, regionally specific federal programmes, like regional development agencies (RDAs), are often limited financially or lack a green/environmental dimension. For instance, on average, RDAs earmark only 4% of their budget on clean technologies and their Community Futures Program does not have an environmental dimension.

Policy priorities on green innovation are also fragmented across federal and provincial governments and their respective departments, causing existing funds to come from a variety of different sources and often in the form of one-off grants to individual firms. This generates mixed signals and reduces efficiency while increasing red tape for applicants. More complementary structured funding is important to address this issue.

Introduction

Rural regions are pivotal in the transition to a net zero-emission economy and in building resilience to climate change because of their natural endowments. Rural regions are home to around 30% of the OECD's population and cover approximately 80% of its territory, containing the vast majority of land, water and other natural resources. These lands are needed for food and renewable energy production from wind, water and biomass. They are also where we find natural beauty, biodiversity and ecosystem services that produce clean air, detoxify waste, provide clean water, sequester carbon and allow for recreation. Forests and wetlands, for instance, function as natural carbon sinks: trees and other vegetation sequester an amount equivalent to roughly one-third of global emissions (IPCC, 2019^[1]). Wind, water, biomass and waste present in rural lands are used to create clean energy. These fundamental values to our well-being are increasingly recognised, as is the duty to protect them for current and future generations.

At the same time, rural communities often struggle to adapt and prepare for the transformational challenges required to move to net zero emissions. Over the past decades, the benefits of globalisation and technological change have not reached many rural places, leading to territorial disparities. Rural economies are experiencing increased competition from less developed countries. The shift to a service economy has largely benefitted cities and important infrastructure, including broadband, is missing. An ageing population, limited economic diversity and dependence on external markets and transport often accelerate their vulnerability. Consequently, many rural communities feel left behind and exposed to a range of challenges they have to deal with (OECD, 2020^[2]). Rural regions and their workers, specialised in economic activities which need to be phased out in the transition to net zero emissions, will need dedicated support.

While rural places are not without their challenges, they are also, unquestionably, places of opportunity that are key in delivering wider well-being to current and future generations. Rural policies have an important role in reaching net zero GHG emission targets while also generating benefits for rural communities. This can happen through more sustainable land management, higher valorisation of ecosystem services, making use of innovative production processes around agriculture, mining and renewable energies and new modes of transportation. At the same time, this requires a fundamental transformation of rural economies and societies.

Transitioning to net zero will require a massive deployment of alternative energy technologies as well as new technologies that are not yet on the market or currently in the demonstration or prototype phase. This means that significant innovation efforts must take place this decade in order to bring these new technologies to market (IEA, 2021^[3]). Many of these innovations will need to occur or be adopted in rural regions where most emissions-intensive industries are located but also where renewable energy can be generated from sun, wind and water and where there is massive potential to develop the circular- and bioeconomy. Supporting innovation in these areas not only diversifies ongoing business activities but also creates new businesses while contributing to environmental and climate protection.

Transition to net zero in rural areas also requires the involvement of Indigenous businesses, peoples and communities. Approximately 1.7 million people in Canada self-identify as Indigenous, which is 5% of the total population. The Canadian Constitution Act (1982) recognises three groups: Indians (now referred to as First Nations), Inuit and Métis. In their position as governors of land, Indigenous peoples in Canada oversee over 40% of Canada's land mass, much of it rural and remote. They also participate in co-management regimes for natural resources, energy and transportation infrastructure projects, making them influential contributors to green innovation in Canada. The Government of Canada is moving to align its laws with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and has made firm commitments to reconciliation.

This chapter investigates how rural Canada can use green innovation to make climate change contributions and boost its rural development. To this end, it looks at regional differences in mitigation potential based on the distributive effects of emissions and highlights specific geographies that suffer distinct adaptation pressures, such as the arctic and coastal areas. It then explains the concept of green innovation and discusses rural-specific considerations for green innovation. Finally, it makes recommendations on how to improve and accelerate innovation in rural Canada that can contribute to climate change mitigation and adaptation efforts and support the resilience of rural communities.

Canada is facing a rural mitigation and adaptation challenge to address climate change

Emissions reduction: Remote rural regions and their industries are essential to achieving the net zero goal in Canada

Climate change is a global challenge threatening the foundations of human well-being. To limit negative impacts, most OECD countries aim for net zero domestic GHG emissions by 2050 (Box 4.1). Deep and broad transformations of economies will be needed. Impacts, local conditions and vulnerabilities vary across territories and by degree of rurality. In Canada, however, production-based emissions are a particular concern for rural regions and policy needs to focus on reducing emissions in rural places to achieve the national net zero emissions goal.

The typology used in this document identifies five types of small regions (TL3) based on the share of the population living in metropolitan areas and an accessibility criterion. It is used to assure OECD comparability across countries regarding the available climate data. The 5 types of regions include 2 types of metropolitan regions – large metropolitan (with a functional urban area [FUA] of more than 1.5 million people) and metropolitan (with an FUA of more than 250 000 people) regions – and 3 types of rural regions – regions near a large city (i.e. regions with access to an FUA of more than 250 000 people within a 60-minute drive), regions with or near a small/medium city (i.e. regions with an FUA between 50 000 and 250 000 people or with access to one within a 60-minute drive) and remote regions (see Chapter 3 for more detail). Throughout this chapter, reference will be made to “rural regions” when referring to the group of non-metropolitan regions. The terms “city” and FUA will be used interchangeably. The document uses the term “large city” to signify a city (FUA) with more than 250 000 inhabitants and “very large” city when referring to a city with more than 1 million inhabitants. The term “areas outside FUAs” is meant to be a comprehensive list of territories with settlements at an intermediate or low-density level, such as towns and suburbs, as defined by the UN Degree of Urbanisation. Remote regions are those in which 50% of its population do not have access to any FUA within a 60-minute drive. The authors acknowledge that the used definition of remoteness, as defined by the OECD, poses some challenges in the Canadian context, as differences between regions that fall into this category can be considerable. Terms such as “rural economy”, “rural places” and “rural communities” are used conceptually for policy purposes and are not meant to reflect any particular territorial definition.

Box 4.1. Canada’s net zero-emission target

Canada has joined over 120 countries in committing to net zero emissions by 2050, including all other Group of Seven (G7) nations (France, Germany, Italy, Japan, the United Kingdom and the United States). The Canadian Net-Zero Emissions Accountability Act, which became law on 29 June 2021, enshrines in legislation Canada’s commitment to achieve net zero emissions by 2050 and provides a framework of accountability and transparency to guide efforts in reaching this goal. The

act establishes a legally binding process to set five-year national emissions targets and develop credible, science-based plans to achieve each target, as well as a series of progress and assessment reports. When developing an emissions target or emissions reduction plan, the Minister of Environment and Climate Change must provide the provinces and territories, Indigenous peoples, the Net-Zero Advisory Body and interested persons with the opportunity to make submissions. The act also established the Net-Zero Advisory Body in legislation, a group of diverse experts from across Canada who engage Canadians and provide independent advice with respect to achieving net zero emissions by 2050.

A number of provinces and cities have already made net-zero-by-2050 commitments, including Guelph, Halifax, Hamilton, Newfoundland and Labrador, Toronto, Vancouver and, most recently, Quebec. Prince Edward Island has also pledged to reach net zero GHG emissions by 2040. Moreover, British Columbia and Nova Scotia have or plan to put into place, provincial net-zero-by-2050 legislation.

Furthermore, a range of First Nations, Inuit and Métis climate strategies have also been developed, striving for net zero emissions by 2050 in order to meet adaptation, mitigation and resilience-building needs in the face of rapid climate change. For instance, Resolution 05/2019 of the Canadian Assembly of First Nations (AFN) officially declared a First Nations Climate Emergency and has since set out to develop an AFN National Climate Strategy. Other examples include the British Columbia First Nations Climate Strategy and Action Plan, the National Inuit Climate Change Strategy and the Métis Nation Climate Change and Health Vulnerability Assessment.

Source: Assembly of First Nations (2019^[4]), *Declaring a First Nations Climate Emergency*, <https://afn.bynder.com/m/5a3de3c7f6cf08b5/original/05-2019-Declaring-a-First-Nations-Climate-Emergency.pdf>; Government of Canada (2023^[5]), *Net-Zero Emissions by 2050*, <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html>; First Nations Leadership Council (2022^[6]), *BC First Nations Climate Strategy and Action Plan*, <https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>; Inuit Tapiriit Kanatami (2019^[7]), *National Inuit Climate Change Strategy*, https://www.itk.ca/wp-content/uploads/2019/06/ITK_Climate-Change-Strategy_English.pdf; Métis National Council (2019^[8]), *Métis Climate Change and Health Vulnerability Assessment*, <https://www.metisnation.ca/uploads/documents/MNCHVA%20FINAL%20Report.pdf>.

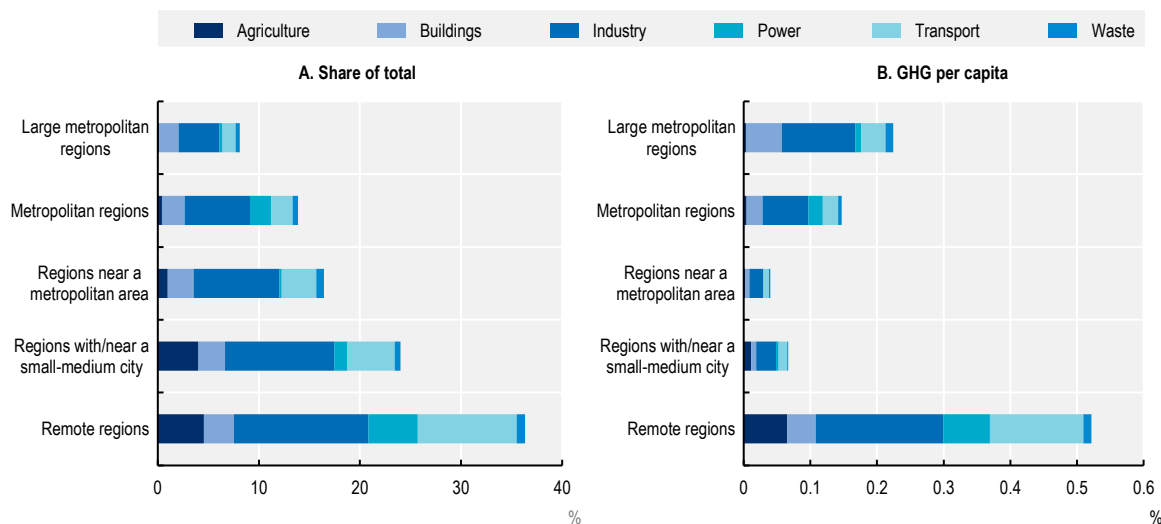
Rural regions in Canada play a particularly important role in mitigating climate change. Production-based emission estimates indicate that both in total and in per capita terms, Canada's remote rural regions have much higher emissions than metropolitan regions (Figure 4.1). Over half (52%) of total GHG emissions is due to production in remote regions in 2022. This is largely due to industrial, including energy exploitation and processing (19% of the total), and transportation activities (14% of the total). This is not the same across other OECD countries, where rural remote regions account for about 16.5% of production-based GHG emissions. In most countries, metropolitan regions emit more GHGs than remote regions in absolute terms (OECD, 2021^[9]). In per capita estimates, however, rural regions always emit the most. In Canada, the biggest contributions to production-based emissions in remote regions come from:

- Industry (combustion for manufacturing, chemical processes, iron and steel production, non-ferrous metals production, non-energy use of fuels, solvents and products use, non-metallic minerals production).
- Transport (road transport, aviation, shipping, railways, pipelines, off-road transport).
- Energy (power industry, oil refineries and transformation industry, fuel exploitation).

This already provides a certain indication of which industries should be targeted for emission reduction policies and where measures such as the implementation of green innovation can make a positive impact. It is also important to acknowledge that the historical GHG emissions directly attributed to Indigenous peoples in Canada are negligible compared to emissions from industry in rural areas. GHG emissions originating from Indigenous communities are estimated to be less than 1 megatonne per year, largely insignificant compared to 670 for the whole of Canada in 2021 (NIEDB, 2022^[10]):

Figure 4.1. Contribution to estimated GHG emissions in Canada, 2022

Share of GHG emissions and GHG per capita



Note: The figures refer to OECD calculations based on estimated GHG emissions data from the European Commission's Joint Research Centre (ECJRC). The ECJRC Emissions Database for Global Atmospheric Research allocates national GHG emissions to locations according to about 300 proxies.

Source: Updated from OECD (2021^[9]), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, <https://doi.org/10.1787/17017efe-en>.

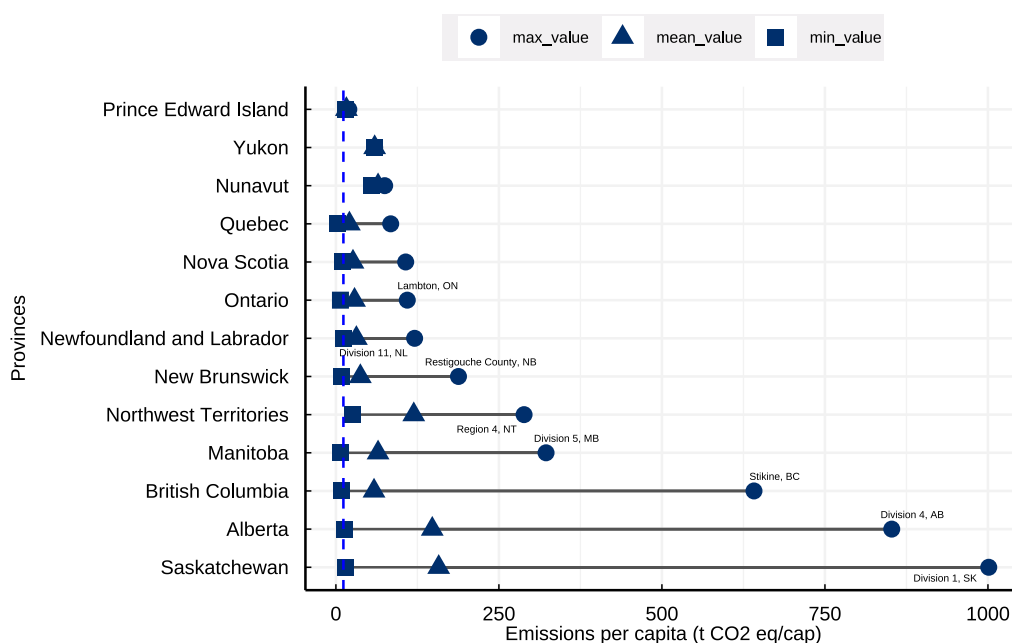
Emissions in Canada are largely uneven across as well as within provinces and territories. For instance, emissions per capita in Saskatchewan are more than six times higher than in Quebec. Likewise, within these large provinces, disparities can be massive. Figure 4.2 demonstrates that in the most extreme cases, such as in Saskatchewan, emissions can vary as much as nearly 1 000 tonnes of CO₂ equivalent per capita (tCO₂eq/cap) between small regions (TL3). Overall, Alberta, British Columbia and Saskatchewan have the highest per capita disparities, while Manitoba, New Brunswick and the Northern Territories have some and Prince Edward Island, Nunavut and Yukon have next to no disparities. Overall, most GHG emissions per capita generated in large Canadian regions (TL2) are above the OECD average of 11.5 tCO₂eq/cap. Only Ontario, Prince Edward Island and Quebec have lower values.

In 2018, the biggest GHG emitter in Saskatchewan came from Division 1 and specifically the oil production sector, which contributes 57% of regional emissions. In Alberta, Division 4's energy production sector is the leading emitter, contributing 68% of regional emissions. In British Columbia, they are highest in Stikine, where the road transport sector produces 59% of regional emissions. In general, the top-emitting small region types (TL3) in all provinces and territories are rural and remote, and the top polluting sectors in each are concentrated in oil production, energy production and transportation (aviation and road).

Figure 4.3 shows the data covering all small regions (TL3) in Canada. It clearly identifies those regions where emissions reductions are the most urgently needed. Still, all Canadian regions are far from reaching net zero by 2050. The UN Paris Agreement commits to pursuing efforts to limit global temperature increase to 1.5 degrees and requires reducing emissions to a per capita lifestyle carbon footprint of around 2 to 2.5 tCO₂ by 2030 and an even smaller 0.7 tonnes by 2050. Currently, no region is reaching this target in Canada; the lowest of all small regions stands at 3.2 tCO₂eq/cap in L'Assomption, Quebec. Even if the more permissive target of 2.5 tCO₂eq/cap is taken, it would mean an average reduction of 99% in emission in the most polluting regions (150 or more tCO₂eq/cap) and an average reduction of 86% for all other regions between 2018 and 2030 to reach the climate goal in all small regions. Rural regions, which emitted more in per capita terms than metropolitan regions in 2018, would need to reduce per capita emissions by

93%, while the latter would need a reduction of 79%. Allowing for regional fluctuations, an overall nationwide reduction of 88% is needed.

Figure 4.2. Emissions estimate disparity between TL3 regions within TL2 regions (province/territory), 2018



Note: Analysis based on 13 TL2 provinces and territorials and 293 small TL3 regions in Canada in 2018. The OECD average is represented by the dashed line.

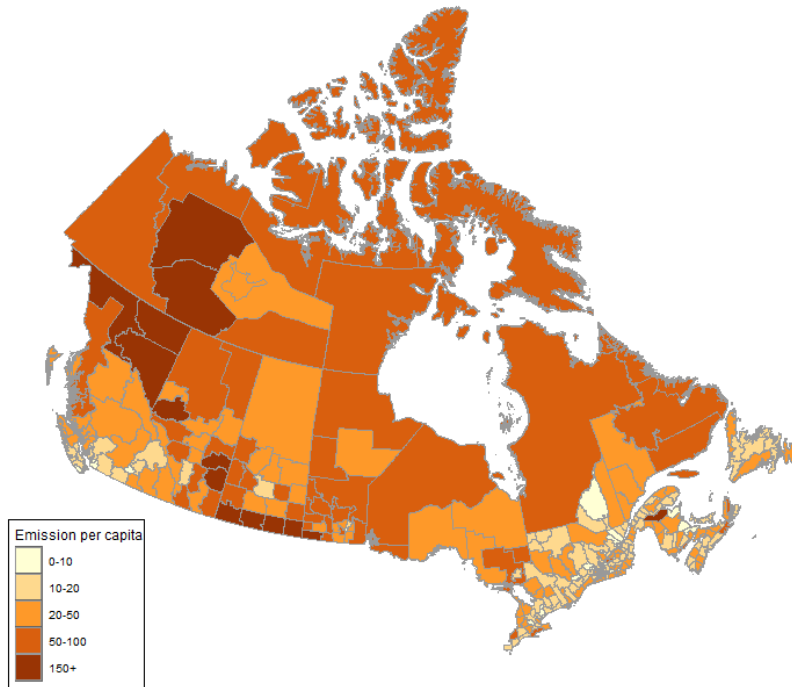
Source: OECD (n.d.^[11]), *OECD Regional Statistics (database)*, <https://doi.org/10.1787/region-data-en>.

A place-based emission reduction strategy is needed in Canada to address these inter-provincial disparities effectively. It will need to directly target large emitting regions and allow for transition according to local characteristics and configurations, considering each place's unique opportunities and challenges. It also demonstrates that emissions cannot be ascribed to just a large region (TL2) such as provinces but need to be understood at a granular level. A more offensive policy response will need to focus on provinces and territories in combination with sectors, given that the main emitters vary by sector and small regions (TL3).

A place-based strategy could support change in regions where most gains can be made by targeting the right sectors and putting in place economic transition programmes suited to local conditions. Place-based emissions-reduction strategies also need to recognise the rights of Indigenous peoples, including through a commitment to economic reconciliation and a net zero transition process that will benefit Indigenous communities. Innovation will be essential to reduce emissions, create new economic sectors with reduced negative environmental impact and reduce the negative effects of economic transitions on individuals and society as a whole.

Despite ongoing climate action since the signing of the Paris Agreement in 2015, emissions in Canadian regions keep rising across most regions. Box 4.4 depicts the evolution of the top and bottom ten emitters from 1990 to 2020. Only in three of the ten largest emitting regions can reductions be observed over the last ten years; these are in the provinces of Alberta and Saskatchewan. Others are on the rise. The majority of low-emitting TL3 regions are in Quebec, where 94% of its electricity supply is derived from hydropower (Canada Energy Regulator, 2022^[12]).

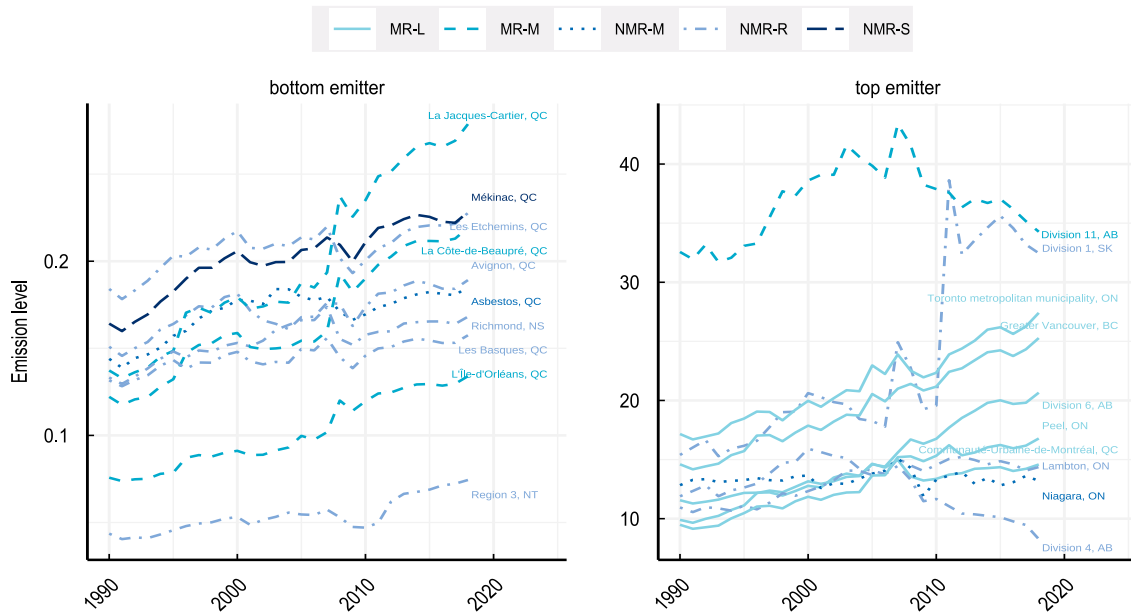
Figure 4.3. Production-based emissions estimates per capita in Canadian TL3 regions



Note: OECD calculations are based on estimated GHG gas emissions to locations according to about 300 proxies. Based on 293 TL3 Canadian regions in 2018.

Source: OECD (n.d.^[11]), *OECD Regional Statistics (database)*, <https://doi.org/10.1787/region-data-en>.

Figure 4.4. Top and bottom emitters (total) per regional type (TL3) and time Canada, 1990-2020



Note: Emission level is given in million tCO₂-eq. Based on 293 TL3 Canadian regions from 1990 to 2018.

Source: OECD (n.d.^[11]), *OECD Regional Statistics (database)*, <https://doi.org/10.1787/region-data-en>.

In this context, policy makers need to realise that delayed action raises costs globally and locally. The costs of delaying action to stabilise GHG at 1.5 degrees Celsius (°C) may be USD 5 trillion per year (7% of annual world gross domestic product [GDP]) (Sanderson and O'Neill, 2020^[13]). Higher local costs may result from the requirement for faster expansion of new technologies. Moreover, if investment in long-lived capital goods and infrastructure is not consistent with the zero carbon transition, it could result in wasted investment spending. Stranded asset risks are particularly large in fossil fuel supply chain firms and regions (OECD, 2023^[14]).

Box 4.2. Regional GHG emission data

In this report, regional emissions are estimated on the basis of the Emissions Database for Global Atmospheric Research of the ECJRC. Production-based or territorial emissions correspond to GHG emitted within a region and enable the setting of reduction targets. Emissions were estimated using the Emissions Database for Global Atmospheric Research (EDGAR), version 6 (Crippa et al., 2021^[15]) and expressed in CO₂ equivalent, considering the 3 main GHGs – namely CO₂, methane (CH₄) and nitrous oxide (N₂O) – and a 100-year global warming potential.

National GHG emissions are attributed to locations according to about 300 proxies for 26 main sectors and subsectors, depending on the type of technology and International Energy Agency (IEA) fuel types, following Intergovernmental Panel on Climate Change (IPCC) reporting formats and guidelines. Locations of emissions are identified with various sources of spatial research (Janssens-Maenhout et al., 2019^[16]). The proxies capture a substantial part but not all of the local emission determinants. For example, residential emission estimates capture buildings and population but not the degree of building insulation. Location estimates of agricultural emissions capture the number and species of ruminant animals but not how they are fed.

The emissions are attributed to five sectors:

1. The power supply sector contains all combustion of fuels for electricity and heat generation.
2. Industry covers the whole value chain from mining primary materials to manufacturing and recycling products. Its includes energy use process emissions and fugitive emissions.
3. Agriculture includes agricultural soils, agricultural waste burning, enteric fermentation and manure management.
4. The residential sector includes buildings and waste.
5. Transport encompasses freight and passenger ground, sea and air transport.

Some care is needed when looking only at production-based emissions as reductions can occur through the outsourcing/offshoring of carbon-intensive activities to other regions or countries, and subsequently importing the goods and/or services provided. Often, these shifts are made to countries/regions with more carbon-intensive production processes and less stringent regulations on carbon abatement. Currently, most OECD countries are net importers of GHG emissions (i.e. their consumption, including through imports, accounts for larger emissions than the emissions generated through their production of goods and services, including those for export markets).

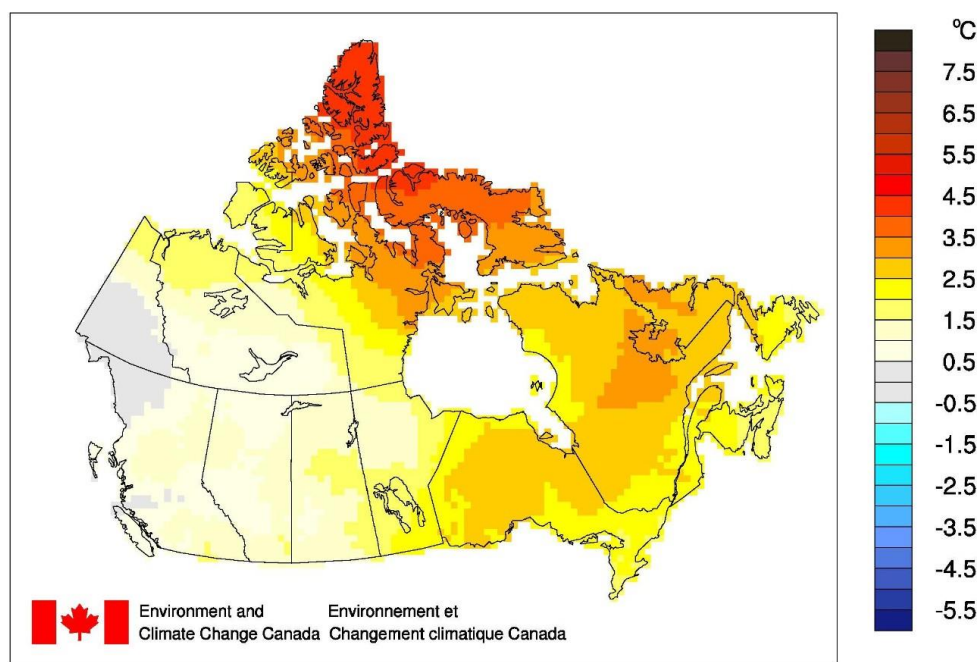
Source: OECD (2021^[9]), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, <https://doi.org/10.1787/17017efe-en>; OECD (2022^[17]), *OECD Regions and Cities at a Glance 2022*, <https://doi.org/10.1787/14108660-en>.

Climate change adaptation: Arctic and coastal areas are particularly vulnerable and require increased speed in rural innovation to adapt

Alongside emissions reduction, climate adaptation is an equally important concern for rural Canada. The Canadian Arctic is experiencing climate change at ever faster rates. Projected future climate changes for the region are substantial. In 2021, parts of northern and most of eastern Canada were 2.5°C above the baseline average (defined as the mean over 1961-90) and most northern parts of the Arctic Archipelago exceeded the baseline average by 3.5°C (Figure 4.5). Overall, northern Canada is expected to warm at more than double the global rate, leading to reductions in Arctic Sea ice, snow cover and permafrost. For instance, Canadian Arctic marine areas, including the Beaufort Sea and Baffin Bay, are projected to have extensive ice-free periods during summer by mid-century (Bush et al., 2022^[18]).

Rising air temperatures cause permafrost to thaw, which has serious consequences for inhabitants of the Arctic region (Jungsberg et al., 2019^[19]), many of whom are Indigenous. Many communities face relocation pressures as infrastructure and houses start sinking into the ground and marine resources that comprise the basis of their livelihoods change. Furthermore, the local sea level is projected to rise, increasing flooding along most of the Atlantic and Pacific coasts of Canada and the Beaufort coast, and the loss of sea ice significantly increases the risk of damage to coastal infrastructure and ecosystem because of larger storm surges and waves (Bush et al., 2022^[18]). Other impacts include the warming of seawaters, such as in the Gulf of St. Lawrence, where warming is combined with decreased oxygen levels, impacting marine species and commercial fishing. Together with the warming of the coastal areas, new species, such as lobsters, are expanding (Robert, 2022^[20]).

Figure 4.5. Annual temperature departures from baseline (mean over 1961-90), 2021



Note: The temperature departures map shows that most of Canada experienced temperatures at least 1.0°C above the baseline average. Temperatures over 2.5°C above the baseline average were recorded in parts of northern and most of eastern Canada and exceeded 3.5°C above the baseline average in the most northern parts of the Arctic Archipelago. Annual temperatures were close to the baseline average in the southern areas of Yukon and northern British Columbia.

Source: Environment and Climate Change Canada (2021^[21]), *Climate Trends and Variations Bulletin - Annual 2021*, <https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations/annual-2021-bulletin.html>.

With many rural communities situated on low-lying coasts, infrastructure built on permafrost and livelihoods in jeopardy, climate adaptation is required to happen much quicker than in other Canadian rural regions. The time pressure also requires a more sustained effort to support innovation from governments, the private sector and civil society to address challenges and make use of opportunities. Hence, climate adaptation needs to feature strongly in rural innovation support. Specifically, rural innovation has the potential to deal with:

- Finding new solutions for making transportation infrastructure (roads, buildings, municipal facilities, industrial facilities, airports, ports) viable and more dynamic to retrofitting as effects of thawing permafrost and ice dynamics increase.
- Making use of new marine transportation and tourism routes while not stressing the fragile ecosystem even further.
- Dealing with aspects of health and well-being, including danger from new and emerging diseases due to thawing permafrost.
- Dealing with changes to traditional fishing, trapping and berry picking due to species and harvest evolutions, as well as cultural impacts from loss of sites of historical or spiritual value.

The population in the Canadian Arctic adds to approximately 70 000 people living in 5 provinces and 3 territories. A large part of the local population is Indigenous and identifies as First Nations, Inuit or Métis. As such, these Northern communities have distinct socio-cultural characteristics. This also means that many Indigenous peoples are among the first to face the direct consequences of climate change due to their dependence upon and close relationship with the environment and its resources. Climate change exacerbates the difficulties already faced by Indigenous communities, including political and economic marginalisation, loss of land and resources, human rights violations, discrimination and unemployment (UN, n.d.^[22]).

Adaptation currently takes place in response to climate impacts and prediction scenarios. Examples include disaster risk management, infrastructure systems and public health. An important step for Canada is the finalisation of Canada's first National Adaptation Strategy (see also Box 4.3). Action is also taken at the territorial level. Among many others, the Inuvialuit Settlement Region, for instance, has its own climate adaptation strategy. Yet, challenges remain and largely evolve around limited resources and institutional capacity. Research specifically denotes challenges with municipal planning, limited capacity and low levels of funding, as well as institutional fragmentation (Ford et al., 2017^[23]). In addition, extreme weather, long distances to markets, create difficulties in scaling innovations and attracting essential workers.

Climate adaptation innovation consequently requires co-operative partnership approaches between the private sector and different levels of government and governments, integrating a broad range of policies, for instance, on land use planning, resource management and health.

Box 4.3. Canada is finalising its first National Adaptation Strategy

In June 2023, the Government of Canada released its first National Adaptation Strategy. The strategy outlines a shared path to a more climate-resilient Canada. This includes a shared vision set across five interconnected systems: disaster resilience, health and well-being, nature and biodiversity, infrastructure and economy and workers. For each system, the strategy has long-term, medium-term and near-term goals and targets, with an evaluation framework to measure progress and plan for future scenarios. This would include a federally led round table with provincial and territorial governments and Indigenous partners that work towards disaster resilience. The strategy is accompanied by action plans for the federal government as well as bilateral federal-provincial/territorial plans and co-development of the Indigenous Climate Leadership Agenda with Indigenous partners.

Incorporating Indigenous knowledge into its guiding principles and future plans for action is a central pillar of the National Adaptation Strategy. It outlines, for instance, that adaptation efforts must respect the jurisdictions of local, provincial, territorial, national and First Nations, Inuit and Métis governments and act to accelerate and build upon their existing efforts. Furthermore, it identifies the Indigenous Climate Leadership initiative as the main pathway for identifying and supporting Indigenous communities' adaptation priorities.

An assessment by the Canadian Climate Institute suggests that the effectiveness of the strategy can be improved in a couple of instances, notably through linking risks more clearly to goals and objectives to mitigate risks, identification of priority action to guide federal and other action plans, enhancing whole-of-government co-ordination and strengthening the monitoring and evaluation framework, aligning it closely to the objectives and targets of the strategy.

Source: Environment and Climate Change Canada (2022^[24]), *Canada's National Adaptation Strategy: Building Resilient Communities and a Strong Economy*, <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/national-adaptation-strategy.html>; Canadian Climate Institute (2022^[25]), "Expert assessment recommends improvements to National Adaptation Strategy", <https://climateinstitute.ca/news/expert-assessment-national-adaptation-strategy/>.

Green innovation definitions

In light of challenges such as vast climate adaptation and mitigation challenges, green innovations are an essential component for managing the ongoing climate and environmental transitions. Green or environmentally friendly innovation generally means innovations that benefit the environment through product, service, process or business innovation. A more detailed definition is provided in Box 4.4. Policy incentives for green innovation are needed because market mechanisms do not allow for enough green innovation. This is because innovators may not reap all of the benefits of their innovation or because the environmental benefits may not be appropriately valued by markets (OECD, 2011^[26]).

Canada does not have a definition for green innovation per se but works with the concept of "clean technology" (in short cleantech), which is defined as follows:

- Any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage.
- Any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility. Their primary use, however, is not one of environmental protection (Government of Canada, 2022^[27]).

A more detailed breakdown of the Canadian context can be found in Annex 4.A. Use of the term cleantech in the context of green innovation can be misleading as it might suggest that it only captures technology-oriented innovation trying to address environmental challenges, even if the definition is broader. Particularly in the rural context, innovations going beyond classical technological innovations, such as social and service innovations, will be important. Consequently, this report will continue to use the term green innovation instead of cleantech.

Box 4.4. Definition of green innovation

Broadly, green innovation is characterised by its positive impact on the environment. However, positive impacts are not straightforward or easily measurable. For instance, many innovations, even if they are environmentally friendly, may cause unforeseeable consequences and result in rebound effects that create environmental problems. Considering this, the European Union defines green innovation as all

forms of innovation that reduce environmental impacts and/or optimise the use of resources throughout the lifecycle of related activities. Following from these considerations, green innovation:

- Compares favourably with relevant alternatives.
- Applies to goods, services, manufacturing processes or business models. The concept in the United States includes innovative regulatory approaches for environmental protection.
- Includes but is not limited to green technologies. It does not necessarily originate in the environmental field or have a technological component.
- Can be radical and systemic (e.g. substituting polluting goods with environment-friendly services) or incremental (e.g. enhancing the resource efficiency of a particular product).

Various concepts fall under the concept of green innovation, including:

- Eco-efficiency (defined as producing more goods and services with less energy and fewer natural resources).
- Cleaner production (a strategy to continuously reduce pollution and waste at the source).
- Eco-design (i.e. the redesign of a product or process to reduce its environmental impacts throughout its life cycle).

Source: OECD (2011^[26]), *Better Policies to Support Eco-innovation*, <https://doi.org/10.1787/9789264096684-en>.

Support for green innovation comes in multiple forms. Many OECD countries have developed national strategies that define different support objectives. These include bridging the gap from the demonstration phase to commercialisation (e.g. in the field of carbon capture and storage or micro combined heat and power generation), improving consumer awareness (e.g. of bio-packaging), defining technical standards (e.g. for electric cars) and building a critical mass (e.g. for combined heat and power generation). They also cover a wide range of policies, including environment, science and technology, industry, transport, competition and energy policies. They mix very diverse tools and initiatives, from support for research and development to market creation and export promotion. They involve initiatives by public authorities at both the national and local levels and offer lessons regarding an appropriate split of responsibilities between them. Roadmaps provide a framework to assess the coherence of these policies (OECD, 2011^[26]).

In Canada, growth of the environmental and clean technology sector is stable but regionally concentrated in three provinces. In 2021, GDP generated by environmental and clean technology products increased only slightly by 0.8%, following a decline of 2.9% in 2020 from 2019. The sector currently accounts for 2.9% of Canada's GDP and the share has remained relatively stable since the first recordings in 2007. Regionally, British Columbia, Ontario and Quebec are the largest contributors to GDP shares. In 2021, Ontario (34.5%) accounted for over one-third of the sector, while Quebec (29.8%) accounted for over one-quarter and British Columbia (15.1%) one-seventh. In 2021, just over half (53.5%) of the national environmental and clean technology products sector's GDP was attributable to the production of environmental goods and services. The remaining 46.5% was attributable to the production of clean technology goods and services¹ (Statistics Canada, 2022^[28]).

At the national level, Statistics Canada conducts two business surveys that cover clean technologies: the Survey of Advanced Technology (SAT) and the Survey of Innovation and Business Strategy (SIBS). They provide insights on the adoption of green innovation on clean tech in companies. According to the 2019 SIBS, 8.6% of firms in Canada adopted clean technologies (compared to 10% in 2017), demonstrating a slight decrease. In the province of Ontario, adoption is highest at 10% and lowest in the Atlantic provinces at 6.7%. Most types of clean technologies used were, across all industries, linked to environmental protection (93.3%), sustainable resource management (72.8%) and waste management, reduction, or recycling (71.8%). Moreover, 42.1% of firms reported undertaking green-focused innovations aiming for environmental benefits between 2017 and 2019 (compared to 40.1% between 2015 and 2017). The largest

share of these relate to innovations with environmental benefits related to the end user or consumer. At TL2 level, Quebec is leading with 45.3%. Compared to 47.5% between 2015 and 2017, 49.3% of firms undertook green innovations through changes in production processes, creating more efficient use of resources between 2017 and 2019. The SAT is working to release a new survey in July 2023, including detailed information on clean technologies at the TL2 level covering 2022. Rural-urban delineation for this data is currently unavailable.

In order to ensure support for green innovation fits with diverse local needs, it is important to consider that innovation in more rural areas goes beyond high-technology innovation, which is often present in regional centres or larger agglomerations. While research is limited, evidence suggests that some rural innovators take a different approach. They are experimental and strategic in that they take the time to steadily improve products and processes without pressure and acquire information to fill knowledge gaps. In this process, the meaningfulness of the work to the community and passing down knowledge through generations is also important as it ensures holistically following projects from beginning to end (Mayer, 2020^[29]). In addition, rural regions face specific bottlenecks to innovate. These include reduced accessibility of networks, readily available knowledge and support, an outmigration of young people that is needed for business succession, interest and ability to innovate and design new products and processes, and reduced digital connectivity.

In order to benefit from the environmental and cleantech sector and the transition to a net zero carbon economy more broadly, Canadians will need access to the requisite infrastructure, which includes access to fast Internet. Canadians from all urban and rural communities rely on access to reliable, affordable, high-speed Internet and mobile connectivity. It is essential for personal and professional communications, to grow a business, apply to jobs and access education and government services. Overwhelmingly, rural and remote communities have identified challenges accessing affordable, high-speed Internet as the number one issue impeding their economic growth.

Policy action to link up green innovation to rural climate challenge needs

Table 4.1 summarises important policy actions that can support green innovations in general and highlight specific considerations for rural places in relation to these areas of action, noting the need to also target small rural SMEs in climate innovation. The following section will address how far the needed policy actions are currently in place in Canada and what can be done to fill the remaining gaps.

Table 4.1. Policy actions to support green innovation for the rural context

Area of policy actions	Key Policies	Considerations for the rural context
Ensuring clear and stable market signals	Government signals, like carbon pricing, are an important indicator of government commitment towards greener growth. This is one instrument that can help to address the externalities associated with environmental challenges.	Green innovation is hard to realise without aligned government signals between government levels, especially for small businesses in rural areas.
Investing in basic and long-term research	Research with a public good character is unlikely to be undertaken by the private sector, because it is exploratory and considered too risky and uncertain for the private sector. Public research needs to cover adaptation and mitigation to climate change and be neutral with regards to certain technologies.	This type of public sector research is likely to occur in metropolitan areas where big research institutions are located; it is important that rural entrepreneurs also have access to relevant knowledge. If innovation is only conceptualised as technology, many important social and service-related innovations for the rural context might not be captured.

Area of policy actions	Key Policies	Considerations for the rural context
Overcoming the dominance of existing technologies and ways of doing business	<p>Support for private investment in innovation, notably R&D, and for the commercialisation of green innovations. Good policy designs need to ensure competitive selection processes, focus on performance, avoid favouring incumbents or providing opportunities for lobbying, ensure a rigorous evaluation of policy impact and contain costs. Proven ways to guard against these problems include multi-year appropriations, independence of the agencies making funding decisions, use of peer review and other competitive procedures with clear criteria for project selection and payments based on progress and outcomes rather than cost recovery or choice of technologies.</p>	<p>Market barriers in rural places might be higher as new market entrants have less of a history of success and investments are high risk and capital intensive. There are also more limited connections to financing networks that might support green innovation.</p>
	<p>Support for general-purpose technologies. To provide support that is technology-neutral, supporting general infrastructure or basic conditions for a wide range of alternative technologies, e.g. storage technologies that are needed for a wide range of technologies or general-purpose technologies, such as information and communication technology (ICT), are key.</p>	<p>General infrastructure and technology provision can be a challenge in rural places, especially in remote places. Where digital connectivity is accessible, it might not be affordable relative to the local income level.</p>
	<p>Fostering the growth of new entrepreneurial firms. New firms and ideas are needed to challenge existing business models; policies can create space for such new firms and enable their entry and growth, through access to finance for instance.</p>	<p>Metropolitan areas often provide various forms of entrepreneurial support; these offers are more limited in rural places and only cover the basics, and specific support is needed for green innovation to take place in rural places also.</p> <p>Business support, work tools and machinery are often scarce in rural communities, which hinders scaling up businesses and helping entrepreneurs enter the larger competitive regional and national market.</p>
	<p>Facilitating the transition to green growth in SMEs. Small companies face bigger challenges in adopting green innovations. Policy can help enterprises participate in knowledge networks, strengthen skills that can lead to innovation and reduce regulatory burdens.</p>	<p>Rural regions often have a large share of SMEs and the support for these in adopting green innovations is particularly important if rural places are to transition successfully.</p>
Diffusion and take-up of green innovation	<p>Fostering diffusion. The diffusion of green innovation should be based on well-functioning intellectual property rights systems. Business networks and university links are likewise needed.</p>	<p>Rural innovators often lack the funds and knowledge to secure patents or have access to relevant legal advice. Also, green adoption requires specific skills and knowledge that might not be accessible.</p>
	<p>Strengthening markets for green innovation. In addition to carbon pricing or other ways of dealing with environmental externalities, demand-side innovation policies are an important part of the policy mix to foster green innovation, as these can help strengthen green innovation in specific markets. For example, standards, well-designed regulations and innovative procurement can encourage green innovation in areas where market signals are not fully effective.</p>	<p>Procurement strategies for sustainable sourcing should also be introduced at the subnational level and in rural municipalities.</p>
	<p>Changing consumer behaviour. Pricing the use of environmental resources has proven to be a powerful tool for influencing consumer and household decisions. Other “softer” instruments also need to be given close attention, including consumer policy and education, as well as green labelling and certification.</p>	<p>Energy efficiency/education on sustainable lifestyle choices should be encouraged.</p>

Source: Based on OECD (2011^[30]), *Fostering Innovation for Green Growth*, <https://doi.org/10.1787/9789264119925-en>.

Assuring clear and stable market signals to foster green innovation

The private sector, particularly SMEs, is considered a potential driving force for the zero-emission transition. They do that notably through innovation in their products and processes. Product innovations include design that replaces non-renewable materials and resources with renewable, recycled, permanent, biodegradable, non-hazardous and compostable materials and resources; and processes innovations involve the recreating processes so that products are made more easily disassembled, recycled, modular (replacement of parts, the recovery and reuse of systems and sub-systems) and repairable (OECD, 2020^[31]).

A stable policy environment is important for innovation, especially in areas where innovation requires large, long-term investments that contain high risk. Major green investments, such as installing carbon capture technology, involve large capital costs and long lead times. Clear government signals, like carbon pricing or other market instruments, are essential signals for government commitments and important for SMEs embarking on the transition. These signals can significantly enhance incentives for firms and households to adopt and develop green innovation and will allow for establishing markets for green innovation. They are particularly relevant for SMEs, which have limited resources available to transition and can only embark on investments for innovations if they are sure they will not be disrupted by election cycles.

In past years, signals about the future direction of climate policy in Canada have been uneven between provinces and territories, and the climate aims of Canada's federal government and provinces are divergent. Especially those provinces that heavily depend on fossil fuels and derive a large share of their revenue from resource extraction have challenged the federal government's climate policies. For example, Alberta and Saskatchewan questioned the constitutionality of the federal Greenhouse Gas Pollution Pricing Act, which sets minimum national stringency standards for GHG emissions pricing, arguing that the federal government stepped outside the bounds of its powers. Canada's Supreme Court rejected this argument in 2021. The country's top court found that, as global warming's impacts go beyond provincial boundaries, it is a matter of national concern (OECD, 2023^[14]).

To date, considerable scepticism over federal climate aims still exists within subnational governments and reduces the stable policy climate needed for green innovation. This can manifest itself, for instance, in the uneven design of large-emitter schemes across provinces and create situations where large emitters easily face reduced carbon costs (Canadian Institute for Climate Choices, 2021^[32]). Low-carbon cost also means reduced incentives for green investments and innovations. An example is natural gas-fired power plants, which are Alberta's large-emitter scheme despite being shielded from competition by their remoteness to other plants, capacity limits on power imports and transmission costs involved in importing electricity from other regions (Olmstead and Yatchew, 2022^[33]). As some areas within provinces contribute such a large share of national emissions, inadequate enforcement of carbon pricing rules could have a big impact on progress towards Canada's emissions targets overall (OECD, 2023^[14]). Other examples for disagreements between provinces and the federal government on dealing with industry-specific emissions can be observed in discussions about the proposed Oil and Gas Emissions Cap (see Box 4.5)

Confidence in the development of future carbon prices is another important factor for stimulating investments in green technologies needed for emissions reductions. As in other countries, future climate policies depend on decisions by future governments. Firms often delay cost-intensive investments in green technology in situations of regulatory uncertainty (Berestycki et al., 2022^[34]). To work through this problem, Canada's federal government is proposing to use a new Canada Growth Fund to offer "contracts for difference" as a means for reducing carbon cost uncertainty. Such agreements offer governmental compensation for firms making major green investments if the carbon price turns out to be lower than planned. Similarly, the business has to return surplus gains to the government if the carbon price turns out higher than expected. Similar arrangements are used to promote investments in clean electricity by removing risk around volatile power prices, as in the United Kingdom (D'Arcangelo et al., 2022^[35]; OECD, 2022^[36]).

Box 4.5. Oil and Gas Emissions Cap

Reducing oil and gas sector emissions is a priority for Canada's federal government. Canada's oil and gas sector accounted for 27% of the country's emissions in 2020 (Norton Rose Fulbright, 2022^[37]). In July 2022, as part of Canada's climate plan, the government released a paper to initiate a formal discussion on two potential regulatory options to limit and reduce GHG emissions from the oil and gas sector, outlining two potential policy options.

The first option would be a cap-and-trade system under the Canadian Environmental Protection Act, which would set a regulated limit on emissions from the sector. The government would set an overall quota of GHG emissions for companies that fall under the cap. It would then issue emissions permits or allowances for each tonne emitted, requiring emitters to surrender one allowance for each tonne of GHG emissions. Emission allowances would apply only to the cap-and-trade system, meaning they could not be recognised, traded or exchanged by other regulatory instruments or carbon pricing systems. Also, to protect against excessive market power, limits on bidding and the number of allowances a facility can hold may be implemented. Environment and Climate Change Canada will determine the mechanisms for distributing allowances at a later date.

The second option would be to modify pollution pricing benchmark requirements to create price-driven limits on emissions from the oil and gas sector under the Greenhouse Gas Pollution Pricing Act. The government would set an "emissions cap trajectory" and then adjust the price of oil and gas as needed. This way, provincial carbon pricing systems would need to be adjusted accordingly to maintain parity. If changes are required, they would include an oil and gas-specific carbon price as well as other measures such as benchmark stringency. For provinces where oil and gas sector emissions make up less than 0.5% of total emissions from the sector, the jurisdiction will be exempted from the benchmark criteria (Government of Canada, 2022^[38]; JD Supra, 2023^[39]).

Regardless of the option chosen, the cap on oil and gas emissions would apply to direct emissions from upstream oil and gas production. The government is still considering whether the cap applies to petroleum refineries and natural gas transmission pipelines emissions. It will not apply to natural gas distribution and oil pipelines or end users. Overall, the cap would apply to all GHGs listed in Canada's National Inventory Report (Government of Canada, 2023^[40]). Significant criticism of the cap proposal comes from both Alberta and Saskatchewan, which declared it unachievable and favoured other methods of reducing emissions or less ambitious targets. The government of Alberta has also announced challenging the cap in court (von Schneel, 2022^[41]).

Source: Norton Rose Fulbright (2022^[37]), "Canada releases discussion paper on capping emissions from upstream oil and gas", <https://www.nortonrosefulbright.com/en-ca/knowledge/publications/d19bd616/canada-releases-discussion-paper-on-capping-emissions-from-upstream-oil-and-gas>; JD Supra (2023^[39]), "Canada's oil and gas emissions cap: Options for the ECCC proposal", <https://www.jdsupra.com/legalnews/canada-s-oil-and-gas-emissions-cap-7590573/>; Government of Canada (2022^[38]), "Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 – Discussion document", <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/oil-gas-emissions-cap/options-discussion-paper.html>; Government of Canada (2023^[40]), *Canada's Greenhouse Gas Inventory*, <https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html>; von Schneel, E. (2022^[41]), "Alberta wants to challenge federal emissions cap in court", <https://www.cbc.ca/news/canada/calgary/alberta-federal-government-oil-gas-emissions-constitution-1.6661484>.

While carbon pricing is important, it is insufficient to incentivise green innovation. While it is important to drive down emissions by incentivising clean innovation development and deployment, and raising the cost for carbon-intensive production and consumption, it is also crucial to encourage greener choices. Recent research suggests that across different countries, the effects of carbon pricing on innovation and zero carbon investment are limited. Carbon pricing often primarily contributes to incremental innovation, which tends to increase efficiency but fails to reduce emissions in sectors that are hard to decarbonise.

For example, carbon prices generally encourage the switch to a marginally cleaner version of conventional processes but will not lead to a breakthrough in climate-neutral technology (Lehne et al., 2021^[42]; Lilliestam, Patt and Bersalli, 2020^[43]). Consequently, additional policies will be needed to strengthen green innovation, including research, support for companies to change business models and innovation diffusion.

Additional government signals towards green innovation have come in the form of clean energy and carbon storage investment tax credit (ITC) announcements in the Canadian 2022 Budget and in the 2022 Fall Economic Statement. The 2023 Canadian Federal Budget, also called Budget 2023, released on 28 March 2023, provides further details on previously announced ITCs and details on further clean energy and technology ITCs.

The 2022 budget included a number of tax measures intended to support Canada's climate objectives by incentivising investment in and development of clean technology while seeking to limit or remove certain tax incentives previously afforded to carbon-based industries. For instance, the 2022 Fall Economic Statement announced the details of the Clean Technology ITC, which will provide support to Canadian businesses in adopting clean technology at a 30% refundable rate (Government of Canada, 2022^[44]). Budget 2023 further expanded the Clean Technology ITC to include geothermal energy systems, used primarily to generate electricity and/or heat solely from geothermal energy. This includes but is not limited to piping, pumps, heat exchangers, steam separators and electrical generating equipment (PwC, 2023^[45]; Government of Canada, 2023^[46]; Norton Rose Fulbright, 2023^[47]). The total expected cost of the Clean Technology ITC is about CAD 6.9 billion over the period 2023-24 to 2027-28 (Government of Canada, 2023^[46]). Furthermore, Budget 2023 introduced a 15% refundable tax credit for eligible investments in non-emitting electricity generation systems (i.e. wind, solar, hydro, nuclear), in abated natural gas-fired electricity generation, electricity storage and equipment used for transmission of electricity between provinces and territories.

To also support Canadian companies that are manufacturing or processing clean technologies, the 2023 budget introduces a refundable Clean Technology Manufacturing ITC of up to 30% of the cost of investments in new machinery and equipment used to manufacture or process key clean technologies and extraction processes, or recycle key critical minerals (Government of Canada, 2023^[46]; Norton Rose Fulbright, 2023^[47]; PwC, 2023^[45]). These tax credits will be an important incentive for Canada's companies to realise more green innovation. The geographical implications and benefits to rural transitions and rural development will remain to be assessed in the implementation of the credits.

Investments in basic and long-term research – The state of green innovation in Canada

National-level performance to support green innovation

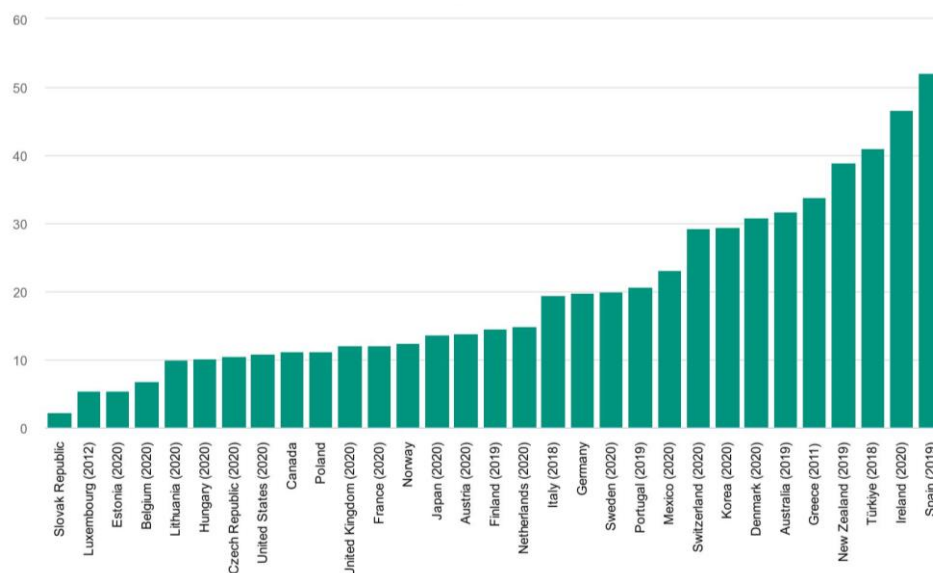
Public funding is the main source for environmentally related research in Canada and is an important factor in supporting green innovation and the growth of the sector. Unfortunately, subnational data on research and development spending, as well as patent registrations, are not available. This section provides a snapshot of the spending situation at the national level. Public research spending has increased significantly in the past five years. Between 2019 and 2020, the Canadian government exceeded its goal of doubling its clean energy spending over five years, reaching CAD 786.8 million (Government of Canada, 2022^[48]). Furthermore, the 2023 Federal Budget earmarked funding for a number of clean economy initiatives, including CAD 18.5 billion over 5 years for targeted programming, financing and investment tax credits. In addition, the federal government projected a potential planned investment of CAD 20 billion from the Canada Infrastructure Bank (CAD 10 billion to clean power and CAD 10 billion to green infrastructure) for major clean electricity/infrastructure projects (e.g. Atlantic Loop) (Government of Canada, 2023^[46]).

Overall, more than 80% of Canada's energy research, development and demonstration budget is allocated to low-carbon technologies, including energy efficiency, carbon capture and storage, power and storage, renewables, hydrogen and fuel cells and nuclear, with the largest shares allocated to energy efficiency

(37%) and nuclear power (22%) (OECD/IEA, 2022^[49]). Renewable energy is less of a target than in most OECD countries. In fact, Canada spends more of its related energy-related R&D budget on fossil fuels (12.6%) than renewable energy (11.3%) (Figures 4.6 and 4.7).

Figure 4.6. Renewable public research, development and demonstration (RD&D) budget, OECD countries, 2021

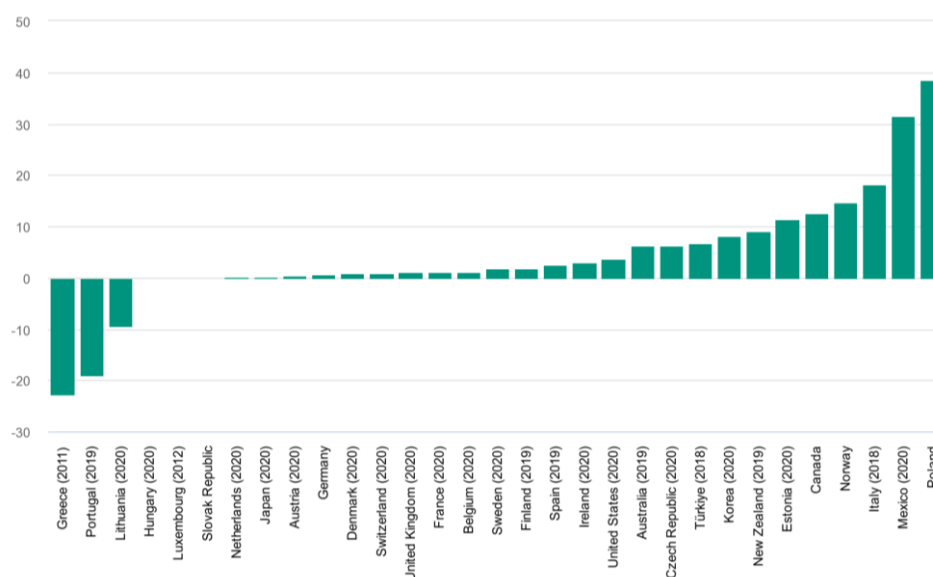
Percentage of total energy public RD&D



Note: Excluding carbon capture and storage. Data are provided for 2021, unless otherwise indicated in brackets. Source: OECD (n.d.^[50]), “Green growth indicators”, <https://doi.org/10.1787/data-00665-en>; based on IEA data.

Figure 4.7. Fossil fuel public RD&D budget, OECD countries, 2021

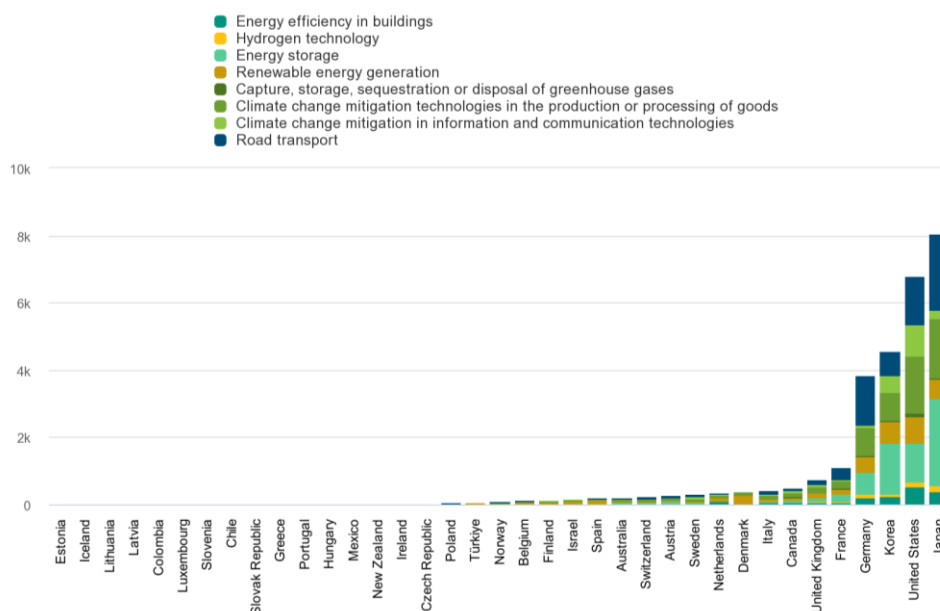
Percentage of total energy public RD&D



Note: Excluding carbon capture and storage. Data are provided for 2021, unless otherwise indicated in brackets. Source: OECD (n.d.^[50]), “Green growth indicators”, <https://doi.org/10.1787/data-00665-en>; based on IEA data.

The number of patent applications in environmentally related technologies originating from Canada increased since the turn of the century. The rate of increase, however, was not as fast as in the France, Germany, Japan, Korea, the United Kingdom and the United States. Canada files fewer environmental patents than other major economies (OECD, 2017^[51]). At the national level, most high-level climate change mitigation technologies are developed in the production and processing of goods (Figure 4.8).

Figure 4.8. Innovation in selected climate change mitigation technologies per country



Note: Number of high-value inventions, last three-year average, by inventor country.

Source: OECD (n.d.^[52]), "Patents in environment-related technologies: Technology development by inventor country", <https://doi.org/10.1787/d ata-00760-en>.

Patent data only captures a fraction of innovation likely to be happening in the area of climate mitigation at the local and firm levels. Many innovations SMEs use to improve energy efficiency, renewable energy generation or develop circular business models are likely not captured in the data. This is also because rural innovation is often not captured by patents, as these are costly and too expensive for small firms. A broader measuring approach that includes a subnational perspective is needed to capture green innovation outside these classical terms of science and technology.

The OECD Environmental Performance Review of Canada (2017^[51]) made the following recommendations to improve green innovation in Canada. Most of these still hold to this day:

- Provide stable and higher public investment in R&D; shift away from indirect tax credits towards competitive and transparent grants; ensure that energy-related R&D focuses on reducing and mitigating environmental impacts from fossil fuel activities rather than encouraging increased oil and gas production; ensure innovation programming extends to renewable energy and energy efficiency and the circular economy.
- Foster domestic demand for clean technology and green innovations through public procurement, fiscal incentives and information sharing; improve federal-provincial-territorial collaboration to improve access to financing for Canadian clean technology firms; encourage a greater private sector role in research, development and technology adoption (OECD, 2017^[51]).

Interdisciplinary research for green rural development

Adaptation and mitigation of climate change in rural places often impact multiple aspects of community and business life. To make rural innovation more successful, it is essential to provide funding to interdisciplinary research and projects to find solutions for complex problems and look at these from different perspectives.

Experimental tools, such as regulatory sandboxes and Living Labs, are one way this can be done; these are often placed within cluster structures. Rural places have an advantage in the use of these experimental tools or other experimentation processes that can provide new public services to a changing economy (see also Chapter 3). This is because, in comparison to more urban counterparts, they have the benefit of available space, function as a rather independent system and have lower living expenses. Consequently, by creating a regulatory environment that eases other pressures on firms, individuals in rural regions may experiment more easily than in high-income, high-turnover regions. Likewise, government public innovation service delivery can benefit through learning and the use of businesses that have found the practice useful for building consensus and ownership.

Canada's Economic Strategy Table for Clean Technology is a collaboration between the government and cleantech industry leaders. In 2018, the table released an ambitious plan to transform clean technology into one of Canada's top five exporting industries. The strategy also considers Canada's regulatory system inconducive to green innovation because it is based on old standards and processes. As part of a set of recommendations, the table argues for increased utilisation of regulatory sandboxes and pilots. For instance, it suggests a regulatory sandbox for the adoption of clean technologies by utilities such as energy storage, energy and power substitution, methane reduction and carbon capture (Government of Canada, n.d.^[53]).

To develop and foster a culture of experimentation, Living Labs have provided good results across the globe and allowed innovators to test solutions for the future at the local level, mimicking real-life situations. The Experimental Lakes Project in Kenora District, Ontario, is such a place. The internationally unique research station encompasses 58 formerly pristine freshwater lakes where innovations are tested, manipulating an entire lake ecosystem and collecting long-term records for climatology, hydrology and limnology that address key issues in water management. Important regional development implications for the project include researchers coming to work in the facility, procurement of local services as well as interactions with schools and other communities teaching students about scientific research, sustainability concepts and career options.

However, commercial implications, spin-offs or other commercialisation are still missing from the project. The project has few links to entrepreneurs or start-ups who might be interested in developing research further. To further facilitate connections and dialogue around innovation for climate change, better match-making needs to happen for businesses and academics to work together. In Scotland, United Kingdom, the service platform Interface takes up that role. Launched in 2015, it connects organisations from a wide variety of industries to all of Scotland's universities, research institutes and colleges. Brokering these collaborations contributes to creating jobs, delivering new products, processes and services, and increasing turnover, profits and productivity for organisations. The service is free and impartial, and is set up with business engagement teams throughout the country that help companies build links with relevant research institutions (for more information, see also Chapter 3) (Interface, n.d.^[54]).

Clusters can be great platforms to encourage greater private sector collaboration with researchers and to develop knowledge sharing around green growth from an interdisciplinary perspective. One Canadian example is Canada's Ocean Super Cluster, a pan-Canadian initiative fostering interdisciplinary ocean research and commercialisation, derisking private investment and contributing to regional development through the support of local innovation centres (Box 4.6). The advantage of clusters is also that they allow for building competitive industries across value chains.

Box 4.6. Setting up interdisciplinary research in rural places

Canada's Ocean Supercluster is an industry-led cluster model that is driving cross-sectoral collaboration with the aim of accelerating innovation and growing Canada's ocean economy. It combines sectors, such as fisheries, aquaculture, offshore resources, transportation, marine renewables, defence, bioresources and ocean technologies, and works across a wide range of stakeholders, including academia, Indigenous and non-Indigenous governments, to advance Canada's position as a global leader in ocean economy. It seeks to establish sustainable ocean innovation by building robust ecosystems that are well-connected and well-equipped to rapidly innovate, commercialise solutions and deliver on the growing ocean opportunity. For instance, it reduces risk for companies and improves the work environment by:

- Increasing data exchange across ocean stakeholders to maximise value and minimise duplication.
- Strengthening connections to develop commercial, sustainable ocean solutions.
- Building an inclusive and highly capable workforce.
- Developing solutions that also address ocean health.

Up until 2022, Ocean Supercluster supported 490 projects worth over CAD 2.1 billion and involved over 2 100 partners. The federal government budget of 2022 further proposed an additional CAD 750 million investment over the next 6 years to further support the growth and development of the clusters in addition to private investments.

Part of the cluster is regional innovation hubs. One of them is located in Holyrood, Newfoundland and Labrador, which is part of the Fisheries and Marine Institute of Memorial University of Newfoundland. Aside from education and training, it also provides a reliable and near-Arctic environment to test, train and explore advancements in ocean research.

Source: Ocean Supercluster (n.d.^[55]), *About Canada's Ocean Supercluster*, <https://oceansupercluster.ca/about/>; The Launch (n.d.^[56]), *Meet - Tap into the Power of the Launch at the Marine Institute*, <https://www.thelaunch.mi.mun.ca/meet/>.

Resource-abundant places and royalty systems

Well-being in resource-abundant rural places in Canada is often closely linked to commodity price fluctuations. This is because benefits like jobs, high wages and flow-on activities to firms that support extracting activities are only supported when prices are high. In addition, most resource extraction is time-limited because sources are finite or phased out because of their negative environmental and climate impact. It is, hence, important to ensure that wealth from natural resources is managed appropriately to ensure future prosperity, especially in these regions. It can also mean that part of the wealth generated from fossil fuel extraction is used to diversify the economy and reinvest into more future-proof innovations, including the green economy. In 2019, Norway, for instance, adjusted its national oil fund, the largest sovereign wealth fund of USD 1.2 trillion, to invest in wind and solar power projects. The fund was created in the 1990s to invest the surplus revenues of Norway's petroleum sector. In 2022, the fund also announced its net zero goals for 2050 (WEF, 2022^[57]). Newfoundland and Labrador's new CAD 100 million Green Transition Fund is currently being set up to support projects that help advance the province's transition to a green economy. This was made possible by a restructuring agreement related to previous offshore oil development (Government of Newfoundland and Labrador, 2023^[58]).

In the Canadian context, it is important that royalty regimes are set up the right way to ensure future prosperity for communities (including their alignment with green transition objectives), especially considering the large increase in resource revenues experienced in 2021 and 2022. Some reforms are already ongoing. In 2022, British Columbia began a two-year transition to a new royalty regime that includes a windfall mechanism. Once revenues from a production facility exceed its capital costs for development, a price-sensitive royalty rate between 5% and 40% depending on the commodity type will apply (Government of British Columbia, 2022^[59]). Indigenous peoples have made calls for resource development decision-making processes and royalty regimes to be adjusted to reflect the principles of the UNDRIP and a more equitable distribution of benefits.

The use of stabilisation or wealth funds can also be useful to deal with revenue fluctuations and future-proofing. Both Alberta and Saskatchewan have run stabilisation and wealth funds. Each heritage fund established in the 1970s was aimed to run like a wealth fund (which accumulates over the longer term, while stabilisation funds primarily aim to smooth out financing over boom-and-bust cycles). Saskatchewan's fund was made too easy to access for current spending and was scrapped in the early 1990s. Alberta's heritage fund is still in operation but has not been consistently inflation-proofed, such that withdrawals have eroded the real value of the fund. Both provinces have introduced (and subsequently scrapped) stabilisation-type mechanisms, such as the Alberta Stabilization Fund that operated from 2003 to 2013 (Fraser Institute, 2021^[60]; 2021^[61]).

Overcoming the dominance of existing technologies and business operating models

Policies to support green innovation in Canada

Canada has made firm commitments in its climate plans and legislation. In March 2022, the Government of Canada released its 2030 Emission Reduction Plan. The plan fulfils the Canadian Net-Zero Emissions Accountability Act requirement that the federal government provide detailed plans in specific milestone years explaining how the outlined measures and strategies will contribute to Canada achieving net zero emissions by 2050. It is hence a planning tool for the federal government and provides a roadmap for how Canadian emissions can be cut 40-60% below 2005 levels by 2030. The plan not only provides emission modelling and analysis, it also functions as a roadmap and outlines sector-by-sector policy actions (buildings, electricity, heavy industry, transportation, nature-based-solutions, waste, oil/gas and agriculture) to be taken.

The plan describes clean technology and climate innovation as cross-cutting opportunities. Specifically, the plan identifies clean technology and climate innovation as crucial factors to drive down emissions and generate clean economic growth. Key targets with regard to innovation are advancing deployments until 2030 on heat pumps, zero-emission vehicles, renewable electricity, efficient buildings and methane reduction. Until 2050, the government wants to promote innovations in negative emissions technologies, clean hydrogen and carbon capture. Priority actions include clear regulatory signals, innovation support, deployment investments and tax incentives (Government of Canada, 2022^[62]).

The plan also identifies Canada's clean technology industry as one of the fastest-growing segments of the economy and forecasts an employment rise of roughly 50% over the next 8 years (Government of Canada, 2022^[62]). It is also stated that the clean growth opportunity extends across every part of the country and all sectors of the economy. Yet, the plan itself does not include reflections on specific needs and challenges existing in different geographies and how opportunities can be realised across diverse Canadian places. There is a need for greater considerations to be taken with regard to incorporating regional and rural needs in federal programming and initiatives. This also holds for most of the programmes run under the federal government's actions to foster green innovation. The most important programmes will briefly be discussed and analysed in the following sections according to their compatibility with rural needs and requirements.

The Canadian Regional Energy and Resource Tables, also called Regional Tables, are a step towards a more place-based approach and seek to co-ordinate regional priorities, funding opportunities and policy and regulatory approaches to boost economic activity to achieve net zero. Recognising that each region has a unique mix of its own natural resources, energy systems and clean technology strengths, the Government of Canada is seeking to establish joint partnerships with each province and territory, as well as formal collaboration with Indigenous partners, to identify opportunities that will transform Canada's traditional resource industries and advance emerging ones. The Regional Tables will empower provinces and territories to choose their own economic priorities and collaborate with the federal government to implement them. Individual action plans will be created to match resources, timetables and regulatory approaches. The tables will also inform Canada's approach to supporting workers and communities and creating sustainable jobs. To ensure a collaborative effort, the government involves multiple stakeholders, including municipalities, industry and business leaders, workers and labour representatives, academics and sector-specific experts and Indigenous communities, groups and leaders (Government of Canada, 2022^[63]; 2023^[64]). At the federal level, the initiative is led by Natural Resources Canada and involves multiple federal institutions, including the RDAs and the Canada Infrastructure Bank. It will help inform project funding decisions within the current federal funding mechanisms, including the Clean Fuels Fund, the Low Carbon Economy Fund and the Smart Renewables and Electrification Pathways Program (Sussex Strategy, 2022^[65]).

The initial phase of the Regional Tables was launched on 1 June 2022, involving British Columbia, Manitoba, and Newfoundland and Labrador. The second phase was announced on 13 October 2022, with New Brunswick, Nova Scotia, Prince Edward Island, the Northwest Territories and Yukon. Ontario announced its participation on 25 October 2022. It will focus on growing a clean and affordable electricity grid, developing critical mineral value chains, leadership in nuclear technology deployment, accelerating clean hydrogen opportunities and advancing a sustainable and innovative forestry sector (Sudds, 2022^[66]; Sussex Strategy, 2022^[67]). With a total of nine regions now participating in the Regional Tables, the goal is to establish Regional Tables in every province and territory in 2023. The Regional Tables are included in the federal funding of the CAD 8 billion Net Zero Accelerator, the CAD 35 billion Canada Infrastructure Bank and the CAD 3.8 billion Budget 2022 for the Critical Minerals Strategy (Government of Canada, 2023^[64]).

Criticism of the tables describes them as not truly tripartite bodies, lacking mandate, resources and authority to balance competing interests. Furthermore, they might be inclined to privilege short-term political considerations over long-term strategy. Announcing them as mechanisms to attain a “low-carbon future” has also been evaluated as diverging from truly zero-carbon goals (Mertins-Kirkwood and Kathen, 2022^[68]).

The Clean Growth Hub is an important advancement but could strengthen its co-ordination with RDAs

In order to channel all relevant information and support on “clean growth”, the Canadian government created a Clean Growth Hub, which serves as a whole-of-government focal point for clean technology, helping innovators and adopters navigate the federal system and enhance co-ordination amongst programmes. To this end, the tool provides an online inventory of clean technology-focused funding programmes. The single-window platform also provides advice from experts on navigating federal offers and tools to help plan and access support. Currently, the platform lists 35 entries, featuring a broad range of different initiatives and funding schemes for companies as well as municipalities or regional governments. Key areas of support are listed in Table 4.2. Some of the listed support is targeted to geographic areas as well as SMEs, which make up a large share of the rural economy.

Table 4.2. Federal funding opportunities listed in the Clean Growth Hub

Five key areas of support directly related to green innovation	Additional general areas of support indirectly related to green innovation	Support for specific geographical areas
<ul style="list-style-type: none"> • Tax reductions on clean energy equipment and clean energy generation • Support for clean energy generation and conservation activities • Research and development for clean technologies, as well as their scale-up • Support for employment readiness for youth in the environmental sector • Community support to retrofit buildings 	<ul style="list-style-type: none"> • Dedicated support for SMEs in the adoption of digital technologies and e-commerce • Job placements and internship support • Support on how to access foreign procurement or facilitate export 	<ul style="list-style-type: none"> • Atlantic Canada, Newfoundland and Labrador • Northern Communities

Source: Based on Government of Canada (2022^[69]), *Funding and Support Opportunities*, <https://ised-isde.canada.ca/site/clean-growth-hub/en/funding-opportunities>.

The hub aims to bring together key federal departments and partners that support clean technology innovation to simplify client services, improve programme co-ordination and enable monitoring and reporting on results. Already in 2017, the OECD noted that the various federal, provincial and territorial organisations involved in supporting clean technology innovation are required to co-ordinate their activities more effectively (OECD, 2017^[51]). The government has taken steps in this direction as a working group with representation at the federal, provincial and territorial levels, which has been established to support the co-ordination and implementation of clean technology commitments across the country as part of the hub. The goal of this is to reduce overlap and identify gaps. Considering the large variety of stakeholders involved in innovation support, this is a step in the right direction, yet, to date, the impact of the hub in co-ordination remains largely opaque.

A limitation of the hub is that it only lists federal support offers and does not provide links to or effectively integrates the work of RDAs as well as provinces/territories. As potential recipients may easily be lost in programme offerings, the tool could become more effective by further consolidating programmes in the hub to reflect at least RDAs programmes, if not also services provided by provinces and territories. Such an exercise might also be useful to identify important gaps or overlaps that easily emerge with multiple entities working towards similar goals.

Sustainable Development Technology Canada offers important support for SMEs wanting to bring innovations to the demonstration phase but lacks impact in rural regions

Another important support for green innovation at the firm level is Sustainable Development Technology Canada (SDTC), which works to accelerate technological shifts for high-potential companies and seeks to build an ecosystem for the commercialisation of sustainable technologies. The organisation acts as a not-for-profit and was created in 2001 by the Government of Canada and supports projects related to climate change, air quality, clean water and clean soil through technological innovation by:

- Funding the development and demonstration of new environmental technologies.
- Fostering and encouraging collaboration among organisations in the private sector, academia, the not-for-profit sector and others to develop and demonstrate new technologies.
- Promoting the timely diffusion of new technologies across key economic sectors in Canada (SDTC, 2021^[70]).

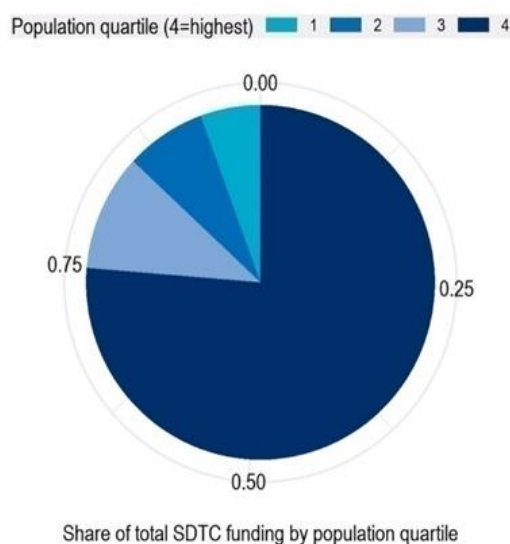
In its work, the fund addresses the existing pre-commercial funding gap and helps producers to further develop and demonstrate their technologies. They do this by providing three funding streams, including seed, start-up and scale-up, which include evaluations of environmental benefits as well as general business criteria such as technology readiness, management capacity, business plan and path to market.

The largest share of funding goes to energy utilisation, energy exploration and production and power generation. The latest evaluation concedes that about one-third of Sustainable Development Technology Fund recipients subsequently were able to commercialise, while larger projects and those receiving other government support have a higher probability of success (ISED, 2018^[71]). Yet, it seems like the ability to raise capital remains the main barrier to reaching the market. Building the right ecosystem to support follow-up through relationships with other partners might thus be helpful in supporting this process. This also includes connecting firms to international opportunities/supply chains, as mentioned in the 2018 evaluation.

The SDTC calculates its impact on jobs generated and reduced CO₂ emissions. They estimate that 20 942 total jobs can be attributed to SDTC-funded projects and that 22.6 megatonnes of CO₂ emission reduction were realised in their supported projects (SDTC, 2021^[70]). Within the programme, important strides are being made to support more women-led firms (41%) being included in the programme. They also aim to increase gender parity and under-represented group representation in their companies. Evaluations on geographical levels have not been carried out so far.

OECD analysis of available data on funded projects shows that most funding has an urban bias and is concentrated in a select number of provinces. Almost 80% of money spent on completed projects between 2004 and 2020 benefitted only 3 provinces: Ontario (32.4%), British Columbia (25.1%) and Alberta (21%); 14% went to Quebec and less than 3% to the remaining provinces. Current spending is even more concentrated, with 65% going only to Ontario and Quebec. Companies that form more rural constituencies seem to not be benefitting from this support as much: 75% of all allocated funding goes to the cities in the highest population quartile or, in other words, to cities with more than 250 000 inhabitants (Figure 4.9). This allocation of funding suggests there is an asymmetry between the needs of regions in addressing climate challenges and the national support provided. This means that either rural places face specific barriers to accessing these funds or the funds do not support what rural innovators are looking for and what is relevant for them.

Figure 4.9. Share of total SDTC funding by population quartile, based on the number of residences



Note: Quartiles of completed SDTC funding as a share of total funding. Completed funding refers to all projects for which funding is completed allocated. Quartiles have been obtained from the distribution of inhabitants of each location to which funding has been allocated. Quartile thresholds are 231 (1st), 19 658 (2nd), 89 490 (3rd) and 249 125 (4th) number of residents.

Source: SDTC (2022^[72]), *About - SDTC is Committed to Full Transparency*, <https://www.sdtec.ca/en/about/accountability/>.

One concrete measure of activating more rural entrepreneurs could be to build on the existent SDTC Innovation Happens Here campaign. It could be used for targeted outreach to rural regions and feature stories from rural places to attract attention. Furthermore, ensuring that innovators are able to access services to the programmes adequately is key. The more general RDAs could provide support where the SDTC may come short, especially in innovation diffusion and adoption of new systems. Likewise, bridging the gap between this fund and the regional and provincial support may provide more opportunities for entrepreneurs from diverse places.

Other federal programmes include the Industrial Research Assistance Program (NRC IRAP) and the Strategic Innovation Fund. The NRC IRAP provides advice, connections and funding to help Canadian SMEs increase their innovation capacity and take ideas to the market. They run a network of 130 offices across Canada. Yet, they do not have a specific cleantech or green innovation support work stream and it remains unclear if staff is able to provide support and guidance regarding these issues. In the past, Strategic Innovation Fund money has gone toward a liquified natural gas plant and other fossil fuel projects (Mertins-Kirkwood and Kathen, 2022^[68]). Their link to other regional agencies like RDAs is also unclear. Canada's NRC IRAP will join the Canada Innovation Corporation, which is currently under creation. The corporation will help Canadian businesses innovate, commercialise, grow and create good jobs in a changing global economy. This operationally independent, outcome-driven organisation will work alongside the private sector to provide targeted support to new and established Canadian firms by delivering funding and advisory services.

As part of the Strategic Innovation Fund, Canada's Net Zero Accelerator is providing CAD 8 billion in support of projects that enable the decarbonisation of large emitters, clean technology and industrial transformation, and the development of a Canadian batteries' ecosystem through activities such as battery cell manufacturing and electric vehicles. For example, the fund has invested CAD 400 million to support ArcelorMittal Dofasco's transition to low-carbon steel production and CAD 25 million in Svante Inc to advance carbon capture technology for cement and hydrogen production. This stream seems to be more focused on breakthrough technologies and large firms.

RDAs have started to shift focus but could do more to support green innovation diffusion by increasing spending and mainstreaming services

Canada's seven RDAs contribute to building a net zero economy by supporting the development of clean technology and economic diversification of SMEs and communities across Canada. The Government of Canada has committed to doubling investment in clean energy research, development and demonstration by the end of 2020, compared with 2015 levels (CED, 2020^[73]). As part of this goal, RDAs have introduced measures to double the total annual support for clean technologies, bringing it to CAD 100 million per year for all RDAs. Considering the total estimated budget of all RDAs for 2022-23 is CAD 2.6 billion, the annual support for clean technologies amounts to 4% of the budget. This 4% is dwarfed by expenditure on traditional support mechanisms.² Considering the pressing need for enterprises to transition, more funding or more integration of green innovation support schemes is necessary. While it might be that some support is not captured in these numbers, there is room for RDAs to further increase budget goals for clean technologies and other innovations that contribute to climate mitigation and adaptation.

A review of the RDA programmes and budgets shows that all agencies mention clean technologies, sustainability or green growth as part of their departmental plans for 2022, as do agencies with departmental plans for 2023-24. Still, how this translates to support or inform the individual programming remains unclear. Also, the agencies do not have clearly defined and measurable targets to support green innovation support and no specific data are collected to track its progress. So far, the only publicly available indicator across a range of RDAs providing information is the export value of clean technologies within the province. This, however, does not allow for any conclusion on the measures provided.

In terms of programming, there is also no specific climate-related programme/mechanism and most of the climate-related innovation support is streamlined through other programmes. Some of these feature requirements demonstrate aspects of sustainability of clean technology by the recipient, such as the Jobs and Growth Funds (see Annex 4.A). One of the most important programmes for rural firms and entrepreneurs is the Community Futures Program, as one of the first entry points for many businesses (see Chapter 3 for further information). However, questions of improving energy use, support of how to calculate environmental footprints or advice on climate-friendly investments are not systematically featured, despite the fact that initiatives, such as the *Sociétés d'aide au développement des collectivités* network, are involved in providing support for sustainability projects in SMEs (Réseau des SADC+CAE, 2021^[74]), creating a gap in services for rural enterprises interested in improving their climate impact.

A positive development is that, under the Government Cleaning Initiative, under which the RDAs also fall, green procurement has become a priority. This includes incorporating environmental considerations into purchasing decisions. This can help motivate suppliers to green their goods, services and supply chains, also in more rural places where some RDA branches are located.

Provincial- and territorial-level green innovation support

At the provincial and territorial levels, ambitions are increasing to support cleantech, which is demonstrated in various strategic plans and as a comparative analysis of all online available provincial and territorial plans demonstrates (Annex Table 4.A.2). In total, 9 out of 13 provinces/territories have a strategy that supports cleantech innovation and 4 out of those 9 have a standalone guideline dedicated to cleantech, which is not part of a larger climate or innovation strategy. Most governments of large regions (TL2) use climate strategies and plans to elaborate their ambitions and focus on innovation and clean technologies to achieve sustainable growth.

The level of detail with regard to cleantech actions is uneven between provinces and territories. Provinces like British Columbia, Manitoba, Ontario and Quebec are a step ahead and present rigorous policy actions to accelerate the green innovation process. These provinces and territories mainly focus on leveraging existing infrastructure to foster innovation and accelerate the growth and impact of green innovation. British Columbia, for instance, has very elaborate actions and measures to achieve net zero emissions. Its CleanBC plan includes a Roadmap to 2030 and the Climate Preparedness and Adaption Strategy seeking to intensify partnerships between British Columbia's cleantech sector and traditional industries. However, sometimes strategies do not seem to be well aligned: British Columbia's Technology and Innovation Policy Framework, for instance, only makes a small reference to the CleanBC climate plan.

A range of regions, especially those with smaller populations, do not have overarching strategies but operate individual cleantech or green innovation programmes. For instance, Nunavut is powering and heating government-owned buildings with renewable energy.

With regard to considering rural specificities, 6 out of 13 strategies or plans mention rural places and seem sensitive to rural needs. Generally, the rural focus aims to support the transition to clean sources of energy by improving, for instance, connectivity in rural areas and clean transportation options. Just as many strategies or plans (6 out of 13) target SMEs, which are important for the rural economy (see also Chapter 3). The objective for SMEs across strategies is to help them scale up and support them in the development of innovative products and processes in the cleantech sector.

Overall, the start date of many of these strategies is no older than 2021, making it difficult to capture or measure the results of the programmes as of today. Moving ahead, it would be important for those provinces and territories that do not have strategies for green innovation or cleantech to further develop these and bundle already existing programmes while assessing potential gaps and them being fit for purpose. Furthermore, following these strategies, concrete actions need to be defined and evaluated at an ongoing basis. In those provinces that have high levels of rurality, it is especially important to add a rural

lens to their green innovation planning, incorporating challenges such as remoteness, transportation cost and limited access to business support and research.

Overall, the analysis of the largest policy programmes existing in Canada to foster green innovation demonstrates that the Canadian government – at all levels – has significantly increased its support and ambitions with regard to climate action and green innovation. Examples of this are the plans and strategies devised, the increasing amount of funds given and the procurement undertaken.

Still, there seems to be a mismatch between the support given to rural areas and the pressures they are under to reduce emissions and adapt to climate change. Conventional green innovation support and strategies are largely space-blind and are likely to contribute to more urban economies, overlooking some of the important existing rural opportunities. As part of that, many do not fully grasp the specific needs, opportunities and challenges existing in different geographies. Those regionally specific programmes are underfunded or lack a green innovation focus. In addition to that, it seems like policy priorities on green innovation are fragmented across federal and provincial governments and their respective departments. This causes existing funds to come from a variety of different sources, often in the form of one-off grants to individual firms. This reduces efficiency and increases red tape for beneficiaries.

The following sections will elaborate on a range of policy actions that can be undertaken to strengthen existing efforts and build on successful programmes and services that are already in place but need to be adjusted to serve rural places as well as urban constituencies.

Policy action: Assure policy coherence across levels of government and allow for more federal-provincial/territorial and Indigenous collaboration

Overall, green funding and financing mechanisms for businesses are rather comprehensive and well-established in Canada. Yet, having many, sometimes overlapping offers or support systems is a challenge. There is a need to further improve federal-provincial/territorial collaboration to support green innovation and green growth opportunities through collaborative funding. Currently, money given to green innovation projects often comes from a variety of sources, including numerous federal, provincial, territorial and private actors. This creates a situation in which companies either have to apply to many different schemes or programmes, which includes significant red tape and transactional costs as they are faced with different application and reporting procedures, or are limited to going with just one smaller source of funding.

To increase the impact of funding and reduce administrative barriers for firms, RDAs and provinces should increase ways of matching projects so that the money they give can have more impact. Furthermore, agencies in the public sector should create simpler application procedures so applicants are not required to fill in basic information repeatedly but can apply with a profile shared amongst agencies. This could also facilitate the application for follow-up support in a context where initial checks have already been completed so that processes can move quickly.

There is an opportunity to take advantage of the already existing Clean Growth Hub to further strategically connect green innovation initiatives from the NRC IRAP, the SDTC, RDAs, provinces and territories and other innovation support stakeholders. For instance, the hub could be used to collectively close data gaps, e.g. with regards to ensuring data consistency and collecting information related to key performance indicators, as well as environmental and economic benefits to be gained from green innovation. The hub could also feature not only federal but also provincial and territorial green innovation support programmes and funds. In this matter, it could be used to streamline options, including collaboration with other funding entities, to minimise duplication and reduce the administrative burden on companies.

Policy action: Evaluating potential regional opportunities and focusing strategic efforts in priority areas

Opportunities for transitioning to a net zero economy are not always clearly visible for governments, businesses and citizens alike. This can have several reasons, including inadequate information and data, misconception – for instance, that urban regions have an advantage because they rely less on carbon-based transportation, have a large share of the service industry and younger population –or simply other day-to-day priorities. Further, services that help firms transition, for instance, by reducing energy use or changing the materials, are more frequently inaccessible to rural firms that want to calculate their footprint or get advice. Consequently, promoting a rural opportunity lens, fostering awareness and providing adequate information are important to activate potential and offer the right services and incentives to unlock greater adoption across rural geographies.

To clearly communicate opportunities for rural places during the transition, the OECD has launched the Rural Agenda for Climate Action (OECD, 2021^[75]). This agenda highlights the role of rural areas in the transition to a zero carbon economy and outlines areas of opportunities to achieve climate goals and support rural development. The most important areas of opportunities are:

- A rural comparative advantage in producing renewable energy due to open spaces and low population density. Rural regions are already leading in renewable electricity production, generating 38% of their electricity using renewable sources in OECD countries. Further, remote OECD regions already produce more than half of their electricity from renewable sources, providing more than a third of all clean electricity in OECD countries (OECD, 2021^[9]). Building on this, rural regions producing renewable energy and becoming energy independent can also establish local innovation ecosystems and link them to new initiatives such as green hydrogen production.
- Ecosystem services are present in rural places. Rural regions cover around 80% of the territory in OECD countries and contain the important associated natural resources and biodiversity needed to sustain our lives. They produce food and energy, clean water and air and sequester carbon. Promoting sustainable land management creates new opportunities for rural regions, especially when rural dwellers are compensated for their efforts in protecting the environment, for instance, through payments for ecosystem services, which often have no economic value. Indigenous peoples throughout Canada have a particular role to play as stewards of land. There is potential for partnerships with Indigenous communities and governments to advance nature-based solutions to climate change.
- Less than 10% of the global economy is circular, with a tendency to decline (Circle Economy, 2022^[76]). Developing the circular and bio-based economy – using renewable resources from rural regions and helping rural businesses more efficiently close, slow and narrow resource loops – is essential to minimise environmental pressures. It also promotes more sustainable local production and offers opportunities for new business models and new markets, for instance, by using the waste from one business as feedstock for another.
- Contribute to decarbonising transport in rural regions by accelerating the transition to more sustainable and innovative mobility options whilst developing and smartly connecting the required physical and digital infrastructure (e.g. renewable energy generation, green hydrogen production and fast Internet connection).

Taking stock of the Rural Agenda for Climate Action, Table 4.3 provides a list of initial consideration strategies for rural opportunities emerging from the climate and environmental transition. Many rural development plans are only partially considering opportunities that can arise from the shift to an environmentally friendly net zero economy. While not all these opportunities are equally applicable to all rural places because rural places are socially, economically, geographically and culturally diverse, understanding this diversity helps to design climate-sensitive rural policy responses. Evaluating these areas of opportunity in the local context and incorporating them into the planning for economic development

at the provincial/regional and municipal levels in relation to the local economic fabric can help to design opportunity-oriented strategies.

Table 4.3. Initial aspects to consider when evaluating rural development opportunities for sustainability transitions

Area	Dimension	Potential actions
Renewable energy	Solar, wind, tidal, biogas, geothermal, etc.	Evaluate the potential for generating renewable energy and its innovation potential.
	Smart grid	Evaluate options to decentralise power grids, link local power generation and storage into a central system, and potential future opportunities to incorporate battery storage (incorporating electric vehicles and local biogas plant links).
Land use	Increasing removal of GHG from the atmosphere	Payments for ecosystem services can mitigate climate change through increased carbon sequestration and reduced emissions by incentivising land managers to provide certain services (conservation and restoration, water, carbon and biodiversity purposes). They can be used to support afforestation, reforestation and bioenergy use with carbon capture and storage, as well as redirect subsidies to remove environmentally harmful subsidies.
	Land use planning	Consider expanding decision-making models for land use planning from short-term economic criteria to one that incorporates environmental and social aspects that incorporate non-market values. Whenever possible, policies unrelated to land use should not provide incentives that contradict spatial objectives. Land use discussions need to be in line with Indigenous rights and should adopt UNDRIP principles.
Circular and bioeconomy	Circular economy	Identify how materials flow throughout the economy and how they may limit or boost the current circularity and the material footprint. Investigate how circular economy principles (design out waste and pollution; keep products and materials in use; regenerate natural systems) can be supported in the local economy and what needs to be done to realise them.
	Bioeconomy	Evaluate the current land use and potentials from existing economies and value chains in the area of renewable raw materials and biogenic residues and waste, which form the basis of a bio-based economy. Investigate which industries can offer points of contact for the bioeconomy that can function as additional starting points for new value-creation options integrating different sectors. Consider what role links to research and development institutions can play.

Source: Based on OECD (2020^[77]), *The Circular Economy in Cities and Regions: Synthesis Report*, <https://doi.org/10.1787/10ac6ae4-en>; OECD (2021^[75]), *OECD's Rural Agenda for Climate Action*, <https://www.oecd.org/regional/rural-development/Rural-Agenda-for-Climate-Action.pdf> (accessed on 15 March 2023); OECD (2021^[9]), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, <https://doi.org/10.1787/17017efe-en>.

In addition, opportunity assessments should be matched with transition strategies in places that require more urgent transition because they are part of the group of high-emitting regions. To speed up CO₂ reduction, the Canadian government needs to develop a considerate transition strategy for places with extremely high-emitting sectors. Figure 4.3 clearly identifies high-emitting places and the underlying industries. Based on these insights, the government should commit to developing specific transition plans for these places and industries and match them with local opportunities. Such a process will need to be developed in co-ordination with multiple government levels and their respective responsibilities. While the national government can play a role in setting the framework condition for such a place-based strategy, provincial/territorial and local levels will be needed to define concrete targets and measures supported by the RDAs. Furthermore, the links between the private sector and civil society are key to long-term success.

Tackling the challenges of rural areas while also ensuring sustainable development and economic growth will require an interface between a number of policy areas such as rural development, agricultural policy, bioeconomy strategies, energy and mobility policy and research and innovation. Regions will need to develop integrated rural strategies to empower businesses and citizens to use resources sustainably through new value chains, skills and collaborative models. Each rural area is unique and will need to reflect its different resources, ecosystems and businesses. Working with its specific stakeholders, actions need to be decided and tailored at the local level, bringing all relevant actors together and making use of available financial resources.

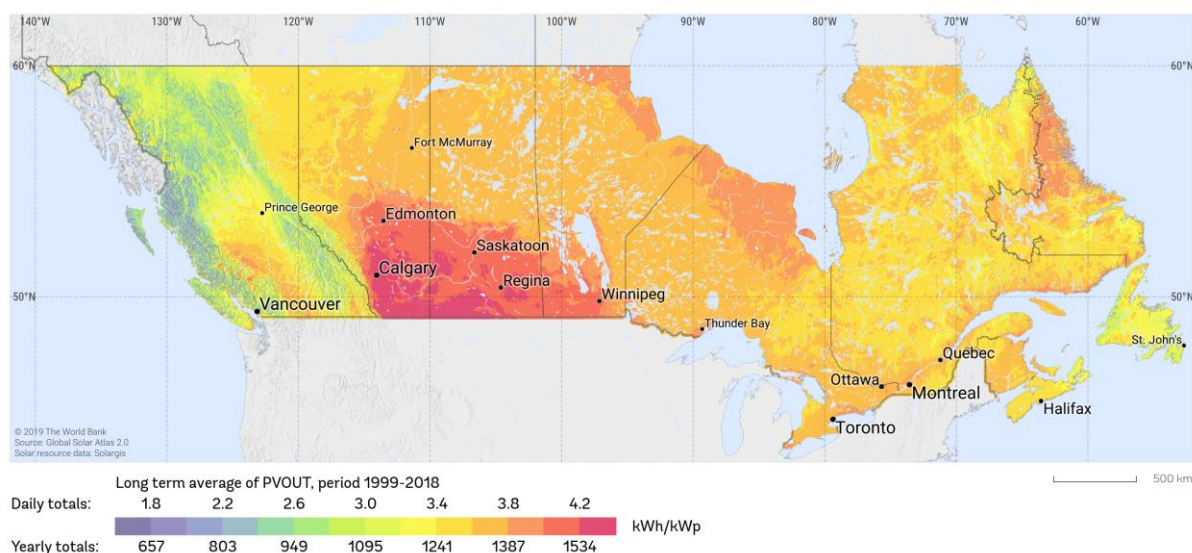
In the case of Canada, for instance, regions such as Alberta and Saskatchewan have the greatest potential for onshore wind and solar electricity (see also Figure 4.10), while they also have the highest share of coal electricity. Offshore potential is very strong, especially on the east coast, as shown in Figure 4.11. The need to reduce these potential barriers to renewable energy development in Canada is illustrated in Box 4.7. Nevertheless, some of these potentials could be translated into rural development opportunities, especially when linked to other innovations. In Quebec, for instance, a full innovation ecosystem has been structured around wind energy in Gaspésie. Starting with the construction of the wind turbine blade factory in the city of Gaspé in 2005, the previously largely natural resources-based economy has seen significant diversification. In June 2007, the Quebec government and regional stakeholders signed an implementation agreement for the development of a cluster initiative (*Créneau d'excellence en énergie renouvelable*, Nuvéo) and in 2022, the factory alone was the largest private sector employer with nearly 400 employees. Due to this project, this number increased to 800 in 2023. As part of the cluster, applied research on renewable energy is also conducted at the Nergica,³ a centre of applied research that stimulates innovation in the renewable energy industry, and other local SMEs are developing around energy production, wind farm installation, transport of turbine components and assembly as well as other industry related services (environmental impact assessments, wind measurement campaigns, operation and maintenance, etc.). Overall, the wind energy cluster comprises some 30 businesses that together represent roughly 1 000 direct jobs in the administrative region.

About 200 communities across Canada rely completely on diesel fuel for heat and power. The vast majority are Indigenous or have significant Indigenous populations. Remote communities consume more than 680 million litres of diesel per year; close to two-thirds of these are used for heat, as many remote communities are in harsh environments. The Government of Canada is investing in several clean energy projects in Indigenous communities that are seeking to transition from diesel to clean energy. For example, the Fort Chipewyan Solar Project has received CAD 4.5 million toward building a 2.2-megawatt solar energy and energy storage project in northern Alberta. Three neighbouring Indigenous groups in Fort Chipewyan own Canada's largest off-grid solar project. It will produce 20% of the community's electricity, displacing 650 000 litres of diesel fuel per year and reducing GHG emissions by 1 743 tonnes annually. Wah-ila-toos⁴ supports the shift to clean energy in Indigenous, rural and remote areas that use fossil fuels for heat or power, including Northern and Arctic regions and industrial sites. The programme prioritises Indigenous-owned or -led projects, or projects with community partnerships, providing support for all project stages and a variety of technology types.

Yet, there are many other opportunities in Canada linked to green innovation. The Pacific Institute for Climate Solutions has identified seven potential clusters that could provide a strong portfolio of opportunities for Canada's green economy. They include low-risk and some high-risk high-reward. These are assessed on the basis of their "national advantage", which considers whether Canada is likely to develop and maintain long-term cost advantage due to: i) the availability of relevant natural resources, upstream inputs or specialised labour skills; ii) the innovation capacity, which is defined as whether Canada has an advantage due to existing firms or research clusters; and iii) market potential. This involves looking at the export potential of a particular technology, either within the North American or global market. As a result, it identified the seven following clusters (Allan et al., 2022^[78]):

- Manufacturing of heavy-duty zero-emission vehicles.
- Green chemistry for biofuels, plastics, net zero fertiliser.
- Carbon capture, utilisation and storage and direct air capture.
- Alternative proteins for the agricultural sector.
- Green and blue hydrogen production.
- Mass structural timber for buildings.
- Net zero aluminium refining.

Figure 4.10. Photovoltaic power potential, Canada

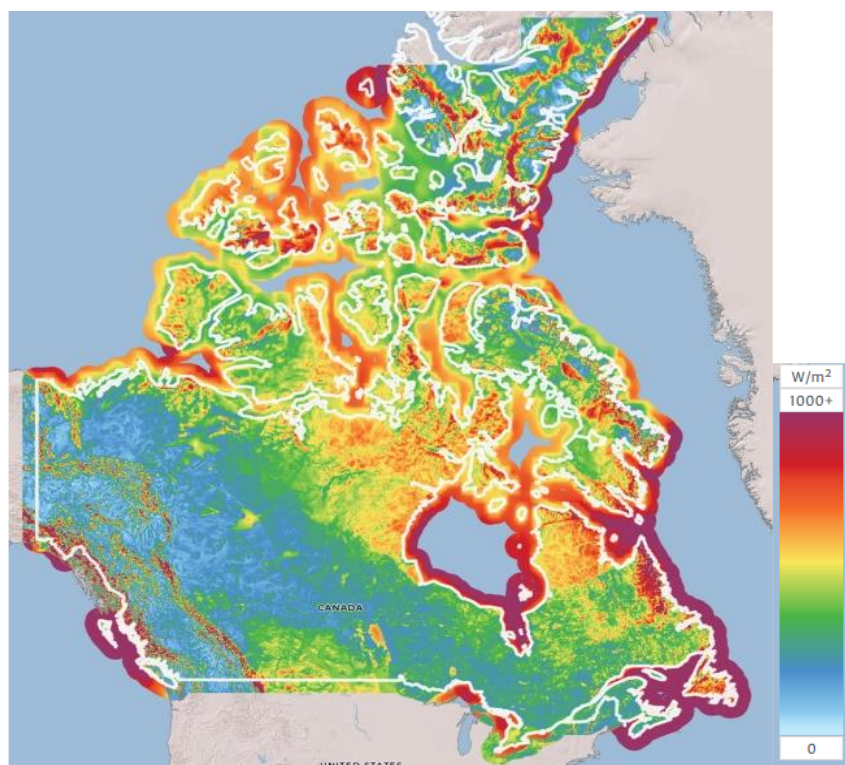


Note: PVOUT represents the amount of power generated per unit of the installed photovoltaic capacity over the long term and it is measured in kilowatt-hours per installed kilowatt-peak of the system capacity (kWh/kWp).

Source: Global Solar Atlas (2022^[79]), *Welcome to the Global Solar Atlas*, <https://globalsolaratlas.info/map?c=11.609193,8.173828,3>.

Figure 4.11. Wind power potential, Canada

Mean wind power density at 100 m



Note: Mean wind power density (W/m²).

Source: Global Wind Atlas (2022^[80]), *Welcome to the Global Wind Atlas*, <https://globalwindatlas.info/en>.

Box 4.7. Overcoming hurdles for renewable energy generation in Canada

Despite the potential for green innovation within the generation of renewable energy for rural areas, some provinces' restrictions on electricity markets still impede this progress. In Canada, each province and territory has a different power market and is in charge of the production, transmission, distribution and market organisation of electricity within its own boundaries. Limited electricity trade between proximate markets reduces access to clean electricity in provinces that are still reliant on fossil fuel energy and allows them to generate very low-cost energy in others. This requires additional government support, such as competitive tenders for renewable electricity generation, feed-in tariffs, tax breaks or subsidies to encourage investment in renewable energy. Grid investments and steps to pool power with competitive markets across regions together with provincial reforms to liberalise electricity markets, could enable clean power for export and reduce barriers to renewable energy generation. The Atlantic Loop system, originally aimed to connect Quebec with electricity markets in Atlantic Canada, was set up to capture these gains; however, the project was abandoned by New Brunswick and Nova Scotia due to cost concerns and a lack of guaranteed supply of power from Quebec (CBC, 2023^[81]), highlighting cost and supply concerns of these projects. Other provinces and regions should continue to pursue bilateral efforts to pool production and invest in cross-border transmission links where feasible (OECD, 2023^[14]).

In addition to market barriers, regulatory obstacles might lower the profitability of renewable energy investments. While consultations are important to ensure process buy-in, they must remain relatively simple and predictable. In Nova Scotia, for instance, project developers must meet specific notification and consultation requirements and, to go ahead, they sometimes need approvals from municipal, provincial and federal authorities (Government of Nova Scotia, 2007^[82]). In addition, outcomes of review processes are subject to broad ministerial discretion and, thus, can be highly uncertain. This could affect the cost of finance for clean energy developments, which are large for projects requiring comprehensive impact assessments and could increase the returns needed to make projects viable.

As some provinces maintain effective bans on offshore wind projects, some governments have made progress in addressing lengthy approval procedures. In 2022, Newfoundland and Labrador ended its ban on offshore wind projects. In order to accelerate the permit process, Alberta, British Columbia and Ontario have co-ordinated provincial approval procedures (see, for example, the Technical Guide to Renewable Energy Approvals (Government of Ontario, 2019^[83]). Additionally, the Offshore Renewable Energy Regulations is an initiative being developed by the Canadian government that aims to ensure operational safety and environmental protection regulations are in place when developing offshore renewable projects while minimising the administrative burden for industries. The proposed regulations were published in Autumn 2023 (Government of Canada, 2023^[84]).

Source: OECD (2023^[14]), *OECD Economic Surveys: Canada 2023*, <https://doi.org/10.1787/7eb16f83-en>; CBC (2023^[81]), "N.S. abandons Atlantic Loop, will increase wind and solar energy projects for green electricity", <https://www.cbc.ca/news/canada/nova-scotia/clean-power-plan-abandons-atlantic-loop-1.6992765>; Government of Nova Scotia (2007^[82]), *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia*, <https://novascotia.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf>; Government of Ontario (2019^[83]), *Technical Guide to Renewable Energy Approvals*, <https://www.ontario.ca/document/technical-guide-renewable-energy-approvals-0>; Government of Canada (2023^[84]), *The Offshore Renewable Energy Regulations Initiative*, <https://natural-resources.canada.ca/public-consultations-and-engagements/the-offshore-renewable-energy-regulations-initiative/25006>.

Box 4.8. Creating rural development from the net zero transition – Example from Quebec

Reducing the environmental impact of aluminium production

Quebec ranks first in North American aluminum production and fourth in global aluminum production. The sector represents 30 000 jobs in nearly 1 500 companies and CAD 7.4 billion in export value in 2020.⁵ Production is mainly carried out in the rural regions of Quebec, namely Saguenay-Lac-Saint-Jean and the North Shore. In 2014, the Quebec government launches its first Quebec aluminum strategy. The current operating cycle is 2021-24. One of the three axes of intervention focuses on innovation and green aluminium, notably with the aim of reducing CO₂ emissions. In 2019, aluminum production generated 4.5 megatonnes (Mt) of CO₂eq, mainly through the production process out of a total emission in Quebec of 84.3 Mt CO₂eq.

The companies running Quebec plants are focusing on producing aluminum with fewer indirect carbon emissions, particularly through the use of hydroelectricity. Launched in 2018, the Elysis project is a joint venture receiving public and private funding. Elysis aims primarily to eliminate GHGs and produce oxygen by replacing the anodes in the traditional aluminum manufacturing process with carbon-free anodes, which have a 30 times longer life span. The new process will reduce costs and increase the production capacity of an aluminum smelter, while eliminating polluting emissions.

Further reducing the needs for new aluminium is equally important. As recycling requires 95% less energy than producing primary aluminum. The AluQuébec⁶ cluster launched the *Valorisation et recyclage* project in 2020, which offers innovation opportunities to SMEs. For example, the family business Lefebvre Industrie-AI⁷ has conducted research and development on a process for reclaiming residues from the Alcoa aluminum smelter in Baie-Comeau on the North Shore. The AluQuébec cluster aims to measure the environmental impact of different aluminum products in the construction sector in more detail.

Source: Information provided by Canada Economic Development for Quebec Regions (CED).

Policy action: Developing subnational data on green innovation to allow for targeted policy action and demonstration of impact

In order to best evaluate regional potentials and opportunities, access to climate-relevant data is fundamental. Data on green innovation in Canada have significantly improved in recent years, especially with the introduction of the Clean Growth Hub and the collection of data on environmental and clean technology employment, GDP generated by environmental and cleantech products, and revenues from goods and services exported as well as domestic sales.

Still, data relevant to green innovation, like employment, cleantech companies, R&D spending, other government grants and patent information, are only available at the national or TL2 level. Table 4.4, for instance, only shows a limited picture of the number of green jobs. According to the Canadian government's definition, green jobs are rather balanced, varying only between 1-2% of total employment per province.⁸ Using the OECD definition, the shares of green jobs are higher. This is largely based on the definition used. However, it also shows a slight variation across provinces. As a proportion of all Canadian jobs, green jobs are highest in Ontario and Quebec, followed by British Columbia and Alberta at some distance. This is not surprising as these provinces probably have the most jobs in general. Data broken down into smaller regions would be essential to better understand green growth potential and the impact of green jobs. Likewise, a more granular understanding of where patents are located and where national RD&D spending goes can significantly increase regional policy makers' decision making.

Table 4.4. Environmental and clean technology employment Canada, 2021

Geography	Employment 2021				Percentage of total jobs	Percentage of jobs per OECD definition
	Cleantech ¹	Environmental sector ²	Combined	Percentage of Canada's cleantech jobs		
Ontario	78 331	48 763	127 094	40	2	12
Quebec	45 941	35 860	81 801	26	2	10
British Columbia	25 322	14 765	40 086	13	2	13
Alberta	16 573	9 035	25 607	10	1	14
Manitoba	7 220	5 967	13 187	4	2	10
Newfoundland and Labrador	3 019	2 549	5 568	2	2	9
Nova Scotia	3 501	2 000	5 501	2	1	11
Saskatchewan	4 298	2 546	6 843	2	1	12
New Brunswick	3 756	3 233	6 989	2	2	10
Northern Territories	76	147	223	0		
Nunavut	106	14	120	0		
Prince Edward Island	424	468	892	0	1	10
Yukon	228	117	345	0		
Canada	188 795	125 464	314 258	-	2	12

1. Refers to environmental goods and services that include clean electricity from renewable sources and nuclear power generation, biofuels and primary goods, and waste management and remediation services.

2. Refers to clean technology goods and services that include manufactured goods, scientific and R&D services, construction services and support services, such as the design and construction of energy-efficient buildings for instance.

Note: This table does not include self-employment and uses the industry classification of supply and use tables. Supply and use tables are built around three classification systems: the input-output industry classification (IOIC) for industries, the supply-use product classification for products (goods and services) and the input-output final demand classification for final demand categories. The IOIC is based on the North American Industry Classification System.

Source: Statistics Canada (n.d.^[85]), Environmental and Clean Technology Products Economic Account, Employment, Table 36-10-0632-01, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610063201>.

Place-based development policy options are limited without good data that disaggregate metropolitan and non-metropolitan regions. For instance, policy actions to foster cleantech adoption, especially in high-emitting regions, might be missing. Consequently, improving data for rural green innovation requires that data are collected below the provincial (TL2) level. This will also provide a better understanding of the benefits rural places are getting from the current support being provided and where there are gaps in support. For example, as well as providing more granular data, the Clean Growth Hub would benefit from including data on public sector funding for R&D, as well as on patents and support provided by different departments, broadening the analysis it can provide. To assist this, RDAs could include a marker on their spending on cleantech-related projects, which could then be added to the database and included in the reporting. An example of one such initiative exists already in ACOA, where “clean growth” expenditure is being tracked.

An important data source to better understand green innovation is business surveys. Quebec has a business survey investigating green business practices at the provincial level. Data from 2019 indicate that only around 8% of companies conduct actions to preserve biodiversity and natural resources, 9% adapt to climate change-induced changes and 13.7% try to reduce emissions associated with their activities. The highest numbers are recorded in the categories of management of residual materials, with 41% of companies acting. The survey also finds that the proportion of companies with eco-responsible business practices is generally lower in the sectors of agriculture, forestry, fishing and hunting, mining, quarrying,

extraction oil and gas and construction than in other sectors. It is also lower for small companies, especially those with fewer than five employees (Brehain, 2019^[86]). Analysis based on geography as per rural and urban delineation is not available. In order to see if there is a geographical difference between the adoption of green business practices across geographies, it would be interesting to include this in the analysis.

Similarly, the United States is integrating a sustainability management module into its 2023 Annual Business Survey. The module addresses how businesses try to meet environmental needs, as well as several key issues concerning carbon emissions, and tries to understand whether or not organisations have taken steps towards sustainability and to what extent. For instance, questions are asked about sustainability prioritisation, objectives and investments to understand the degree to which companies are investing in green innovation. Furthermore, by collecting information on direct and indirect carbon emissions tracking, the government tries to understand how firms are advancing in carbon emissions reduction and shaping future plans for decarbonisation. The survey also makes it possible to understand and measure the environmental benefits the business introduced via innovations and if they were obtained during the end user's consumption or use of a good or service. Examples of the questions are provided in Box 4.9.

Box 4.9. Survey-based firm green innovation measurement in the United States

Below are two examples of questions included in the United States Annual Business Survey innovation module

Innovation and environmental benefits within this business¹.

1. During the three years from 2020 to 2022, did this business introduce innovations with any of the following environmental benefits obtained within this business? If yes, was the extent of that contribution a great deal or not?

	Yes, to a <u>great</u> extent	Yes, but <u>not to a great</u> extent	No
a. Reduced material or water use per unit of output			
b. Reduced energy use or CO ₂ "footprint" (i.e. reduced total CO ₂ emission)			
c. Reduced soil, noise, water or air pollution			
d. Replaced a share of materials with less polluting or hazardous substitutes			
e. Replaced a share of fossil energy with renewable energy			
f. Recycled waste, water or materials for own use or sale			

Innovation and environmental benefits during use of goods or services

2. During the three years from 2020 to 2022, did this business introduce innovations with any of the following environmental benefits obtained during the end user's consumption or use of a good or service? If yes, was the extent of that contribution a great deal or not?

	Yes, to a <u>great</u> extent	Yes, but <u>not to a great</u> extent	No
a. Reduced energy use or CO ₂ "footprint"			
b. Reduced air, water, soil or noise pollution			
c. Facilitated recycling of product after use			
d. Extended product life through longer-lasting, more durable or easier-to-repair products			

Source: U.S. Census Bureau (2022^[87]), *Information for Respondents*, <https://www.census.gov/programs-surveys/abs/information.html>.

Policy action: Providing the right support in rural places and their businesses

SMEs have a critical role to play in the transition to carbon neutrality. Even though individual SMEs may have a small carbon footprint, their aggregate impact is likely significant. Information and research on the contribution of SMEs are still scarce but suggest that small firms worldwide make up 50% of GHG emissions (ITC, 2021^[88]). United States- specific research indicates that small businesses contribute to USD 60 billion in annual energy costs and nearly half a billion tonnes of annual carbon emissions, equivalent to powering half of the homes in the United States every year (Hill, 2015^[89]). Furthermore, SMEs and entrepreneurs are needed as a source of innovation, developing technologies, processes and services to address environmental challenges (OECD, 2021^[90]). Focusing on SMEs is important in the rural context, as companies in rural places are often smaller than in urban areas.

Across the OECD, a range of factors push SMEs into reducing their environmental footprint. These include:

- Pressure for cost reduction due to increased energy prices or carbon tax.
- Changing consumer demands.
- Larger firms looking to develop greener supply chains.

Within that process, SMEs continue to face different challenges, including a lack of knowledge on changing environmental requirements, limited access to skills, finance and technologies as well as red tape, which prevents SMEs from greening their operations or scaling up green products and services. The business case for SME greening is often complex and insights on how to best support this are not fully developed. In addition, the COVID-19 pandemic and the recent price spikes in energy have left some SMEs with limited resources and reduced consumer demand. This makes SMEs vulnerable and further reduces their capacity to engage in greening activities requiring investments (OECD, 2021^[90]).

In the Canadian context, SMEs in the Quebec region have specifically identified a range of challenges in relation to the environmental shift (see Table 4.5). The challenges cover a broad spectrum, from accessing markets and commercialisation to funding, technical capabilities and access to business ecosystems. They also highlight the different communities – depending on the local climate and transition impacts. Similar research is also happening in other provinces/territories. For instance, in Atlantic Canada, the Atlantic Economic Council is trying to understand the impact of the shift to net zero emissions (Atlantic Economic Council, 2023^[91]).

Table 4.5. Challenges of the environmental shift for SMEs in Quebec

Category	Challenge
Markets and commercialisation	<ul style="list-style-type: none"> • Difficulty in accessing the Canadian domestic market and environmental-technological solutions across Canada. • Lack of capacity for enviro-technological developers to promote their products. • North American “lowest-bidder” policy goes against the growth of green technologies. Lack of technical criteria, including a GHG reduction, may be a potential additional criterion. • Need for additional support for cleantech pre-commercialisation and commercialisation efforts. The technological and commercial risks are greater for clean technologies and the return on investment is harder to justify.
Funding	<ul style="list-style-type: none"> • More substantial and riskier environmental investments. • Better matching of public and private funding. • Lack of technical knowledge for funding and poor knowledge of available funding sources. • Issue of access to funding, particularly in the pre-commercialisation phase.

Category	Challenge
SMEs' technical capabilities	<ul style="list-style-type: none"> • Lack of knowledge of environmental assessment tools. • Need for SMEs to be better equipped to measure their environmental impact, particularly in terms of measuring direct and indirect GHG generation. • Difficulty identifying technologies available on the market. • Lack of expertise and personnel to initiate and undertake the shift.
Ecosystems	<ul style="list-style-type: none"> • Need to boost environmental ecosystems, with close attention being paid to regional contexts, industrial sectors and the related environmental issues. • Need to regionalise the services the support ecosystem provides to reach businesses in all regions, including those in remote regions. • Need for more efficient networking between cleantech developers and businesses that plan to adopt clean technologies. • Difficult for SMEs to be just one of many organisations in the various green transition fields, including the circular economy.
Communities, sectors and groups affected	<ul style="list-style-type: none"> • Challenges for communities that need to prepare for climate change issues that are affecting (or will affect) their economies. • Challenges for communities that are more vulnerable to the green transition owing to the presence of industries that are threatened or that need to change significantly (e.g. primary metal manufacturing; support activities for mining, oil and gas; and plastics and rubber products manufacturing). • Challenges to ensure the economic participation of various under-represented groups in Quebec's green economy (e.g. Indigenous peoples, newcomers, women, etc.).

Source: CED (n.d.^[92]), *Issues, Challenges and Business Needs*, Canada Economic Development for Quebec Regions.

Although Canada has put in place an increasing number of policies to foster green growth, these are not always well adapted to SMEs and entrepreneurs located in rural places. As argued earlier, many policies have a bias towards urban areas, where larger businesses and research institutions are present, and ecosystems function based on agglomeration. These services offer important services, including information and advice on regulations, and offer grants and loans, but often do not consider aspects like technical capabilities present in rural places, the need for funding in the pre-commercialisation phase and lack of focus on specific industrial sectors and related environmental issues. Accelerating the uptake of greening by SMEs requires mainstreaming rural issues into broader SME and entrepreneurship policy frameworks and ensuring that climate and environmental policies take the perspective of SMEs better into account.

To boost green innovation support, federal and provincial governments should make an effort to improve access to resources, especially to provide financing where private investors shy away to allow for more risks to be taken, develop technical knowledge provision and allow the sharing of information for Canadian rural clean technology firms and other kinds of green innovations. A range of actions could include:

- Streamlining green innovation across all programming areas of RDAs and aligning mechanisms related to innovation with net zero emissions targets and contributions to climate change mitigation. This could include introducing requirements for demonstrating the firm's compatibility with net zero-emission targets or positive environmental impact as a condition for funding.
- Leveraging the existing Community Futures Programs to provide green services in rural places where no other measures can reach and thereby help fill some of the service gaps and bundling capacities. This could be done by featuring business support on innovation for climate change, including preparing businesses to assess possible climate risks (physical, price, product, regulation), improve energy and waste efficiency in their businesses and across value chains, helping them to source power from renewable resources or minimising waste, save and integrate Indigenous knowledge,

support green innovation energy, water and materials, recycle and reuse materials or waste, while offering green products and services. An example of such a service on the island of Gotland in Sweden can be found in Box 4.10.

- In remote areas where services are not available, increased (online) peer-to-peer learning could be used to substitute services like the Community Futures Program. RDAs could actively pair and match different businesses that are looking to learn from each other.
- Sustainable Development Technology Canada (SDTC) should consider developing a rural SME programme that specifically targets rural entrepreneurs and tries to address specific rural needs through funding, giving them remote access to their networks and services. A dedicated communications campaign targeted at rural innovators might also increase participation from these constituencies.

Box 4.10. Energicentrum Gotland, Sweden: Enabling local transitions

Energicentrum Gotland was established in 2021 as part of the regional development strategy and the Energy Agency's government mission, which aims for the region of Gotland to operate on a fully renewable energy system by 2040. Energicentrum Gotland is one of Sweden's 16 regional energy offices. It is owned by Region Gotland.

The centre is set up as a knowledge and capacity-building hub that acts as an information centre and advisory service. It is channelled into the following four workstreams: i) mobility; ii) self-production and energy communities; iii) energy efficiency; and iv) storage and flexibility.

The goal is to enable people and businesses on Gotland to transition to an efficient and sustainable energy system. The centre advises companies, organisations and private individuals actively working with their own buildings and activities across a broad range of subjects:

- Hydrogen installations for both storage- and fuel purposes.
- Electro- and biofuel-protection.
- Electrification systems for marine- and transport sectors.
- Artificial intelligence technologies to support behavioural-based applications in the energy system.
- Technology for inductive charging within the existing road network.
- Energy infrastructure for electric aviation and energy communities.

Energicentrum Gotland's centre of action is to facilitate active communication and participation with the island's public and business community, as well as to provide individualised support. Its platform connects people to share best practices and organises events linked to energy transition. The service is free and impartial. The overall goal is to inspire and increase the level of knowledge, commitment and willingness to invest in and convert to a sustainable energy society.

Source: Energicentrum Gotland (2022^[93]), *Homepage*, <https://energicentrum.gotland.se/> (accessed on 15 June 2023).

Policy action: Enabling Indigenous-led green innovation

Approximately 1.7 million people in Canada self-identify as Indigenous, which is 5% of the total population. In Canada today, the Constitution Act (1982) recognises three groups: Indians (now referred to as First Nations), Inuit and Métis. This recognition includes "existing aboriginal and treaty rights" (Section 35). Indigenous rights under Section 35 vary from group to group, creating constitutional and legal divisions (OECD, 2020^[94]). In May 2016, Canada also announced its full support for the United Nations Declaration

on the Rights of Indigenous Peoples (UNDRIP). The UNDRIP is an international human rights instrument that affirms the minimum standards for the survival, dignity and well-being of Indigenous peoples throughout the world. Among other standards, Article 3 of the UNDRIP recognises Indigenous peoples' right to self-determination, including the right "to freely determine their political status and freely pursue their economic, social and cultural development" (UN, 2007^[95]). Article 4 affirms Indigenous peoples' right "to autonomy or self-government in matters relating to their internal and local affairs" and Article 26 states that "Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired" (UN, 2007^[95]).

On 21 June 2021, the UNDRIP act received royal assent and immediately came into force in Canada. The act requires the Government of Canada to work in consultation and co-operation with Indigenous peoples to co-develop an action plan to achieve the objectives of the UN declaration, take measures to ensure that federal laws are consistent with the declaration and report annually on progress. The action plan must be completed by June 2023.

OECD research has shown that the Indigenous population is more likely to be located in predominantly rural regions. Approximately 60% of Canada's Indigenous peoples live in rural regions, compared to 27% of the non-Indigenous population (OECD, 2020^[94]). This makes Indigenous peoples particularly relevant for rural policy making, especially in those areas with otherwise minimal territorial occupancy. The support of Indigenous peoples is hence critical to the successful achievement of rural innovation in Canada and the potential innovation can play an important role in contributing to mitigation and adaptation objectives.

Indigenous peoples are particularly influential contributors in climate change debates because they are governors of significant parts of Canadian land. Since the announcement of the Government of Canada's Comprehensive Land Claims Policy in 1973 and the establishment of the British Columbia Treaty Process in 1992, 29 comprehensive land claim and/or self-government agreements have been ratified and brought into effect. They cover over 40% of Canada's land mass (Government of Canada, 2016^[96]). Treaty settlement land granted through comprehensive land claim agreements with the Crown or reserve land under the First Nations Land Management Act ensures autonomy over the management of land and natural resources located within it. Furthermore, many Indigenous groups share the responsibility and the authority over land issues with Canadian government authorities in joint institutions for environmental governance, such as natural resource boards and land councils or for natural reserves.

A significant amount of work has been done between Canada and Indigenous partners to work jointly on climate change commitments. Since the launch of the Pan-Canadian Framework on Clean Growth and Climate Change, Canada, in collaboration with leaders of the Assembly of First Nations, the Inuit Tapiriit Kanatami and the Métis National Council, established three distinctions-based Senior Bilateral Tables on Clean Growth and Climate Change. Since then, First Nations, Inuit and Métis partners have been working in conjunction with the Canadian government at these tables to ensure that Indigenous peoples are full and effective partners in climate action and support collaborative planning and decision making, information sharing and engagement on federal climate measures. The First Nations-Canada Joint Committee on Climate Action has released three annual reports to the Prime Minister of Canada and the National Chief of the Assembly of First Nations. The latest publication sets out five areas of focus:

- Advance First Nations' full and effective participation in clean growth and climate change programmes.
- Ensure Canada's climate solutions build on First Nations climate leadership and promote its full inclusion in emerging climate actions.
- Promote the meaningful participation of First Nations in the carbon pollution pricing system.
- Monitor progress on First Nations climate leadership and the full and effective participation of First Nations in climate change programmes.
- Foster intergenerational and intersectional dialogue on climate change (JCCA, 2021^[97]).

Furthermore, more than 20 collaboration mechanisms have been established with Indigenous partners across departments involved in Canada's strengthened climate plan "A healthy environment and a healthy economy" (2020), covering a diversity of objectives (from project selection to policy advice), scales (national, regional and local), responsibilities (from co-management to engagement) and areas of focus (adaptation, conservation, climate and infrastructure) (Environment and Climate Change Canada, 2020^[98]). The Canadian Net-Zero Emissions Accountability Act formalised this trend by creating statutory requirements to engage and take into consideration Indigenous knowledge and the UNDRIP when setting GHG emissions reduction targets. In doing so, the act renewed the impetus for a renewed nation-to-nation, government-to-government relationship on climate with First Nations, Inuit and Métis.

Creating space for Indigenous-led processes, governance, decision making and knowledge systems is essential to the success of Canada's response to climate change as well as economic reconciliation. This also means that working with First Nations, Inuit and Métis is essential to exploring how institutions, governance practices and jurisdictional arrangements can enable green innovation created by and for Indigenous peoples.

Making room for Indigenous voices helps bring forward aspects of policy that complement solutions that have traditionally been the focus of non-Indigenous governance structures, such as technological solutions, clean growth, economic incentives and cost-benefits analysis. Evidence demonstrates that mobilising Indigenous knowledge (see also Box 4.11) in research and decision-making reinforces Canada's response to the various impacts of climate change, including on culture, food and water security, resource co-management, conservation of lands and waters, economic development, community infrastructure, and health and well-being (Environment and Climate Change Canada, 2020^[99]). Studies have also shown that businesses utilising Indigenous knowledge in their processes are proven to be in line with government goals in sustainability and environmental protection (Kusumastuti et al., 2022^[100]). The increasing number of Indigenous Protected and Conserved Areas (IPCAs) and Indigenous Guardians demonstrate clear conservation and biodiversity benefits (equal or higher than traditional protected areas), social and economic benefits, and positive returns on investments (i.e. estimated to vary between a minimum of two-to-one and a maximum of ten-to-one) (SVA Consulting, 2016^[101]; EPI, 2016^[102]). While initially focused on conservation objectives, IPCAs and Indigenous Guardians offer great potential to advance nature-based solutions, nature-based carbon sequestration, carbon offsets and climate monitoring objectives, all of which are currently being explored or implemented in partnership with Indigenous communities.

In addition, a growing number of successful initiatives have advanced approaches to weave Indigenous and non-Indigenous knowledge systems together. A few examples are portrayed below:

- The Geographic Information System programmes by the Aurora Research Institute (ARI, 2022^[103]). Adopting the "two eyes" approach of combining Indigenous and Western knowledge (Wright et al., 2019^[104]), the programme researchers learn from community elders how to observe patterns in wildlife and the landscape to grasp changes in the ecosystem while also utilising scientific methodology for quantitative analysis. This integrative approach allows for a fuller understanding of the effects of climate-driven changes in local arctic conditions. Another facet of the co-operation offered is employment opportunities for local workers to leverage their knowledge of the land to help collect permafrost data. In this way, local knowledge is incorporated into evidence-based policy making, which is crucial in mounting sufficient safeguards against events such as rising sea levels and permafrost thawing.
- Another partnership between Indigenous communities and the Canadian Coast Guard relates to coast rescue and marine safety. The Indigenous Community Boat Volunteer Program provides funding to coastal Indigenous communities in ten provinces and territories to buy boats and marine safety equipment in view of strengthening marine search and rescue and promoting marine safety (Government of Canada, 2022^[105]). As coastal Indigenous communities have expertise in navigating

local waters, they can often act as first responders in emergency situations. With the birth of new Arctic Sea routes driven by climate change, local knowledge is more important than ever to respond to evolving waterways and conditions. This partnership reinforces the participation of Indigenous communities in water management and increasing traffic in the Arctic Sea.

- The Aboriginal Aquatic Resource and Oceans Management (AAROM) programme assists Indigenous groups in acquiring the administrative capacity and scientific/technical expertise to facilitate their participation in aquatic resource and ocean management and encourages the establishment of collaborative management structures that contribute to integrated ecosystem/watershed management and planning processes. The programme includes 33 departments, including 15 in British Columbia, 12 in Atlantic Canada/Quebec, 3 in the Northwest Territories, 1 in the Yukon and 2 national organisations. AAROM is unique among federal Indigenous programmes in that it provides core and relatively secure funding for non-treaty-based science and technical activities.

Box 4.11. Indigenous knowledge

Indigenous knowledge is a term used to describe understanding, skills and philosophies developed by societies with long histories of interacting with their natural surroundings. It is cumulative and diverse, building on the experiences of previous generations and evolving in the context of contemporary society. It can be transmitted through storytelling, experience, intention and connectedness. Indigenous knowledge is integral to a cultural complex that also encompasses language, governance structures, resource use practices, social interactions, rituals and spirituality. In practice, the term can refer to a distinctive political and social perspective and set of interests rooted in shared history.

Indigenous knowledge originates from the intimate relationship that Indigenous peoples have with the natural environment, which serves as the foundation for their economic, cultural, social and subsistence practices. It synergistically complements science-based approaches by relying on long-term observations, incorporating larger sample sizes, involving harvesters as researchers and occasionally providing a valuable cross-reference for scientifically observed changes in resources and ecosystems. Indigenous peoples are able to conduct land use studies and reclaim the traditional stories, relationships and governance systems rooted in their deep connection with the land. Through this intergenerational experience and observation, Indigenous peoples were amongst the first to notice climate change and have critical knowledge to manage and adapt to it.

The significant contributions of Indigenous knowledge to environmental, regulatory and resource development decisions have been internationally recognised. When integrated into the decision-making process, the distinctive perspectives and inherent value of Indigenous knowledge enrich the outcomes of the discussions. Indigenous peoples' observations and knowledge about the environment provide an important source of information on climate change. Indigenous knowledge systems can offer a more holistic approach to the environment that may complement the disciplinary nature of western science. It operates at a much finer spatial and temporal scale than science and includes understanding how to cope with and adapt to environmental variability and trends. Indigenous knowledge thus makes an important contribution to climate change policy and science by observing changing climates, adapting to impacts and contributing to global mitigation efforts.

Source: OECD (2020^[94]), *Linking Indigenous Communities with Regional Development in Canada*, <https://doi.org/10.1787/fa0f60c6-en>; Indigenous Climate Hub (n.d.^[106]), *Traditional Knowledge (TK) and Climate Change*, <https://indigenousclimatehub.ca/traditional-knowledge-tk-and-climate-change/>; NIEDB (2022^[10]), *National Indigenous Economic Strategy for Canada 2022*, https://niestrategy.ca/wp-content/uploads/2022/12/NIES_English_FullStrategy_2.pdf.

Going forward, Canada should advance on championing Indigenous climate leadership in the spirit of implementing the UNDRIP, advancing reconciliation with Indigenous peoples and upholding Indigenous rights in economic reconciliation. This includes continuing to remove barriers to self-determined climate action and providing adequate funding to address capacity constraints in an effort to emerge as successful, large-scale project leaders on green innovation, by:

- Strengthening the role of Indigenous peoples at the climate change and innovation policy nexus consistent with the UNDRIP. Rural green innovation endeavours need to seek stronger partnerships and collaboration with Indigenous communities and First Nations, Inuit and Métis governments. This includes supporting Indigenous-led solutions and meaningfully incorporating sources of local and traditional knowledge.
- Promoting Indigenous clean energy strategies, support for Indigenous clean energy capacity building and providing long-term financial support for the implementation of Indigenous climate strategies and Indigenous participation in Canada's carbon pricing regime.
- Ensuring that Indigenous entrepreneurs have access to capital and enabling programmes to fully participate in the Canadian green economy.
- Creating information and gateway platforms for Indigenous entrepreneurs to navigate the range of resources and services available in the field of green innovation.
- Ensuring the potential of the IPCAs and Indigenous Guardians is used to advance green innovation around nature-based solutions.

Diffusion and take-up on green innovations

Policy action: Empowering local governments and local communities to take action and create local markets

Many rural and remote regions in Canada have an abundance of renewable resources. However, rural and remote areas in Canada are not yet advancing enough to develop a sustainable zero carbon economy. At the same time, strategies to mobilise these resources also need to tackle the distinct challenges of rural areas. As mentioned earlier, rural places have less access to essential infrastructure and services, including educational facilities, healthcare, public transport and job opportunities, than their urban counterparts. Rural places in Canada also see a shift in demographics as people move to where these opportunities are available. At the same time, rural populations tend to have high levels of voluntary and collaborative activities within the community. These strengths create significant opportunities for making use of collaborative models to unlock opportunities in industries such as the bioeconomy, renewables and decarbonised mobility.

Like all government levels, local governments also have a role in fostering local domestic demand for clean technology and green innovations through public procurement, fiscal incentives and information sharing. For instance, municipalities and other local government agencies can ascribe to sourcing certified sustainable resources to foster change in the local business community.

Currently, climate action at the local level varies greatly across Canada. Climate action and municipal activities often reflect provincial policy lines in the way climate considerations are featured in local development plans or how climate goals are featured in land use planning. In British Columbia, for instance, the province just launched a specific programme to support local government bodies in creating local climate projects in 2022. As part of the programme, they also provide information for different types of local governments, from small (below 50 000 inhabitants) to large (Box 4.12).

Box 4.12. British Columbia's CleanBC Local Government Climate Action Program

British Columbia's Local Government Climate Action Program provides local governments and Modern Treaty Nations with predictable and stable funding to support and accelerate the implementation of local climate action. It was designed considering input from local governments, the Union of British Columbia Municipalities (UBCM), Modern Treaty Nations and the independent Climate Solutions Council.

From 2022 onwards, British Columbia's funding for the programme amounts to CAD 76 million over 3 years. The distribution of funds to eligible governments will be determined by the population of each town and a base amount. Governments that take part have to provide evidence that money was used for initiatives that further the goals of the CleanBC Roadmap to 2030 or of the Climate Preparedness and Adaptation Strategy. To be eligible, participating governments are required to complete a number of reporting requirements and demonstrate matching funding or in-kind contributions for local climate initiatives equal to 20% of their provincial allocation.

To meet unique community needs, there are three different webinars designed for small local governments, large local governments and Modern Treaty Nations. Overall, the programme enables community-specific action to reduce emissions and increase climate resilience and knowledge sharing among local governments and Modern Treaty Nations.

Source: Government of British Columbia (2022^[107]), *Local Government Climate Action Program*, <http://www.gov.bc.ca/local-government-climate-action-program>.

The Federation of Canadian Municipalities plays an important role in setting climate goals at the local level across the country, enabling local governments to access resources, share experiences and learn from best practices to achieve those goals. Their Green Municipal Fund (GMF) is a crucial element, offering funding, transferring knowledge and developing skills to help municipalities switch to sustainable practices faster. One promising example is the Regional Energy Coach pilot that encourages affordable housing providers to think big about innovative sustainability solutions. Coaches offer comprehensive project management and technical support and provide walk-through energy assessments and one-on-one coaching to help municipalities deliver transformative projects. The current urban-rural balance analysis of the GMF shows an approximate match between the percentage of funding received and the percentage of the population.⁹ The GMF works to support rural communities' participation in their capacity and knowledge-sharing initiatives and to mitigate particular hurdles for them to overcome, like long travel times or limited digital infrastructure. It should also be acknowledged that funding reflecting per capita data does not account for geographical challenges such as limited available skills or increased costs for retrofitting buildings in remote communities.

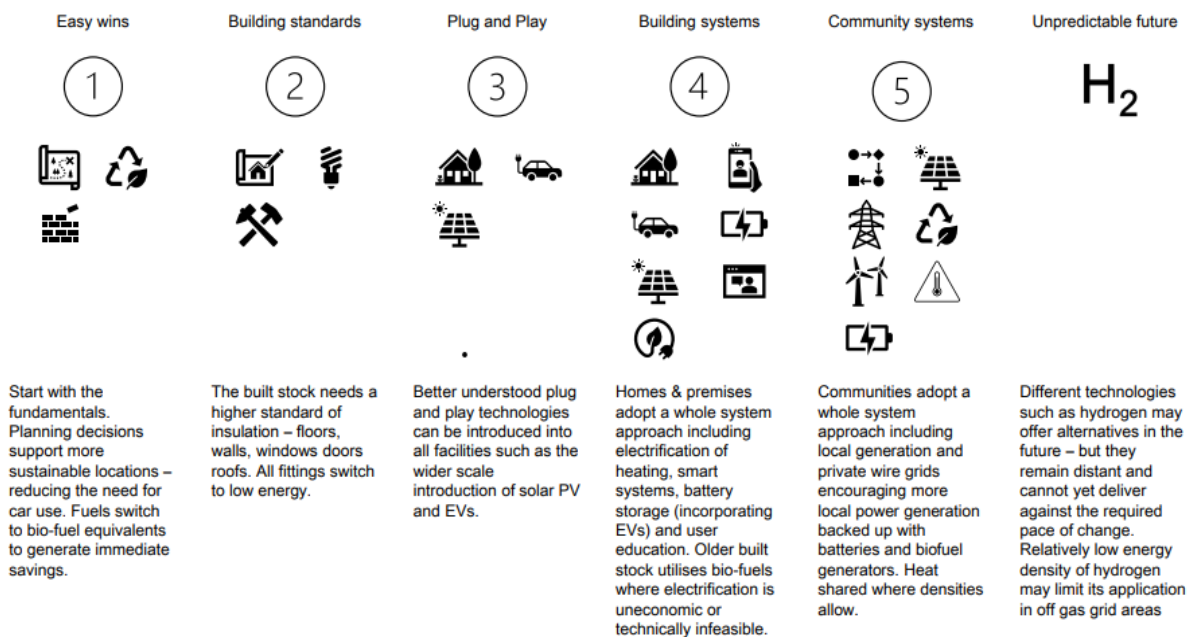
As local governments are at different stages in their zero carbon transition, it might also be useful to create communities of practice based on different levels of transition. Since 2021, the Tamarack Institute is hosting Community Climate Transitions, a collective impact movement aimed at supporting a just and equitable climate transition. This is done by hosting a community of practices, webinars and events, producing publications that share our learnings and supporting our members with specialised coaching. The Climate Transitions Cohort is a unique opportunity for communities across Canada to learn from some of the most promising emerging solutions and collaborative governance innovations to build and/or advance a climate action plan that is unique to their local needs (Tamarack Institute, n.d.^[108]).

Figure 4.12 provides a suggestion on different stages for villages or towns to move towards a zero carbon future, starting with low-hanging fruit and then moving to more advanced systems. Guiding communities based on their level of experience can be useful to improve the effectiveness of proposed measures within

communities and provide a pathway of development beyond individual measures that are developed in a fragmented or piecemeal fashion. As part of a net zero pathway, municipalities can also be incentivised to innovate further and move up the ladder faster.

Existing federal government training initiatives help close gaps in capacity in smaller municipalities, including through Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) programme. Funding is available for local adaptation efforts, including through Infrastructure Canada's Disaster Mitigation and Adaptation Fund, which the federal government has committed to top up. Calls on the fund are expected to increase as communities move from assessing risks to implementing adaptation plans (Canadian Climate Institute, 2022^[109]). Technical support can also help local authorities assess the costs and benefits of alternative adaptation investments.

Figure 4.12. Towards a net zero carbon village system



Source: Rural England (2021^[110]), *Opportunities and Challenges for Rural Communities from Net Zero Carbon Legislation*.

Policy action: Creating role models and information sharing on leading practices

In addition to hard data and clear economic incentives, for instance through cost savings or carbon pricing, “softer” instruments also need to be given close attention, including client education and information. These can include:

- Communication campaigns to show the impacts of green innovation on regional and national economies, how citizens and different actors can contribute to it and share success stories.
- A dedicated website to share knowledge and good practices concerning green innovation as part of the Clean Growth Hub.
- Events for knowledge sharing, networking and the promotion of green innovation at the local level, as well as conferences and seminars in schools and universities.
- Use of social media to provide quick updates and information on the topic and related events.

Storytelling and the creation of role models are powerful tools to inspire opportunity-oriented thinking from green innovation. Methods to foster this kind of outreach are currently present in the SDTC Innovation Happens Here campaign and through RDA websites. The SDTC campaign portrays how regular people engage in cutting-edge clean technology research. The short film portrays entrepreneurs who are supported by the programme and how they strive to innovate while also following environmental values. Similarly, the CED provides a success story page that allows for filtering for “green economy” and covers company portrayals such as from Kuma Brakes located in the Gaspé Peninsula (see also section above). While these examples are a good step in the right direction, more could be done to advocate for rural climate innovation.

With the support of the RDAs, the federal government could develop a dedicated rural climate innovation campaign, showcasing leading practice examples from different parts of the country that demonstrate how innovation for climate change can have a positive impact on regional development. It could also help explain various concepts like net zero, ecosystem services or circular and bioeconomy that might be unfamiliar or loaded with misconceptions. For instance, the concept of circular economy is often misconceived as just a synonym for recycling. While displaying the relevant actors, it should also explain and link to funding opportunities and advisory support accessible to businesses that would like to contribute.

Locally, events and awards are also good opportunities to build awareness as well as provide information and deal with potential misconceptions. Examples from Germany and Scotland can be found in Box 4.13. Furthermore, certificates and labels can enhance trust and lead to more sustainable consumption choices, which will again stimulate green growth. Canada could consider introducing a label for cleantech or green innovations.

Box 4.13. Building capacity and enthusiasm for the bioeconomy and circular economy

The circular economy in Glasgow, Scotland

Since 2015, the Glasgow Chamber of Commerce hosts Circular Glasgow and is responsible for delivering this initiative alongside Zero Waste Scotland, Glasgow City Council and key stakeholders. Circular Glasgow aims to build best practices and capacity on the circular economy across Glasgow businesses, helping them identify opportunities to support and implement circular ideas. This is done through: workshops and a series of knowledge-sharing business-to-business networking events; Circle Assessment, a tool which helps businesses understand opportunities to become more circular; and the Circle Lab, an online hackathon event to find a circular solution to local challenges. The Circle Lab sought solutions to make Glasgow’s event industry more circular. From over 200 contributions, the 3 winning ideas include a deposit-based reuse system for food and drink containers, circular designs for event marketing and branding, and a scheme that will repurpose organic waste into energy and fertilisers. Ways to turn these ideas into pilot projects are now being explored. The city is currently developing a circular economy roadmap.

BioDENKER bioeconomy innovation prize, Germany

The phase-out of lignite coal marks a turning point for the regional coalfield in the state of North-Rhine-Westphalia, Germany, away from the fossil-based linear economy and towards a circular bioeconomy. With good conditions for a high-yield agricultural and food industry, strong regional industries, proximity to cities and an extraordinarily dense research landscape, the Rhinish mining area is very well positioned to work towards a sustainable bioeconomy.

With the aim of promoting a sustainable bioeconomy in young companies, the BioDENKER start-up award is looking for courageous people and innovative, bio-based business models. At the premiere in

2021, a total of 23 start-ups applied for this award. The winner, EEDEN GerMan from Mönchengladbach, uses a green, chemical upcycling process to recycle used cotton-based textiles again and again, without any loss of quality. Textiles that largely end up in landfills or are incinerated thus find their way back into the (circular) economy.

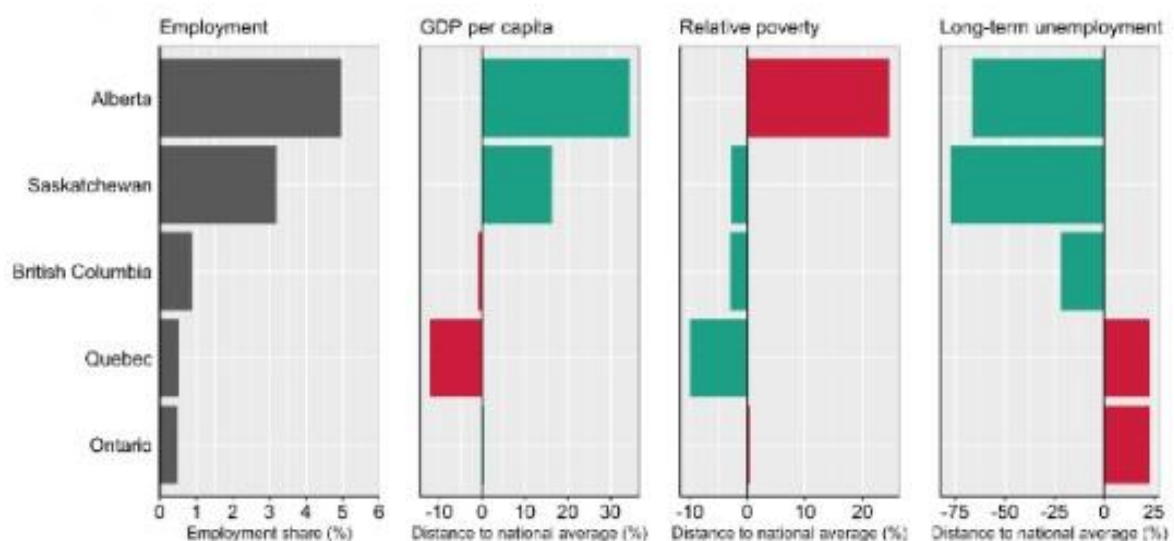
Source: OECD (2020^[31]), *The Circular Economy in Cities and Regions: Synthesis Report*, <https://doi.org/10.1787/10ac6ae4-en>; Bioökonomierevier (2021^[111]), *Bioökonomie im Business? Zeigt uns Eure innovative Geschäftsidee!*, https://www.bioökonomierevier.de/BioDENKER_Startups.

Policy action: Providing the right skills for clean innovation

Adaptation and mitigation pressures and opportunities are different across geographies. Depending on the respective geographical area, there will be both employment gains and losses due to the transition to net zero GHG emissions. Employment in sectors that may be subject to job loss by 2040 as a result of policies to reduce emissions in line with the climate objectives in the Paris Agreement are located all over Canada. While oil and gas extraction activities may not be at risk of employment loss across all OECD countries by 2040, they are more likely to be at risk in Canada. Oil is extracted at higher costs in Canadian regions than in other oil-supplying regions. Policies to drive GHG emissions to net zero will first drive the highest-cost producers out of the market. Therefore, investment in oil extraction risks becoming stranded, resulting in substantial economic loss. Employment in the sector is particularly strong in Alberta and Saskatchewan. Canadian regions with the largest shares of employment in the oil and gas extraction sector have higher GDP per capita and lower long-term unemployment; however, relative poverty is high in Alberta (Figure 4.13)

Figure 4.13. Regions with employment in the extraction of crude petroleum, natural gas and manufacture of coke and refined petroleum products, and regional socio-economic indicators

Large regions (TL2) with employment in selected sector, 2017



Note: In this figure, poverty risk is assessed from individual survey responses indicating there have been times in the past 12 months when they did not have enough money to buy food that they or their family needed. Long-term unemployment is defined as having been unemployed for 12 months or more.

Source: OECD (2021^[9]), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, <https://doi.org/10.1787/17017efe-en>.

The transition to net zero GHG emissions needs to be just and avoid social hardship (see also Box 4.14). This also means creating new green jobs, ideally where workers are being laid off, and equipping the latter with the right skills to work in and around jobs developing and working with green innovations. The prospect of green jobs in Canada is good but differences between regions are difficult to grasp.

To be able to serve future green skills needs, workers need to have the right skills and knowledge. Research indicates that the cleantech sector is already facing workforce shortages. This makes competition even harder. The most difficult occupations to hire were identified as engineers, designers (in special technology fields), technicians, drivers, equipment operators, managers, maintenance staff and craftsmen (ECO Canada, 2020_[112]). While employers are trying to address these shortages individually, it is important for Canada to work on more comprehensive solutions to bring together industry, government and academia to ensure that the needed skills are available to the whole sector. Employers surveyed by Eco Canada (2020_[112]) also expressed the need for additional training and certifications in the areas of environment, waste management and recycling, energy efficiency, alternative energy, sustainability and health and safety to fill skills needs.

Launched in 2017, Canada's Innovation and Skills Plan aims to strengthen innovation and improve Canada's position in the global race for competitiveness by making sure its talented people have the right tools to succeed in a new economy (Government of Canada, 2017_[113]). It covers a range of measures, including investments in childcare and early learning, more flexible work arrangements and an increase in the affordability of post-secondary education, including for adult learners to learn new skills. It also focusses on advancing digital skills, coding and promoting science, technology, engineering and mathematics (STEM) among young Canadians. Part of the strategy is also support for the cleantech sector, including access to finance for investments and research for clean energy and transportation (Government of Canada, 2017_[114]). Despite its focus on innovation and cleantech, the plan does not specify any measures to advance the development of green skills in the Canadian workforce and does not mention an assessment of future skills needs for the industry it is seeking to build.

In 2023, the Government of Canada released the interim Sustainable Jobs Plan that lays out the federal government plan to help train workers for sustainable jobs. Sustainable jobs are those of a net zero emissions economy but they also refer to a just transition for workers and fair income, job security, social protection and social dialogue. The interim plan for 2023-25 seeks to lead workers away from the fossil fuel industry and towards clean energy and sets an initial frame for the Sustainable Jobs Action Plan that will be released every five years starting from 2025. The first Sustainable Jobs Action Plan was released in June 2023.

Ten key priority areas define the interim plan:

- The first two key priorities set out the governance of the plan. First, a Sustainable Jobs Secretariat will co-ordinate government policies across the government and be in charge of developing future sustainable job plans. The exact composition and mandate of the secretariat are still to be defined.
- Second, the Sustainable Jobs Partnership Council will act as an advisory body for the ministers overseeing sustainable jobs policy. The council will formalise and facilitate a social dialogue between the public sector, the private sector and the labour movement across all regions of Canada, including rural and remote communities.
- As a third key priority, the interim plan seeks to develop economic strategies through the Regional Energy and Resources Tables (hereafter the Regional Tables) to identify, prioritise and pursue opportunities for sustainable job creation and economic growth. The Regional Tables will inform Canada's approach to supporting workers and creating sustainable jobs.
- Fourth, the interim plan will introduce a sustainable jobs stream under the Union Training and Innovation Program as well as a Sustainable Jobs Training Centre. The centre will bring together workers, unions, employers and training institutions across the country to examine the skills of the

labour force today and forecast future skill requirements to help 15 000 workers upgrade and gain green skills. An additional 20 000 apprenticeships are expected to be created in the labour market.

- As a fifth point, the interim plan intends to advance funding for skills development towards sustainable jobs with an investment of CAD 802.1 million over 3 years.
- Moreover, the Sustainable Jobs Plan will improve labour market data collection, tracking and analysis, as well as facilitate the creation of indicators that can help to track the creation of sustainable jobs. This initiative will be run in partnership with Statistics Canada.
- The plan commits to the principle of free, prior and informed consent for establishing a National Benefits-Sharing Framework, ensuring that Indigenous communities directly benefit from major resource projects. The plan will also directly promote Indigenous-led solutions in the clean energy space projects across Canada.
- The interim plan will increase investor motivation and draw in industry leadership to support workers. It will require substantial investment beyond the public sector and involve private sector capital and expertise.
- International co-operation also plays a crucial role in the creation of sustainable jobs. Through the interim plan, Canada will be involved in the exchange of best practices and valuable insights through bilateral and multilateral channels, specifically pertaining to the development of green jobs (Government of Canada, 2023^[115]; 2023^[116]).
- The final key priority includes introducing legislation on sustainable jobs. In June 2023, the Minister of Energy and Natural Resources advanced this key action area by introducing the Canadian Sustainable Jobs Act, which includes a framework for accountability, engagement and transparency. Specifically, the legislation includes guiding principles, governance structures and reporting requirements (Government of Canada, 2023^[117]).

Overall, the Sustainable Jobs Plan sets out a comprehensive agenda to support workers in the transition to a clean economy. It addresses the need for green workforce development initiatives in all regions and recognises the imperative of integrating Indigenous communities into the clean economy. This approach is critical to accessing a larger talent pool to meet future workforce needs. Overall, the Sustainable Jobs Plan combines many of the existing programmes and budgetary elements into a comprehensive strategy. The Secretariat and council governance elements and the link to the Regional Tables give it an important whole-of-government perspective reflecting upon Canada's geographical variety. The establishment of the Sustainable Jobs Partnership Council builds upon the social dialogue process that started with the Task Force on Just Transition, marking a positive step forward. The plan also importantly addresses the necessity for green workforce development initiatives across all regions and recognises the imperative of integrating the Indigenous peoples into the clean economy. Regional table consultations should focus on addressing stakeholders' real problems and engage in meaningful dialogue. While acknowledging RDAs and their role in creating green jobs, co-ordination between the plan and RDA programmes is not specified. As the plan rolls out in more detail, its real impact on rural green innovation will need to be evaluated in the future.

Box 4.14. The just transition concept

The policy objective of a “just transition” refers to actions that are intended to reduce the negative effects of industrial and economic transitions on individuals and society as a whole. Just transition was first promoted by the North American labour movements in the 1970s to refer to a variety of measures to protect workers' rights in the wake of government-led environmental legislation and regulations impacting the labour market. In the context of international climate discussions and through the advocacy of global union organisations, just transition rose to prominence on a worldwide scale.

In 2015, the International Labour Organization (ILO) adopted a set of guidelines based on inputs from governments, businesses and trade unions to ensure a just transition. These guidelines highlight the need for policy coherence between actions taken on climate change and economic development as well as industrial, labour market and enterprise policies. They emphasise the need to pay special attention to regions and workers that could be negatively affected. The guidelines recommend action to anticipate the adverse effects of the transition, implement international labour standards and actively promote social dialogue (ILO, 2015^[118]). Regional just transition initiatives are policies and interventions directed to manage industrial transitions at the subnational level in line with just transition goals. Just transitions are inherently place-based and, as such, regional policies are important instruments for managing these transitions.

Research by Krawchenko (2021^[119]) has identified that, globally, there are nine thematic policy areas of intervention for just transition initiatives across selected OECD countries:

- Macroeconomic and growth policies.
- Industrial and sectoral policies.
- Enterprise policies.
- Skills development.
- Occupational safety and health.
- Social protection.
- Active labour market policies.
- Rights.
- Social dialogue and tripartism.

Source: ILO (2015^[118]), *Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for All*, https://sustainabledevelopment.un.org/content/documents/22092wcms_432859.pdf; Krawchenko, T. (2021^[119]), “How do we manage a just transition? A comparative review of national and regional just transition initiatives”, *Sustainability*, p. 13.

This study has already highlighted the importance of ensuring that all people in different regions have an opportunity-oriented mindset towards the transition to a green economy. A broad understanding of environmental and sustainability principles should be present in all workers, influencing their expertise, attitudes and skills. Early education on sustainable development could play an important role in raising awareness and shaping attitudes. While different approaches are present in Canada, interviewees shared their impression that education for sustainability was taking place on an ad-hoc basis rather than systematically. To foster the development of clean skills at an early age, it would be important to mainstream environmental and sustainability principles in all education curricula from school to university level. In the Netherlands, for instance, the European Centre of Excellence for Sustainable Water Technology (Wetsus) has developed activities for primary and secondary schools in the city of Leeuwarden in addition to research activities and collaboration with universities (Box 4.15). Mainstreaming green skills into broader curricula can also contribute to increased environmental awareness and enables actors to both drive and adapt to changes associated with the transition to a green economy.

Future activities should build on existing projects where possible but expand assisting colleges and universities in the adaptation of curricula, especially for business and finance courses. Furthermore, academic and training institutions should be encouraged to better prepare their students to tackle challenges faced in the Canadian cleantech industry through enhanced partnerships to provide work-based learning opportunities to students.

Box 4.15. The European Centre of Excellence for Sustainable Water Technology, Leeuwarden

Wetsus in Leeuwarden has developed a wide range of educational activities to build a talent pipeline for water management technologies.

The centre collaborates with primary and secondary schools, working with a team of six teachers on various projects. At primary level, activities revolve around the discovery of water. In secondary school, activities include cluster excursions, design assignments, guest lectures, competitions and the development of teaching materials in collaboration with education.

The centre has also developed a Master's degree in Water Technology, a two-year programme offered jointly by Wageningen University, the University Twente and the University of Groningen. It also welcomes PhD students and post-doctoral researchers and collaborates with a large network of universities.

Source: Wetsus (n.d._[120]), *Homepage*, www.wetsus.nl/.

At the firm level, engaging them in training and education can help boost productivity and ultimately enhance the contribution of local firms to the green transition. Common mechanisms to support workforce development in existing firms include financial incentives such as training subsidies, training vouchers and tax incentives to encourage employees to take training or for employers to provide training for new skills. Training measures include support to handle digital technologies or helping firm managers better identify their company's training needs.

In a situation of industrial transition, the goal is to help workers affected by lay-offs to find new positions. Doing this without forcing them to relocate is often a challenge but an important element of successfully managing the industrial transition because it buffers social hardship. Policies aimed at increasing the likelihood of finding a job through improving skillsets and facilitating the match between the newly skilled and job vacancies can help regions transition. In general, policy responses to the increase in temporary unemployment due to transition include the redesign and strengthening of local public employment services and providing workforce and management training. In this context, special attention needs to be paid to the integration of under-represented and disadvantaged groups, such as women, older people and Indigenous peoples (OECD, 2019_[121]).

Skills anticipation and assessment exercises (e.g. skill needs assessments, forecast and foresight exercises) can provide information to tailor the offer of education and training programmes more effectively to local needs. For Canada's rural places, there seems to be a limited assessment and vision of what future skills will be needed and where and how to support the development of these skills. As previously mentioned, there is a significant lack of comparable data at the local level for understanding the cleantech industry and local labour market needs. Local governments need to be assisted in monitoring the transition to a green economy. An interesting example is France, where a national observatory for employment and jobs in the green economy has been created (Box 4.16). One of its observatory's pillars of work is to assist with local indicators in French regional and local areas. It also supports economic sectors in assessing the impact of the transition to the green economy. Furthermore, the Scottish Government has developed a powerful strategy for green skills in its Climate Emergency Skills Action Plan (CESAP). The plan sets out a clear direction for the changes needed in the skills system and signals the role that industry, communities and individuals across Scotland will play in achieving this, as described in Box 4.17.

Box 4.16. National observatory on green skills and jobs in France

The Observatory for Green Skills and Jobs is a structure for dialogue and work among various stakeholders, which the French General Commission co-ordinates for sustainable development. It aims to build a methodological framework to conduct studies, collect data and ensure a shared diagnosis on green growth jobs, professions and training. It produces an annual review of its activity, including a synthesis of observation results.

In particular, it:

- Identifies and analyses economic activities, trades and professions related to the green economy and lists associated jobs.
- Carries out statistical monitoring of jobs and trades related to the green economy in connection with equivalent work carried out at the international level.
- Examines the socio-demographic trends of employed persons concerned by the above-mentioned activities.
- Analyses the types of recruitment.
- Identifies the skills required and training needed to meet the needs of employers and support those affected by these changes.
- Identifies the possibilities of territorial application of conducted analysis.

One particular work theme of the overarching project is to develop regional observatories for training and employment and help local stakeholders develop methods and tools for collecting comparable regional data.

Source: Ministère de la Transition écologique et de la Cohésion des territoires (n.d.^[122]), *L'observatoire national des emplois et métiers de l'économie verte*, <https://www.ecologie.gouv.fr/observatoire-national-des-emplois-et-metiers-leconomie-verte>.

Box 4.17. Green skills in Scotland

The Climate Emergency Skills Action Plan (CESAP) sets out a clear direction for the changes needed in the skills system and signals the role that industry, communities and individuals across Scotland will play in achieving this. The CESAP was published in December 2020 and focuses on the key actions needed over the next five years to 2025, with an update of the plan by the end of 2023.

The CESAP provides new evidence based on the skills needs of a net zero economy considering demographics, population and the availability of people, specific skillsets and geographies. It identifies potential opportunities for job growth across five broad areas of economic activity and notes priority areas for activity to drive economic change. The CESAP has been developed through engagement with industry leadership groups and an expert group comprising Skills Development Scotland, the Scottish Funding Council, Zero Waste Scotland, the Scottish Cities Alliance, NatureScot, the Scottish Government's Domestic Climate Change and Skills Divisions, Highlands and Islands Enterprise, Scottish Enterprise, South of Scotland Enterprise, the Universities of Edinburgh and Strathclyde.

Three categories of green jobs have been identified, providing a framework against which to gauge likely skills demand and develop and focus interventions when the CESAP moves to its implementation phase.

These are:

- New and emerging jobs that relate directly to the transition to a net zero economy, e.g. hydrogen cell technicians, carbon monitoring technicians and urban miners.
- Jobs affected by the transition to a net zero economy that will need enhanced skills or competencies, e.g. architects and environmental consultants.
- Existing jobs that will be needed in greater numbers as the result of the transition to a net zero economy, e.g. insulation installers, energy assessors and designers and multiskilled onsite operatives.

Two important measures defined in the plan are the establishment of a Green Jobs Skills Hub that will cascade intelligence into the skills system on the numbers and types of green jobs that will be needed over the next 25 years and a Green Jobs Workforce Academy. The academy will support existing employees and those who are facing redundancy to assess their existing skills and undertake the necessary upskilling and reskilling they need to secure green job opportunities as they emerge. Various other activities and in-depth descriptions can be found in the Climate Emergency Skills Action Plan 2020-2025.

Source: Scottish Government (2020^[123]), *Climate Emergency Skills Action Plan 2020-2025*, <https://www.skillsdevelopmentscotland.co.uk/media/47336/climate-emergency-skills-action-plan-2020-2025.pdf>.

¹ The Environmental and Clean Technology Products Economic Account measures the production of goods and services that reduce the environmental impacts of the Canadian economy. Two broad categories of goods and services are recognised: environmental goods and services (including clean electricity from renewable sources and nuclear power generation, biofuels and primary goods and waste management and remediation services) as well as clean technology goods and services (including manufactured goods, scientific and R&D services, construction services and support services). Examples of clean technology goods and services include solar panels and the design and construction of energy-efficient buildings.

² Some RDAs may have more than this percentage of funding. For example, the proportion of CED-Q expenditure devoted to clean technologies is 11.8% of total programme funding on clean technologies projects, and encourage some networks of more general business support such as those administered by the Community Futures programme, have been helping businesses integrate sustainable development practices.

³ For more information, see <https://nergica.com/about-us/>.

⁴ For more information, see <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reduce-emissions/reducing-reliance-diesel.html>.

⁵ For more information, see https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/economie/publications-adm/politique/PO_strategie_aluminium_2021-2024_MEI.pdf?1637077590.

⁶ For more information, see <https://aluquebec.com/>.

⁷ For more information, see <https://www.lefebvre-al.com/>.

⁸ The OECD applies a bottom-up and task-based approach for measuring and quantifying green jobs. Bottom-up approaches define green jobs based on the skills or tasks different occupation require and the extent to which those tasks or skills are green. Each occupational task is classified as a binary measure as green or non-green. Using that information, the green intensity of an occupation is computed, which can be broadly defined as the proportion of tasks within an occupation that are green. An occupation is considered green if its green intensity is larger than 10%. This means that at least 10% of the tasks it entails are green.

Canada measures green jobs as the employment from the provision of environmental and clean technology goods and services based on the Environmental and Clean Technology Products Economic Account. It measures the production of goods and services that reduce environmental impacts' contribution to the Canadian economy. Two broad categories of goods and services are recognised. The first refers to environmental goods and services that include clean electricity from renewable sources and nuclear power generation, biofuels and primary goods and waste management and remediation services. The second refers to clean technology goods and services that include manufactured foods, scientific and R&D services, construction services and support services, such as the design and construction of energy-efficient buildings for instance.

Estimating the share of green jobs depends on detailed employment data at the regional level. Canada's statistical office is estimating employee jobs based on the National Occupation Classification. The OECD estimates the percentage of employment based on the International Standard Classification of Occupations (ISCO).

⁹ Municipalities with populations under 10 000 inhabitants are classified as rural. In the case of regional municipal governments, to be considered rural, each member municipality must have a population of fewer than 10 000. Urban regional municipalities are those where at least 1 member municipality has a population of 10 000 or more.

Annex 4.A. Additional tables and figures

Annex Table 4.A.1. Green innovation support through RDAs

RDA	2022-23 budget estimates (CAD)	Specific green innovation programme	Positive environmental impact as a support requirement	Mention of green innovation/climate adaptation and mitigation yearly plan	Regional development strategies	Data on results
Atlantic Canada Opportunities Agency (ACOA)	436 503 645	Yes, Canada Coal Transition Initiative.	Some – Jobs and Growth Funds, and other federal programmes ¹ need to support the transition to a green economy. ²	Support the greening of the region's economy through industrial decarbonisation with new clean technologies and products. Activities will leverage the region's significant potential for renewable energy, electrification and energy efficiency and help advance the Atlantic Loop initiative to connect surplus clean power to regions transitioning away from coal.	Atlantic Growth Strategy, includes mentioning clean growth, refers to federal funding programmes and the provincial strategies as well as the Clean Power Roadmap for Atlantic Canada.	Value of exports of clean technologies (in CAD) from Atlantic Canada.
Canada Economic Development for Quebec Regions (CED)	597 799 633	No, channelled through Regional Innovation and Community Vitality Grant Programs.	Some – Jobs and Growth Funds and other federal programmes need to support the transition to a green economy.	Fund technology transfer organisations for businesses, particularly in the clean technology field. Contribute to accelerating the greening of the economy, a priority of the Government of Canada, in particular by supporting projects for the development, commercialisation and adoption of new clean technologies and products in areas such as	The CED Sustainable Development Strategy 2020-2023 mentions special attention given to projects that help improve environmental performance. The CED has committed to investing CAD 50 million in the 2025-26 budget for clean growth and supporting the development of clean technologies to export CAD 200 million in value. The green economy is a dedicated theme on the webpage and many examples from the region are featured.	Number of clean technology projects and total budget of clean technology projects.

RDA	2022-23 budget estimates (CAD)	Specific green innovation programme	Positive environmental impact as a support requirement	Mention of green innovation/climate adaptation and mitigation yearly plan	Regional development strategies	Data on results
				bioproducts, bioenergy, energy efficiency and other measures associated with sustainable development. The CED also supports businesses via the Regional Economic Growth through Innovation programme to reduce their environmental footprint.		
Canadian Northern Economic Development Agency (CanNor)	92 835 216	No, channelled through other programmes.	Some – Jobs and Growth Funds and other federal programmes need to support the transition to a green economy.	Support for business scale-up for clean technologies.	The Departmental Sustainable Development Strategy refers to contributing to the Pan-Territorial Growth Strategy, which mentions: encouraging the development and deployment of new technologies and innovative practices to support continuous productivity and environmental improvements within the sector, as well as supporting ongoing federal plans on clean technologies.	Number of investments in cleantech projects supported by CanNor in the territories.
Federal Economic Development Agency for Southern Ontario (FedDev Ontario)	700 586 596	No, channelled through other programmes.	Some – Jobs and Growth Funds and other federal programmes need to support the transition to a green economy.	Goal to prioritise clean growth and support climate action including zero-emission vehicles and circular economy initiatives. Focus on investments that accelerate the commercialisation of clean technologies and the decarbonisation of the industrial base to transition to a green future.	Not available	Value of exports of clean technologies (in CAD) from Ontario (southern Ontario not available).
Federal Economic Development Agency for Northern Ontario (FedNor)	123 822 898	No, channelled through other programmes.	Some – Jobs and Growth Funds and other federal programmes need to support the transition to a green economy.	Support the responsible sourcing of natural resources as well as take advantage of new sectors and markets, with a focus on supporting sustainable and environmentally friendly activities.	Not available	Value of exports of clean technologies (in CAD) from Ontario (southern

RDA	2022-23 budget estimates (CAD)	Specific green innovation programme	Positive environmental impact as a support requirement	Mention of green innovation/climate adaptation and mitigation yearly plan	Regional development strategies	Data on results
						Ontario not available).
Prairies Economic Development Canada (PrairiesCan)	423 468 683	No, channelled through other programmes.	Some – Business scale-up and productivity offer focus areas in clean resources and clean technologies. Jobs and Growth Funds need to support the transition to a green economy.	Building a new clean technology sector and promoting the adoption of clean technologies. Invest in and advocate for cleaner resource development and green growth.	The Departmental Sustainable Development Strategy 2020 to 2023, outlining contribution to Federal Sustainable Development Strategy (FSDS) goal of clean growth through investing in clean technology and targets related to climate action and clean energy. Under the Clean Growth and Climate Change initiative, communities in Alberta and Saskatchewan are supported in the transition from coal-fired electricity generation (capacity building, entrepreneurship, start-up expansion and supply chain development).	Value of exports of clean technologies from the Canadian Prairies.
Pacific Economic Development Canada (PacifiCan)	255 011 262	No, channelled through other programmes.	Some – RIS with clean technology and resources as two of six priority sectors. Jobs and Growth Funds need to support the transition to a green economy.	Promoting the adoption of clean technologies.	Departmental Sustainable Development Strategy 2020 to 2023, outlining contribution to FSDS goal of clean growth through investing in clean technology and targets related to climate action and clean energy. Under the Clean Growth and Climate Change initiative, communities in Alberta and Saskatchewan are supported in the transition from coal-fired electricity generation (capacity building, entrepreneurship, start-up expansion and supply chain development).	Value of exports of clean technologies from British Columbia.

Note: Other federal programmes include the Regional Economic Growth through Innovation (REGI) and Community Futures Program. Support the development and adoption of clean technology. Help communities and businesses plan and drive clean, sustainable economic growth. Partner with organisations to catalyse the development of green regional clusters. Work with organisations supporting businesses to transition to a green economy. Support businesses that develop or market new clean technologies; support the adoption of clean technologies that help improve environmental performance while boosting productivity, growth and competitiveness; support organisation that foster the development or transfer of clean technologies.

Source: Based on PacifiCan (2021^[124]), *2022-2023 Departmental Plan*, <https://www.canada.ca/en/pacific-economic-development/corporate/transparency/departmental-plans/2022-2023-departmental-plan.html>; CED (2020^[73]), *Departmental Sustainable Development Strategy 2020-2023*, <https://www.canada.ca/en/employment-social-development/corporate/reports/sustainable-development/2020-2023.html>; Government of Canada (n.d.^[125]), *2022-23 Departmental Plan*, <https://www.canada.ca/en/atlantic-canada-opportunities/corporate/transparency/2022-23-departmental-plan.html#s6>; CanNor (2019^[126]), *Pan-Territorial Growth Strategy*, https://www.cannor.gc.ca/DAM/DAM-CANNOR-CANNOR/STAGING/texte-text/pan-terr-growth-strategy2018-19_1564507799759_eng.pdf; Government of Canada (2022^[127]), *The Government Expenditure Plan and Main Estimates - 2022-23 Estimates*, <https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates/2022-23-estimates.html>.

Annex Table 4.A.2. Examples of key provincial and territorial level strategies for clean tech and green innovation

Province/territory	Eco-innovation objectives present in climate or innovation strategies	Examples of specific cleantech actions or goals	Announced period of the strategy /programme	Presence of rural focus	Presence of focus on SMEs
Alberta	Yes – as part of a larger innovation strategy The Alberta Technology and Innovation Strategy is an innovation hub that sets out the Alberta government's research and commercialisation priorities and includes key initiatives to grow the technology sector and diversify Alberta's economy. One of four areas of focus in this strategy is energy, minerals and cleantech, to elaborate new clean energy sources and technologies that are efficient, cost-effective and reliable, and innovative technologies to strengthen Alberta's geological, geoscience and geotechnical resources.	Establish a clean hydrogen centre of excellence to leverage Alberta's existing expertise and infrastructure to become a leader in hydrogen innovation.	2022-25	Yes – The strategy intends to support the Alberta Broadband Strategy and improve Internet speeds and connectivity in underserved rural, remote and Indigenous communities. Sector research and commercialisation priorities include, among others, the bioeconomy, the production of renewable energy, and rural development.	-
British Columbia	Yes CleanBC is a British Columbia government's plan to lower climate-changing emissions by 40% by 2030. The province is collaborating with partners, industry and local governments to take action. CleanBC has set two strategies: the CleanBC Roadmap to 2030 and the Climate Preparedness and Adaption Strategy . By pairing British Columbia's resources with innovation and partnership between the province's cleantech sector and traditional industries, the programme intends to reach net zero emissions by 2050.	Abundant supply of clean and affordable hydroelectric power as an alternative to fossil fuels.	2021-30	Yes – One key aspect of the programme is the expansion and maintenance of resource roads and clean transportation options suited to rural and remote living areas that depend upon these routes for the movement of essential goods and services. In addition, the programme invests in extreme weather preparedness and water infrastructure for agriculture to increase rural economic development.	Investments through In BC, a CAD 500 million public fund that invests in opportunities with social impact and financial outcome, are provided to help SMEs scale up and reach their highest potential.
Manitoba	Yes – as part of a larger growth strategy As part of Manitoba's Economic Growth Action Plan , the Innovation Growth Program supports businesses that create economic growth in the life sciences and health, ICT and new media, agriculture sector as well as in the clean technology sector.	Accelerate the economic growth of Manitoba businesses by developing and commercialising innovative products and processes in relation to clean technologies.	2019-no announced expiration date	Rural Manitoba is a partner organisation of the Economic Growth Action Plan and oversees the initiatives of the plan in rural Manitoba. The regional organisation is led by the Manitoba Chambers of Commerce and the Association of Manitoba Municipalities.	The programme provides cost-sharing assistance to SMEs to assist them in developing and commercialising new innovative products and processes. It provides a non-repayable grant of up to CAD 100 000 per project to cost-share eligible expenses on a 50/50 basis.

New Brunswick	<p>Yes – as part of the climate strategy</p> <p>The Climate Change Action Plan includes three pillars (government leadership and accountability, reducing GHG emissions and preparing for climate change) to address climate change priorities. In the context of reducing GHG emissions, one action is powering the province with clean and renewable energy by supporting innovative technologies and introducing clean technology adaptation incentives. Within the framework of the action plan, the provincial government intends to develop a Clean Electricity Strategy by 2025 to achieve net zero electricity emissions by 2035.</p>	<p>Develop a suite of tools to create a pipeline of innovative clean technology, from research to commercialisation and support clean technology adoption.</p>	2022-27	<p>The Climate Change Action Plan intends to support local governments and rural districts in efforts to reduce GHG emissions and build low-carbon rural communities. The provincial government collaborates with regional service commissions, local governments and rural districts to ensure that progress on climate change adaptation plan development and implementation are reported annually, and adaptation plans are completed for 50% of all local government and rural districts by 2025 and 100% by 2030.</p>	<p>By developing a sustainable economic development plan focused on decarbonisation opportunities and barriers, the programme intends to reduce GHG emissions by ensuring that SMEs have the appropriate tools and resources to compete in the transitioning economy by, for example, identifying, validating and pursuing the development of new industrial clusters that will support the decarbonisation.</p>
Newfoundland and Labrador	<p>Yes, as part of the climate strategy</p> <p>The Climate Change Action Plan includes an objective to build and strengthen early-stage clean technology innovation and research, development and demonstration and accelerate clean technology commercialisation.</p> <p>The Renewable Energy Plan, a sectoral plan, prepared through consultation with the public, Indigenous governments, industry and stakeholders, supports the development of renewable energy resources to enhance the generation, transmission and use of clean power. The programme encompasses short-, medium- and long-term action plans. One of four focus areas is the support of the innovation ecosystem for the development of the industry.</p>	<p>Implement initiatives to achieve clean economic growth in Newfoundland and Labrador and Making Newfoundland and Labrador a Clean Energy Centre of Excellence.</p>	2019-24; 2021-26	<p>Newfoundland and Labrador are collaborating throughout the province, including Indigenous governments and organisations, industry and stakeholders, to maximise the development and use of the province's renewable energy resources. A long-term action in all four focus areas of the programme is to leverage local expertise and partnerships.</p>	<p>The award-winning Turn Back the Tide website was designed as a one-stop shop to provide user-friendly information and resources to individuals, businesses and communities on how they can improve their energy efficiency and reduce their carbon footprint.</p> <p><i>Buying Green: A Guide for Purchasing Environmentally Preferable Products</i> was developed and published in consultation with businesses to better integrate climate change considerations into procurement.</p>
Nova Scotia	<p>Yes</p> <p>In the context of the Environmental Goals and Climate Change Reduction Act, Nova Scotia's Climate Change Plan for Clean Growth has 68 actions to support the reduction of GHG emissions and respond to the impacts of climate change. One of the three focus areas is the creation of a clean electricity system by phasing out coal-fired electricity by 2030 through the creation of provincial</p>	<p>Build at least 500 megawatts of new local, renewable energy and 50 megawatts of new community solar.</p> <p>Expand global production and export of green</p>	2022-27	<p>The programme invests in cleaner transportation options to enhance connectivity across rural communities. Concretely, it intends to build more electric vehicle charging stations, increase the number of zero-emission vehicles, e-bikes, marine vehicles and electrify public transit across the province by partnering with</p>	<p>Provide funding support for farms and other small businesses to adopt more solar power.</p>

	regulations.	hydrogen by setting a target for 5 gigawatts of offshore wind by 2030 to support the production.		municipalities and the federal government.	
Northwest Territories	Yes – as part of the climate strategy The NWT Climate Change Strategic Framework focuses on three key goals: transition to a lower carbon economy, improve knowledge of climate change impacts, and build resilience and adapt to a changing climate. It is part of the Pan-Canadian Framework on Clean Growth and Climate Change and is intrinsically linked with the 2030 Energy Strategy .	Transition to a lower carbon economy. Improve knowledge of climate change impacts. Build resilience and adapt to a changing climate. Develop tools that help decision makers cope and adapt to climate-related impacts.	2019-23	The programme focuses on working together with Indigenous, rural and remote communities in their transition to clean sources of energy by, for example, identifying potential cleaner air shelters to reduce the impacts of wildland fire smoke on human health or implement composting in small to medium-sized communities to reduce GHG emissions from community landfills.	-
Nunavut	No, but multiple individual projects, for instance the South Baffin Energy Management Project intending to introduce renewable energy in 45 buildings owned by the government of Nunavut in 6 communities of the South Baffin region and support with the implementation of solar panels, water-saving fixtures and solar hot-water systems.	-	-	No	-
Ontario	Yes Besides Ontario's Cleantech Strategy , which is now archived as it was made under a previous government, the Made-in-Ontario Environment Plan touches on a lot of topics addressing climate change, one of a few being the clean technology sector.	After creating the Cleaner Transportation Fuels regulation and retooling Ford of Canada's Oakville Assembly Complex into a global hub for battery electric vehicle production among other things, the strategy seeks to develop a low-carbon hydrogen strategy	2018-no announced expiration date	No	-

		that would create jobs and help move towards GHG reduction targets.			
Prince Edward Island	Yes – as part of the Prince Edward Island 2030 Net Zero Framework The Prince Edward Island 2040 Net Zero Framework has an objective to build an innovative ecosystem for clear technologies and solutions, and multiple individual projects, for instance, the Cleantech Park , which is a hub for business and education and includes a Cleantech Learning and Innovation Centre as well as a Cleantech Academy.	Build an innovative ecosystem for clean technologies and solutions Invest in pilots and essential infrastructure to support the deployment of clean technology. Accelerate the use of advanced agricultural clean technology.	2022-40	Key directions include growing the use and availability of affordable and dependable public transit in rural areas and ensuring access to reliable broadband Internet to support smartly designed communities.	The framework prioritised investing in more efficient and cleaner processes for Prince Edward Island industries and businesses.
Quebec	Yes The Québec Research and Innovation Investment Strategy invests in sustainable, inclusive research and innovation to excel at the global level and create more economic and social wealth. The strategy has five key priorities: excel in research, science, and technology; create an environment conducive to the development of innovation; support in-company investments and the commercialisation of innovations; develop talent and a scientific and innovation culture; and rely on promising sectors and catalyst projects (see notes for more examples of programmes.)	Quebec has launched an initiative to encourage businesses to adopt clean technologies and eco-responsible practices to become more competitive while reducing their environmental footprint and will furthermore introduce a tool that enables it to integrate environmental, social and governance issues into the analysis of investment and financing projects according to its responsible investment and	2022-27	No	SMEs are supported by industrial research sector groups, which help implement innovation measures in various fields to bolster their competitiveness through the adaptation and transfer of innovative solutions. The programme supports innovation through government procurement, in-company investments and the commercialisation of innovations for start-ups and SMEs. CAD 22.5 million over 5 years support SMEs by offering them priority access to specialised support services provided by entrepreneurs in residence at Investment Quebec and updated financing tools, in particular to enable them to export in their turnover, broaden their innovation and exporting, boost their productivity and expand.

		sustainable financing policy.			
Saskatchewan	Yes – as part of the climate strategy The Cleantech Accelerator Program , as part of Prairie Resilience: A Made-in-Saskatchewan Climate Change Strategy , is a collaborative partnership between Innovation Saskatchewan (a government agency responsible for implementing Saskatchewan’s technological and research innovation priorities) and Foresight cleantech accelerator centre. It is a six-week mentoring and support programme.	Successfully accelerate and commercialise the growth and impact of cleantech ecosystems by providing innovators with the skills and resources they need.	2021-no announced expiration date	No	The accelerator programme focuses on positioning SMEs in the cleantech sector for long-term growth and helps businesses navigate the investor and funding landscape.
Yukon	No, but multiple individual projects, for instance the Yukon Green Infrastructure Program focusing on meeting GHG reduction targets for Yukon-government-owned public infrastructure and more resilience to climate change. The programme targets five pillars: climate change impacts, reliable operations, value for taxpayer dollars, leadership and excellence and local economic benefits, all encouraging the development of local supply chains.	-	-	No	-

Note: In addition, the 2030 Plan for a Green Economy (Government of Quebec, 2023_[128]) is the first electrification and climate change policy framework in Quebec. It defines the climate actions that various partner ministries and public agencies will carry out. Other initiatives in Quebec include: *Programmes d'aide pour un Québec vert et prospère*, which has no rural focus but one on SMEs via the *Programme PME en action* (Government of Quebec, 2022_[129]); Bioénergies, with an SME focus and a partial rural focus through maple product producers (Government of Quebec, 2023_[130]); Écoperformance, which has no rural focus but is available for all types of businesses (Government of Quebec, 2023_[131]); *Programme de valorisation des rejets thermiques* with no SME or rural focus, but available to farm industry (Government of Quebec, 2023_[132]); and *Défi GES -Industrie* with no rural or SME focus (Government of Quebec, 2023_[133]).

Source: Based on Government of Alberta (2022_[134]), *Alberta Technology and Innovation Strategy (ATIS)*, Government of Alberta; Government of British Columbia (2022_[59]), *CleanBC*, <https://cleanbc.gov.bc.ca/>; Government of Manitoba (2022_[135]), “Manitoba government provides more than \$900,000 to businesses through innovation growth program”, <https://news.gov.mb.ca/news/index.html?item=56857>; Province of New Brunswick (2022_[136]), *Our Pathway Towards Decarbonization and Climate Resilience*, <https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/climate-change-action-plan-progress-report-2022-2023.pdf>; Province of Newfoundland Labrador (2022_[137]), *Maximizing Our Renewable Future - A Plan for Development of the Renewable Energy Industry in Newfoundland and Labrador*, <https://www.gov.nl.ca/iet/files/Renewable-Energy-Plan-Final.pdf>; Province of Nova Scotia (2022_[138]), *Our Climate, Our Future - Nova Scotia's Climate Change Plan for Clean Growth*, <https://climatechange.novascotia.ca/sites/default/files/uploads/ns-climate-change-plan.pdf>; Government of Northwest Territories (2019_[139]), *2030 NWT Climate Change Strategic Framework - 2019-2030 Action Plan*, Government of Northwest Territories; Government of Canada (2020_[140]), “Government of Canada partners with Nunavut for renewable and energy-efficiency projects”, <https://www.canada.ca/en/environment-climate-change/news/2020/08/government-of-canada-partners-with-nunavut-for-renewable-and-energy-efficiency-projects.html>; Government of Ontario (n.d._[141]), *A Made-in-Ontario Environment Plan*, <https://www.ontario.ca/page/made-in-ontario-environment-plan>; Prince Edward Island (n.d._[142]), *Cleantech on Prince Edward Island*, <https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/clean-tech-on-prince-edward-island>; Government of Quebec (2022_[143]), *The 2022-2027 Québec Research and Innovation Investment Strategy*, https://cdn-contentu.quebec.ca/cdn-contentu/adm/min/economie/publications-adm/politique/PO_SQRI2_2022-2027_MEI_EN.pdf; Government of Saskatchewan (2021_[144]), “Province announces launch of Cleantech Accelerator Program”, <https://www.saskatchewan.ca/government/news-and-media/2021/january/06/province-announces-launch-of-cleantech-accelerator-program#:~:text=The%20program%2C%20which%20will%20be,month%20to%20access%20the%20program>; Government of Yukon (n.d._[145]), *The Yukon Green Infrastructure Program*, <https://yukon.ca/en/blogs/yukon-green-infrastructure-program>; Government of Quebec (2023_[128]), *2030 Plan for a Green Economy*, <https://www.quebec.ca/en/government/policies-orientations/plan-green-economy> (accessed on 10 November 2023).

Annex Table 4.A.3. Taxonomy of products considered clean technologies by industry and sector/technology area

Sector/technology	Products
Smart grid and energy storage	<ul style="list-style-type: none"> • Smart grid demand management • Transmission and distribution • Mechanical storage • Electrochemical storage • Electrical storage • Thermal storage • Hybrid storage • Energy storage service
Precision agriculture, forestry and biodiversity	<ul style="list-style-type: none"> • Precision inputs • Machinery and equipment • Aquaculture • Wild flora and fauna management • Sustainable forestry
Mining, processing, materials, manufacturing and industry	<ul style="list-style-type: none"> • Minerals use • Green mining and processing • Advanced and lightweight materials
Renewable and non-emitting energy supply	<ul style="list-style-type: none"> • Wind • Bioenergy • Geothermal • Hydro • Solar • Nuclear • Waste to energy
Energy efficiency	<ul style="list-style-type: none"> • Energy and resource-efficient modifications and improvements • Measurement controls and monitoring • Industrial design and related services • Efficient industrial equipment • Efficient commercial and residential equipment
Biofuels, bioenergy and bioproducts	<ul style="list-style-type: none"> • Biofuel production • Bioenergy production • Equipment for producing biofuels and bioproducts • Biochemicals • Biomaterials
Waste and recycling	<ul style="list-style-type: none"> • Non-hazardous waste collection • Separating and sorting • Disposal • Recycling • Compaction • Centralised biological reprocessing and composters
Air, environment and remediation	<ul style="list-style-type: none"> • Emission control; monitoring and compliance; management or treatment or industrial services for air pollution, flue gas and GHG management • In situ and ex situ physical, chemical, biological, and thermal treatment of soil, sediment and sludge • Noise and vibration abatement • Environmental protection activities • Protection from radiation

Sector/technology	Products
Transportation	<ul style="list-style-type: none"> • Fuel-efficient automotive equipment • Fuel-efficient aerospace equipment • Infrastructure and traffic control
Water and wastewater	<ul style="list-style-type: none"> • Treatment of industrial wastewater; treatment of sewage; wastewater management • In and ex situ physical, chemical, and biological treatment of groundwater, surface water and leachate • Control, containment, and monitoring services; treatment of air emissions or off gases • Treatment of drinking water and filtration systems • Water efficiency; measurement and control of water use; water recycling

Source: Government of Canada (2022^[27]), *Clean Technology Data Strategy*, <https://ised-isde.canada.ca/site/clean-growth-hub/en/clean-technology-data-strategy>.

References

- Allan, B. et al. (2022), *Canada's Future in a Net-Zero World: Securing Canada's Place in the Global Green Economy.*, Smart Prosperity Institute, Transition Accelerator and Pacific Institute for Climate Solutions. [78]
- ARI (2022), *Geographic Information Systems*, Aurora Research Institute, [103]
<https://nwtresearch.com/project-category/geographic-information-systems>.
- Assembly of First Nations (2019), *Declaring a First Nations Climate Emergency*, Resolution no. 05/ 2019, <https://afn.bynder.com/m/5a3de3c7f6cf08b5/original/05-2019-Declaring-a-First-Nations-Climate-Emergency.pdf>. [4]
- Atlantic Economic Council (2023), *Implications for Atlantic Canada's Economy in the Pursuit of Net-Zero Emissions*, <https://www.apec-econ.ca/netzero/>. [91]
- Berestycki, C. et al. (2022), "Measuring and assessing the effects of climate policy uncertainty", *OECD Economics Department Working Papers*, No. 1724, OECD Publishing, Paris, [34]
<https://doi.org/10.1787/34483d83-en>.
- Bioökonomierevier (2021), *Bioökonomie im Business? Zeigt uns Eure innovative Geschäftsidee!*, https://www.bioökonomierevier.de/BioDENKER_Startups (accessed on 15 March 2023). [111]
- Brehain, S. (2019), *Les pratiques d'affaires écoresponsables*, [86]
<https://statistique.quebec.ca/en/fichier/pratiques-affaires-ecoresponsables.pdf>.
- Bush, E. et al. (2022), *Canada's Changing Climate Report in Light of the Latest Global Science*, Government of Canada, [18]
<https://changingclimate.ca/site/assets/uploads/sites/2/2022/03/CCCR-2022-Supplement-Final.pdf> (accessed on 1 June 2023).
- Canada Energy Regulator (2022), *Provincial and Territorial Energy Profiles - Quebec*, [12]
<https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-quebec.html>.
- Canadian Climate Institute (2022), *Closing Canada's Adaptation Gap*, [109]
<https://climateinstitute.ca/publications/closing-canadas-adaptation-gap/>.
- Canadian Climate Institute (2022), "Expert assessment recommends improvements to National Adaptation Strategy", <https://climateinstitute.ca/news/expert-assessment-national-adaptation-strategy/>. [25]
- Canadian Institute for Climate Choices (2021), *2020 Expert Assessment of Carbon Pricing Systems*, Environment and Climate Change Canada, [32]
https://publications.gc.ca/collections/collection_2021/eccc/En4-434-2021-eng.pdf.
- CanNor (2019), *Pan-Territorial Growth Strategy*, Canadian Northern Economic Development, [126]
https://www.cannor.gc.ca/DAM/DAM-CANNOR-CANNOR/STAGING/texte-text/pan-terr-growth-strategy2018-19_1564507799759_eng.pdf (accessed on 15 March 2023).

- CBC (2023), “N.S. abandons Atlantic Loop, will increase wind and solar energy projects for green electricity”, Canadian Broadcasting Corporation, [81]
<https://www.cbc.ca/news/canada/nova-scotia/clean-power-plan-abandons-atlantic-loop-1.6992765>.
- CED (2020), *Departmental Sustainable Development Strategy 2020-2023*, Canada Economic Development for Quebec Regions, [73]
<https://www.canada.ca/en/employment-social-development/corporate/reports/sustainable-development/2020-2023.html> (accessed on 15 March 2023).
- CED (n.d.), *Issues, Challenges and Business Needs*, Canada Economic Development for Quebec Regions. [92]
- Circle Economy (2022), *The Circularity Gap Report 2022*, Circle Economy, Amsterdam, [76]
<https://www.circularity-gap.world/2022>.
- Crippa, M. et al. (2021), “Food systems are responsible for a third of global anthropogenic GHG emissions”, *Nature Food*, Vol. 2/3, pp. 198-209, [15]
<https://doi.org/10.1038/s43016-021-00225-9>.
- D’Arcangelo, F. et al. (2022), “A framework to decarbonise the economy”, *OECD Economic Policy Papers*, No. 31, OECD Publishing, Paris, [35]
<https://doi.org/10.1787/4e4d973d-en>.
- ECO Canada (2020), *Cleantech Defined: A Scoping Study of the Sector and its Workforce*, [112]
https://info.eco.ca/acton/attachment/42902/f-2fdc765f-432c-4e92-8d0b-8adfc29cf524/1/-/-/-/ECO-Canada_Cleantech-Report_02192020.pdf.
- Energicentrum Gotland (2022), *Homepage*, <https://energicentrum.gotland.se/> (accessed on 15 June 2023). [93]
- Environment and Climate Change Canada (2022), *Canada’s National Adaptation Strategy: Building Resilient Communities and a Strong Economy*, Government of Canada, [24]
<https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/national-adaptation-strategy.html> (accessed on 7 December 2022).
- Environment and Climate Change Canada (2021), *Climate Trends and Variations Bulletin - Annual 2021*, [21]
<https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations/annual-2021-bulletin.html> (accessed on 15 March 2023).
- Environment and Climate Change Canada (2020), *A Healthy Environment and a Healthy Economy*, [98]
https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf.
- Environment and Climate Change Canada (2020), *Climate Science 2050: Advancing Science and Knowledge on Climate Change*, [99]
<https://publications.gc.ca/site/eng/9.892783/publication.html>.
- EPI (2016), *Valuing Coastal Guardian Watchmen Programs: A Business Case*, EcoPlan International Inc., [102]
<https://coastalfirstnations.ca/wp-content/uploads/2019/03/Valuing-Coastal-Guardian-Watchmen-Programs-A-Business-Case.pdf>.
- First Nations Leadership Council (2022), *BC First Nations Climate Strategy and Action Plan*, [6]
<https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>.

- Ford, J. et al. (2017), "Climate change and Canada's north coast: Research trends, progress, and future directions", *Environmental Reviews*, Vol. 26, pp. 82-92. [23]
- Fraser Institute (2021), "Alberta and Saskatchewan need new rules to save revenue", <https://www.fraserinstitute.org/article/alberta-and-saskatchewan-need-new-rules-to-save-revenue>. [60]
- Fraser Institute (2021), *Repairing Alberta's Heritage Fund for the Long Term*. [61]
- Global Solar Atlas (2022), *Welcome to the Global Solar Atlas*, <https://globalsolaratlas.info/map?c=11.609193,8.173828,3> (accessed on 15 March 2023). [79]
- Global Wind Atlas (2022), *Welcome to the Global Wind Atlas*, <https://globalwindatlas.info/en>. [80]
- Government of Alberta (2022), *Alberta Technology and Innovation Strategy (ATIS)*, Government of Alberta. [134]
- Government of British Columbia (2022), *CleanBC*, <https://cleanbc.gov.bc.ca/>. [59]
- Government of British Columbia (2022), *Local Government Climate Action Program*, <http://www.gov.bc.ca/local-government-climate-action-program>. [107]
- Government of Canada (2023), "A Made-In-Canada plan: Affordable energy, good jobs, and a growing clean economy", in *Budget 2023 - A Made-in-Canada Plan: Strong Middle Class, Affordable Economy, Healthy Future*, <https://www.budget.canada.ca/2023/report-rapport/chap3-en.html> (accessed on 15 March 2023). [46]
- Government of Canada (2023), *Canada's Greenhouse Gas Inventory*, <https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html>. [40]
- Government of Canada (2023), "Government of Canada releases interim Sustainable Jobs Plan to enable the creation of good, middle class jobs across Canada", <https://www.canada.ca/en/natural-resources-canada/news/2023/02/government-of-canada-releases-interim-sustainable-jobs-plan-to-enable-the-creation-of-good-middle-class-jobs-across-canada.html>. [116]
- Government of Canada (2023), "Government of Canada tables the Canadian Sustainable Jobs Act to enable the creation of good, middle-class jobs across Canada", <https://www.canada.ca/en/natural-resources-canada/news/2023/06/government-of-canada-tables-the-canadian-sustainable-jobs-act-to-enable-the-creation-of-good-middle-class-jobs-across-canada.html>. [117]
- Government of Canada (2023), *Net-Zero Emissions by 2050*, <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html>. [5]
- Government of Canada (2023), *Regional Energy and Resource Tables*, <https://natural-resources.canada.ca/climate-change/regional-energy-and-resource-tables/24356> (accessed on 15 March 2023). [64]
- Government of Canada (2023), *Sustainable Jobs Plan*, <https://www.canada.ca/en/services/jobs/training/initiatives/sustainable-jobs/plan.html> (accessed on 31 May 2023). [115]

- Government of Canada (2023), *The Offshore Renewable Energy Regulations Initiative*, [84]
<https://natural-resources.canada.ca/public-consultations-and-engagements/the-offshore-renewable-energy-regulations-initiative/25006>.
- Government of Canada (2022), *2022 Fall Economic Statement*, [44]
<https://www.budget.canada.ca/fes-eea/2022/report-rapport/FES-EEA-2022-en.pdf> (accessed on 14 March 2023).
- Government of Canada (2022), *Canada's 2030 Emissions Reduction Plan*, [62]
<https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/plan.html>.
- Government of Canada (2022), *Clean Technology Data Strategy*, [27]
<https://ised-isde.canada.ca/site/clean-growth-hub/en/clean-technology-data-strategy>.
- Government of Canada (2022), *Funding and Support Opportunities*, [69]
<https://ised-isde.canada.ca/site/clean-growth-hub/en/funding-opportunities> (accessed on 15 March 2023).
- Government of Canada (2022), *Indigenous Community Boat Volunteer Program*, [105]
<https://www.ccg-gcc.gc.ca/search-rescue-recherche-sauvetage/indig-boat-bateau-autoch-prog-eng.html>.
- Government of Canada (2022), *Mission Innovation*, [48]
<https://www.nrcan.gc.ca/climate-change-adapting-impacts-and-reducing-emissions/canadas-green-future/mission-innovation/18612> (accessed on 6 October 2023).
- Government of Canada (2022), "Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 – Discussion document", [38]
<https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/oil-gas-emissions-cap/options-discussion-paper.html>.
- Government of Canada (2022), "Regional tables launched to collaboratively drive economic opportunities in a prosperous net-zero future", [63]
<https://www.canada.ca/en/natural-resources-canada/news/2022/06/regional-tables-launched-to-collaboratively-drive-economic-opportunities-in-a-prosperous-net-zero-future.html> (accessed on 15 March 2023).
- Government of Canada (2022), *The Government Expenditure Plan and Main Estimates - 2022-23 Estimates*, [127]
<https://www.canada.ca/en/treasury-board-secretariat/services/planned-government-spending/government-expenditure-plan-main-estimates/2022-23-estimates.html> (accessed on 15 March 2023).
- Government of Canada (2020), "Government of Canada partners with Nunavut for renewable and energy-efficiency projects", [140]
<https://www.canada.ca/en/environment-climate-change/news/2020/08/government-of-canada-partners-with-nunavut-for-renewable-and-energy-efficiency-projects.html>.
- Government of Canada (2017), *Budget Plan 2017*, [114]
<https://www.budget.canada.ca/2017/docs/plan/toc-tdm-en.html>.
- Government of Canada (2017), *Canada's Innovation and Skills Plan*, [113]
https://www.budget.canada.ca/2017/docs/themes/Innovation_en.pdf.

- Government of Canada (2016), *General Briefing Note on Canada's Self-government and Comprehensive Land Claims Policies and the Status of Negotiations*, <https://www.rcaanc-cirnac.gc.ca/eng/1373385502190/1542727338550>. [96]
- Government of Canada (n.d.), *2022-23 Departmental Plan*, Atlantic Canada Opportunities Agency, <https://www.canada.ca/en/atlantic-canada-opportunities/corporate/transparency/2022-23-departmental-plan.html#s6> (accessed on 15 March 2023). [125]
- Government of Canada (n.d.), *Clean Technology*, Canada's Economic Strategy Tables, https://ised-isde.canada.ca/site/economic-strategy-tables/sites/default/files/attachments/ISED_CleanTechnologies.pdf. [53]
- Government of Manitoba (2022), "Manitoba government provides more than \$900,000 to businesses through innovation growth program", <https://news.gov.mb.ca/news/index.html?item=56857>. [135]
- Government of Newfoundland and Labrador (2023), "Provincial government launches new Green Transition Fund", <https://www.gov.nl.ca/releases/2023/iet/0621n04/> (accessed on 6 October 2023). [58]
- Government of Northwest Territories (2019), *2030 NWT Climate Change Strategic Framework - 2019-2030 Action Plan*, Government of Northwest Territories. [139]
- Government of Nova Scotia (2007), *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia*, <https://novascotia.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf>. [82]
- Government of Ontario (2019), *Technical Guide to Renewable Energy Approvals*, <https://www.ontario.ca/document/technical-guide-renewable-energy-approvals-0>. [83]
- Government of Ontario (n.d.), *A Made-in-Ontario Environment Plan*, <https://www.ontario.ca/page/made-in-ontario-environment-plan>. [141]
- Government of Quebec (2023), *2030 Plan for a Green Economy*, <https://www.quebec.ca/en/government/policies-orientations/plan-green-economy> (accessed on 10 November 2023). [128]
- Government of Quebec (2023), *Bioénergies*, <https://transitionenergetique.gouv.qc.ca/affaires/programmes/bioenergies> (accessed on 10 November 2023). [130]
- Government of Quebec (2023), *ÉcoPerformance*, <https://transitionenergetique.gouv.qc.ca/affaires/programmes/ecoperformance> (accessed on 10 November 2023). [131]
- Government of Quebec (2023), *Pourquoi valoriser les rejets thermiques*, <https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/energie/planifier-transition-energetique-entreprise/valorisation-rejets-thermiques/pourquoi-valoriser-rejets-thermiques> (accessed on 10 November 2023). [132]
- Government of Quebec (2023), *Programme Défi GES – Industrie*, <https://www.environnement.gouv.qc.ca/programmes/defi-ges/index.htm> (accessed on 10 November 2023). [133]

- Government of Quebec (2022), *Programmes d'aide pour un Québec vert et prospère*, [129]
<https://www.economie.gouv.qc.ca/bibliotheques/programmes/programmes-lies-a-lenvironnement/programmes-daide-pour-un-quebec-vert-et-prospere> (accessed on 10 November 2023).
- Government of Quebec (2022), *The 2022-2027 Québec Research and Innovation Investment Strategy*, [143]
https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/economie/publications-adm/politique/PO_SQRI2_2022-2027_MEI_EN.pdf.
- Government of Saskatchewan (2021), "Province announces launch of Cleantech Accelerator Program", [144]
<https://www.saskatchewan.ca/government/news-and-media/2021/january/06/province-announces-launch-of-cleantech-accelerator-program#:~:text=The%20program%2C%20which%20will%20be,month%20to%20access%20the%20program.>
- Government of Yukon (n.d.), *The Yukon Green Infrastructure Program*, [145]
<https://yukon.ca/en/blogs/yukon-green-infrastructure-program>.
- Hill, D. (2015), "Small business: The 'neglected middle' of climate change", [89]
https://www.huffpost.com/entry/small-business-the-neglec_b_6289210?guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlMnVbS91cmw_c2E9dCZ.
- IEA (2021), *Net Zero by 2050*, International Energy Agency, [3]
<https://www.iea.org/reports/net-zero-by-2050>.
- ILO (2015), *Guidelines for a Just Transition towards Environmentally Sustainable Economies and Societies for All*, International Labour Organization, [118]
https://sustainabledevelopment.un.org/content/documents/22092wcms_432859.pdf.
- Indigenous Climate Hub (n.d.), *Traditional Knowledge (TK) and Climate Change*, [106]
<https://indigenousclimatehub.ca/traditional-knowledge-tk-and-climate-change/> (accessed on 15 March 2023).
- Interface (n.d.), *Homepage*, [54]
<https://interface-online.org.uk/>.
- Inuit Tapiriit Kanatami (2019), *National Inuit Climate Change Strategy*, [7]
https://www.itk.ca/wp-content/uploads/2019/06/ITK_Climate-Change-Strategy_English.pdf.
- IPCC (2019), *Climate Change and Land - Summary for Policymakers*, IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, Intergovernmental Panel on Climate Change. [1]
- ISED (2018), *Sustainable Development Technology Fund - Audit and Evaluation*, Innovation, Science and Economic Development Canada, [71]
https://ised-isde.canada.ca/site/audits-evaluations/sites/default/files/attachments/h_03866_01-eng.pdf (accessed on 15 March 2023).
- ITC (2021), *SME Competitiveness Outlook 2021: Empowering the Green Recovery*, International Trade Centre, [88]
<https://intracen.org/resources/publications/sme-competitiveness-outlook-2021-empowering-the-green-recovery.>

- Janssens-Maenhout, G. et al. (2019), “EDGAR v4.3.2 Global Atlas of the three major greenhouse gas emissions for the period 1970-2012”, *Earth System Science Data*, Vol. 11/3, pp. 959-1002, <https://doi.org/10.5194/essd-11-959-2019>. [16]
- JCCA (2021), *Joint Committee on Climate Action Annual Report to the National Chief and the Prime Minister*, Joint Committee on Climate Action, <https://afn.bynder.com/m/6fdcb3e25dfb74c0/original/Joint-Committee-on-Climate-Action-Annual-Report-to-the-National-Chief-and-the-Prime-Minister-2021.pdf>. [97]
- JD Supra (2023), “Canada’s oil and gas emissions cap: Options for the ECCC proposal”, <https://www.jdsupra.com/legalnews/canada-s-oil-and-gas-emissions-cap-7590573/>. [39]
- Jungsberg, L. et al. (2019), “Atlas of population, society and economy in the Arctic”, *Nordregio Working Paper*, No. 3, <http://norden.diva-portal.org/smash/get/diva2:1352410/FULLTEXT03.pdf> (accessed on 23 October 2019). [19]
- Krawchenko, T. (2021), “How do we manage a just transition? A comparative review of national and regional just transition initiatives”, *Sustainability*, p. 13. [119]
- Kusumastuti, R. et al. (2022), “Finding the context indigenous innovation in village enterprise knowledge structure: A topic modeling”, *Journal of Innovation and Entrepreneurship*, Vol. 11/19, <https://doi.org/10.1186/s13731-022-00220-9>. [100]
- Lehne, J. et al. (2021), “The EU ETS: From cornerstone to catalyst - The role of carbon pricing in driving green innovation”, Jaques Delors Institute, <https://institutdelors.eu/en/publications/the-eu-ets-from-cornerstone-to-catalyst/>. [42]
- Lilliestam, J., A. Patt and G. Bersalli (2020), “The effect of carbon pricing on technological change for full energy decarbonization: A review of empirical ex-post evidence”, *WIREs Climate Change*, Vol. 12/1, <https://doi.org/10.1002/wcc.681>. [43]
- Mayer, H. (2020), “Slow innovation in Europe’s peripheral regions: Innovation beyond acceleration”, *Schlüsselakteure der Regionalentwicklung - welche Perspektiven bietet Entrepreneurship für ländliche Räume?*, Verlag der Österreichischen Akademie der Wissenschaften. [29]
- Mertins-Kirkwood, H. and N. Kathen (2022), *Bet Big: A Citizen’s Guide to Green Industrial Policy in Canada*, Canadian Centre for Policy Alternatives, https://policyalternatives.ca/sites/default/files/uploads/publications/National%20Office/2022/10/Bet%20Big_FINAL.pdf. [68]
- Métis National Council (2019), *Métis Climate Change and Health Vulnerability Assessment*, <https://www.metisnation.ca/uploads/documents/MNCHVA%20FINAL%20Report.pdf>. [8]
- Ministère de la Transition écologique et de la Cohésion des territoires (n.d.), *L’observatoire national des emplois et métiers de l’économie verte*, <https://www.ecologie.gouv.fr/observatoire-national-des-emplois-et-metiers-leconomie-verte>. [122]
- NIEDB (2022), *National Indigenous Economic Strategy for Canada 2022*, National Indigenous Economic Development Board, https://niestrategy.ca/wp-content/uploads/2022/12/NIES_English_FullStrategy_2.pdf. [10]

- Norton Rose Fulbright (2023), *2023 Canadian Federal Budget: Clean Energy*, [47]
<https://www.nortonrosefulbright.com/en/knowledge/publications/c607b13e/2023-canadian-federal-budget-clean-energy> (accessed on 15 March 2023).
- Norton Rose Fulbright (2022), “Canada releases discussion paper on capping emissions from upstream oil and gas”, <https://www.nortonrosefulbright.com/en-ca/knowledge/publications/d19bd616/canada-releases-discussion-paper-on-capping-emissions-from-upstream-oil-and-gas>. [37]
- Ocean Supercluster (n.d.), *About Canada’s Ocean Supercluster*, [55]
<https://oceansupercluster.ca/about/>.
- OECD (2023), *OECD Economic Surveys: Canada 2023*, OECD Publishing, Paris, [14]
<https://doi.org/10.1787/7eb16f83-en>.
- OECD (2022), *OECD Economic Surveys: United Kingdom 2022*, OECD Publishing, Paris, [36]
<https://doi.org/10.1787/7c0f1268-en>.
- OECD (2022), *OECD Regions and Cities at a Glance 2022*, OECD Publishing, Paris, [17]
<https://doi.org/10.1787/14108660-en>.
- OECD (2021), “No net zero without SMEs: Exploring the key issues for greening SMEs and green entrepreneurship”, *OECD SME and Entrepreneurship Papers*, No. 30, OECD Publishing, Paris, <https://doi.org/10.1787/bab63915-en>. [90]
- OECD (2021), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, OECD Publishing, Paris, <https://doi.org/10.1787/17017efe-en>. [9]
- OECD (2021), *OECD’s Rural Agenda for Climate Action*, OECD, Paris, [75]
<https://www.oecd.org/regional/rural-development/Rural-Agenda-for-Climate-Action.pdf>
 (accessed on 15 March 2023).
- OECD (2020), *Linking Indigenous Communities with Regional Development in Canada*, OECD Rural Policy Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/fa0f60c6-en>. [94]
- OECD (2020), *Rural Well-being: Geography of Opportunities*, OECD Rural Studies, OECD Publishing, Paris, <https://doi.org/10.1787/d25cef80-en>. [2]
- OECD (2020), *The Circular Economy in Cities and Regions: Synthesis Report*. [77]
- OECD (2020), *The Circular Economy in Cities and Regions: Synthesis Report*, OECD Urban Studies, OECD Publishing, Paris, <https://doi.org/10.1787/10ac6ae4-en>. [31]
- OECD (2019), *Regions in Industrial Transition: Policies for People and Places*, OECD Regional Development Studies, OECD Publishing, Paris, <https://doi.org/10.1787/c76ec2a1-en>. [121]
- OECD (2017), *OECD Environmental Performance Reviews: Canada 2017*, OECD Environmental Performance Reviews, OECD Publishing, Paris, [51]
<https://doi.org/10.1787/9789264279612-en>.
- OECD (2011), *Better Policies to Support Eco-innovation*, OECD Studies on Environmental Innovation, OECD Publishing, Paris, <https://doi.org/10.1787/9789264096684-en>. [26]
- OECD (2011), *Fostering Innovation for Green Growth*, OECD Green Growth Studies, OECD Publishing, Paris, <https://doi.org/10.1787/9789264119925-en>. [30]

- OECD (n.d.), “Green growth indicators”, *OECD Environment Statistics (database)*, [50]
<https://doi.org/10.1787/data-00665-en>.
- OECD (n.d.), *OECD Regional Statistics (database)*, [111]
<https://doi.org/10.1787/region-data-en>.
- OECD (n.d.), “Patents in environment-related technologies: Technology development by inventor country”, *OECD Environment Statistics (database)*, [52]
<https://doi.org/10.1787/data-00760-en>.
- OECD/IEA (2022), “RD&D Budgets per GDP”, *IEA Energy Technology RD&D Statistics (database)*, [49]
<https://doi.org/10.1787/enetech-data-en>.
- Olmstead, D. and A. Yatchew (2022), “Carbon pricing and Alberta’s energy-only electricity market”, *The Electricity Journal*, Vol. 35/4, p. 107112, [33]
<https://doi.org/10.1016/j.tej.2022.107112>.
- PacificCan (2021), *2022-2023 Departmental Plan*, Pacific Economic Development Canada, [124]
<https://www.canada.ca/en/pacific-economic-development/corporate/transparency/departmental-plans/2022-2023-departmental-plan.html>
 (accessed on 15 March 2023).
- Prince Edward Island (n.d.), *Cleantech on Prince Edward Island*, [142]
<https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/clean-tech-on-prince-edward-island>.
- Province of New Brunswick (2022), *Our Pathway Towards Decarbonization and Climate Resilience*, [136]
<https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/climate-change-action-plan-progress-report-2022-2023.pdf>.
- Province of Newfoundland and Labrador (2022), *Maximizing Our Renewable Future - A Plan for Development of the Renewable Energy Industry in Newfoundland and Labrador*, [137]
<https://www.gov.nl.ca/iet/files/Renewable-Energy-Plan-Final.pdf>.
- Province of Nova Scotia (2022), *Our Climate, Our Future - Nova Scotia’s Climate Change Plan for Clean Growth*, Department of Environment and Climate Change, [138]
<https://climatechange.novascotia.ca/sites/default/files/uploads/ns-climate-change-plan.pdf>.
- PwC (2023), *2023 Federal Budget Analysis*, [45]
<https://www.pwc.com/ca/en/services/tax/budgets/2023/2023-federal-budget-analysis.html>
 (accessed on 15 March 2023).
- Réseau des SADC+CAE (2021), *Développement durable*, [74]
<https://www.sadc-cae.ca/fr/developpement-durable/> (accessed on 10 November 2023).
- Robert, D. (2022), “Warming waters in the Gulf of St. Lawrence are disrupting commercial fishing”, *The Conversation*, [20]
<https://theconversation.com/warming-waters-in-the-gulf-of-st-lawrence-are-disrupting-commercial-fishing-194477>.
- Rural England (2021), *Opportunities and Challenges for Rural Communities from Net Zero Carbon Legislation*. [110]
- Sanderson, B. and B. O’Neill (2020), “Assessing the costs of historical inaction on climate change”, *Scientific Reports*, Vol. 10/1, [13]
<https://doi.org/10.1038/s41598-020-66275-4>.

- Scottish Government (2020), *Climate Emergency Skills Action Plan 2020-2025*, [123]
<https://www.skillsdevelopmentscotland.co.uk/media/47336/climate-emergency-skills-action-plan-2020-2025.pdf>.
- SDTC (2022), *About - SDTC is Committed to Full Transparency*, Sustainable Development Technology Canada, [72]
<https://www.sdtec.ca/en/about/accountability/>.
- SDTC (2021), *Annual-Report-2021-22: Innovation Happens Here*, Sustainable Development Technology Canada, [70]
<https://www.sdtec.ca/wp-content/uploads/2022/09/SDTC-Annual-Report-2021-22-EN.pdf> (accessed on 15 March 2023).
- Statistics Canada (2022), “Environmental and Clean Technology Products Economic Account 2021”, [28]
<https://www150.statcan.gc.ca/n1/en/daily-quotidien/221219/dq221219c-eng.pdf?st=PKyOlijKc>.
- Statistics Canada (n.d.), *Environmental and Clean Technology Products Economic Account, Employment*, Table 36-10-0632-01, [85]
<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610063201>.
- Sudds, J. (2022), “Ontario joins Canada’s Regional Energy & Resource Tables”, [66]
<https://jennasuddsmp.ca/news/ontario-regional-energy> (accessed on 15 March 2023).
- Sussex Strategy (2022), “Canada’s Minister of Natural Resources announces launch of Ontario’s Energy & Resource Table”, [67]
<https://www.sussex-strategy.com/posts/canadas-minister-of-natural-resources-announces-launch-of-ontarios-energy-resource-table> (accessed on 15 March 2023).
- Sussex Strategy (2022), “Ottawa launches regional energy and Resource Tables initiative”, [65]
<https://www.sussex-strategy.com/posts/ottawa-launches-regional-energy-and-resource-tables-initiative> (accessed on 15 March 2023).
- SVA Consulting (2016), *Analysis of the Current and Future Value of Indigenous Guardian Work in Canada’s Northwest Territories*, [101]
<https://www.indigenousguardianstoolkit.ca/sites/default/files/Community%20Resource%20Indigenous%20Leadership%20Initiative%20and%20Tides%20Canada%20Analysis%20of%20Current%20and%20Future%20Value%20of%20Indigenous%20Guardian%20Work%20in%20Canada%27s%20Northwest>.
- Tamarack Institute (n.d.), *Introducing the 2024 Community Climate Transitions Cohort*, [108]
https://www.tamarackcommunity.ca/climate-transitions-cohort?utm_campaign=Climate+Transitions&utm_source=hs_email&utm_medium=email&_hsenc=p2ANqtz--XLJi2cTG17RIDeaVA_Iht4VtrSM7dXefzpGkUxhWc2Zjz_dEMRdsiKv32QijQWt-iktH6daXkp2lfmoGc7aNxTwbby8GUxY2SLjboOWAA2I3a.
- The Launch (n.d.), *Meet - Tap into the Power of the Launch at the Marine Institute*, [56]
<https://www.thelaunch.mi.mun.ca/meet/>.
- U.S. Census Bureau (2022), *Information for Respondents*, United States Census Bureau, [87]
<https://www.census.gov/programs-surveys/abs/information.html>.
- UN (2007), *United Nations Declaration on the Rights of Indigenous Peoples*, United Nations, [95]
https://social.desa.un.org/sites/default/files/migrated/19/2018/11/UNDRIP_E_web.pdf.

- UN (n.d.), *Climate Change - The Effects of Climate Change on Indigenous Peoples*, United Nations, <https://www.un.org/development/desa/indigenouspeoples/climate-change.html>. [22]
- von Schneel, E. (2022), "Alberta wants to challenge federal emissions cap in court", CBC, <https://www.cbc.ca/news/canada/calgary/alberta-federal-government-oil-gas-emissions-constitution-1.6661484>. [41]
- WEF (2022), "Norway's massive sovereign-wealth fund sets net-zero goals", World Economic Forum, <https://www.weforum.org/agenda/2022/09/norways-massive-sovereign-wealth-fund-sets-net-zero-goal/>. [57]
- Wetsus (n.d.), *Homepage*, European Centre of Excellence for Sustainable Water Technology, <http://www.wetsus.nl/>. [120]
- Wright, A. et al. (2019), "Using two-eyed seeing in research with Indigenous people: An integrative review", *International Journal of Qualitative Methods*, Vol. 18, p. 160940691986969, <https://doi.org/10.1177/1609406919869695>. [104]

OECD Rural Studies

Enhancing Rural Innovation in Canada

Innovation is broader than science and technology, yet often statistics and government programmes narrowly focus on this type of innovation. In rural places, this is particularly relevant as not all firms have the capacity to be competitive in high-tech innovation. With around one in five Canadians living in Canada's rural regions, better understanding how to promote broader notions of innovation for rural places by increasing entrepreneurship, including for women, advancing the green transition, and improving the provision of services is critical to boost rural productivity, and increase well-being standards. The report sets the scene for rural innovation in Canada, explores the policy and governance environment for key regional innovation initiatives, and includes a special topic chapter on green innovation in rural regions of Canada.



PRINT ISBN 978-92-64-55048-3
PDF ISBN 978-92-64-50226-0



9 789264 550483