

# Post-Secondary Education and Innovation

KNOWLEDGE BRIEF



## INTRODUCTION TO POST-SECONDARY INNOVATION

Recent decades have seen growing expectations on post-secondary institutions to fulfill roles not only as educators and researchers, but also to contribute to their surrounding regional and national economic, social, and cultural environments.<sup>1-3</sup> There is a broad range of models and concepts describing potential ways that post-secondary institutions can innovate in these areas.<sup>2,3</sup>

For example, early studies considered post-secondary institutions as “knowledge factories” that can have local economic impacts through the spillover of scientific knowledge (e.g., new college graduates added to the local workforce).<sup>3</sup> Another example is the “entrepreneurial model”, which claims that post-secondary institutions promote the development of their regions by engaging in patenting, licensing, and academic spin-off activities generated from subjects such as engineering, information technology, and biotechnology.<sup>2</sup> Then there is the “regional innovation system (RIS) approach”, which is explicitly focused on how post-secondary institutions can contribute to regional economic development.<sup>2</sup> Finally, models such as “mode 2” and the “engaged university” go beyond regional economic development and direct attention to social, cultural, and societal activities that post-secondary institutions can potentially engage in.<sup>2,3</sup>

This knowledge brief will provide an overview of literature highlighting some of the **potential ways for post-secondary institutions to contribute to regional innovation in rural regions** such as the Columbia Basin-Boundary region. The main focus is on the role of post-secondary institutions in the RIS approach because of the explicit aim of influencing regional economic development.

Examples of applied research collaborations between colleges and industry sectors, drawn from Colleges and Institutes Canada’s [Innovation Showcase](#), have been added to text boxes throughout this document. These examples highlight innovation projects from mainly rural regions of Canada.

## EDUCATION AND INNOVATION

Post-secondary education is an important ingredient in regional innovation. Currently in British Columbia (BC) the shortage of workers with the necessary education and skills to help companies grow and innovate is estimated to be costing the economy up to \$7.9 billion in potential GDP and over \$1.8 billion in lost tax revenues annually.<sup>4</sup> Fortunately, the education and training role of post-secondary institutions in rural regions can contribute to the availability of a well-trained workforce that can stimulate productivity, innovation, and clusters within industry sectors.<sup>5,6</sup>

### DEVELOPING SOFTWARE FOR THE FORESTRY INDUSTRY<sup>16</sup>

[Selkirk College's Geospatial Research Centre](#) supported a local forestry software company in designing software for forestry harvesting operations, production, and domestic and international lumber sales. The software was customized for southeastern BC, but has potential to be used across the global forestry industry.

To enhance innovation capabilities in rural regions, some scholars recommend that rural regions focus on skills provided at the level of technical colleges, engineering schools, management schools, etc.<sup>7</sup> In BC, many employers want post-secondary institutions to increase emphasis on work-integrated learning, including co-operative education, internships, mentoring, capstone projects, group work, and post-secondary institution-based consultancy opportunities.<sup>4</sup>

### AQUACULTURE AND HYDROPONICS IN SOUTHERN ALBERTA<sup>17</sup>

[Lethbridge College](#) is helping the region's aquaponics producers overcome technical problems and policy obstacles through an applied research project in a campus greenhouse. Aquaponics combines aquaculture and hydroponic food growing methods through a water re-circulation system. Produce grown in the campus greenhouse is being sold in southern Alberta restaurants.

Collaboration between post-secondary institutions (e.g., through shared knowledge and resources) can enable colleges to build their areas of expertise, which in turn can enhance student learning opportunities that have long-term benefits on regional economic development and innovation (See [Rural Workforce Development Strategies Knowledge Brief](#)).<sup>8</sup>

## RIS APPROACH

As the Columbia Basin Rural Development Institute's knowledge brief on [Regional Innovation](#) explains, regional innovation systems involve multiple public and private stakeholders collaborating to support innovation to stimulate economic development in a region.<sup>9,10</sup> The production and transmission of knowledge and skills is a key building block for a RIS.<sup>7</sup>

According to the RIS approach, post-secondary institutions play a core role in the regional innovation process as they are considered to be a key player in a region's knowledge infrastructure.<sup>1,2</sup> Knowledge infrastructure is the physical and organizational infrastructure needed to support innovation.<sup>11</sup> Post-secondary institutions are active in shaping regional innovation outcomes and network elements (e.g., links and nodes).<sup>1</sup>

The RIS approach emphasizes that knowledge can be exchanged between post-secondary institutions and industries through contract research, formal research and development collaborations, commercialization activities, and non-financial forms of knowledge transfer such as knowledge spillover and informal relationships.<sup>2</sup> A crucial element to the RIS approach is that post-secondary institutions share knowledge not only with large corporations, but also small-and-medium sized enterprises and industry clusters.<sup>3</sup>

### NORTHERN MINING TECHNOLOGY<sup>18</sup>

[Yukon College](#) and the mining industry in northern Canada are partnering on research and innovation in environmental technologies adapted for mining in northern environments. Lab and field experiments include bioremediation at mine sites, metal uptake in constructed wetlands, and other environmentally conscious mining techniques. Students are also benefiting from learning opportunities in the classroom, lab, and field, as well as access to new laboratory equipment.

Colleges and Institutes Canada notes that colleges and related post-secondary institutions across Canada partner with public and private sector partners to foster innovation in all sectors of the economy.<sup>12</sup> Since the 2010-2011 school year, there has been an increase in partnerships between colleges and micro-enterprises (1 to 4 employees), small-and-medium sized enterprises (5 to 500 employees), large corporations (over 500 employees), and non-profit sector.<sup>12</sup> However, the country as a whole is still behind its global competition in key measures of innovation.<sup>13</sup>

### METALLURGY RESEARCH AND SME PRODUCTIVITY<sup>19</sup>

[Cégep de Trois-Rivières](#) is partnered with a multinational corporation (RioTintoAlcan) and eight SMEs from the aluminum industry across various urban and rural regions in Quebec. RioTintoAlcan subcontracts research and development in casting-alloys to a research centre at Cégep de Trois-Rivières, which has the necessary scientific resources and materials. The knowledge and innovations from this research then benefits the SMEs, most of which do not have the scientific resources and specialized equipment to conduct the research on their own. For example, one project was able to increase casting capacity while also using less metal. Students also benefit from this work through course curriculum, end-of-studies project opportunities, and internships.

Some scholars have been critical of early writing on the RIS approach for setting unrealistic expectations about the research, innovation, and value creation contributions that local post-secondary institutions should have on the region.<sup>3</sup> However, more recent writings have also emphasized the importance of contributions from post-secondary institutions from outside a region (e.g., provincial, national, and international networks).<sup>2</sup> For example, companies in the rural regions of Horten (electronics industry) and Raufoss (lightweight material goods industry) in Norway develop most of their important research-based knowledge through collaborations with major research institutes and universities in other regions of the country.<sup>14</sup>

Many studies on innovation focus on examples of regional collaborations that result in major success stories (e.g., Silicon Valley and Stanford University).<sup>3,15</sup> But this emphasis on a few key urban areas risks overgeneralizing the potential for highly innovative and successful collaborations between industry sectors and universities, while undervaluing the role that local context has in shaping economic development opportunities.<sup>3,15</sup>

## ADAPTING FORESTRY TO CLIMATE CHANGE<sup>20</sup>

The [College of New Caledonia's Natural Resources and Environmental Technology program](#) in BC's central interior is collaborating on an applied forestry research project with local forest companies, the provincial government, three research forests, and researchers at other post-secondary institutions. The project is trying to determine which tree species are better adapted for future climate change impacts and will provide commercial forest products. In addition to the industry benefiting, a long-term goal is to provide a teaching and demonstration facility (i.e., research forest sites) for forestry students.

It is important for policy makers and regional economic development practitioners to acknowledge that there is a great deal of complexity and diversity within a post-secondary institution, and that post-secondary institutions play different roles in different regional economies.<sup>3</sup> The future success of each post-secondary institution will, to a large extent, “depend upon their strategic choices and the local abilities to upgrade curricula, develop new areas of research and to build alliances.”<sup>1</sup>

The ability of post-secondary institutions to take on the role of

developing regional economic, social, and cultural environments is dependent on a number of circumstances.<sup>1</sup> This includes the characteristic of the individual institutions, the various regions in which they are located, and the national policy frameworks.<sup>1</sup>

## REFERENCES AND RESOURCES

1. Arbo, P. & Benneworth, P. *Understanding the Regional Contribution of Higher Education Institutions: A Literature Review*. (2007).
2. Tripl, M., Sinozic, T. & Smith, H. L. The Role of Universities in Regional Development: Conceptual Models and Policy Institutions in the UK, Sweden and Austria. *Eur. Plan. Stud.* **23**, 1722–1740 (2015).
3. Uyarra, E. Conceptualizing the Regional Roles of Universities, Implications and Contradictions. *Eur. Plan. Stud.* **18**, 1227–1246 (2010).
4. Mckean, M., Coburn, V. & Maclaine, C. *PSE Skills for a Prosperous British Columbia: 2016 Edition*. (2016).
5. Whitener, L. A. & Parker, T. Policy Options for a Changing Rural America. *Amber Waves* **5**, 58–65 (2007).
6. Gibbs, R. Education as a Rural Development Strategy. *Amber Waves* **3**, 20–25 (2005).
7. Tödting, F. & Tripl, M. One size fits all? Towards a differentiated regional innovation policy approach. *Res. Policy* **34**, 1203–1219 (2005).
8. Fox, H. L. Six workforce development initiatives that are laying the pathway to success. *Community Coll. J. Res. Pract.* **39**, 727–740 (2015).
9. Asheim, B. T., Smith, H. L. & Oughton, C. Regional Innovation Systems: Theory, Empirics and Policy. *Reg. Stud.* **45**, 875–891 (2011).
10. Asheim, B. T. & Coenen, L. Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Res. Policy* **34**, 1173–1190 (2005).
11. Doloreux, D. What we should know about regional systems of innovation. **24**, 243–263 (2002).

12. Colleges and Institutes Canada. *Inclusive Innovation at Colleges and Institutes: Highlights from the 2015-2016 CICan Applied Research Survey*. (2016).
13. Colleges and Institutes Canada. *Applied Research: Partnered Innovation for Businesses and Communities*. (2016).
14. Isaksen, A. & Karlsen, J. Can small regions construct regional advantages? The case of four Norwegian regions. *Eur. Urban Reg. Stud.* **20**, 243–257 (2012).
15. Isaksen, A. Building Regional Innovation Systems: Is Endogenous Industrial Development Possible in the Global Economy? *Can. J. Reg. Sci.* **24**, 101–120 (2001).
16. Colleges and Institutes Canada. Cloud Mapping for Forestry Planning. Available at: <https://www.collegesinstitutes.ca/applied-research/cloud-mapping-for-forestry-planning/>.
17. Colleges and Institutes Canada. Raising Fish to Grow Good Gardens. Available at: <https://www.collegesinstitutes.ca/applied-research/raising-fish-to-grow-good-gardens/>.
18. Colleges and Institutes Canada. Mine Life Cycle. Available at: <https://www.collegesinstitutes.ca/applied-research/dr-amelie-janin-industrial-research-chair-for-colleges-in-mine-life-cycle/>.
19. Colleges and Institutes Canada. Franco Chiesa, Industrial Research Chair in Aluminum Transformation. Available at: <https://www.collegesinstitutes.ca/applied-research/franco-chiesa-industrial-research-chair-in-aluminum-transformation/>.
20. Colleges and Institutes Canada. Tackling the Effects of Climate Change on B.C. Forests. Available at: <https://www.collegesinstitutes.ca/applied-research/tackling-the-effects-of-climate-change-on-b-c-forests/>.

*The Columbia Basin Rural Development Institute, at Selkirk College, is a regional research centre with a mandate to support informed decision-making by Columbia Basin-Boundary communities through the provision of information, applied research, and related outreach and extension support. Visit [www.cbrdi.ca](http://www.cbrdi.ca) for more information.*