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PERSPECTIVES

EDUCATION AND WORKFORCE: FOR A MORE PRODUCTIVE AND EQUITABLE SOCIETY

Training for the Bioeconomy of Tomorrow

Building the Workforce that will Drive Quebec's Growth

BRYAN CAMPBELL

Emeritus Professor, Department of Economics,
Concordia University
CIRANO Researcher and Fellow

MICHEL MAGNAN

Full Professor, John-Molson School of Business,
Concordia University
CIRANO Researcher and Fellow

ROBERT NORMAND

Project Director, CIRANO

Over the last decade, the bioeconomy has proven to be a transformative force in advanced economies. Aligning the skills of graduates from educational institutions and the needs of the labour market in this sector has become a critical issue to consider. In a CIRANO report (Campbell et al., 2025), the authors offer analyses based on job postings in the United States, Canada and Quebec, and help paint a picture of the current and potential trends in labour market demand linked to the new bioeconomy.

GENEVIÈVE DUFOUR

Director of Major Collaborative Projects, CIRANO

FÉLIX-ANTOINE JOHNSON

Research professional

MOLIVANN PANOT

Project Director, CIRANO

The bioeconomy, an outgrowth of the life sciences, now reaches into sectors as varied as health, agriculture, chemicals, medical technology and data management. Long seen as a scientific niche, the bioeconomy has become much more: it's an important ecosystem that generates jobs, investments and high-value-added innovations.

The consulting firm McKinsey predicts that up to 60% of the processes that create physical products for the global economy will have some connection to the bioeconomy (McKinsey Global Institute, 2020). The term **Bioeconomy** refers to any economic activity derived from the life sciences and is primarily divided into three sectors. **Biotechnology**, a technology applied to innovation or product development in the life sciences and/or made possible by those innovations. **Biomanufacturing**, the production of goods and services at commercial scale using biological systems. **Bioengineering**, the application of engineering practices and principles to the life sciences, including chemical, mechanical and electrical engineering.

Bioeconomy jobs do not necessarily require university degrees

We analyzed job postings on a comprehensive American database compiled by the firm LinkUp, dating from 2008 to 2024. LinkUp is a real-time labour demand data provider that collects millions of job postings daily, directly from employer websites. We extracted postings associated with the bioeconomy using NAICS codes defined by the Coalition of State Bioscience Institutes. Postings are classified by sub-sector and by degree type.

Our methodology combines a quantitative analysis of growth dynamics with a textual analysis of skills based on keyword searches, illustrated by abbreviated job postings. For this study, we retained job postings for years 2018 and 2022.

Our findings reveal that bioeconomy employment grew at an average annual rate of approximately 21%, a pace far exceeding that of the economy as a whole. This dynamic is driven primarily by three major sub-sectors: pharmaceuticals, medical devices and equipment, and research, testing and medical laboratories. The most defining characteristic of this employment growth lies not in its scale, but in its composition.

Contrary to a widely held assumption, the rise in demand from bioeconomy companies is not concentrated in positions requiring undergraduate university degrees or advanced degrees. On the contrary, demand is growing most rapidly for jobs attained after college training, technical certificates or two-year programs.

The share of postings requiring a bachelor's degree, particularly in the medical devices and laboratory sub-sectors saw a decline, while counting overall growth in absolute terms. This shift does not reflect a decline in the skill level required, but rather a change in the nature of the skills being sought.

A new professional: the “applied specialist”

Companies are no longer simply looking for generalists trained in theoretical foundations, but for professionals capable of operating immediately in standardized, highly technological environments with strict regulatory constraints. This is a strong and lasting trend. It reflects the maturation of the bioeconomy: as innovations move out of research laboratories and into industrial, clinical and commercial processes, demand shifts to those with experience in execution, a skill essential to scaling up.

Five career groups account for most of the recent rise in demand: laboratory and biomanufacturing technicians, clinical research coordinators, healthcare and diagnostic support staff, clinical and scientific data managers, and developers and specialists in digital systems, with a specific application to the life sciences.

Technician positions stand out for their volume and growth. The most sought-after specializations require a thorough knowledge of procedures, a rigor in documentation and the ability to work in regulated environments. These occupations embody a new type of professional: the applied specialist. The makeup of this position lands at the intersection of science, technology, regulation and data management.

One of the major findings from our job postings analysis is the growing importance of hybrid skills. Programming (notably Python), data management, cloud computing and the fundamentals of software engineering now occupy positions historically associated with the laboratory or clinical support.

What has also changed is that a knowledge of regulatory compliance (e.g., ISO standards, Good Manufacturing Practice, Good Clinical Practice) now cuts across all professional categories. What was once a specialized skill has become a fundamental competency.

For employers, these hybrid skills are more than a luxury; they are necessary for ensuring quality, traceability, safety and compliance for systems that have become increasingly complex. For training systems, it poses a major challenge: How do you develop increasingly adept employees but avoid the never-ending training that comes with it.

Beyond technical know-how, job postings reveal a rapid rise in so-called relational or human skills: adaptability, problem-solving, communication, leadership and a good work ethic. These competencies are growing more quickly than many traditional technical skills. This evolution reflects the organizational reality of the bioeconomy: multidisciplinary teamwork, rapidly evolving protocols, and constant interaction between scientific, regulatory, IT and commercial functions. Collective performance takes precedence over isolated individual expertise.

Integrating these competencies into training is a pedagogical challenge. They cannot be developed through lectures alone. They require experiential environments, with actual projects, simulations, internships and real-world learning. This calls for closer integration between educational institutions and workplaces.

Drawing lessons from the US

In the United States, the response to labour market pressures in the bioeconomy has been swift and pragmatic. Public authorities have relied on community colleges as pillars of advanced technical training, developing close partnerships with industry.

Initiatives such as InnovATEBIO, the National Center for the Biotechnology Workforce, and MassBioEd apprenticeship programs rest on three key principles: employer-college partnerships for curricula, educational and training flexibility and a clear-eyed view of the labour market (National Biotechnology Innovation Center). The positive results, in terms of employment outcomes and retention, have been telling.

Quebec possesses a structural lever comparable to American community colleges, namely its network of CEGEPs, which is unique in North America. However, this potential lever has not been fully realized for its service to the emerging bioeconomy. The challenge to Quebec lies not in the creation of new institutions but in the reconfiguration of missions, content and incentives.

The Canadian Alliance for Skills and Training in Life Sciences (CASTL) initiative is a hands-on biomanufacturing training centre that reflects a desire to offer high-level operational training.

However, these initiatives remain peripheral to the mainstream training system. CASTL functions as a one-off training, without any formal connections to CEGEPs or universities. Costs, program duration and the absence of academic recognition limit their academic reach. Meanwhile, enrolment and graduation rates in relevant technical programs remain modest, suggesting a deficit in visibility, guidance and pathways for young people.

Move from a program to a competency mindset

Workforce training should be better aligned with the needs of the bioeconomy sector. In particular, college programs should centrally integrate the regulatory environment, data management and integrity, applied digital skills, and laboratory and production practices, employing real-world conditions.

Company internships should become the norm, and should be financially supported to reduce participation costs for small and medium-sized enterprises and bioeconomy startups. Industry-recognized micro-credentials – laboratory safety, compliance, data systems – would enable modular and adaptive career pathways.

There's still a window of opportunity

The bioeconomy offers Quebec an exceptional opportunity to combine scientific innovation, the creation of skilled jobs and a sustainable economic transition. But this opportunity rests on one condition: the collective capacity to train, attract, and retain an adaptable workforce.

The message from the data we analyzed is clear: The future of the bioeconomy will not be decided solely in research laboratories, but in classrooms and workshops, and through internships and applied learning environments.

Quebec has the institutional fundamentals to make this transition. What remains is a capacity to transform, which needs to be done without delay. This transformation will depend on private investment and will also require government support to develop both the necessary human and financial capital.

References

Campbell, B., Magnan, M., Normand, R., Dufour, G., Johnson, F.-A., & Panot, M. (2025). *L'émergence de la bioéconomie : Implications pour le développement du marché du travail au Québec* (2025RP-30, Projects Reports, CIRANO.) <https://doi.org/10.54932/HXXC7192>

InnovATEBIO: National Biotechnology Innovation Center. <https://innovatebio.org/>; <https://www.biotechworkforce.org/>

MassBioEd (Massachusetts Biotechnology Education). <https://www.massbioed.org/>

McKinsey Global Institute, 2020: The Bio Revolution - Innovations transforming economies, societies, and our lives. 200 pages. <https://www.mckinsey.com/industries/life-sciences/our-insights/the-bio-revolution-innovations-transforming-economies-societies-and-our-lives>

National Center for the Biotechnology Workforce. <https://www.ncbioimpact.org/partners/national-center-biotechnology-workforce>

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