

rebuilding NEW BRUNSWICK

New Brunswick Bioscience Sector Strategy
2012-2016

growing together

New  Nouveau
Brunswick

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Sector Definition

The New Brunswick bioscience sector includes companies that use biotechnology¹ applications to develop a wide range of bio-based products and services including animal, plant and human health diagnostics; natural health products; genomics; bio-chemicals and bioremediation. The sector has the potential to reduce costs and increase yields in food production; solve environmental problems; assist with preventative health care, as well as create higher value-added uses of traditional resources or biomass materials including waste products.

Industry Overview

The bioscience sector is somewhat of a hybrid, including components of a number of industries. Measures of key indicators such as Gross Domestic Product and employment that could be used to compare this sector to others are not available through Statistics Canada data. A survey conducted by BioAtlantech in 2008 collected benchmark data on the New Brunswick bioscience sector and revealed that the industry has approximately 20 core companies, conducts a significant amount of research and development (R&D), and has a number of highly skilled bioscience researchers working in industry and post-secondary education. In addition to the core companies that focus on bio-based products and services, the study identified at least 20 other companies in such industries as food manufacturing and consulting engineering that also have developed revenue streams from bio-based products and services.

Use of marine by-products presents an economic development opportunity for the New Brunswick bioscience sector. Each year, the seafood industry produces more than 58,000 tonnes of seafood by-products in addition to the waste water from cooking. Recognizing this opportunity, the Coastal Zones Research Institute in Shippagan is working closely with the seafood processing industry to develop new technologies for the extraction, isolation and characterization of bioactive ingredients from marine waste.

Bioscience applications related to the aquaculture industry are also an area for significant development in New Brunswick, in particular building on the expertise which has developed around fish health. For example, the Research and Productivity Council in Fredericton is working to improve the health and survival of aquaculture fish through research on probiotics, bacteria which confer a health benefit to the fish. Advances in this area would be expected to contribute greatly to the continued competitiveness of the aquaculture sector by reducing their costs of production.

¹ Biotechnology, as defined by the Organization for Economic Co-operation and Development (OECD), is the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

Bioscience is also expected to play an important role in advancing developments in the agriculture industry. The BioPotato Network, a consortium of public and private industry organizations, has been working to develop value-added by-products from potatoes as well as exploring the genetic ability of potatoes to provide more nutritional value to food products such as low glycemic potatoes and purple pigmented potatoes rich in antioxidants. Diets made up of foods with low glycemic index can help manage diabetes, aid in weight loss, reduce the risk of heart disease and stroke, improve blood cholesterol levels and prolong physical endurance. Pigmented fleshed potato varieties are of interest to french fry manufacturers given the functional food aspect of health-promoting pigments. The BioPotato Network has also been pursuing alternate products and uses for potatoes such as starch to produce bio-plastics and the production of bio-pesticides that use natural bioactive components.

The environmental sector in New Brunswick has advanced expertise in bioremediation, biogas development and soil detoxification. There is a tremendous opportunity to capitalize on these assets given the growing demand for environmental technologies in the global market.

Pre-commercial bioscience research and development is being conducted throughout the province in a variety of fields. The Collège Communautaire du Nouveau Brunswick (CCNB) Biorefinery Technology Scale-up Centre in Grand Falls provides cutting-edge research on pilot-scale processing which uses agricultural, forestry and marine sources of biomass to produce fuels derived from renewable resources. Researchers at the Wood Science Technology Centre, located at the University of New Brunswick, are investigating production of composites from agricultural residues for use in the construction industry as well as comparing biomass production in woody perennials for biofuel uses.

The industry in New Brunswick is well positioned to seize some emerging opportunities in the health field where New Brunswick has significant strengths in human health genetics/genomics research as it relates to cancer, diabetes, obesity, and other life-threatening diseases. In addition, New Brunswick may be attractive for research investment in testing and health diagnostics for preventative health care and/or relevant regional disease conditions found among “founder populations” in the province.

In neighbouring Prince Edward Island (PEI), where development of the bioscience sector has been a focus since 2005, the sector represented \$77 million in sales during 2010. The sector employs more than 900 people, including 200 PhDs, at over 40 companies and research centres. Investments in infrastructure, a well-coordinated Federal-Provincial policy and support program, and a competitive business environment have resulted in investment in PEI.

In New Brunswick, access to world-class researchers and facilities, and the availability of biomass resources, provides an excellent platform for companies to continue to capitalize on an abundant number of bioscience opportunities, particularly within the fields of plant (agriculture and forest) and marine/aquaculture products, biomedical, environment, and genomics (plant, animal and human). Biotechnology has the potential to assist New Brunswick companies to improve productivity and profitability, develop new bio-products and services, increase crop yields, prevent and cure diseases such as cancer and diabetes, and provide significant diversification opportunities in the agriculture, marine, and forestry industries.

A review of the bioscience sector in New Brunswick reveals the following main strengths, weaknesses, opportunities, and threats (SWOT).

Strengths

- Access to primary resources
- Strong research/institutional capacity
- Genetic pool of interest for clinical trials
- Active industry champions
- Existing infrastructure in varied technologies with application across the bioscience sector
- Genetic collections of plant (potatoes, taxus) and marine (arctic char) species

Opportunities

- Demand for health-related solutions and nutraceuticals
- Partnering, strategic alliance with larger established companies
- Demand for therapeutic treatment and cosmetic uses
- Demand for renewable energy sources
- Demand for environmental solutions and water reclamation
- Development of applications to decrease cost of health care

Weaknesses

- Limited combined business management and technical expertise
- Weak bioscience brand locally and internationally
- Limited access to financial support
- Limited wet lab space/growing facilities² which meet regulatory requirement for handling plant or animals produced by biotechnology

Threats

- Competition from other jurisdictions for human resources and capital
- Evolving regulatory environment
- Uncontrollable risks to resource inputs

Globally, the major drivers for development in the bioscience sector can be summed up by the words “heal, feed and fuel”. It is recognized that biotechnology holds the potential to address many health

²**Wet laboratories** are laboratories where chemicals, drugs, or other material or biological matter are tested and analyzed requiring water, direct ventilation, and specialized piped utilities. Wet laboratories are typically located within a building specifically designed to house them.

Growing facilities include greenhouse facilities or growth chambers, capable of precisely controlling and monitoring light, temperature, humidity and carbon dioxide and with systems designed to prevent the entrance or exit of plant, insect, or microbial material and contain any plant or animal life forms contained within or other regulatory requirements.

issues related to diseases and aging of the population, the need to feed a growing global population, and the need to reduce global dependence on non-renewable energy sources. An additional driver more specific to New Brunswick is the opportunity for new economic activity and diversification of existing traditional resource industries such as agriculture, fisheries and forestry.

Considering the above drivers, in addition to the SWOT analysis, the following strategic areas for investment and activity have been identified as key areas to pursue to promoting business development in the emerging bioscience sector.

- Increased bio-product diversification through adoption of new technologies and processes
- Support of private and institutional research to develop targeted products and technologies for identified market opportunities.
- Improved partnering to increase spin-off of institutional innovations and enable New Brunswick bioscience companies to access new technologies, financing and markets
- Transparent regulatory environment
- Building the bioscience brand for New Brunswick to help attract investment

Strategic objectives have been developed under five pillars including People, Innovation and Productivity, Business Environment and Regional Cooperation, Access to Capital and Infrastructure, and Market Access. The strategic objectives flow directly from the SWOT analysis above. Each is followed by initial work plan items which have been identified as a means of contributing to fulfillment of the strategic objective.

1. People

Investing in highly skilled people to work in the biosciences is critical to the development of the sector in New Brunswick. New Brunswick is fortunate to have a skilled workforce, including globally recognized researchers with world class education and training centres, and R&D facilities. New Brunswick universities currently offer 27 science programs and graduate 270 science professionals annually. New Brunswick Community Colleges offer 14 programs and train on average 170 technicians annually who are skilled for work in the bioscience sector. Human resource development will need to continue to be a focus in order to build a critical mass of people to support the growth of this emerging sector. The development of management skills will be equally important to the industry, as attracting investors, managing production and effective marketing are all required to bring research to successful commercialization. The development of tools such as recruitment material, scholarships and/or co-op programs, would be beneficial to stimulating interest and increasing enrolment in bioscience-related post-secondary education programs.

As there are a limited number of trained and skilled workers and researchers within the province in the short-term, attracting skilled workers from outside will be important to fostering growth in the sector. The highly competitive North American market for human resources in the bioscience sector presents a challenge. Retaining and attracting world-class researchers and management personnel

skilled in the bioscience sector will require New Brunswick to demonstrate the current opportunities and to commit to developing an industry that will deliver future career opportunities.

Strategic Objectives – People

- a) Develop a comprehensive understanding of the industry’s human resource needs and current training capacity.
 - i. Develop a human resource profile of the industry.
 - ii. Develop a plan to address labour needs, identify training requirements and potential changes to existing training programs based on the human resource profile.
- b) Build the skills needed for a strong bioscience sector in New Brunswick.
 - i. Develop tools, such as recruitment material, to encourage career interest in bioscience professions.
- c) Foster entrepreneurship in the bioscience sector.
 - i. Provide networking and partnership opportunities to match business people with bioscience graduates and researchers.
- d) Focus efforts on attraction and retention of highly qualified professionals to meet the needs of the bioscience sector.
 - i. Create a New Brunswick Talent Community – an online database and job matching platform.
 - ii. Work with bioscience employers to provide information and outreach activities for recruitment and repatriation (i.e., conferences and career fairs).

2. Innovation and Productivity

Bioscience is one of the most research-intensive sectors in the world. According to the survey conducted by BioAtlantech in 2008, there were 700 active bioscience research projects at university institutions in New Brunswick, generating more than \$23 million in project activity. New Brunswick can leverage its primary resources to attract investment by local and foreign companies seeking to develop products to meet growing demands to heal, feed and fuel the world in a sustainable manner. Significant opportunities for new product development have been identified in various fields including health and nutraceuticals, therapeutic treatments, cosmetics, renewable energy, and environmental solutions.

New Brunswick’s research capacity is supported by the presence of three universities with bioscience programs, several not-for-profit research institutions as well as federal research institutions in forestry, agriculture, fisheries and bio-informatics, all of which are conducting research relevant to the bioscience sector. Establishment of appropriate linkages between the research community and industry will help enable this research to be commercialized into revenue streams for both

researchers and industry. To facilitate commercialization of bioscience research, the provincial government will continue to work closely with partners, including university, college and research institution technology transfer offices, to identify and link industry stakeholders with researchers.

While bioscience companies play a large role in bringing products/technologies to the market, researchers also play an integral role in new product/technology development. Good partnerships and networking between researchers working in similar fields at a regional, national or international level are critical to the success of bioscience R&D. Such partnerships are prevalent in New Brunswick's public research institutions; 11 out of New Brunswick's 13 public research institutions partner internationally. This outreach helps increase capacity and visibility in bioscience research. Currently, research institutions in New Brunswick hold 11 patents, including three in Europe and two in Asia, with the remainder split between Canada and the United States. Strategic actions will focus on helping researchers market and licence these patent to generate production revenue streams.

Government programming to support R&D investments and productivity improvements continues to be important. Working together with industry and federal partners, the provincial government will encourage continued investments in innovation. Ensuring a coordinated approach to funding will enable all partners to maximize the impact of their investment. Government will assist industry to understand the competitive environment and to identify new opportunities to enable development of new bio-products and services. The Province will also continue to work closely with the federal government to strengthen research capacity to help bioscience companies and new entrants continue their R&D efforts through facilities such as the Coastal Zones Research Institute in Shippagan, the Huntsman Marine Science Centre in St. Andrews, the CCNB Centre d'excellence en sciences agricoles et biotechnologiques in Grand Falls, as well as the Potato Research Centre, the Wood Science and Technology Centre and the Research and Productivity Council in Fredericton.

Strategic Objectives - Innovation and Productivity

- a) Stimulate more investment in bioscience research and technology adoption by New Brunswick businesses.
 - i. Support acquisition and adoption of equipment/technology to enable the production of value-added bioproducts and services.
- b) Promote a coordinated approach to bioscience business development from concept to commercialization.
 - i. Identify new technologies and products under development and actively seek commercialization opportunities.

3. Business Environment and Regional Cooperation

As an emerging, research-intensive industry, the cost of conducting research, the transparency of regulatory policies, and the visibility and recognition of the sector as an economic engine are

important factors that form the basics of the business environment. To support development of the bioscience sector it is important for all partners, including BioAtlantech as an industry champion, to work collaboratively to attract investment, work with partners both within and outside the province to mobilize and coordinate research activity, and minimize barriers to development.

To ensure that research costs remain competitive with other jurisdictions, the provincial government and partners support industry with financial assistance as well as research capacity. The federal and provincial governments combine to offer one of the most generous R&D tax credits in the world. Research funding to support different stages of product development, especially the critical prototype development and product demonstration stages, is offered through the New Brunswick Innovation Foundation. The federal Atlantic Innovation Fund and National Research Council (NRC)-Industrial Research Assistance Program provide funding for projects near or at the commercialization stage. Organizations such as the Regional Health Authorities, the Atlantic Cancer Research Institute and the NRC-Institute for Information Technology lab located in Moncton, as well as two satellite medical schools in Moncton and Saint John, provide the infrastructure capacity to support bioscience research in the health field. The enabling agriculture research and innovation component of the Growing Forward program provides assistance with funding to move activities through to the pre-commercialization or pre-adoption phase in support of the development of new agri-products, processes and practices.

The creation of strategic business alliances with larger, established entities can be extremely important to enabling New Brunswick companies to commercialize their products and access markets. Such partnerships can help them access more capital or new technologies, experience and business contacts, and/or established marketing and sales channels.

The regulatory environment has a significant impact on the ability of a company to introduce new products and services to market. Depending on the nature of the products and technologies being developed, bioscience companies may have to deal with multiple agencies at both the provincial and federal levels. The process for regulatory approval can impact the ability of companies to react quickly to satisfy new demands for products; therefore a clear and efficient regulatory environment is critical to enabling growth in the sector. Regional cooperation through the Council of Atlantic Premiers may be an effective means for advocating for federal regulatory improvements. Policies to ensure crown allocation decisions regarding biomass are fair and transparent along with accurate information on the available supply are important to the overall business environment for biosciences.

Strategic Objectives - Business Environment and Regional Cooperation

- a) Promote New Brunswick's competitive business environment for the bioscience sector.
 - i. Develop a prospectus specific to bioscience for use in investment attraction.
- b) Facilitate the development of strategic business alliances.
 - i. Organize incoming and outgoing missions to meet with representatives of potential anchor companies.

- c) Ensure a regulatory environment that minimizes impediments to growth while addressing health and safety concerns.

4. Access to Capital and Infrastructure

Given that the bioscience sector is relatively new, companies often lack visibility among potential investors and have difficulty attracting capital. The fact that bioscience companies often lack tangible assets for securing creditors, as the sector is largely founded on human capital, compounds this challenge. This presents a significant hurdle for companies which may need to access several sources of funding through the full research, development and commercialization cycle of a product or service. Costs for some activities, such as clinical trials for health products, can be extremely high. In such cases there is a significant threat that companies may need to relocate to larger centres with more abundant capital.

Companies looking to diversify into the biosciences, both as a means to grow, and to complement or stabilize existing operations, need access to capital in order to make strategic investments in new infrastructure. This is the situation faced by primary fish processing plants looking to diversify into new bioproducts such as extracted pigments, proteins or other valuable by-products of processing waste.

To improve access to capital, actions will focus on promoting the industry and improving its visibility to potential investors. Recognizing that the industry faces a number of challenges as noted earlier, the provincial government will work with its partners to continue to offer flexible programming to help mitigate the financial challenges. The New Brunswick Innovation Foundation is an important potential source of investment for companies in the sector.

In addition to direct funding, the Province will also work with partners to develop the business case for specific infrastructure investments. For instance, a multi-user, state-of-the-art wet lab facility with a full suite of business services, as well as growing facilities which meet regulatory requirements for plant and animals produced using biotechnology, would serve to enable existing businesses and attract new ones. Such investments would require a fully developed business case in order to demonstrate that private and public investments are justified and are economically sound.

Strategic Objectives - Access to Capital and Infrastructure

- a) Create a venture capital fund available to bioscience companies.
 - i. Work with the other Atlantic Provinces to establish a Venture Capital Fund that provides funding to bioscience companies.
- b) Strengthen strategic infrastructure capacity.
- c) Improve access to current funding programs.
 - i. Finalize and promote the availability of the bioscience funding portal as a tool to assist companies to develop their business cases and access funding.

5. Market Access

The United States is the leading export market for bioscience companies, followed by Europe and Asia. According to the 2008 study by The Agricola Group and BioAtlantech, bioscience companies generated almost half their revenues from international sales. International opportunities will likely come from both developing and industrialized markets. Developing markets may be looking for bioscience technologies, for example, to support infrastructure investments in water purification and sewage treatment. In more mature markets such as Europe, the demand may be more for environmentally-friendly or health-promoting bio-based consumer products such as cosmetics and food supplements. In third world countries, there will be a demand for agricultural products which have been improved to increase production yields to feed and heal the population.

Provincial efforts to improve market readiness will focus on collecting and disseminating research to companies, including trends, competitors and technologies. Activities will also focus on helping to ensure that companies are aware of required certification for selling some products and services in international markets.

There are also considerable market opportunities for bioscience companies to support traditional industries in New Brunswick. For example, bioscience applications that improve fish health and develop new value streams from fish by-products can significantly strengthen New Brunswick's aquaculture industry. In order to realize these opportunities, the Province can play a role by building research awareness and industry intelligence in order to match researchers with company leaders in traditional industries such as fishing, forestry and agriculture.

Strategic Objectives – Market Access

- a) Improve access to new export markets.
 - i. Organize trade missions and facilitate participation at domestic and international conferences.
- b) Support companies seeking to meet regulatory and certification requirements for market access.
 - i. Support certification initiatives to ensure compliance with regulatory requirements.

Performance Measurement

Key indicators for the biosciences sector that will be used to assess performance over the duration of the strategy include Gross Domestic Product, employment and productivity. At this time, reliable statistics to benchmark the sector in New Brunswick are not available. Completion of an asset map as a priority activity under this strategy will establish the baseline information required for comparison in subsequent years. Prince Edward Island and Québec have been identified as potential jurisdictions to be used for performance comparison purposes.