Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

AGRICULTURE AND AGRI-FOOD CANADA

SCIENCE & INNOVATION STRATEGY

Canada

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Why Government Invests in Agriculture

The Canadian agriculture and agri-food industry is a cornerstone of our economic and social fabric. The sector is a key contributor to the high quality of life enjoyed by citizens across the country. It is vital to our nation's economic success, currently producing some eight per cent of our gross domestic product (GDP), and accounting for one in eight jobs nationwide. Primary agriculture is the second largest primary sector in Canada based on GDP. Food and beverage processing is the largest manufacturing sector in seven of our ten provinces, and is the second largest manufacturing sector in Canada. Productivity performance growth in most sectors of the agriculture and agri-food industry has been exceeding the overall business sector average. Through corporate tax revenues and direct and indirect employment, the agriculture industry makes a valuable contribution to our ability to finance social programs and other initiatives.

Further, the industry's successes are a very visible source of national pride, indicative of the technological capability of the country as a whole.

As well, the agriculture and agri-food industry is important to Canada's position globally. The Canadian agriculture and agri-food system is increasingly internationally focused, both in terms of investment and trade. Accumulated foreign direct investment in the Canadian agriculture and agri-food sector has more than doubled since 1990. And, despite challenges to exports for red meats, Canada was the fifth largest exporter of agriculture and agri-food products in the world in 2004. As such, the industry is an important source of foreign exchange and a positive contributor to Canada's balance of payments.

Most governments around the world invest in their agriculture and agri-food industries for food security reasons, for economic reasons, and to attain national policy objectives. Canadian investment in the agriculture industry also meets some key economic and social policy objectives:

Food Safety:
Stewardship of the system for safe and secure food production and distribution.

Economic Prosperity:
Supports the government's goal for a growing and prosperous economy, and regional economic development.

Quality of Life:
Contributing to a sustainable agriculture sector, contributing directly to the nation's standard of living.

Understanding and Protecting Canada's Environment:
Helping to achieve environmental and sustainable development goals.

Contributing to Canada's International Roles and Responsibilities: Supporting Canada's place in the world.

TABLE OF CONTENTS

AAFC SCIENCE AND INNOVATION STRATEGY

EXECUTIVE SUMMARY

A | INTRODUCTION

The Canadian agriculture and agri-food industry accounts for just over eight percent of Canada's Gross Domestic Product, $26.5 billion of which comes from exports (ranking fifth worldwide). As well, the industry provides one in eight Canadian jobs, employing nearly 2.1 million persons. The industry's importance also transcends economic terms. Global trends are remarkable in their depth and breadth and occur with great rapidity, redistributing power, knowledge, and resources. Such influences are particularly important to trading nations, such as Canada, whose priorities are shaped by what goes on in the world. By its nature, agriculture is integrally connected to the solutions to most emerging national issues, such as infectious diseases, future energy supply concerns, the health deficit, climate change and terrorism. Agriculture's connection to these priorities falls into the following primary themes:

- Public health, safety and security – the link between food, nutrition, health and wellness; the safety and security of our capacity to produce food
- Environmental sustainability and stewardship – agricultural management practices that enhance environmental stewardship, and advancing new bioproducts and bioprocess technologies to enhance the Climate Change performance of the energy, natural resources, transportation, construction and agri-food sectors in particular;
- Energy – to generate energy directly from the use of biomass (e.g. bio-ethanol, bio-diesel, biogas) and indirectly from the use of bioprocess technologies (anaerobic digestion, pyrolysis, gasification); and,
- Global economic competition – the application of agriculture science and innovation to support Canadian farms' and agri-industries' international competitiveness and productivity in this significant export sector.

Yet, global agriculture is at a crossroads, having undergone radical transformation, both structurally and technologically, in the latter half of the 20th Century. Advances in agricultural science and technology have increased international competition, with each stage of the agriculture system driving out operational costs, becoming more consolidated and larger in operational scale. Decreasing commodity prices, caused in part by over supply; in turn caused in part by more advanced production methods and technologies; and the declining profitability puts increased pressure to produce more and remove further operational costs. As a result of this spiral effect, farm profitability, sustainable growth, competitiveness of the sector and the economic success of rural communities have all deteriorated significantly. More than ever before, industry stakeholders are raising the alarm that a new sense of urgency has arrived, with a growing call for change to our industry.

New knowledge discovery and its application is part of the solution. Science generates knowledge about how significant societal challenges may be addressed, and on which the sector can build innovations to enhance productivity and competitiveness – to achieve greater job creation, profitability and wealth creation. Innovation transforms the knowledge into benefits for Canadians, involving the processes by which ideas for new (or improved) products, processes, or services are developed and commercialized in the marketplace (i.e. innovation is only successful when knowledge leads to change in the way things are done or a product that is diffused in the marketplace).

New knowledge needs to fuel Canadian innovation that, in turn, affects every aspect of food and non-food production, changing the way Canadians grow, process, preserve, transport, distribute, and use the products derived from agriculture. In other words, new discoveries and their application are crucial to ensuring Canadian farmers and the Canadian public benefit from Canada's natural advantage, i.e. its ability to produce food and an ever-increasing range of non-food products from the land. Examples of these new applications include new bio-materials, bio-medical and bio-health products, bio-fuels, bio-energy, bio-chemicals, and bio-pharmaceuticals.

While there is a good foundation and capacity for innovation in Canada, our ability to capture the benefits of our science investments will require renewed thinking about how we work together, how we optimize the use of our scientific resources and how we manage our investments in science and technology to ensure returns across the innovation value chain.

To continue on this path, we need to focus on new priorities, new challenges and new opportunities, and to build new critical mass and to develop new partnerships among Canada's university, government and industrial sectors to enhance returns on investments in science and innovation. Innovation efforts must also be supported by the development of a coordinated and enabling public policy and regulatory framework that keeps pace with the advances in science and technology.

As one of the most significant contributors to agricultural science and technology research in Canada, Agriculture and Agri-Food Canada (AAFC) is committed to ensuring that the right investments are made in science and innovation, and that research focuses on the right priorities at the right time, for the benefit of Canada's agriculture and agri-food sector and all Canadians. AAFC has been providing solutions for agriculture, rural communities and Canadians for over 120 years. We have adapted our expertise and our efforts to address new challenges and opportunities as they arose. Responding to the current agriculture industry's "crisis call" and providing solutions for the new challenges and opportunities facing the sector and Canadians is driving a new era of adaptation and focus at AAFC.

B | SCIENCE CONSULTATIONS WITH THE SECTOR

We began this new era by consulting approximately 300 representatives from Canadian producer organizations, processors, provincial and municipal governments, and other stakeholder groups in eleven regional consultation sessions in October-November 2005. These regional consultations culminated in the first national Agriculture Science and Innovation Symposium, held in Gatineau, Quebec on November 22-23, 2005 and attended by some 120 senior officials from agriculture, agri-industry, universities, provincial government, and other federal departments and agencies. Their input formed a key guide to the development of the Strategic Goals and Objectives of this AAFC Science and Innovation (S&I) Strategy, communicated below.

Producers, processors and other stakeholders expressed a clear set of expectations:

- **Producers** want new opportunities that increase their farm income
- **Processors** want value-added food products, and new uses for agricultural production, new products and new markets
- **Consumers** (domestically and globally) want increased assurance of the safety and quality of the food system and enhanced environmental performance of the agriculture and agri-food sector; and are leading a strong "going green" focus
- **Provinces and rural communities** want economic development opportunities from agriculture

Key messages guided the development of the AAFC strategic plan:

1. Do the right things – focus on national priorities.
2. Do things right – ensure excellence in science.
3. Catalyze a healthy, vibrant agriculture industry and rural economies.
4. Meet the innovation challenge.
5. Enhance agriculture industry importance to Canada.
6. Establish continuous consultation and strategic advice mechanisms.
7. Provide scientific and technical support to decision-making.

A summary of comments and advice from the various consultations and the proceedings of the Symposium are available under "Science Consultations" on the AAFC web-site at www.agr.gc.ca/science-consultations.

Resoundingly, the clearest message was that the status quo is no longer acceptable. Our response to their feedback is best summarized in the table below – our six key change messages.

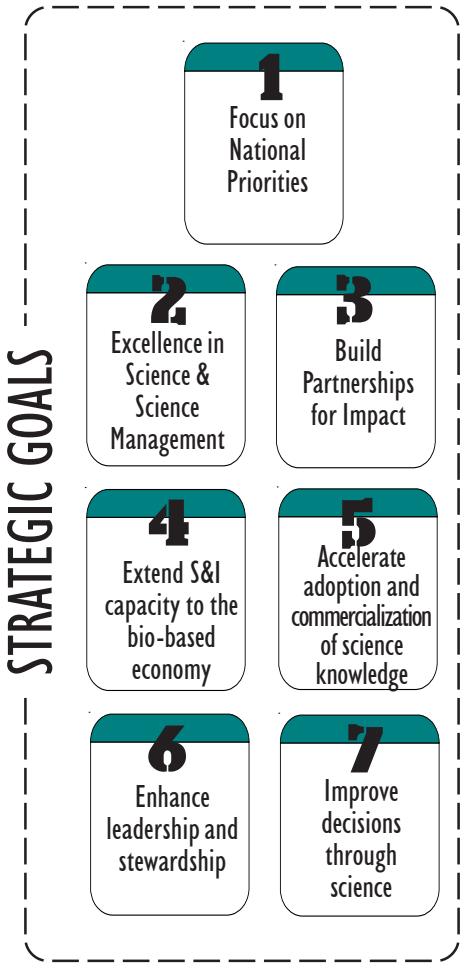
An unrelenting focus on excellent science and the impact of our outputs will ensure our industry's ability to address its many challenges for years to come. We will increasingly demand of ourselves not only science excellence, but also management and operational excellence – and, more importantly, a commitment to provide leadership to build the same excellence in innovation with Canada's agriculture and rural stakeholders.

We have agreed on the key change messages that will help us get there. We recognize, however, that real change does not happen easily or quickly, but requires sustained committed leadership.

SIX KEY CHANGE MESSAGES

1. AAFC will align its research efforts with existing and emerging national priorities.
2. All science and innovation investments will be reviewed against a set of clear principles and criteria. Resources will be focused on multi-year, peer-reviewed programs.
3. Benefits for all Canadians will be enhanced through new coordination, cooperation and partnership strategies and architectures with other federal and provincial departments and agencies, academic institutions and industrial organizations.
4. AAFC research will stimulate creation of new bio-based products that generate economic, social and environmental benefits.
5. AAFC will play a leadership role establishing science and innovation clusters that bring together stakeholders to form complete innovation chains that maximize the benefits to participants, communities and Canadians.
6. AAFC will be a leader in science and innovation in emerging sectors of the bio-economy; while continuing to be a reliable partner that complements efforts of other organizations in more mature sectors.

C|AAFC S&I STRATEGIC GOALS AND OBJECTIVES



Goal #1:
Focusing Our Science and Innovation Investment on National Priorities

AAFC investments in science and innovation must seek an appropriate balance among existing and new markets and products and between public and private investment along the innovation chain from scientific discovery through final product commercialization or adoption of new tools or practices. Within this Strategic Goal, the major objectives are to:

1. Play a leadership role in addressing national priorities
2. Continue to provide sector support in areas where no other science and research suppliers exist
3. Champion flagship projects to improve the lives of Canadians and advance Canada's industrial base
4. Support leading-edge, future-looking research searching for revolutionary new ideas and knowledge

Goal #2:
Excellence in Science and Science Management

To achieve our goals for the sector will require a commitment to pursue excellence in conducting and managing our science and research efforts. We will pursue innovative improvements in the way we plan our research, in our processes, principles and criteria for selecting investments, and in the application of our skills and abilities and research management processes when conducting research projects. Within this Strategic Goal, the major objectives are to pursue continuous improvement in:

1. Research Planning, Reporting and Management systems
2. Developing and applying the highest and best standards of scientific excellence

Goal #3:
Partnering For Impact

One of the key foundations to AAFC's S&I Strategy will be to provide a "return on investment" to Canadians. In this context, important outcomes that can be achieved include a strengthening of Canada's agricultural producers and small and medium-sized enterprises (SMEs), the rural economies in which they operate, the knowledge base that is the foundation for innovation, and our ability to sustain regional innovation clusters in the future.

1. To build strong science-supported rural clusters, more directly supporting agricultural producers and SMEs
2. To integrate Canada's national agriculture clusters with strengths and priorities of rural economic environments
3. To focus and intensify S&I collaboration with universities, government departments and agencies, and other organizations

Goal #4:
Extending Integrated National Science and Innovation Capacity to the bio-based economy

Ensuring there are no gaps in the essential science and innovation capacity within the national system to support sustainable profitability and growth of the Canadian agriculture and agri-food sector in the 21st century is our commitment.

Bioproduct innovation is intensely science and technology driven. Novel, competitive, inexpensive, high-quality bioproduct and bioprocess development will require the work of many scientific disciplines and sectors of society. Collectively, we face a number of challenges in supporting these new science-based opportunities for the sector: new skills and abilities are needed; world class infrastructure and facilities, and, most importantly, partnerships among government, universities and private enterprise that promote multidisciplinary approaches and provide development opportunities for Canada's young scientists. Within this Strategic Goal, the major objectives are:

1. For people, to commit to skills development
2. For infrastructure, to expand capacities at facilities across Canada
3. For funding, to increase support along the innovation chain
4. For partnership, to structure deeper and more meaningful relationships with industrial partners

Goal #5:
Accelerating adoption and commercialization of scientific knowledge

This Strategic Goal is focused on activities that will speed the rate at which scientific knowledge and technologies are adopted and commercialized to enhance the return on public investments in agricultural R&D.

1. Develop and streamline administrative processes
2. Focus S&I programming on building value chains and supporting commercialization strategies
3. Promote industry understanding of science-based opportunities and build networks that speed innovation and commercialization

Goal #6:
Enhancing Strong Leadership and Stewardship supported by enhanced cooperation and communication mechanisms

This Strategic Goal is focused on the continuation of stakeholder engagement and stewardship in the process of maintaining Canada's excellence in science and innovative performance, ensuring that AAFC's S&I Strategy will continue to reflect the priorities of Canadians. Within this Strategic Goal, the major objectives are:

1. To increase collaborations with domestic agriculture organizations, consortia and innovation centres
2. To enhance communication to raise stakeholder engagement in priority setting
3. Play a leadership role in developing S&I strategy and stewardship of its implementation

Goal #7: Providing Science Knowledge and Advice

This Strategic Goal is focused on ensuring informed decision-making by government, industry and Canadians through better understanding of science and research results and their implications. Making our science and research results accessible by the global science and research community contributes to the advancement of knowledge for the benefit of all. Within this Strategic Goal, the major objective is:

1. To develop and implement a science communications strategy – ensure the dissemination of accurate and timely scientific knowledge and advice to enable informed decision-making by:
   - government policy and program decision-makers
   - agriculture and agri-food sector decision-makers
   - communities of interest on specific issues
   - global science and research communities

D | Principles and Criteria for Science and Innovation Investment

AAFC is tailoring our Science and Innovation Strategy to meet the needs of our stakeholders more directly, applying our knowledge and capacities in agriculture science to respond to their priorities. This process of greater engagement and commitment to address broad challenges is reshaping the conduct of science in research organizations throughout government and other public sector research organizations. Collectively, there is an understanding that the demands for collaboration and inter-disciplinary effort are fast becoming the status quo, and a common focus on broader challenges is becoming the common framework for all stakeholders.

AAFC is committed to providing leadership for Canada's agriculture industry, ensuring that the broader science and innovation resources are leveraged to address this industry's most meaningful challenges and opportunities. Our stakeholders have given us a clear message. This is a time for change, a time to demonstrate tangible results for the Canadian public. We are responding to that message.

AAFC will address priorities through a combination of its own capacity and partnership with other research providers to build critical mass and the right teams with complementary skills. AAFC will work on ways to encourage collaboration, including mechanisms to facilitate sharing of human resources, facilities and equipment, and funding. Potential partners include:

- other government departments with whom we share common goals, a complementary mandate and expertise;
- universities, where a wide range of disciplines and interests are fostered
- industry, where the capacity exists, along with ability and desire to translate knowledge into innovation.

These partners may be domestic or international. AAFC will pursue domestic partners where capabilities exist and can be enhanced. Internationally, AAFC will pursue partnerships where technologies of interest already exist; to share our technologies so that they can be improved; and to develop opportunities to raise and expand Canada's global influence and enhance trade relations.

To ensure that Canadians are recognized for having among the world's best science, AAFC will apply the highest standards for science excellence. Every one of our projects or programs will be reviewed against a set of clear and transparent criteria. These will include:

- Scientific excellence
- Focus on addressing national priorities
- Focus on generating critical mass of R&D in areas that have the potential to make a sustainable difference for the agriculture and agri-food sector, for Canada and Canadians
- Capability for technology transfer
- Ability to achieve appropriate policy and regulatory environment
- Capacity for innovation and advancement of knowledge
- Focus on projects that engage the required elements for a complete innovation chain
- Focus on engaging the federal, provincial, academic and industrial collaborators and partners needed to create innovation chains that will deliver significant results

> AAFC is committed to providing leadership for Canada's agriculture industry, ensuring that the broader science and innovation resources are leveraged to address this industry's most meaningful challenges and opportunities. Our stakeholders have given us a clear message. This is a time for change, a time to demonstrate tangible results for the Canadian public. We are responding to that message.

1 | INTRODUCTION

Global agriculture experienced a radical transformation, both structurally and technologically, in the latter half of the 20th century. Driven by advances in science and technology, the pace of change will undoubtedly continue to accelerate in the years to come.

With this change come challenges and new opportunities for Canada and the Canadian agriculture and agri-food sector. A number of socio-economic factors are driving Canada's agriculture science agenda. They include Canada's relatively small domestic market base that contributes to a high dependence on international trade; the emergence of new partners and competitors, including China and India; environmental sustainability and the effects of climate change; public health and security issues.

To address burgeoning health care costs, increasing emphasis will be put on how food and nutrition can play a role in preventative health care management. To address the rising cost of fossil fuels that continue to pressure our industrial base, increasing emphasis will be put on diversifying energy and industrial feedstocks derived from renewable resources. If Canada's economy, both rural and urban, is to benefit from its wealth of natural resources, innovation will be needed to add "knowledge content" to the products of the land.

Science and innovation are priorities for the Government of Canada. Science generates knowledge – science creates knowledge on which the sector can build innovations to enhance profitability. Innovation transforms knowledge into benefits for Canadians – innovation involves the processes by which ideas for new (or improved) products, processes or services are developed and commercialized in the marketplace (i.e. innovation is only successful when knowledge leads to change in the way things are done or a product that is diffused in the marketplace).

In the agriculture and agri-food sector, new discoveries and their application will be crucial to ensuring Canadian farmers and the Canadian public benefit from Canada's natural advantage, i.e. its ability to produce food and an ever increasing range of products from the land. Research fuels innovation that in turn affects every aspect of food and non-food production, changing the way Canadians grow, process, preserve, transport, distribute and use the products derived from agriculture.

The federal government's vision for science includes focused science and technology programs, a talented and committed workforce, state-of-the-art equipment, partnerships and networks to leverage resources and research capacity, and an enabling administrative, fiscal and regulatory environment.

There is a good foundation and capacity for innovation in Canada, with many success stories to the agriculture and agri-food sector's credit. New science and innovation, will allow agriculture to expand beyond food and feed to include biomaterials, bio-medical and bio-health products, bio-energy, bio-chemicals and bio-pharmaceuticals.

Canadian products need to compete on the basis of quality, safety, and environmental attributes, as well as knowledge content to better respond to changing consumer demands. The ability to enter new markets quickly will also be of critical importance.

Farm profitability, sustainable growth, competitiveness of the sector and the economic success of rural communities will depend on how we collectively respond to these challenges and opportunities. Key elements of that response will be found through new knowledge discovery and its application.

But to fully reap the potential yield of new products, new uses, new markets and new solutions to significant national problems, will require renewed thinking about how we work together, how we optimize the use of our scientific resources and how we manage our investments in science and technology to ensure returns across the value chain.

To continue on this path, we need to focus on priorities, to build critical mass and to develop partnerships with Canada's university, government and industrial sectors to enhance returns on investments in science and innovation. Innovation efforts must also be supported by the development of a coordinated and enabling public policy and regulatory framework.

Agriculture and Agri-Food Canada (AAFC) is an important contributor to agricultural science and technology research in Canada. AAFC is committed to ensuring that the right investments are made in science and innovation, and that research focuses on the right priorities at the right time, for the benefit of Canada's agriculture and agri-food sector and all Canadians.

AAFC has been providing solutions for agriculture, rural communities and Canadians for over 120 years. We have adapted our expertise and our efforts to address new challenges and opportunities as they arose. Responding to the current agriculture industry's "crisis call" and providing solutions for the new challenges and opportunities facing the sector and Canadians is driving a new era of adaptation and focus at AAFC. An unrelenting focus on excellent science and the impact of our outputs will ensure our relevance for years to come. We will demand of ourselves science excellence, management excellence and operational excellence. We have agreed on the key change messages that will help us get there. We recognize, however, that real change does not happen easily or quickly, but requires sustained committed leadership.

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5. AAFC will play a leadership role establishing science and innovation clusters that bring together stakeholders to form complete innovation chains that maximize the benefits to participants, communities and Canadians.
6. AAFC will be a leader in science and innovation in emerging sectors of the bio-economy; while continuing to be a reliable partner that complements efforts of other organizations in more mature sectors.

II | CONSULTATION WITH THE SECTOR

The input of stakeholders is an important element in the development of an AAFC Science Strategy. In 2005, stakeholder opinion and feedback were collected through a number of consultation initiatives:

- Approximately 300 representatives from producer organizations, processors, provincial and municipal governments, and stakeholder groups met in eleven regional consultation sessions in October-November 2005. Consultations sought stakeholder feedback and advice on the results of the AAFC science review, our science focus, proposed science direction and research priorities, and the role of government in meeting the changing needs of the sector.

- The first AAFC Agriculture Science and Innovation Symposium was held in Gatineau, Quebec, on November 22-23, 2005; it was attended by some 120 senior officials from producer, processor, and other agri-industry organizations, and provincial, university, and other federal department representatives.

- Approximately 40 bilateral consultations with stakeholder organizations were conducted over the summer and fall of 2005.

- In addition, all Canadians had the opportunity to offer input through web-based consultations on the AAFC web-site.

Throughout these consultations, producers, processors and other stakeholders expressed a clear set of expectations and directions:

Expectations

- **Producers** want new opportunities that increase their farm income
- **Processors** want value-added food products, and new uses for agricultural production, new products and new markets
- **Consumers** (domestically and globally) want increased assurance of the safety and quality of the food system and enhanced environmental performance of the agriculture and agri-food sector; and are leading a strong "going green" focus
- **Provinces and rural communities** want economic development opportunities from agriculture

Directions

- Enhancing **farm profitability and sector competitiveness** through innovative and sustainable production systems
- Enhancing **human health and wellness** through food and nutrition
- Enhancing **food safety and biosecurity** of the agriculture and agri-food system
- Understanding the nature and potential of Canadian **bio-resources**
- Enhancing sector **environmental performance** in cost effective ways
- Developing **new opportunities** for agriculture **from bio-resources**

A summary of comments and advice from the various consultations and the proceedings of the Symposium are available under "Science Consultations" on the AAFC web-site at **www.agr.gc.ca/science-consultations.**

Consultation feedback is summarized by the following messages that guided the development of this strategic plan:

1. Do the right things. Focus AAFC science and innovation efforts on national priorities identified by the agriculture and agri-food sector, the department, economic stakeholders and the Government of Canada. Ensure continued relevance through ongoing consultations.

2. Do things right. Ensure that research undertaken is conducted in a manner consistent with achieving excellence in science. Select, monitor and evaluate science research using the highest standards. Implement excellent science management practices. Ensure accountability every step of the way.

3. Catalyze a healthy, vibrant agriculture industry and rural economies. Transform AAFC research outputs into technology and know-how that serve the Canadian agri-food sector and build our global competitive advantage, particularly around agri-food and bio-product quality attributes and sustainability.

4. Meet the Innovation Challenge. Play a leadership role in developing value chains and accelerating the rate of adoption and commercialization of scientific knowledge. Focus on enhancing farm profitability, sector growth and competitiveness as well as rural community economic development.

5. Enhance the relative importance of the agriculture industry to Canada's overall economic activity and global standing. Work with partners to develop agri-based solutions for government and industry that address policy objectives in health care, environment, energy, biosecurity, food safety and quality, rural community development and international trade.

6. Establish continuous consultation and strategic advice mechanisms. Ongoing advice from stakeholders will be crucial to ensuring continued focus on the "right things." Commit to listening to stakeholders, and establish regular stakeholder consultations and feedback mechanisms. Play a leadership role in overseeing the development of a national agriculture S&I Strategy and stewardship of its implementation.

7. Provide necessary scientific and technical competencies and knowledge to support decision-making by government, industry and Canadians. Provide a scientific basis for credible, flexible and timely policy, program and regulatory development.

The stakeholders' vision for the development of the agriculture and agri-food sector is expressed as follows:

AGRICULTURE AND AGRI-FOOD SECTOR VISION 2010–2025

Short-term:
Innovative products and services from sustainable agricultural production systems provide solutions that enhance human, animal and environmental health and wellness, enhance our energy sources, mitigate climate change, and improve the quality of life of both rural and urban Canadians.

Medium-term:
Canadian global competitiveness is based on the production of differentiated products from our bioresource base that meet or exceed global market requirements.

Long-term:
Agriculture is the key economic driver of the Canadian and rural economies as the bio-economy and sustainable development replace the non-renewable economy.

III | AAFC STRATEGIC GOALS AND OBJECTIVES FOR SCIENCE & INNOVATION

Overview

An essential principle underlying the development of AAFC's S&I strategy is a focus on supporting a strong Canadian industry. Sustainable production and the development of value-added products will contribute to economic prosperity of farmers, the agri-food sector, rural communities and Canadians. Based on advances in science and technology, agriculture has increasing opportunities to provide solutions to key national socio-economic problems, including rising health care costs, energy and greenhouse gas production, environment sustainability, and security. The health sector and the energy sector in particular are areas that hold great potential to "create, capture and deliver value."

It is important to develop new ways of working with other organizations, new business models and new collaborations, particularly with non-traditional partners outside of agriculture. In the future, agriculture will have increased opportunities to take advantage of scientific breakthroughs from nanotechnology, genomics, biotechnology, medicine, chemistry, physics, and other areas.

The goals for AAFC's S&I Strategy arise from our consultation process. Together, they form a comprehensive and integrated set of objectives that guide the creation of a foundation for growth that addresses the areas of concern to our stakeholders, as well as our ability to deliver them. The strategic goals are:

1. Focusing our science and innovation investment – tightening the linkage between our science and innovation investment portfolio and national priorities;

2. Delivering world-class science and science management – enhancing our global reputation for science excellence;

3. Partnering for impact – addressing the need to catalyze a healthy, vibrant agriculture industry and rural economies; providing scientific knowledge to support public priorities and develop agri-based solutions for government and industry that address policy objectives in health care, environment, energy, biosecurity, food safety and quality, rural community development and international trade;

4. Extending integrated national science and innovation capacity to the bio-based economy – working with science partners to ensure that the Canadian agriculture and agri-food sector has access to the science capabilities needed to support sustainable profitability and growth in the 21st century;

5. Accelerate the adoption and commercialization of scientific knowledge – Serve as catalyst for industry innovation results addressing the need to: delivering commercial impact for Canadian industry; preparing Canadian industry to receive the benefits of our S&I results;

6. Enhancing strong leadership and stewardship – addressing the need for continued consultations and strategic advice; and

7. Improve decision-making through science knowledge and advice – ensuring government, industry and public decision-making is informed by science and research results and implications. Develop effective science communications.

Figure 1: Overview of Canada's Agriculture and Agri-Food S&I Strategy

AAFC SCIENCE AND INNOVATION STRATEGY

GOAL 1: focus science and innovation investment on national priorities

AAFC investments in science and innovation must seek an appropriate balance:

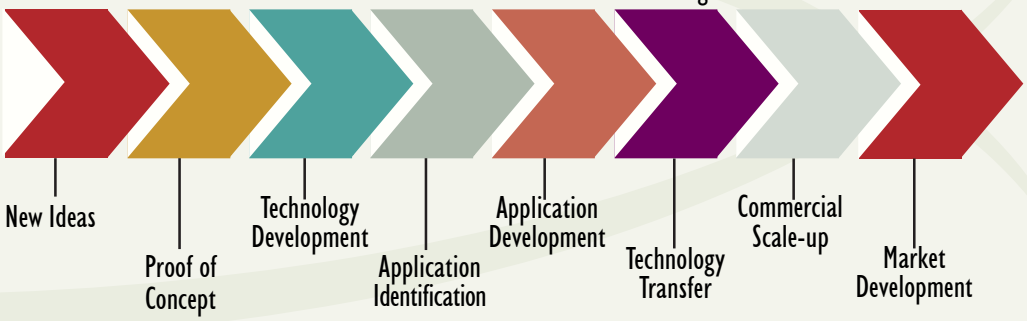
- among the four quadrants in the market-products matrix . . .

Figure 2 The Market Products Matrix

. . . and

- between public and private investment along the innovation chain from scientific discovery through final product commercialization or adoption of new tools or practices.

Figure 3 The Innovation Chain



1 Play a leadership role in addressing national priorities

Our stakeholder consultations identified outcomes that are nationally important to the agriculture and agri-food sector and Canadians. The following seven priorities reflect areas of opportunity where science and innovation are needed to achieve these national objectives and where AAFC has a mandate to act. These priorities are:

1. **Enhance human health and wellness through food, nutrition and innovative products.**
   Health is a priority issue for governments and Canadians. Increased attention to disease prevention and wellness to reduce health care costs over the long-term are becoming a national strategic focus. AAFC has a role to play in discovering bioactive molecules and in using scientific knowledge to help develop new, healthy food products that improve nutrition and wellness in the population. Our focus is on improved understanding of the link between food, nutrition, health and wellness leading to increased opportunities for agriculture in producing foods and nutraceuticals and other innovative health related products.

2. **Enhance the quality of food and the safety of the food system.**
   The safety of the food system is a responsibility of government. The Canadian Food Inspection Agency inspects the food system to enforce standards. AAFC has a responsibility to work with the sector to develop tracking and tracing systems tools and techniques as well as food safety tools, technologies and practices. AAFC develops diagnostic tools and performs research to better understand the identification, mode of action and control mechanisms that help to reduce food borne hazards including toxins, residues, contaminants, pathogens and allergens.
   In addition, research on quality preservation and enhancement strategies and practices help position Canada as a world leader in this area.

3. **Enhance security and protection of the food supply.**
   Detection, monitoring and control of threats to the safety of the food supply are of increasing concern to government and Canadians. AAFC's role is in the development and application of physical and biological systems models to predict the probable spread, behaviour and impact of threats to the security and protection of Canadian food production and distribution systems. AAFC science and research enhances Canadian capability to detect and mitigate threats to the security and protection of Canadian food production and distribution systems. This starts with research that helps to understand causal agents of potential and emerging threats.

4. **Enhance economic benefits for all stakeholders.**
   Expanding the horizons of agricultural research beyond ongoing focus on the efficiency of current production systems to explore new production opportunities and practices and the prospects for total product utilization will help to position agriculture as a key economic driver of the Canadian and rural economies. AAFC science and research will focus on providing agri-based solutions to national issues and priorities while seeking opportunities to enhance the profitability and competitiveness of farmers, the agri-food system, rural communities and Canadian industry.

5. **Enhance environmental performance of the Canadian agricultural system.**
   Environmentally responsible agricultural production and processing has both public and private benefits. Climate change and greenhouse gas reductions are a current priority. Water is an emerging priority from both a quality and availability perspective. Understanding and managing the interaction between commercial agriculture and natural eco-systems is an area of increasing interest. Adapting Canadian agriculture to changing climatic conditions is an emerging priority.

6. **Enhance understanding of Canadian bioresources and protecting and conserving their genetic diversity.**
   Developing authoritative information on the nature and characterization of Canadian bioresources is a core public good activity. This research provides a wealth of information that supports further work to achieve environmental, economic, social, and security objectives. Assembling, conserving and using working collections of bioresource information and investing in the facilities and practices to preserve the genetic diversity in Canada is a key focus for AAFC.

7. **Develop new opportunities for agriculture from bioresources.**
   New products, new uses, and new markets for agri-based biomass require research to develop strategies as well as tools, techniques, and processes that enhance total biomass utilization. Identification and development of bioplatforms for effective industrial development of agri-based ingredients and products as well as collaborative work in developing authoritative information on biorefinery processes will help to position agriculture and rural communities for future success.

2 Continue to provide sector support where no other science and research providers exist

Notwithstanding growth opportunities in new uses, new markets and new products from agriculture, ongoing support for existing products in existing markets is required now and in the foreseeable future. AAFC will continue our traditional role of providing support to the agriculture and agri-food sector with a focus on research endeavours where no other providers exist. Ensuring there are no gaps in the essential science and innovation capacity within the national system to support sustainable profitability and growth of the Canadian agriculture and agri-food sector in the 21st Century is our commitment. We will pursue new partnership opportunities and new means and mechanisms of accomplishing this objective.

3 Champion flagship projects to improve the lives of Canadians and advance Canada's industrial base

As Canada's traditional agriculture production faces increasing economic pressures, S&I advances must be sought that support Canadian producers' transition to newer, higher-value opportunities through new products with increased "knowledge content" that would also benefit rural economies. AAFC will pursue a leadership role with other national and international research providers in focussing on large-scale research projects with potential for significant transformative impact. The creation of research centres of excellence focused on creating new opportunities for the sector will have a catalytic effect for investment from stakeholders.

4 Conduct leading edge, future-looking research searching for revolutionary new ideas and knowledge

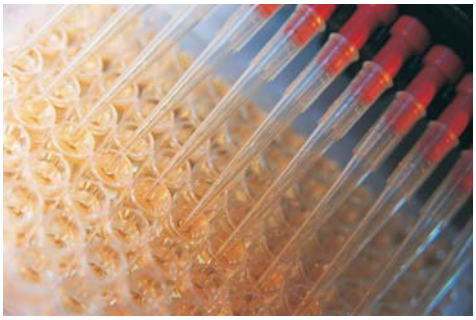
Investigator-driven, highly future-looking research is essential in the search for revolutionary new ideas and knowledge with the potential to confer strategic advantages to Canada. Such projects are inherently speculative and high-risk, with somewhat unclear implications for research results, but they are essential ingredients in positioning agriculture and Canada for future success.

GOAL 2: excellence in science and science management

To achieve our goals for the sector will require a commitment to pursue excellence in conducting and managing our science and research efforts. We will pursue innovative improvements in the way we plan our research, in our processes, principles and criteria for selecting investments, and in the application of our skills and abilities and research management processes when conducting research projects.

1 Developing and applying best practices in research planning, reporting and management

AAFC will seek continuous improvement in its practices and processes for research planning, reporting and management. We will pursue the development of the highest standards of excellence in research project management incorporating best practices and developing and using innovative planning and project management systems. Performance indicators will be developed and improved to ensure continuous monitoring of progress towards management and planning goals and objectives in addition to the tracking of research impacts on national priorities.



2 Apply the highest and best standards of scientific excellence

To ensure that Canadian science is recognized as being among the world's best, AAFC will pursue the highest standards for science excellence and the transparent review of our projects or programs against a set of clear criteria, including:

- Scientific excellence
- Focus on addressing national priorities
- Focus on generating critical mass of R&D in areas that have the potential to make a sustainable difference for the agriculture and agri-food sector, for Canada and Canadians
- Capability for technology transfer
- Ability to achieve appropriate policy and regulatory environment
- Capacity for innovation and advancement of knowledge
- Focus on projects that engage the required elements for a complete innovation chain
- Focus on engaging the federal, provincial, academic and industrial collaborators and partners needed to create innovation chains that will deliver significant results

GOAL 3: partnerships for impact

One of the key foundations to AAFC's S&I Strategy will be to provide a "return on investment" to Canadians. In this context, one of the more important outcomes that can be achieved is a strengthening of Canada's agricultural producers, small and medium-sized enterprises (SMEs), the rural economies in which they operate, the knowledge base that is the foundation for innovation, and our ability to sustain regional innovation clusters in the future.

Ensuring there are no gaps in the essential science and innovation capacity within the national system to support sustainable profitability and growth of the Canadian agriculture and agri-food sector in the 21st century is our commitment.

1 Build strong science-based rural clusters, more directly supporting agricultural producers and SMEs

Agriculture and Agri-Food Canada is an important source of funding and a producer of science and technology research in Canada. AAFC is committed to ensuring that the right investments are made in science and innovation, and that research focuses on the right priorities at the right time, for the benefit of Canada's agriculture and agri-food sector and all Canadians.

R&D organizations are increasingly focusing on integrated chains of innovation. The traditional separation of basic research, applied research, development, production and application must be overcome. Integrated product development processes, simultaneous engineering and the cross-functional integration spanning R&D, marketing and product production are key to innovation management.

There is growing recognition that regional innovation clusters are key to economic development. It is generally recognized that developed countries are moving from economies based on tangible (physical) assets to economies based on commercialization of ideas and knowledge. Economic success of the innovation chain is determined by a region's effectiveness in using its advantages to create and expand knowledge assets and to convert them into economic value.

In practice, this means the ways in which regional physical and human resources are mobilized and how new knowledge is transferred from the laboratory to production facilities will be key determinants of the economic success of the region.

2 Integrate Canada's national agriculture clusters with strengths and priorities of rural economic environments

Several changes in the innovation process have resulted in a new paradigm of national innovation that is significantly different from the traditional model. In contrast to the traditional path to innovation, the new paradigm of national innovation is characterized by:

- intense market and technology interaction;
- multiple centers of research and learning (at different geographical locations);
- cross-functional research (comprising different segments of the value chain);
- reverse and interactive technology transfer, between different geographical locations as well as between different functional units.

This model of national innovation builds on multiplicity and dispersion of competencies. This approach contributes to accelerated conversion of knowledge into marketable products, and their integration with advanced production systems, to enhanced interactivity between markets and research centers, and to the establishment of multiple centers of technology transfer. Because of this regional approach, R&D organizations will be in a position to react quickly to dynamic changes in economic, environmental and social challenges and opportunities based on their location advantages.

3 Focus and intensify S&I collaboration with universities, government departments and agencies, and other organizations

AAFC will address priorities through a combination of its own capacity and partnership with other research providers to build critical mass and the right teams with complementary skills. AAFC will work on ways to encourage collaboration, including mechanisms to facilitate sharing of human resources, facilities and equipment, and funding. Potential partners include:

- other government departments with whom we share common goals, a complementary mandate and expertise;
- universities, where a wide range of disciplines and interests are fostered
- industry, where the capacity exists, along with ability and desire to translate knowledge into innovation.

These partners may be domestic or international. AAFC will pursue domestic partners where capabilities exist and can be enhanced. Internationally, AAFC will pursue partnerships where technologies of interest already exist; to share our technologies so that they can be improved; and to develop opportunities to raise and expand Canada's global influence and enhance trade relations.

Partnerships are particularly beneficial as a means of optimizing investments in expertise and increasingly expensive and complex state-of-the-art facilities and equipment. Partnerships also facilitate and promote cross-discipline collaboration. Through the pursuit of strategic partnerships, greater opportunities may be garnered from the collective investments and efforts in science, research, technology and innovation in support of the agriculture and agri-food sector, Canadians and the government.

This integration through partnerships approach will lead to a number of benefits, including:

- improved joint planning and collaboration – partnering helps facilitate the collective identification and funding of priority research areas, thereby maximizing results for Canadians in areas of strategic national significance.
- improved efficiency and accountability – partnering helps eliminate duplication and overlap, thereby helping to maximize taxpayer dollars; partnering leads to improved operational efficiency and effectiveness of our collective national agriculture and agri-food research efforts; provides an integrated overview of funds allocated and spent on science activities; and sets out clear accountability for the appropriate management of those resources.
- optimization of physical, financial, and human resources – partnering provides critical mass to support priority areas of national importance, while contributing to the respective mandates of partners, thereby increasing our collective capacity to undertake research that is increasingly multidisciplinary, collaborative and complex.

A key objective in working through partnerships with other players and the sector is to ensure that essential capacities and capabilities are developed within the science and innovation system across Canada.

GOAL 4: extending our integrated national science and innovation capacity to the bio-based economy

Ensuring there are no gaps in the essential science and innovation capacity within the national system to support sustainable profitability and growth of the Canadian agriculture and agri-food sector in the 21st century is our commitment.

Bioproducts are strategically important to Canada. Major benefits can be derived from Canada's exceptionally large biomass resource. Canada is in an excellent position to benefit given its resource base, expertise and developing community-based eco-industrial clusters. The biomass opportunity will provide new revenue streams for the traditional agricultural and forestry sectors and communities. Bioproducts are poised to challenge petroleum-based products as the basis of the economy in the twenty-first century.

Bioproduct innovation is intensely science and technology driven. Breakthroughs in biological sciences and information technology are pushing the frontiers of science and research. Novel, competitive, inexpensive, high-quality bioproduct and bioprocess development will require the work of many scientific disciplines and sectors of society. Canada will need state-of-the-art infrastructure and facilities, and, most importantly, partnerships among government, universities and private enterprise that promote multidisciplinary approaches and provide development opportunities for Canada's young scientists.

Bio-based products have the potential to improve the sustainability of natural resources, environmental quality, and national security while competing economically. Agricultural and forest crops may serve as alternative feedstocks to fossil fuels, and serve to moderate price and supply fluctuations in international petroleum markets, and help to diversify feedstock sources that support the nation's industrial base. Some rural areas would be well positioned to support regional processing facilities dependent on locally grown crops.

In particular, the production and use of bioproducts offers the following potential benefits:

- use of currently under-utilized productivity in agriculture;
- reliance on products and industrial processes that are renewable;
- development of better-performing products;
- development of novel materials;
- revitalization of rural economies through production and processing of renewable resources in smaller communities.

Collectively, we face a number of challenges in supporting new science-based opportunities for the sector…

- New skills and abilities are needed.
  - Advances in science and technology require the development of, and access to, highly qualified personnel
- Facilities and equipment will be required
  - The new science requires access to state-of-the-art facilities and equipment
- New collaborations and partnerships are essential
  - The increasing complexity of issues and the consequent need for multi-disciplinary approaches to develop effective solutions means that **no one research provider can expect to have all the necessary resources** to effect change
  - Collaborations and partnerships are needed to ensure the collective investments and efforts of national research providers are optimized
  - New funding mechanisms are needed to support effective collaboration and partnership

1 People – commit to skills development

Innovation requires highly qualified personnel. The intellectual capital of a research organization is its most precious asset and also the most difficult to recruit. The researchers who make all these things happen are a very mobile community, much in demand around the world. They are attracted first and foremost by adequate public support for interesting leading-edge research with good students and colleagues in state-of-the-art facilities. The flip side is that the best of them leave quickly when they sense a hesitation by government to continue supporting their work.

2 Infrastructure - expand capacities at facilities across Canada

The S&I strategy must include investment in capital assets to ensure access to state-of-the-art facilities and equipment needed to support research relevant to the sector. Acting as a catalyst for this, AAFC will make significant strategic investments in facilities, some shared with other partners. Our objective will be to create clusters containing the elements required for a successful innovation chain.

3 Increase the support to the innovation chain

Research requires broad-ranging collaborative partnerships. Addressing the challenges and opportunities facing the agriculture and agri-food sector will require strategic investment in the right type of science and technology research by a variety of participants. Innovative funding mechanisms are needed to support this broad participation (e.g. industrial partners, producers, SMEs, academia, agencies, and international partners).

Governments and other science and technology providers working together can build sustainable competitive advantage for Canada. Objectives include:

- Harnessing existing and new investment and focusing on national priorities
- Providing incentives to facilitate national integration and synergy
- Ensuring basic S&I provides the foundation for innovation and growth

4 Structure deeper and more meaningful relationships with industrial partners

AAFC's industrial partners will make a meaningful contribution to Canada's innovation system. Their participation will result in increased research funding, integration with centres of knowledge, and access to important infrastructure. As a source of "knowledge spillover", their involvement also supports the goal of encouraging greater S&I adoption by Canada's agricultural producers and SMEs.

This is accomplished through programming that supports the establishment of value chains and strategies to develop and market new products and new processes, and to capture new market opportunities.

GOAL 5: accelerate adoption and commercialization of scientific knowledge

This Strategic Goal is focused on activities that will speed the rate at which scientific knowledge and technologies are adopted and commercialized to enhance the return on public investments in agricultural R&D.

1 Develop and streamline administrative processes

Speed the adoption and commercialization of scientific knowledge and technologies by reducing the administrative burden on partners i.e. intellectual property management, contracts, etc.

2 Focus S&I programming on building value chains and supporting commercialization strategies

Use incentives to encourage the establishment of value chains and the development and implementation of commercialization strategies for innovations based on new science and technology.

3 Promote industry understanding of science-based opportunities and build networks that speed innovation and commercialization

Liaise with industry and other stakeholders to enhance understanding of the potential of new science and technology and facilitate the establishment of networks of potential partners or value chain members to accelerate the rate of adoption and commercialization of science knowledge and technologies.

GOAL 6: enhance leadership and stewardship supported by enhanced cooperation and communication mechanisms

This Strategic Goal is focused on engaging stakeholders in a cooperation and communication process, ensuring that AAFC's S&I strategy will continue to reflect the priorities of Canadians.

1 Increase collaborations with domestic agriculture organizations, consortia and innovation centres

Ongoing consultation with provinces, universities, and non-government organizations and institutes will help identify opportunities for collaboration and the development of multi-disciplinary research clusters. Partnerships can be an effective way to pursue development of an integrated national agriculture S&I strategy. Private sector involvement will also be encouraged as appropriate. AAFC will partner with others to:

- develop and maintain strategic science and research capacity through an integrated national investment strategy across science providers that ensures we have the right facilities, the right equipment and the right skills to support the agriculture and agri-food sector now and in the future, and
- ensure that the best facilities, equipment and research skills that Canada has to offer are brought to bear on national priorities.

2 Enhance communication to raise stakeholder engagement in priority setting

Ongoing advice from stakeholders will be crucial to ensuring continued focus on the "right things." AAFC commits to listening to stakeholders, and establishing regular stakeholder consultations and feedback mechanisms. AAFC will ensure:

- the continued relevance of Canada's agriculture science and innovation efforts through ongoing consultation with stakeholders;
- the continued application of strategic thinking through advice received from advisory bodies; and that
- the quality of our science meets international standards through peer review.

3 Play a leadership role in developing S&I strategy and stewardship of its implementation

A national mechanism is needed to facilitate the development of the coordination, cooperation and collaboration required to ensure optimum benefits are achieved for the agriculture and agri-food sector and Canadians from collective national investments in science and research. AAFC will play a leadership role in:

- establishing a recognized forum (mechanism) for discussion and strategic coordination among the key decision-makers that influence or control the development and maintenance of science and research capacity – expertise, facilities, equipment, funding – in support of national, regional and sector priorities for the agriculture and agri-food sector in Canada;
- using this forum to seek agreement on strategic science capacity requirements and research priorities for coordinated investment and action; and
- pursuing collaborative action to establish a critical mass of science and research capacity focused on specific priorities.

GOAL 7: improve decision-making through science knowledge and advice

This Strategic Goal is focused on ensuring informed decision-making by government, industry and Canadians through better understanding of science and research results and their implications. Making our science and research results accessible by the global science and research community contributes to the advancement of knowledge for the benefit of all.

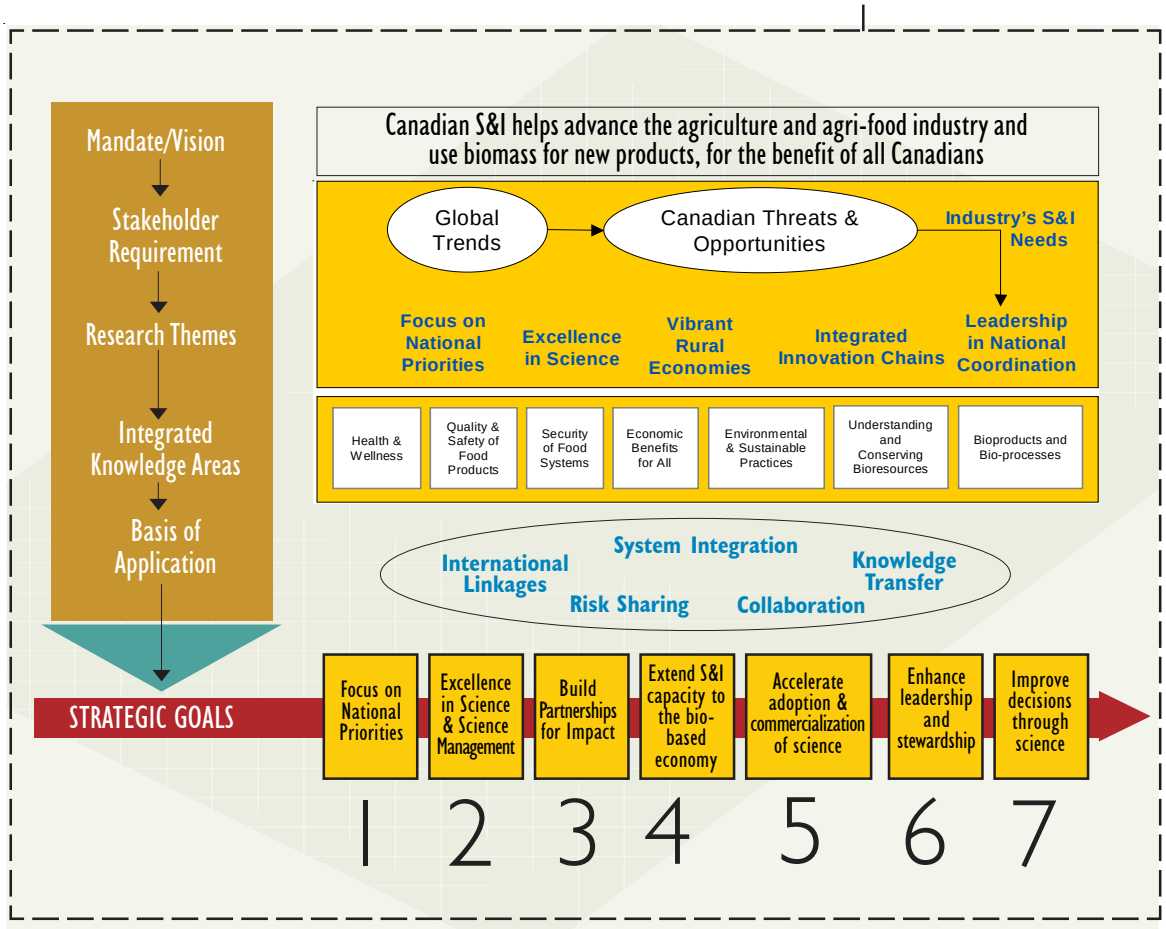
1 Develop and implement a science communications strategy

Ensure the dissemination of accurate and timely scientific knowledge and advice to enable informed decision-making by:

- government policy and program decision-makers
- agriculture and agri-food sector decision-makers
- communities of interest on specific issues
- global science and research communities

IV | OUR STRATEGIC PLANNING PROCESS

Our S&I Strategy was prepared following the process outlined below, starting with AAFC's mandate and long term vision for the industry. The inputs to our S&I Strategy include an understanding of stakeholder requirements from many consultations, developing research themes that align with those priorities, and leveraging AAFC's core knowledge strengths. An understanding of how this knowledge can be applied to address the national challenges facing Canadian agriculture is also integral to the shaping of our S&I Strategy.



V | AAFC STRATEGIC OUTCOMES

1 Enhancing human **health and wellness** through food, nutrition and innovative products

End Outcomes 2015-2030

- Canadians among healthiest people in the world due to health promotion and disease prevention attributable to better understanding of linkages between food and health, access to high-quality nutritious foods responding to diverse needs of Canadian society, and authoritative information about food, functional foods and nutraceuticals allowing informed choices by consumers.
- Significant reductions in Canadian health care costs and increased longevity achieved due to enhanced wellness and well-being of Canadians of all ages.
- Canadian functional food and nutraceutical standards set world standards.

Intermediate Outcomes 2010-2015

- Authoritative information about food, functional foods and nutraceuticals allow Canadians to tailor their diets to suit their personal needs.
- Nutritious, high-quality foods are readily available and more appealing than less nutritious alternatives.

Immediate Outcomes 2006-2010

- Health claims for functional foods and nutraceuticals are recognized and endorsed by official standards.
- Foods with functional properties are characterized and used in the production of healthy products.

Science Deliverables 2006-2010

- Foods and feeds with functional properties are identified and strategies developed to preserve bioactivity through the production-harvest-storage-distribution chain.
- Understanding of nutritive components of specific foods and their mode of action in disease prevention, and health and wellness promotion is available.
- Health claims for functional foods and nutraceuticals are substantiated by research.

2 Enhancing the **quality of food and the safety of the food** system

End Outcomes 2015-2030

- Canada's world class food safety and quality monitoring system is considered as a model to follow and sets the international standards.
- Consumers of Canadian food know what it contains, how it was produced, where and by whom, and how it was handled throughout the food chain from primary production throughout the marketing chain to the final consumer.
- Canadian expertise in the design, development and management of food safety and quality control systems is sought out globally.

Intermediate Outcomes 2010-2015

- The Canadian food chain develops an outstanding ability to detect, monitor and control food-borne hazards from primary production through final consumption.
- Canada develops a world-class tracking and tracing system that acts as the backbone of Canada's food product information system.
- Ability to model and predict food safety and quality outcomes based on the integrated knowledge of production and processing systems, hazards including emerging problems, and mitigation measures.

Immediate Outcomes 2006-2010

- Science-based information on food-borne hazards in Canadian food, including toxins, residues, contaminants, pathogens and allergens, is available in Canada.
- Food safety and product quality enhancement and preservation systems are developed and implemented based on authoritative scientific information and available science-based tools and knowledge.
- Reduced threats to food safety from animal disease are achieved.
- Improved food quality is achieved through better animal welfare and crop improvement.
- Improved food quality is achieved through alternative production practices.

Science Deliverables 2006-2010

- Food safety and product quality preservation strategies and practices are recommended based on authoritative research.
- Science-based tools and knowledge are available to support the development and implementation of tracking and tracing and identity preservation systems.

3 Enhancing the **security and protection of the food supply**

End Outcomes 2015-2030

- The security and protection of Canada's food production and distribution systems are second to none.

Intermediate Outcomes 2010-2015

- Canadian capability to prepare for, prevent and mitigate the incidence and impact of, respond to, and recover from various threats to the security and safety of Canadian food production and distribution systems is world-class.

Immediate Outcomes 2006-2010

- Canadian food system security is recognized as equivalent to, or better than, the requirements set by our major customers.
- Enhanced Canadian capability to detect and mitigate, in real time, various threats to the security and protection of Canadian food production and distribution systems.
- Physical and biological systems models are used to predict the probable spread, behaviour and impact of threats to the security and protection of Canadian food production and distribution systems.

Science Deliverables 2006-2010

- Scientific collaboration in the development and implementation of food production and distribution protection and security system that meets market requirements set by major customers.
- Detection and mitigation tools, techniques and strategies for various threats to the security and protection of Canadian food production and distribution systems.
- Scientific collaboration in the development and implementation of physical and biological systems models that predict the probable spread, behaviour and impact of threats to the security and protection of Canadian food production and distribution systems.

4 Enhancing **economic benefits** for all stakeholders

End Outcomes 2015-2030

- Canadian commercial farmers earn an acceptable level of income from farm and farm related activities.
- The Canadian agricultural sector including its related agri-based industries provides a variety of high-quality employment opportunities in thriving rural communities.
- Canadian agri-based products and services are globally competitive and marketed worldwide.
- Canadian expertise in agri-based industries is sought out internationally.
- Canadian production systems are adapted to potential changes to climate.

Intermediate Outcomes 2010-2015

- Agri-based economic development opportunities in rural communities provide a variety of high-quality employment opportunities as well as market and investment opportunities beyond the farm gate for Canadian agricultural producers.
- Interrelated agricultural production and processing activities underlie the development of rural community based bio-economy clusters that provide globally competitive products and services.

Immediate Outcomes 2006-2010

- Canadian farmers have access to production risk management tools and practices that help to reduce costs, increase value and enhance quality of crops and livestock produced.
- Farm outputs include energy and nutrients, some of which displace formerly purchased inputs on the farms that produce them and in the local community.
- Best methods to respond to threats to the security and safety in Canadian food production and distribution systems are developed.

Science Deliverables 2006-2010

- Whole crop/animal/residue utilization systems that enhance income opportunities at the farm level are described.
- Integrated whole farm production systems that improve production efficiency and product competitiveness are described.
- Production systems, including organic production systems that help to reduce costs while delivering quality products that can attract higher prices and reduce risk to human and environmental health are described.
- Production risk management products, techniques and technologies are produced to help prevent, mitigate or control the incidence and impact of production risk factors for crops and livestock in various regions across Canada.
- Adaptation strategies to climate change are identified.
- Science based standards to enhance sector profitability and ensure market access are developed.

5 Enhancing **environmental performance** of the Canadian agricultural system

End Outcomes 2015-2030

- Canadian agriculture contributes solutions to achieve a high quality environment domestically and globally.
- Commercial farms provide environmental services and agricultural products.
- Canadian expertise in sustainable agricultural resource management and development and the natural ecosystem interface is sought out globally.

Intermediate Outcomes 2010-2015

- Sustainable agricultural resource management and development practices and the provision of environmental services contribute to enhanced profitability and competitiveness of Canadian agriculture.
- Canadian agriculture is seen to be a key provider of solutions that enhance environmental quality domestically and globally.

Immediate Outcomes 2006-2010

- Mechanisms rewarding commercial agricultural operators for environmental services commensurate with their value are developed and implemented.
- Environmental performance of commercial agriculture is enhanced by adopting science-based sustainable agricultural resource management and development practices.
- Producers design, adopt and optimize integrated production systems that contribute to Canada's emission reduction targets based on practical renewable energy production.

Science Deliverables 2006-2010

- Authoritative information on sustainable agricultural resource management and development and a sustainable commercial agriculture–natural ecosystem interface is made available.
- Authoritative information on the impact and value of environmental services provided by commercial agriculture practices is produced.
- Authoritative information on beneficial management practices that reduce soil and water contamination from nutrients, pathogens and pesticides, that improve farm waste disposal, and that reduce soil and water contamination from crops and livestock is produced.

- Authoritative information on beneficial management practices that reduce agricultural GHG emissions, particulate emissions and nuisance odours, including information that allows producers to design and optimize integrated production systems that contribute to Canada's emission reduction targets through developing practical renewable energy production is made available.
- Authoritative information on beneficial management practices that reduce agricultural GHG emissions, particulate emissions and nuisance odours from livestock and crop residue.
- Authoritative information on beneficial management practices that reduce soil degradation is produced.
- Authoritative information on management practices that enhance water use efficiency including wastewater recovery is produced.
- Authoritative information on management practices that support a sustainable interaction between commercial agriculture and natural ecosystems is produced.

6 Enhancing understanding of **Canadian bioresources** and protecting and conserving their genetic diversity

End Outcomes 2015-2030

- Canadians have an appreciation of the benefits of using and conserving the biological resources that exist within their territory
- Canadian expertise in classification, assessment, conservation and preservation of bio-resources is sought out globally

Intermediate Outcomes 2010-2015

- Physical and biological systems models are used to predict the behaviour of biological resources in response to change (farming practices, climate change etc.).
- Canadian agri-industries are able to identify opportunities to use bio-resources and their constituent parts to enhance their competitive position in domestic and global markets
- Canadians and Canadian industries have an enhanced understanding of how to protect and conserve the biological diversity in Canada.

Immediate Outcomes 2006-2010

- Physical and biological systems models are developed to predict the behaviour of biological resources in response to change (farming practices, climate change etc.).
- Agri-industries have an enhanced understanding of the potential to use bio-resources and their constituent parts
- Authoritative information on practices, techniques and tools to protect and conserve the biological diversity in Canada is available

Science Deliverables 2006-2010

- Authoritative information on the classification and attributes of Canadian bioresources
- Scientific collaboration on the development and implementation of physical and biological systems models to predict the behaviour of biological resources in response to change (farming practices, climate change etc.).

7 **Developing new opportunities** for agriculture from **bioresources**

End Outcomes 2015-2030

- The Canadian rural and urban economies have grown and diversified by increasing the value and number of products derived from renewable resources.
- Substitution of renewable biological resources for non-renewable resources has created new clean industries based on novel agricultural and bioresource utilization technologies and processes.
- Biorefineries have become the backbone of globally competitive integrated bioeconomy clusters.

Intermediate Outcomes 2010-2015

- Canadian agricultural biomass is used to produce biofuels and other forms of bioenergy which contribute to a substantial net reduction of greenhouse gas emissions while decreasing the requirement for fossil fuels.
- Agri-economic development based on the biorefinery concept and new business models is producing biofuels, industrial materials, and chemicals from agricultural biomass in way that encourages producer participation and enhances the overall profitability of the sector.

Immediate Outcomes 2006-2010

- Technologies are implemented by industry to increase the use of Canadian biomass to meet the 5% renewable fuel target in 2010.
- A new Canadian biorefinery industry emerges based on new knowledge and platforms provided by improved feedstock production systems, biomass conversion technologies, and non-food product diversification from Canadian biomass.

Science Deliverables 2006-2010

- Knowledge and applications from genomics and biotechnology for the development of non-food crops, livestock improvement and novel foods.
- Scientific collaboration in the development of biomass, bioprocesses and biorefinery systems for the production of biofuels, industrial biomaterials and chemicals, and health products.