



SUSTAINABLE PROTEIN INNOVATION



MANITOBA PROTEIN RESEARCH STRATEGY

Defining the Research
Ecosystem in Manitoba



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Executive Summary

Industry, academia, government and non-profits are working together to strengthen Manitoba's position as a global leader in sustainable protein. Collectively, these stakeholders developed the [Manitoba Protein Advantage Strategy](#) – a comprehensive action plan to accelerate strategic sustainable protein initiatives. This strategy highlights the need for robust work on knowledge and information generation – one of the key pillars in the Manitoba Protein Advantage Strategy.

Manitoba has a robust research ecosystem, and with strategic direction and targeted resources, the province can advance its position as a leader in sustainable protein innovation. [Dr. James House](#), professor at the University of Manitoba's Department of Food and Human Nutritional Sciences, with the support of Research Associate [Dr. Erin Goldberg](#) (University of Manitoba) developed the Manitoba Protein Research Strategy (MPRS) to help advance Manitoba's Protein Advantage. The MPRS will serve as a work plan for a Strategic Research Chair in Sustainable Protein.

The MPRS identifies priority research gaps and their connections to the four factors of sustainability: health, environment, sociocultural, and economic. Beyond specific research expertise, MPRS envisions the future Chair to be a nexus for research collaboration and knowledge translation activities. By doing so, the Strategic Research Chair in Sustainable Protein will foster important connections between academia and industry while leading strategic research priorities that will attract investment in the protein sector for long-term economic growth.

The MPRS highlights 46 strategic research projects under four main themes:

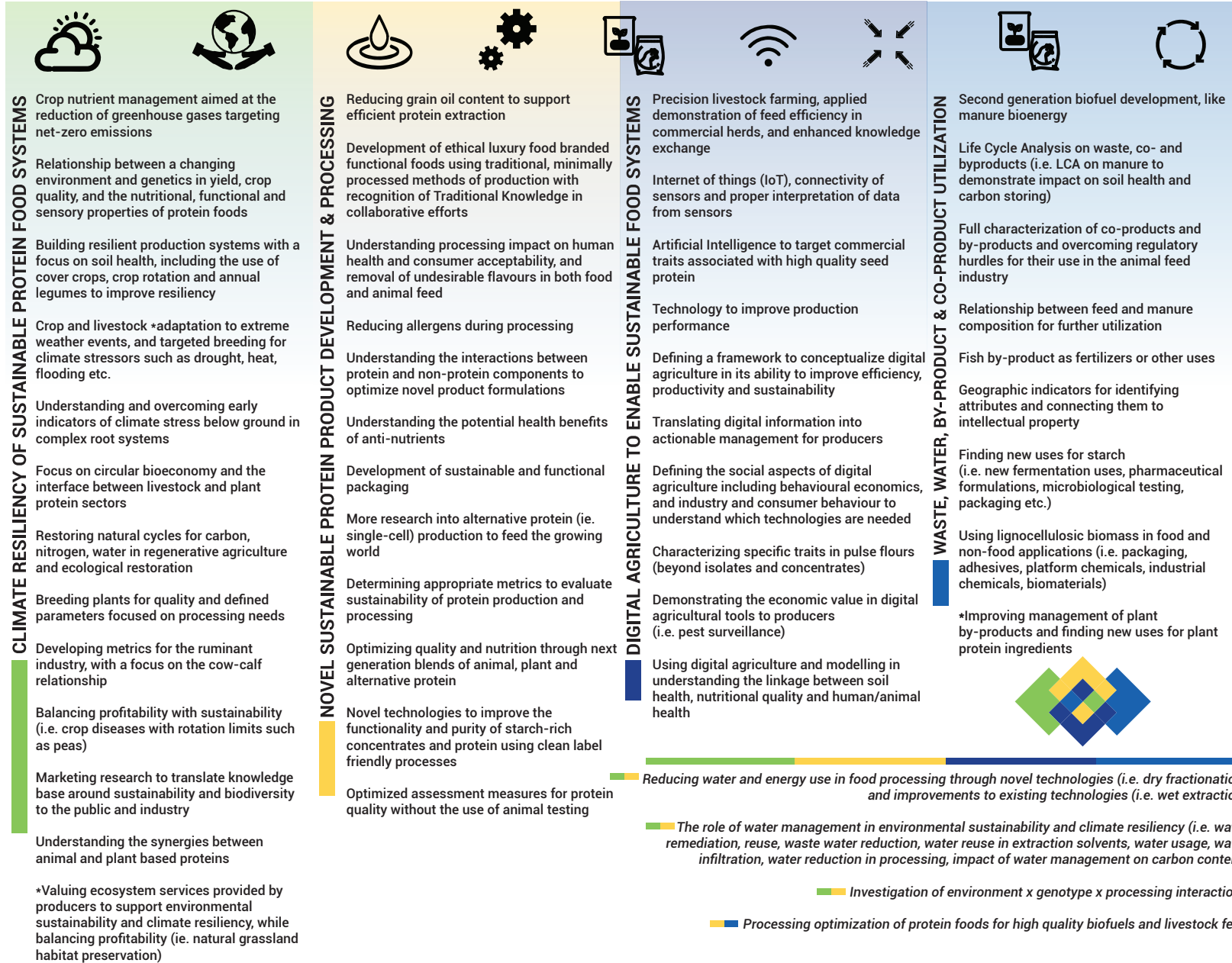
1. Climate resiliency of sustainable protein food systems
2. Novel sustainable protein product development and processing
3. Digital agriculture to enable sustainable food systems
4. Waste, water, by-product and co-product utilization

Recommendations

The key MPRS recommendations focus on the need for funding, collaboration with industry, training of highly qualified personnel and better understanding of provincial infrastructure.

1. Manitoba should focus efforts on the research priorities identified under the four themes of climate resiliency of sustainable protein food systems; novel sustainable protein product development and processing; digital agriculture to enable sustainable food systems; and waste, water, by-product and co-product utilization.
2. Manitoba should develop targeted programming to fund the identified research priorities. Program design should consider both the capacity of enterprises and the public versus private outcomes.
3. Manitoba should continue to evolve the MPRS under the leadership of a Strategic Research Chair in Sustainable Protein.
4. Manitoba should leverage existing committees and structures to support the Strategic Research Chair in Sustainable Protein to strengthen collaboration within Manitoba's robust protein research ecosystem and guide programming to advance the MPRS.
5. Manitoba should strengthen synergies between government, the research community and industry through networking opportunities and digital tools through the development of a Sustainable Protein Research Network.
6. To build momentum on the MPRS, Manitoba's protein research community should collaborate with global experts and institutions to advance common strategic priorities in protein research and innovation.

Priority Areas in Sustainable Protein Research



Note: *In addition to the research gaps identified through the gap analysis, top priorities from our initial surveys were included if they were not already represented.

Rising Global Demand

With a growing world population and increasing income levels in emerging markets, the global demand for sustainable protein is continually rising. Protein produced and processed in Manitoba is among the world's highest quality. Identifying key research opportunities and potential challenges in the protein sphere is critical in maintaining Manitoba's position as a global leader of sustainable protein.

Rising consumer awareness regarding adequate protein intake and the associated health benefits, concurrent with rising wealth in developing nations, has also contributed to this rise in demand for high quality sustainable protein. The overall sustainability of the full production and utilization cycle is a key challenge facing the protein supply sector. Sustainability, as defined by the FAO/WHO, strives to achieve a balance between four factors (Figure 1):

1. Place minimal pressure and impact on the environment
2. Promote all aspects of an individual's health and wellbeing
3. Be accessible and culturally acceptable
4. Be economically viable and affordable



Figure 1: Four factors of sustainable protein

Manitoba Protein Advantage Strategy

Industry, academia, government and non-profits are working together to strengthen Manitoba's position as a global leader in sustainable protein. Collectively, these stakeholders developed the Manitoba Protein Advantage Strategy – a comprehensive action plan to accelerate Manitoba's strategic sustainable protein initiatives. This strategy highlights the need for robust work on knowledge and information generation – one of the key pillars in the strategy.

The Protein Advantage Strategy outlines the significance of information and knowledge, and their important role in advancing sustainability in the agricultural and agri-food sector. The desired outcome for the information and knowledge pillar in the Manitoba Protein Advantage Strategy is:

Contributors to the Sustainable Protein initiative have appropriate access to relevant, reliable, and usable information, knowledge and intellectual property to advance the Sustainable Protein agenda.

This report describes how Manitoba can begin to move towards achieving this goal.

Manitoba Protein Advantage Strategy

Long-term Goal

Through strengthened collaboration and accelerated innovation, Manitoba realizes its collective and equitable potential to produce protein that is diverse, high quality, healthy and increasingly sustainable.

Ultimate Benefit

Manitoba proudly leads Canada and the world as an innovative model for high-value sustainable protein that nurtures and benefits all people, the local environment, and the climate.

Knowledge Generation

The MPRS was developed by:

- Identifying protein sector knowledge champions within each academic, industry, government, and non-government setting that could contribute to the development of a research asset map. Knowledge champions represent all actors involved in the protein value chain, and include expertise drawn from the four factors of sustainability. Identifying knowledge champions was critical to an in-depth analysis of the strengths, weaknesses, opportunities and threats within Manitoba’s protein sector.
- Delivering a Manitoba Sustainable Protein Research Symposium to:
 - a) Present findings on protein research projects.
 - b) Provide a knowledge exchange forum among academia, industry and government along the protein value chain.
- Identifying of high-priority research focus areas within a transdisciplinary collaboration framework in order to guide future research programming and project development.

The MPRS will guide the work plan for a Strategic Research Chair in Sustainable Protein, who will act as the nexus for research collaboration, knowledge sharing and industry engagement. Other chair positions in food processing have been recently established by the University of Manitoba; therefore the new chair position needs to be taken into context with other established efforts.

Manitoba’s Protein Research sector

The MPRS surveyed a total of 116 people and conducted 35 follow-up interviews. Academic researchers, industry members, and government representatives participated in the survey along with representatives from not for profits and industry associations (Figure 2a). Forty five per cent of survey respondents worked in very large institutions (500+ employees), the majority being from the University of Manitoba (Figure 2b).

Figure 2a

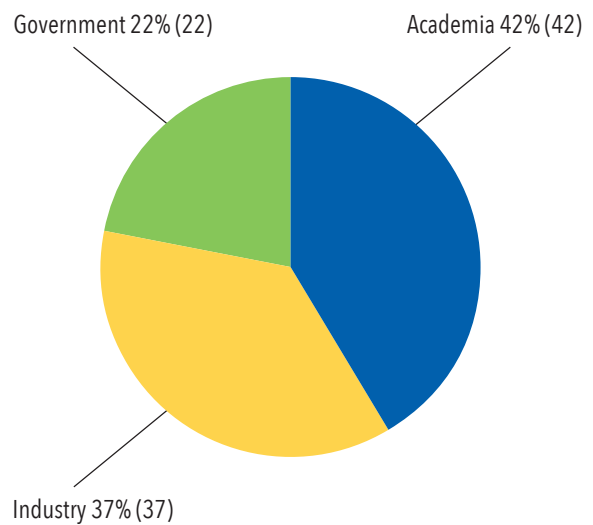


Figure 2b

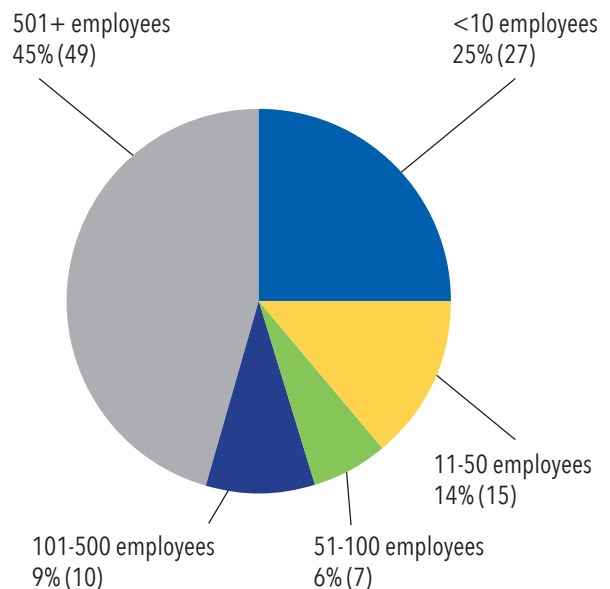


Figure 2: Survey respondents organized by sector (Figure 2a) and number of employees (Figure 2b)

Figure 3 shows survey respondents' research areas. Fifty-three per cent of survey respondents were conducting research in primary production/harvesting, followed by 35 per cent in both processing and food safety or nutritional assessment. A total of 54 researchers (47 per cent of survey participants) were conducting research in multiple areas within the protein food system. A number of researchers indicated they conduct research in other research areas including environmental sustainability, land and water management, digital agriculture, crop genetics, soil science, socio-economics, food sovereignty, flavouromics, biomaterials and infectious diseases.

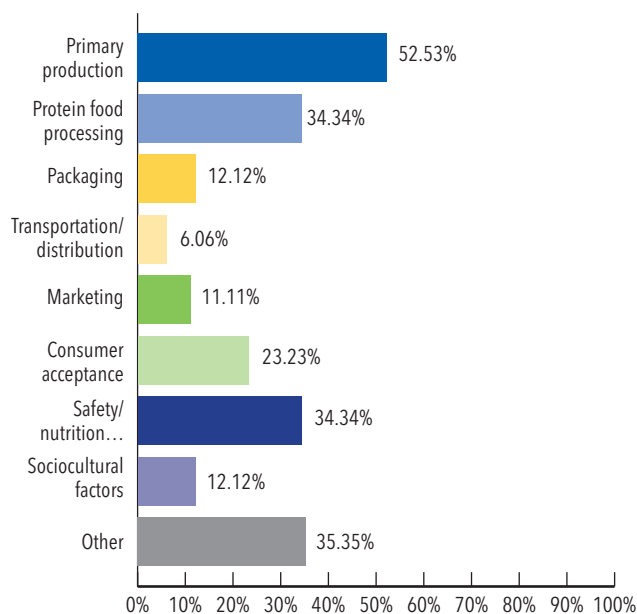


Figure 3: Survey respondents' sustainable protein research areas

Infrastructure

Manitoba researchers work with a wide array of infrastructure available across the research ecosystem ranging from unique databases, field infrastructure, clinical infrastructure, laboratories, animal models and various processing equipment for milling, extraction and purification.

Research limitations

Eighty-three per cent of survey respondents indicated their ability to conduct protein-related research is limited by funding (**Figure 4**). Funding was the most limiting factor followed by highly qualified personnel (HQP) and equipment. Respondents indicated SMEs' lack of funding opportunities, limitations in matched funding formulas, and the high expense to access facilities and databases as contributing factors.

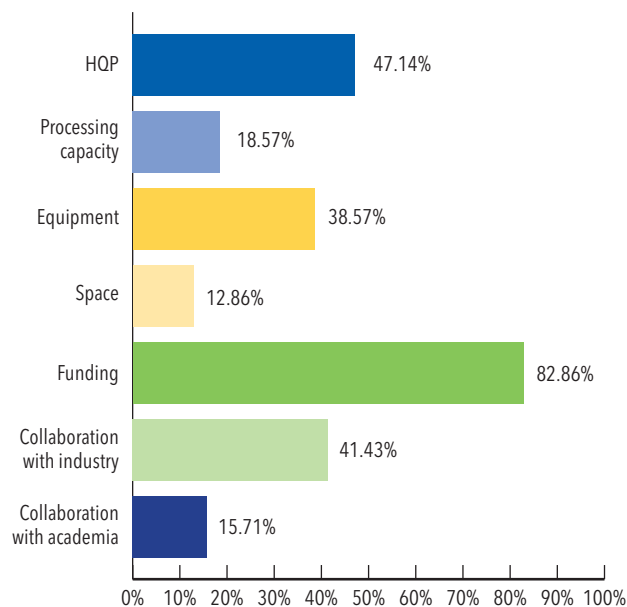


Figure 4: Factors limiting researchers' ability to conduct sustainable protein research



After stratifying data by sector, the MPRS determined academics and government representatives expressed collaboration with industry was the second highest limitation (53 per cent and 45 per cent, respectively) followed by access to HQP (53 per cent and 36 per cent, respectively) followed by access to HQP (53 per cent and 36 per cent, respectively) (Figure 5b, Figure 5c). For industry, access to equipment (43 per cent) was the second highest limitation followed by HQP (39 per cent) (Figure 5a). While lack of space was a limiting factor for some in academia and industry, respondents did not express this concern among those working in government (Figure 5c).

Figure 5a

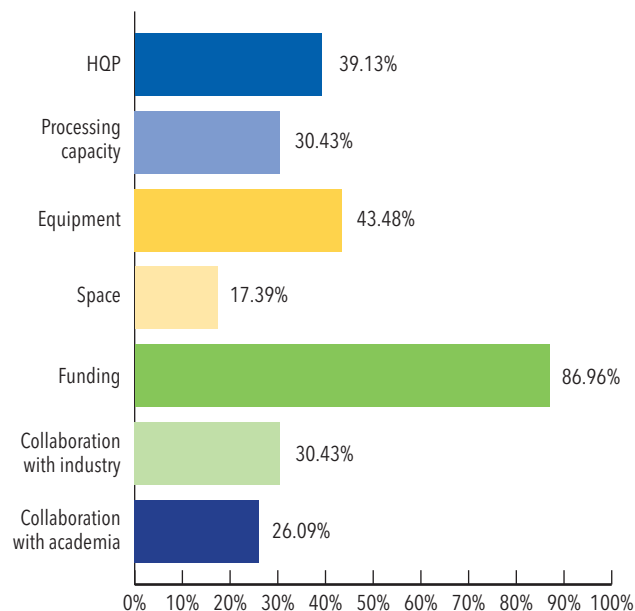


Figure 5b

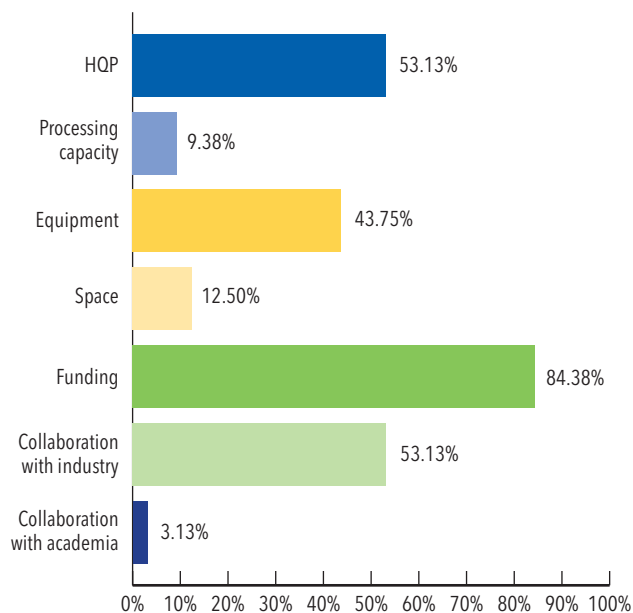


Figure 5c

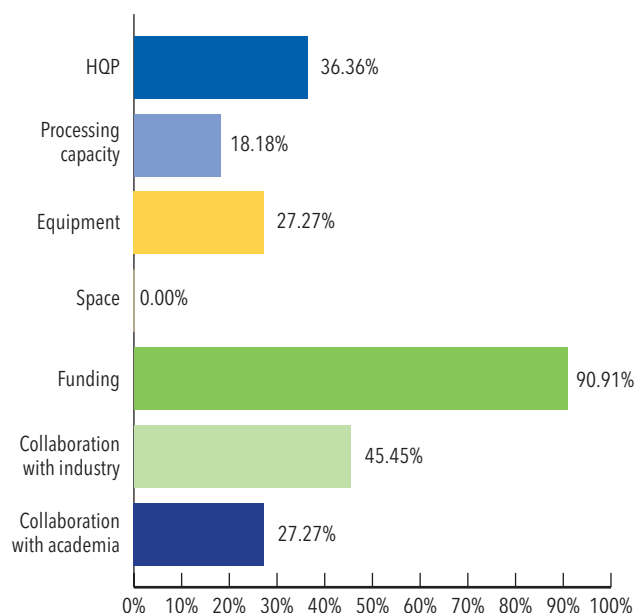


Figure 5: Factors limiting researchers' ability to conduct sustainable protein research in industry (Figure 5a), academia (Figure 5b) and government (Figure 5c)



Applied research

Researchers who completed the survey conducted both applied and discovery research based on the following definitions:

- **Applied (competitive research)** includes strategic research and development (R&D) activities in the commercial stages to design novel, or make improvements to, existing products or infrastructure.
- **Discovery (pre-competitive research)** includes early R&D activities in fields such as the natural, health, and social sciences and engineering conducted prior to entering the commercial stages, and usually involves a collaborative approach with others to achieve a common goal.

In some cases, researchers did not participate in applied research. For those not conducting applied research, participants listed the following reasons for not participating:

- not conducting research of any kind (i.e., may work in demonstration, program delivery or non-profit organizations funding research)
- have not had the opportunity or been approached
- not a priority area or not in organizational mandate
- currently building industry collaborations

- focus on basic research
- having a different approach
- lack of funding (i.e., small scale agriculture or Indigenous partners not having matching funding for applied research grants)

For participants interested in participating in applied research, the barriers they experience include:

- funding, in particular for long-term projects
- finding expertise in rural communities
- time constraints
- intellectual property or ownership concerns
- lack of clear outcomes
- lack of opportunities to developing industry linkages

Some reasons participants gave as to why they are not interested in participating in applied research included:

- importance of remaining unbiased and non-partisan
- outside of focus or mandate
- focused on results that can be broadly implemented
- lack of capacity or expertise



Research opportunities

The MPRS asked questions about general research opportunities and specific research endeavours in the surveys and interviews to determine key research gaps. While the majority of opportunities relate to primary production and harvesting, many involve all aspects of the food system.

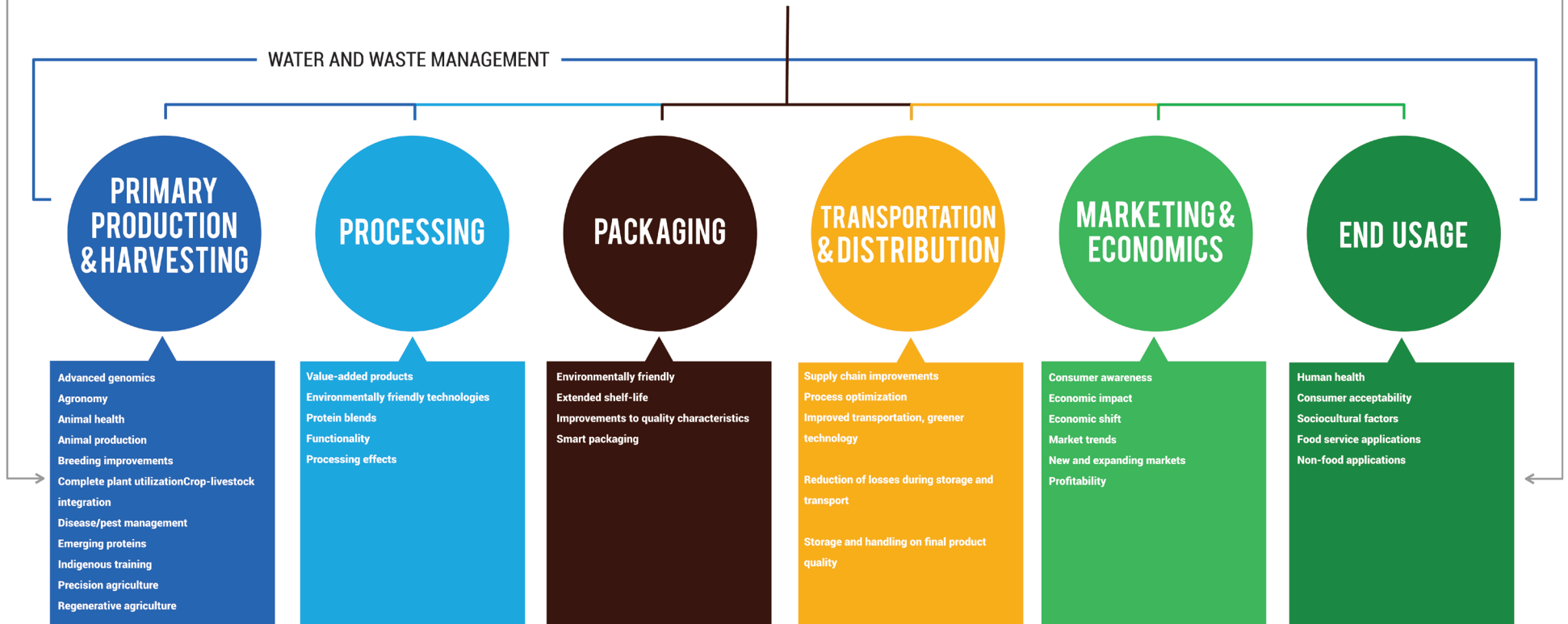
Opportunities discussed the most included (frequency):

- plant protein research (7), with emphasis on cereals protein (4)
- starch (5) as a useful co-product and by-products (3) from protein crops
- improvements in varietal development (4)
- increasing protein quality (4) and protein content/profile (3)
- artificial intelligence (3) and related technological advancements in digital agricultural and food systems
- assessing the impact of agricultural management practices on the nutritional and quality attributes of protein crops (3)
- finding new markets for protein foods grown in Manitoba, and expanding existing markets (3)
- new product development and value-added for existing products (3)
- improving public trust and education (3)

SAFETY, TRACEABILITY, CAPACITY BUILDING FOR EMERGENCIES, PUBLIC TRUST AND EDUCATION

SUSTAINABLE PROTEIN

ENHANCED EFFICIENCY AND COLLABORATION BETWEEN INDUSTRY AND ACADEMIA, ON-GOING FUNDING AND SUPPORT



DIGITAL AGRICULTURAL & FOOD SYSTEMS

ARTIFICIAL INTELLIGENCE, AUTOMATION, DIGITAL TWIN, IMAGING (CT, INFRARED, 3D), SENSORS

Figure 6: Summary of sustainable protein research opportunities. Note: items included under each area of the protein food system relate to the overarching opportunities we heard from researchers. Some opportunities, such as water and waste management and digital agriculture, span across the entire food system.

Research Priorities of Manitoba's Research and Development Agencies

The Research and Development (R&D) fee-for-service agencies in Manitoba (Food Development Centre, Cereals Canada, Red River College Polytechnic, Canadian Centre for Agri-Food Research in Health and Medicine, Richardson Centre for Food Technology & Research) echoed similar priorities to researchers and groups, however MPRS identified some key areas that stood out from other research institutions.

Key MPRS recommendations focus on the need for funding, collaboration with industry, training of HQP and an understanding of provincial infrastructure. The MPRS recognizes specific research areas as priority areas including by-product utilization (e.g., starches), additional value added opportunities, improved water utilization throughout the system, sustainability of protein extraction, removal of anti-nutrients and allergens during processing, emerging proteins as well as food service applications.

MPRS data collection identified an array of opportunities throughout the protein food system, with some overlapping themes across the entire system. Manitoba has done well so far and the MPRS has clearly identified further improvements and gaps. This information was used to identify key research projects for immediate action.

Knowledge Dissemination

Research Symposium

Showcasing Manitoba's sustainable protein sector and highlighting the work of local researchers was an important piece in the MPRS disseminating the most current sustainable protein knowledge. The University of Manitoba, Manitoba Agriculture and Manitoba Industry-Academia Partnership (MI-AP) hosted its first Manitoba Sustainable Protein Research Symposium and Sustainable Protein Academic Industry Meeting Day (AIMday™) from June 22-24, 2021, which was funded by the Governments of Canada and Manitoba through the Canadian Agricultural Partnership (CAP).

The symposium attracted 324 attendees. Speakers presented research on each of the four sustainability factors: health, environment, sociocultural, and economic. The symposium featured trainee engagement as a critical element. M.Sc. and Ph.D. students, and post-doctoral fellows were provided the opportunity to present research and were awarded prizes for top trainee presentations at the end of each breakout session.

Networking and engagement sessions, as well as static industry booths provided further opportunity for trainees and researchers to engage with industry. This was especially important because the MPRS's surveys revealed collaboration with industry and access to HQP as major limitations to the ability to conduct research. A lack of industry connections became a barrier for many when attempting to participate in applied research.

At AIMday™, industry groups submitted questions to research experts, who answered through an exchange of knowledge and ideas focused on finding novel pathways to solutions. The unique format of AIMday™ involves a series of "one question, one hour" workshops where teams candidly discuss each topic. MI-AP funded a total of 10 proposals after AIMday™, including those from Manitoba Agriculture Diversification Centres, Manitoba Beef & Forage Initiatives, Prairie Cricket Farms, Prairie Oat Growers Association, Topigs Norsvin, and Warburtons.

The Sustainable Protein Research Network

The data collected by the MPRS through surveys was used to populate The Sustainable Protein Research Network – a database of protein related researchers, facilities, equipment and contacts.

The research network will be developed to self-populate with researchers' and institutions' information, ongoing sustainable protein research and available analytical equipment. This research network will eventually expand to include assets across Canada.

To continue advancing the Sustainable Protein Research Network, MPRS secured funding through Protein Industries Canada (January 2022 to March 2023). The MPRS expects modifications and impact on the protein ecosystem to include:

1. Data Trust Infrastructure Build and Research Network Integration
 - » A data trust that allows users to interoperate with each other's data without the actual exchange of data through the trust. This allows connections and collaborations between researchers and industry without a third-party connector. MPRS will mitigate issues of background data ownership and privacy concerns with this addition.
2. Search Function Wireframes
 - » An algorithm that informs search results, and links similar search criteria. This provides a more robust result, which MPRS needs to deliver the best possible search results.
3. Protein Network Approval Workflow
 - » A responsive workflow approval process that facilitates collaboration with appropriate oversight to the data hosted on the network. This will be critical for data integrity.
4. Data Integrity Management
 - » Maintaining the network's current information and ensuring pertinence to Manitoba's sustainable protein ecosystem is critical to maintain long-term trust of stakeholders.
5. Cross-platform Functionality Needs Assessment
 - » A detailed assessment of the three most used browsers and device types to inform cross-platform functionality development work. This will result in a responsive and reactive platform that operates seamlessly across platforms to facilitate greater stakeholder uptake and engagement.
6. Search Export Capability Wireframes
 - » Deploy search export capability in multiple forms to allow for a system that saves and exports search results, with the ability to download data and save searches. This will enhance efficiency and enable a more user-friendly experience.

Further development of the network is envisioned to be led by the proposed Strategic Research Chair in Sustainable Protein, with the goal of expanding the network across Canada. This will improve Manitoba's understanding of all protein research-related assets available within Canada to foster improved collaboration across the entire ecosystem.

Conclusions

The MPRS identified key priorities such as increased collaboration between academia, industry and government, and a focus on sustainability throughout the food system. Government is seen as a facilitator to advance research priorities through appropriate funding programs, a connector between industry and academia, and a provider of strategic policy direction.

Appropriate funding programs remain an important component to advance the strategy. Programs such as public/private cost-sharing and the partnerships needed to advance shared priorities must be further evaluated. In particular, the current 50:50 cost-matching structure may not be suitable for all project priorities and partnership structures.

Upon reflection of the research gaps identified through the MPRS, it is recommended that the province considers supporting a Strategic Research Chair in Sustainable Protein to advance the Manitoba Protein Advantage Strategy. The Chair will focus on the areas of sustainability, particularly in relation to the four themes identified by the MPRS including: climate resiliency of sustainable protein food systems, novel sustainable protein product development and processing, digital agriculture to enable sustainable food systems, and waste, water, by-product and co-product utilization. The Chair should possess a strong record of past research funding, training HQP to advance sustainable protein research in Manitoba, and be a focal point for knowledge translation and training activities.

The identification and prioritization of research projects through the MPRS will help establish a Strategic Research Chair in Sustainable Protein to further advance Manitoba's sustainable protein agenda by positioning Manitoba as a worldwide hub for high-quality, sustainable protein with advanced infrastructure and an enhanced collaborative ecosystem. The MPRS recommends the appointed Chair focus on all aspects of sustainability, and be equipped to advance multiple themes identified by the MPRS.

The MPRS created a knowledge exchange framework, and began the important work to establish a Sustainable Protein Research Network, including a useful tool to enhance collaboration among the various sectors conducting protein-related research in Manitoba. It serves as a template to be expanded across Canada, as individuals not already captured in the current network may populate it with new information as it arises.

The Manitoba Sustainable Protein Research Symposium is an important element in knowledge transfer, placing local research at centre stage of the changes sweeping the global sustainable protein food system, and creates opportunities for collaboration with industry and other researchers across the entire protein research ecosystem in Manitoba, Canada, and the world.





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