

Change Through Research: Strategic Research Plan 2024-29

Message from the Vice-President (Research and International)

The next chapter in our research mission is not business as usual—it's a rethinking of how we engage with each other and the world. Rooted in the rich history and diversity of Manitoba, *Change Through Research: Strategic Research Plan 2024-29* champions research by, for and with Indigenous Peoples. This approach will create pathways to social and economic Reconciliation and guide us toward new possibilities. This plan builds upon disciplinary strengths and embraces inter and multi-disciplinary expertise in new ways to explore bold thematic ventures and opportunities for UM to lead on the global stage. It's through this renewed vision that we will drive transformational change.

From Arctic accessibility and climate change to food and water security, Health research and so much more, our institution has significant research capacity to solve complex economic, environmental and social issues. Our new research plan is a bold blueprint to position our researchers as leaders in these essential areas, at home and beyond. By aligning with other institutional strategic plans, including *MOMENTUM: Leading Change Together, University Strategic Plan 2024-2029* and *Reconciliation Framework (date TBD)*, the plan will provide flexibility and responsiveness to the evolving needs of the university community. Through multidisciplinary research discovery and knowledge mobilization, it will address global challenges head on.

The development of *Change Through Research* has been a collective effort of the entire UM community. Over the past year and a half, we have heard from hundreds of researchers, innovators, staff and students on their ideas and priorities for research excellence. I would like to express my gratitude to each person who contributed their thoughts and areas to help shape the future of research and innovation.

I would also like to thank each member of the Strategic Research Plan Committee for their hard work and dedication over the course of this process. Their commitment to listening and learning from the institutional community is reflected in the grassroots development of the plan.

We are ready to move forward, together, with clear line of sight and clarity of purpose, to take on the challenges of tomorrow and build a brighter future for all.



B. Mario Pinto
Vice-President (Research and International)



Photo credit: Mike Latschislaw

Strategic Research Plan 2024-2029 - University of Manitoba

Change through Research

Preamble

In January 2023, Drs. Annemieke Farenhorst, Mario Pinto, and Karen Schwartz began leading a committee consisting of 18 faculty researchers representing diverse disciplines in the strategic research planning process. Committee members planned and facilitated five hybrid, iterative engagement sessions with University of Manitoba (UM) faculty, staff, and students from February through June. The initial session introduced the vision for the strategic research plan, focusing on opportunities, needs, and potential thematic areas of impact. The theme of the second session was Indigenous research. In the third session, attendees had more targeted conversations to narrow thematic areas. Sessions to discuss research impact and frame UM's research vision, mission, and values rounded out the consultation process. Attendance at each consultation session was robust, with between 60 and 100 participating in-person and on-line. An additional option to provide comments on-line generated approximately 40 responses. During the final stages in July, committee members discussed and provided feedback on the Plan's thematic areas. Other members of UM community contributed additional insights to the draft plan throughout the Fall. Committee members met in January 2024 to consult and review the final document after feedback from the Senate.

Introduction

As UM starts a new chapter in its research mission, it is helpful to reflect on our influence as researchers, the paths we have taken, and the effect of time, place, and global events on the new paths we will forge. UM will celebrate its location on the Prairies, embrace Indigenous roots and Peoples, enhance its work in health and well-being, expand on its commitment to advancing human rights and social justice, build on its research in water and food security, advance action on climate change, and position itself as the leader in making the North more accessible and connected. The time is right for UM to build on its rich history and relationships to support a diverse body of researchers as they discover, make impacts, and drive creative solutions.

The fundamental pursuit of knowledge and understanding is the principal focus of a university. For example, the education of students inspires critical, creative, and analytical thought. Graduates will be adaptable to new situations and able to respond to cultural, economic, systemic, and societal challenges—the unanticipated.

Purposeful, fruitful, cross sector collaborations between academic researchers and industry, government, clinical, and community partners are a central component of UM's commitment to innovation. Our partners include publics, industry, Indigenous governments and communities, non-governmental organizations, schools, patients and their caregivers, and under-served communities. These collaborative partnerships will help to ensure a pathway from discovery to impact and solutions for society.

Co-located living laboratories will actively facilitate co-development to support the beneficial collaboration spaces for ideas, multi-disciplinary innovation, and imaginative learning environments. Bridging programs that tie emerging talent to industry, government, community, the creative arts, and clinical placement settings will support the next generation of highly skilled researchers and workforce talent, equipping them to transform ideas into knowledge mobilization and translation. Such bridging will also establish connections for post-graduation engagement, employment, and enterprise partnerships. Delivering proof-of-concept programs and nurturing successful start-ups and scale-ups through incubators and accelerators will yield future innovation dividends. Such innovation programs enable high-value employment and increased productivity across industries and beyond. Clustering key research and development (R&D) within interdisciplinary programs can speed the delivery of medical interventions, modern manufacturing, and transformative digital technologies for economic and societal benefit.

Strong collaborative relationships will not develop spontaneously. The expectations, backgrounds, and even the languages among sectors are different and productive partnerships can be frustrated. It is critical to nurture the nexus between multiple sectors. The activities of discovery and knowledge mobilization, translation, and commercialization research are part of one ecosystem of Research & Development & Delivery (for societal and economic impact). Upon this model, we impose bidirectional flow between the individual R, D, and D elements to better represent reality in the research-innovation ecosystem. Such an ecosystem is sometimes driven by a cutting-edge discovery and at other times by a market or environmental need. Opportunities for future growth in both directions will be enhanced through open communication and a culture of mutual respect. UM has an opportunity to act as a champion to expand alternative models of knowledge translation through entrepreneurship and social entrepreneurship, creative arts, communication, and education. Diverse programs and collaborative spaces for student and faculty researchers provide opportunities to enhance our culture of research and innovation. We are committed to academic freedom and see it as a driver of research excellence.

Our Vision:

Research Grounded in Relationships, Committed to Change

Our Research Mission:

To transform research culture, to advance understanding, and create positive societal impact

Our Research Values:

- Respect
- Relationality
- Responsiveness
- Responsibility
- Reconciliation
- Reciprocity
- Relevance

The incorporation of seven research values signifies the importance of the seven sacred teachings or laws in Indigenous culture and the Haudenosaunee (Iroquois) philosophy's Seventh Generation Principle that any decisions made today must take into account their impact seven generations into the future.

Moving Forward

UM's tradition of research impact has been far reaching. UM researchers contributed to the development of the first canola variety which spawned an industry that now generates \$30 billion a year for the Canadian economy and accounts for almost one-third of global vegetable oil consumption. UM is home to the originator of modern implant dentistry, the discovery of an Rh immune vaccine to prevent hemolytic disease in newborns, contributions to the development of Time-of-Flight mass spectrometry and research in combinatorics, early advancement in environmental education and conservation, as well as global leadership in public health programs including maternal and child health and communicable diseases. UM Libraries is home to many unique archives and special collections including the Icelandic Collection, Prairie Literature Collections, and the Ukrainian Canadian Experience and UM counts numerous nationally and internationally recognized musicians, artists, and writers among its alumni.

Today, UM researchers are also involved in publishing foundational research and policy work in Indigenous governance, Indigenous Studies, and the protection of Indigenous languages; ensuring critical commentary on issues impacting Indigenous Peoples; partnering in activist scholarship; interpreting and exploring contemporary issues through natural sciences and engineering, education, environmental sciences and studies, and the creative arts. Some researchers provide advice and evidence-based analyses to governments, boards, and commissions, thereby impacting community and government decisions. Other contributions include groundbreaking studies to deepen local, national, and global understandings of and responses to intimate partner violence; wrestling with ethical issues and artificial intelligence; unearthing, recording, and examining radical histories of marginalized social justice movements; making significant contributions to law reform; and acting as strong advocates in ensuring a more equitable and diverse research and education landscape. Notwithstanding the topic or discipline, UM is proud to support its scholars, whose research and scholarship will continue this tradition of innovation on new and critical issues.

We aspire to be in the top 200 in the world and in the top 10 in Canada in the Center for World University Rankings (currently 282 and 11, respectively), in the top 251-300 in the Times Higher Education Rankings and top 13 in Canada (currently 351-400 and 15, respectively), and in the global top 100 in 10 subject areas in the Shanghai Global Ranking of Academic Subjects Rankings (currently ranked 201-300 globally; 101-150 in Oceanography, Telecommunication Engineering, Food Sciences & Technology, and Dentistry & Oral Sciences; and 151-200 in Transportation Science & Technology and Pharmacy & Pharmaceutical Sciences). With respect to the Times Higher Education Impact Rankings, which assess the performance of universities against the 17 United Nations Sustainable Development Goals (SDGs), we aspire to be ranked in the top 100.

To accomplish these measures of success, we will embrace the principles of equity, diversity, inclusion, and accessibility and understanding the spectrum of gender, race, ethnicity, sexual orientation, ability,

and other identities and their intersections. We will combat the cultural phenomenon of the Tall Poppy Syndrome where successful people, particularly women, are resented and criticized for their success in the workplace. We will do this by promoting cultural change through mentorship and celebrating the accomplishments of early career and mid career researchers. Inclusion as the unquestioned norm is the goal.

Research-Teaching Nexus

To achieve our vision, UM will foster research and scholarship into innovative pedagogies and the broad education of our students, who will become the next generation of decision makers. Students must be trained differently to prepare them for their many careers in an extended lifetime. At the core of this mission is teaching the art of creative, critical, and adaptive thought so that individuals and teams will be able to perform at different depths in areas that may be completely foreign, engaging in dialogue in diverse platforms. Through diversification of our student population, UM will ensure that it educates global citizens, ambassadors of the future, who are equipped to improve life in an ever-changing, complex world, in terms of wealth creation and economic prosperity but also in ensuring social equity and global citizenship.

The research-teaching nexus is highlighted to provide students with a research experience as an integral part of their learning experience. Inclusion of the undergraduate research experience through university research assistantships (URAs) and unique experiences in the classroom will enrich UM research and prepare students to apply their knowledge and generate new knowledge in future careers; some will become the next generation of researchers. A dedicated allocation of URAs to Indigenous students will encourage and build pathways to future opportunities. Work-integrated learning opportunities in the external workplace through co-op and internship opportunities will prepare students for the future workforce. In each of these scenarios, students will build essential communication, leadership, and team-building skills, (time) management skills, and critical-thinking and problem-solving skills. More intense efforts at the graduate level through academic supervision in higher-degree programs and external internships will generate the thought leaders and decision makers of tomorrow.

Thematic Areas

UM's Strategic Research Plan (2024-2029) will coalesce diverse efforts in seven research themes: Foundations; Social Justice and Human Rights; Research by, with, and for Indigenous Peoples; Water and Food Security; Health and Well-being; Climate Action and Sustainability; and Manitoba, Hudson Bay, Arctic, and the World. The thematic areas are already strong and present, but a clearer focus will serve to elevate UM research, resulting in greater external recognition and profile.

These themes are meant to interconnect and promote the Mi'kmaq concept of Etuaptmumk ("two-eyed seeing"), coined by Mi'kmaq Elder Albert Marshall, in which each eye brings either an Indigenous or Western perspective. Using those two views dynamically in parallel leads to a productive way forward. Marshall further elaborated that it is when these views differ markedly, at the frustrated interface, that innovation occurs.

1. Foundations

Fundamental research in the sciences, engineering, social sciences, humanities, and health sciences are celebrated at UM; exploration underlies all advances of clinical, scientific, economic, and societal value. The UM further recognizes the vital role that creative work and artistic expression play in enriching the human experience. Indeed, creative arts, design, and performance are vital areas of inquiry, illustrated by the broad range of both national and internationally distinguished contributions from the Centre for Creative Writing and Oral Culture, the Desautels Faculty of Music, the School of Art, the Faculty of Education, and the Faculty of Architecture. Writers, artists, musicians, actors, film makers, and composers contribute through a diverse range of artistic disciplines, fostering creativity, innovation, and critical thinking within the university community and to critical acclaim. These fundamental threads weave a rich tapestry which serves as a foundation of knowledge relevant to Canadian society, and upon which UM will build its inter- and multi- disciplinary themes. Harmony between fundamental, theoretical, and applied research will also lead to reciprocal systems of development. Significant efforts are underway in centres and institutes such as the Manitoba Quantum Institute and Winnipeg Institute for Theoretical Physics.

In a rapidly evolving geopolitical context, a deep understanding of the past is paramount to informing present and future strategies. Whether it is understanding the origins of the universe and the primordial world, the fundamentals of philosophy, modern thought, languages and cultures, or probing fundamental mathematical, physical, and biological principles, the pursuit of fundamental knowledge is the cornerstone of research at UM. These pursuits are enhanced through the lens of Indigenous knowledge and ways of knowing that are guiding us on our path to reconciliation by recognizing and seeking to address the ways in which the historical roots of the Doctrine of Discovery have violated Indigenous human rights.

Our path will be defined by being bold, daring to experiment, pushing the frontiers and challenging ideas.

2. Social Justice and Human Rights

Social justice is about the fair distribution of wealth, opportunities, and privileges in society, and aims to rectify social inequities and disparities. Social justice can only be achieved by addressing systemic injustices including ableism, ageism, antisemitism, colonialism, homophobia, Islamophobia, racism, sexism, and transphobia and building a world with more equal distribution of resources and opportunities. Human rights are the rights inherent to all people, codified in both Canadian and international law, and complement Indigenous rights. In a time of climate crisis, we know that neither social justice nor human rights can be separated from environmental justice. The United Nation's 17 Sustainable Development Goals (SDGs), including no poverty (1), zero hunger (2), good health and well-being (3), gender equality (5), clean water and sanitation (6), sustainable cities and communities (11), and peace, justice, and strong institutions (16) provide tangible targets for us to work toward, goals that are supported by researchers across UM.

UM researchers are well-positioned to support the research that makes change toward these SDGs, and social justice and human rights more generally. The UM's robust social justice and human rights research

landscape is anchored in the Centre for Human Rights Research, Arthur V. Mauro Institute for Peace & Justice, Centre for Defence and Security Studies, Manitoba Centre for Health Policy, Ongomiizwin – Indigenous Institute of Health and Healing, Institute for Global Public Health, National Collaborating Centre for Infectious Diseases, Centre on Aging, and Research and Education for Solutions to Violence and Abuse (RESOLVE).

Taking people-centred, grassroots, inter-sectional and inter-disciplinary approaches, UM researchers drive solutions to human rights challenges such as mass violence and genocides, human rights abuses and political repression, racism and discrimination, and income insecurity. Through the lens of social sciences, education, and the law, researchers are examining the connections between educational equity and access; refugees and migration futures; and health equity, including advancing physical and mental wellness. UM researchers are finding pathways toward reconciliation; economic and environmental justice for vulnerable populations; peace and conflict resolution; the rights of Two-Spirit, Lesbian, Gay, Bisexual, Transgender, and Queer Plus (2SLGBTQ+) communities; and equality and empowerment of women and girls. UM researchers are showing how both human rights and social justice frameworks provide critical tools for addressing the structural inequalities faced by Indigenous Peoples and governments in Canada and throughout the Indigenous world and can bolster Indigenous sovereignty and self-determination. Scholars in the creative arts also play a crucial role in fostering critical conversations and promoting social justice through the power of writing, music, and the visual arts, facilitating a deeper understanding of diverse perspectives and advocating for human rights.

Researchers across UM contribute to research that works for a more just and sustainable world where human rights are respected, and social justice is more than a slogan. Human rights and social justice research tie together researchers from different faculties and colleges and crosses disciplines and research models and methods. We will work towards centering social justice and human rights in our research endeavours.

3. Research by, for, and with Indigenous Peoples

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) recognizes and protects the individual and collective rights of Indigenous Peoples including the right to self-determination, self-government and full enjoyment of all human rights and fundamental freedoms recognized in international law. These include the right to education, freedom from discrimination, and the right to maintain political, legal, economic, social, and cultural institutions. The Truth and Reconciliation Commission of Canada (TRC) gathered archival documents and testimonies of survivors of residential schools and has insisted that reconciliation among Indigenous Peoples and all other residents should follow certain principles for Canada to flourish in the future. It is noteworthy that UM hosts the National Centre for Truth and Reconciliation. The Centre's guidance involves taking action to: address colonial legacies; close social, health, and economic gaps between Indigenous Peoples and all other residents; establish and maintain mutually respectful relationships; value the knowledge that Indigenous Elders and Knowledge-Keepers bring; support cultural revitalization; and sustain education and dialogue on the

legacy of residential schools, treaties, Indigenous rights, and the contributions of Indigenous Peoples to Canada.

Both UNDRIP and the TRC offer helpful starting points when considering research by, for, and with Indigenous Peoples. Such research is seen as a pathway to reconciliation and must be central in all efforts undertaken by UM researchers. Research by, for, and with Indigenous Peoples means, first and foremost, all research engages in partnership involving Indigenous researchers and/or communities. First Nations, Inuit, Métis Peoples and communities are diverse and context-dependent, and we are committed to honouring their distinctions. For this reason, it is also essential to empower, build trusting, meaningful, and genuine relationships, and work in equal partnership on issues that bring value and benefit to the people and communities involved. Successful relationships with Indigenous communities include reciprocity in representation, relevance and commitment to the community, and a responsibility to take direction and learn from Indigenous communities while giving back to those communities through research.

Research by, for, and with Indigenous Peoples at UM explores a vast and fascinating array of topics across multiple fields and disciplines. It is integral to our vision, mission, and values. Areas of transformative and impactful research include: Indigenous history; Indigenous languages; Aboriginal law and treaty rights; Indigenous governance and rights; health and socio-economic equity for Indigenous Peoples; food and water security and sovereignty; gender-linked Indigenous cultures and practices; co-creating places and spaces with Indigenous communities; artistic and cultural resurgence; Indigenous land-based practices; reimagining education including Indigenizing curricula and pedagogy, applying Indigenous knowledge and culture to Western concepts, and enhancing educational opportunities for children and youth; and amplifying Indigenous voices by honouring Indigenous knowledge and artistic traditions, and embracing decolonial perspectives and cultural revitalization.

Research by, for, and with Indigenous Peoples reframes perspectives about, and approaches to, research, because it incorporates Indigenous perspectives, knowledges, paradigms, and tools at its core. Part of this reframing involves shifting the research lens from a deficit-based focus that seeks to fix problems for Indigenous Peoples, and instead acknowledges the historical and ongoing impact colonialism has created in sustaining the underlying structures and conditions that adversely impact the lives of First Nations, Inuit and Métis Peoples in Canada. Indigenous Elders, Knowledge-Keepers, individuals, and communities hold a significant amount of knowledge about solutions, which can be applied in regional, national, and international spheres.

When considering the other thematic areas in this Strategic Research Plan, we note that each theme is enriched by Indigenous knowledge and research undertaken by, with, and for Indigenous Peoples and communities. We aspire to embed Indigenous holistic approaches and views in a good way in all of UM research as a pathway to reconciliation.

4. Water and Food Security

Water and food are inextricably linked to each other and to the economic, social, and environmental well-being of the planet. Canada holds 20% of the Earth's freshwater resources and Manitoba is known as the province with 100,000 lakes. Food and nutrition security is embedded in SDG 2 and reflects a central pillar of sustainable food systems. However, threats to water and food resources are increasing and are often linked to deforestation and urbanization on a global scale. Climate change exacerbates these threats by altering weather patterns, causing shifts in precipitation, salinity, and temperature of oceans, and increasing the frequency and intensity of extreme weather events. Such threats impact water and food security on local, national, and global scales. By engaging in interdisciplinary research, UM researchers and scholars in the creative arts are raising awareness about the complex interconnectedness between water, food security, and socio-environmental issues, fostering innovative approaches and inspiring action towards sustainable solutions.

Anishinaabe Nibi Inaakonigewin (water law) recognizes that human beings do not own water and that we must respect water because it has a spirit, it can heal, and it can also suffer. Such respect requires the protection of water resources to ensure the sustainability of all life in ecosystems. Water security requires access to safe and clean water for domestic, agricultural, industrial, and environmental purposes, while also addressing issues of water scarcity, quality, and equity.

Notwithstanding plentiful freshwater, many First Nations and Inuit families in Canada continue to be among the billions of people in the world lacking safe drinking water. UM research contributes significantly to water policy, conservation, management, and governance; community-based water monitoring; Indigenous water sovereignty; prairie land use and management, including approaches involving remote sensing and artificial intelligence; hydrology, landscape ecology, wetland ecology, and watershed processes modeling; environmental and sustainability education; and clean energy and circular economies. These approaches include appreciation of Indigenous cultural and spiritual meanings of water. As the United Nations Academic Impact Hub for Clean Water and Sanitation (SDG 6), UM researchers, in collaboration with Indigenous partners, continue to lead in interdisciplinary research on water systems, conservation, and protection; management of water quantity and quality; the impact of climate change on systems and security; and wastewater treatment.

Food and nutrition security is embedded in SDG 2 and reflects a central pillar of sustainable food systems. This security is achieved when all people across the lifespan continuum have guaranteed access to foods that are safe, affordable, culturally appropriate, and healthy. Ongoing challenges to food and nutrition security include geopolitical, social, and environmental factors. In addition to food security, scholars are focusing on food sovereignty, supporting the right to healthy and culturally appropriate food where production and distribution lie with local producers. UM researchers are uniquely positioned to address ongoing and future challenges through the Canadian Centre for Agrifood Research in Health and Medicine, the Richardson Centre for Food Technology and Research, the National Centre for Livestock and the Environment, the Canadian Wheat Board Centre for Grain Storage Research, the Ian N. Morrison Research Farm, the Glenlea Research Station, and the Point Field Research Laboratory.

UM has strengths in fundamental and applied research for the recycling of on-farm resources and biodiversity conservation. UM researchers are leaders in food science and nutrition, excelling in pre-

commercial development and testing of food quality and nutrition through food-processing techniques and state-of-the-art analyses; integrated crop and livestock systems; greenhouse gas mitigation; water resource protection; promoting carbon sequestration and climate resilience; and adopting dietary patterns that reduce nutrition-related chronic diseases. UM researchers are driving the fourth agricultural revolution through cellular communication and data algorithms and processing, data storage and security, precision agriculture, and artificial intelligence.

5. Health and Well-Being

The World Health Organization (WHO) shows the interconnectedness between health and well-being, and other SDG goals. Progress in other areas cannot happen without ending poverty and hunger, having access to clean and safe water, educating children and youth, achieving gender equality, reducing inequities, dismantling racist and colonial structures, enhancing climate action and education, addressing conflicts of interest from commercial entities, and reducing violence, exploitation, and abuse. Similarly, health and well-being are integral to, and entwined with, the other thematic areas identified in this document: social justice and human rights; climate action, sustainability, and North and Arctic accessibility; water and food security; and research by, for, and with Indigenous communities.

Recognizing the highest attainable standard of health as a fundamental right of all human beings, the WHO describes it as “a state of complete physical, mental and social well-being.” SDG 3 highlights the importance of good health and well-being and includes targets in the areas of maternal, newborn, and child health; communicable and non-communicable diseases; sexual and reproductive health; healthy aging; and equitable access to health care. UM leads in these and other areas within the province of Manitoba, in partnership with First Nations, Inuit, and Métis communities, and globally in countries such as Burkina Faso, India, Kenya, Nigeria, Pakistan, Peru, South Africa, Tanzania, Thailand, and Ukraine. Focusing broadly on the diversity of all human beings, UM health researchers partner with individuals, communities, organizations, health care facilities, and populations of all kinds, including those relegated to the margins of society, as they actively work to advance health and wellness.

UM researchers are driving innovation through centres and institutes such as the Institute for Global Public Health, the Manitoba Centre for Health Policy, Ongomiizwin - Indigenous Institute of Health and Healing, Cancer Care Manitoba, Children’s Hospital Research Institute of Manitoba, George & Fay Yee Centre for Healthcare Innovation, the Institute of Cardiovascular Sciences, Health Sciences Centre, and the Centre on Aging. Notably, UM is the global leader in maternal, newborn, and child health *at scale*. Other expertise includes: optimizing population-level health through the Program Science approach; composition and value of human breast milk and connections to the microbiome; prevention of child maltreatment; infectious diseases and managing pandemics including public health strategies; interrogating the effects of inhaled air pollution on health and disease; understanding the interplay between the immune system and inflammation during infectious and non-communicable diseases in HIV, HPV, and mpox, for example; developing new therapies and vaccine strategies and exploring public acceptance and trust in these health technologies and products; pre-clinical research in biology, kinesiology and physiology in health and disease; advancing research in aging, diabetes, neurobiology,

asthma and respiratory disorders, inflammatory bowel diseases, rheumatoid arthritis, transplantation immunology, and cancer; multidisciplinary genomic diagnostic and clinical therapies for rare diseases; health and wellness for the 2SLGBTQIA+ communities; health economics; and developing medical instrumentation and sensors. As it has been well demonstrated that the creative arts have transformative power on mental, emotional, and physical well-being, UM scholars are also exploring the therapeutic potential of the arts, contributing to research that promotes holistic healing, improves quality of life, and enhances the understanding of the human experience.

Not only are UM researchers contributing their expertise in these areas, but they are also focused on ensuring that patients and their caregivers remain the first and foremost partners, with an emphasis on personalized, tailored medical care. Patients and their caregivers are being engaged early as research partners and not just as research participants, enhancing trust and enabling the incorporation of patient-driven perspectives into research planning. This approach generates evidence that is relevant and meaningful to them, encourages better-informed patient decision-making, and enhances knowledge translation. Ultimately, patient-centred research builds research capacity that is socially and culturally appropriate, thereby facilitating the development of a broader all-inclusive research environment necessary for generations of successful outcomes.

UM leads in health data management for the Province of Manitoba by exploring the rich and unique trove of interconnected health and social data in Manitoba and advising government on public health policy. Community-led health and wellness initiatives that advance equitable access to better health care for under-served populations, including Northern and rural Indigenous communities in Manitoba and Nunavut, are also providing solutions for society.

6. Climate Action and Sustainability

At UM, our planning for sustainability is integrated at all levels. Our ongoing operations and initiatives strive to promote well-being while reducing environmental impact. UM has committed to net-zero greenhouse gas emissions by 2050. Transformations like these are a necessary part of our future, and this research theme recognizes our leadership in climate change research and the vision the UM community has for a sustainable tomorrow. From arctic system science and new materials research to governance models and Indigenous design, sustainable transformations anchor a wide swath of UM research, particularly through collaborative projects in the North. Such collaboration and community engagement provide an opportunity for students to be involved in producing knowledge for climate action through meaningful societal change, increasing optimism, well-being, and a sense of being in control.

While climate science often considers large-scale processes, climate risks are experienced at the local scale through climate-induced disasters. Climate action that supports the challenges faced by communities who are and will be impacted by climate change is required. For example, the Arctic region is experiencing an alarming rate of warming, surpassing three times the global average. The Antarctic is witnessing a dramatic reduction in the rate of ice growth, and the rate of melting icebergs has increased markedly. These rapid changes are leading to extensive transformations with far-reaching global

consequences. Such changes have profound impacts on communities and ecosystems through changing sea levels, temperature and salinity of oceans, and ocean currents. These impacts are unevenly distributed throughout the world, and efforts to respond need to address geographic, social, political, and cultural inequalities. Climate action must be based in socially and ecologically accountable relationships informed by critical and complex analysis. UM researchers, including those at the Centre for Earth Observation Science, Centre for Defence and Security Studies, National Centre for Livestock and the Environment, the Ian N. Morrison Research Farm, and Natural Resources Institute, are working with partners at local, national, and global scales on responses that build sustainable futures. They have made advances in understanding climate change and predictions of consequences, adaptation practices, community-based responses, and education.

In this complex, oceans play a vital role in regulating climate and weather patterns and are a crucial carbon sink. Canada is among more than 100 countries supporting the United Nations goal of protecting 30% of marine and coastal areas by 2030, to halt and reverse biodiversity loss while bolstering resilience to climate change. Given that two-thirds of Canada's coastal regions are in the Arctic, the preservation of ecosystems in Hudson Bay and James Bay will be central to meeting this challenge. In partnership with Indigenous rights-holders, UM researchers are national and international leaders in understanding and communicating the ocean's role in climate change and developing research and monitoring programs.

Through centres and institutes such as the Manitoba Institute for Materials, UM is developing new materials, processes, and technologies that advance sustainability and reduce environmental impacts. New technologies for power generation and distribution, innovative local grids, and new transportation modes are being developed in partnership with Northern communities. Remote sensing, satellite, antennae, and drone technology development to mitigate greenhouse gas emissions are also areas of strength at UM.

Climate action demands various approaches across multiple disciplines. For example, architecture research and practice focus on environmental responsibility including how we design our buildings, spaces, and landscapes to improving construction techniques, enhancing energy efficiency, fostering community engagement, and incorporating Indigenous design. Researchers in engineering fields including computer, geotechnical, and transport engineering and construction and water management, are developing analytical and modeling tools and probing augmented reality methods and the use of digital twins in systems design. Asper School of Business and the affiliated UM Transport Institute researchers are working toward improving sustainability in transportation and logistics, including the role of cargo airships in the North. Scholars in the creative arts are addressing climate action and sustainability by using the arts as a platform for raising environmental awareness, advocating for sustainable practices, and inspiring positive action towards a more ecologically conscious society. Finally, educational researchers are exploring ways to teach and motivate people of all ages on sustainability, environmental stewardship, climate change, and renewable energy matters.

7. Manitoba, Hudson Bay, Arctic, and the World

UM has long been a research leader in the Arctic and Prairie regions, with a specific focus on climate change and its effects on Arctic sea ice, carbon capture and storage and other chemical and biochemical processes, contaminants in sea water and associated risks to food chains, and mitigation of marine oil

spills. Researchers are also examining climate change adaptations in Indigenous communities and climate change mitigation in agricultural production. Critical research in these areas has been expanded significantly across numerous fields and disciplines including human rights; transportation economics and supply chain management; engineering; public health; infectious diseases; habitat and population studies of wildlife; ecology and biodiversity; oceanography; navigability forecasting; climatology; hydrology; permafrost thaw; satellite, drone, and Internet of Things technologies; governance and security; social determinants of health; and data management.

Community leaders across Western Hudson Bay initiated discussions with UM researchers to take control of their own socio-economic futures and direct transportation/shipping developments in a sustainable and responsible way. This overture is consistent with UM's reconciliation strategy where researchers are recognizing the critical need to undertake research that is driven, co-designed, and co-led by Indigenous partners, including Indigenous leaders and communities. This work is informed and inspired by the Indigenous worldview encapsulated in the Inuktitut term *Avativut* ("our environment") and the Cree term *Wahkotowin* ("kinship and connectedness of people, water, air, land, and animals").

Motivated by the need to transport vast resources (energy, potash, minerals, and agricultural products), the possibility of expanding the shipping season across Hudson Bay in light of changing climate, and the ever-growing pressure on the capacity and geopolitical stability of the global supply chain, researchers are focusing on developing future transportation pathways. These pathways will provide shorter and geopolitically more stable trade routes connecting central/western Canada to Europe/Africa and Central/South America.

Envisioning a new framework, Indigenous leaders, communities, and researchers are focusing on socio-economic prosperity and wellness for communities in a changing climate to detect, monitor, reduce, and mitigate risks associated with massive infrastructure development. This work involves marrying cutting edge science with Indigenous knowledges to ensure the Arctic and Prairies thrive and supporting community-led initiatives to protect and conserve the biodiversity on Indigenous territories in the area. All stakeholders agree that it is no longer acceptable to work within outdated colonial frameworks where imprudent planning could devastate ecosystems and Indigenous homelands, jeopardize physical and mental health, human rights, and well-being, and exacerbate Canada's geopolitical and security risks.

Indigenous leaders, communities, and UM researchers are reimagining access through and proper management of Hudson Bay to transform community and regional connectivity, economic futures, and strengthen regional and global supply chains. This approach will help support Indigenous sovereignty, enhance the voices of Indigenous communities, increase affordability for those living in Northern and remote areas; provide opportunities for better education, training, and capacity-building for community youth; and improve health and well-being for the First Nations and Inuit people in the region.

Supporting Research through the 4 Ps – People, Partnerships, Platforms, and Processes

We recognize that to embrace our research mission, we must:

- Attract and retain talented **people**, including graduate students, postdoctoral fellows, staff, and faculty and with particular focus on currently under-represented scholars and stated commitments to Reconciliation and the Scarborough Charter. This includes creating and

maintaining learning and working environments that are respectful and inclusive, and providing mentoring, professional development, and social opportunities for early career researchers who are establishing their research programs;

- Foster **partnerships** and collaborative relationships with communities, industry, government, social and educational institutions, and NGOs within Manitoba and beyond through initiatives such as the University Indigenous Research Connect Program, Lab2Market for graduate students and postdoctoral fellows, and UM's new entrepreneurship hub IdeaStart;
- Enhance **platforms** for research by updating physical and digital infrastructure; improving access to infrastructure funding opportunities for mid-career researchers; enhancing tools for the UM community and external users to enable easier identification of research opportunities; facilitating two-way flow of people and ideas between the UM and external communities; and growing opportunities for cultivating social innovation and commercialization;
- Provide more efficient **processes** for research-related administration including funding proposal submissions to Research Services, changes to the Research Administration System for Research Ethics Board protocol submissions and approvals, and enhanced support for developing large-scale, institutional-level funding proposals through the Major Projects Office. Incorporate flexibility of process that allows for community-grounded and emerging methodologies where current processes present an unreasonable barrier to doing research in a way considered respectful and ethical by the community(ies) involved.

Conclusion

The very foundation of research at UM is about discovery and advancing knowledges. The themes described above also lead to meaningful impact, signaling that the research we do matters. Some themes embrace community-based research, working for and with communities, while others lead to knowledge translation and commercialization.