IDEA

CONCEPT

CREATIVITY

RESEARCH

TECHNOLOGY

SOLUTION

INNOVATION

ANNUAL HIGHLIGHTS 2019

International Minerals Innovation Institute

Cultivating the Path Forward

Executive Director's Message

With 2019 seeing several research, development & demonstration, and diversity & inclusion projects successfully conclude, it is notable that IMII committed funds in 2019 to invest in the future of mining. With nearly $1 million set aside for projects supportive of the minerals industry's digital transformation, $1 million committed to further diversity & inclusion in the minerals industry's workforce, and the ability to leverage $1.2 million with Mitacs to increase capacity and capabilities in research, development & demonstration through student internships, IMII is making investments that will have an impact on the future of mining in Saskatchewan and elsewhere.

Al Shpyth,
Executive Director

Chair's Message

2019 was a year which saw IMII make significant investments in the future of mining. At year's end, IMII had committed $3.65 million to support 19 projects and initiatives to 2023. IMII's education & training investments continued the commitment to diversity & inclusion in the minerals industry's workforce and saw the start of new investments in the future of work and mining's digital transformation. Initiatives launched in 2019 include a five-year commitment to students in mining-related STEM programs through two major scholarships – the "iMpowered" Scholarship Award and the "IMII Mining Futures" Award – and an MOU with Mitacs to provide funding and training for technical students, graduate students, and post-doctoral fellows through industry-academic research collaboration and internships.

IMII's Board of Directors also undertook a renewal of the organization's strategic plan to 2024, which will continue to ensure that IMII advances innovations which matter to mining for years to come.

Arnfinn Prugger,
Board Chair

Our vision is Saskatchewan being home to the world's most innovative and sustainable mining and minerals industry

IMII's mission is to be an industry-led catalyst driving innovation and sustainability in minerals sector research, development, education and skills-training.

Research, Development & Demonstration

Cutter Bit Performance, University of Saskatchewan

A multi-disciplinary research team in the College of Engineering at the University of Saskatchewan utilized cutter bit machine data from the Saskatchewan mining industry to develop post-secondary teaching materials. In addition, they identified 19 potential research projects that were divided by undergraduate and graduate in the disciplines of Civil, Geological, Electrical or Mechanical Engineering.

Mining Materials Research Cluster—Corrosion, University of Saskatchewan and University of Regina

This four year project explored four areas of corrosion in the mining industry, concrete corrosion, corrosion inhibitors, stress corrosion cracking and slurry erosion corrosion. Funding from IMII, Western Economic Diversification, NSERC and Mitacs of *$2.4 M* supported equipment, research and saw *25* HQP participate in the project. Several significant outcomes from the project are:

- A hard x-ray Spectro microscopy method was developed to study the corrosion of polymer-coated rebar without removing the coating and have proven that this method can be used to study real-world samples.
- Two effective corrosion inhibitors were identified that can be used for corrosion control in potash solution mines and could have great potential to provide benefits to industry .
- A custom potash slurry flow loop was constructed and implemented. A flat specimen holder (for installation in the slurry flow loop) was constructed that allows for the erosion corrosion ranking of any flat material in a potash slurry.
- An empirical correlation was developed to predict erosion-corrosion under certain conditions.

Deep Hydrogeological Research to Support Brine Management, University of Saskatchewan

This project explored the response of deep saline aquifers to their continued use for waste water management through two sub projects, “Geochemical and Isotopic Tools to Support Hydrogeological Investigations and Modeling of Potash Mine Flows” and “Assessment of Injection Well Capacity for Brine Disposal in Saskatchewan”. Further work on the isotopes systems is currently being pursued with funding from Global Water Futures and an NSERC Discovery Grant.

Geochemical models have been created by a MSc student to explain the distribution of chloride and oxygen and hydrogen isotopes and will be further refined in her PhD program.

Quantification of Scaling Bar Impacts for Underground Mine Safety , University of Saskatchewan

This project was to establish the feasibility of developing a device capable of providing a simple to understand "safe-unsafe-unknown" evaluation of the impact from a scaling bar on the mine roof (known as “sounding”), that can be used to inform the decision of whether installation of ground support or further testing (e.g. drilling or ground penetrating radar) is needed.

They successfully developed classification algorithms that can classify the recordings as “drummy” or “tight” with good accuracy and optional classification algorithm that can classify the recordings as “drummy”, “tight” or “unknown” with tunable confidence probabilities.

The project is moving to Phase 2 to develop a prototype device suitable for underground testing .

DEMOday

Our second annual DEMOday was held on April 3, on the eve of the 11th Annual Saskatchewan Mining Supply Chain Forum in Saskatoon. DEMOday is an event in which supply chain companies can present their innovations directly to Saskatchewan's major mining companies and have them considered for further review and potentially financial and in-kind support.

The five supply chain innovations and companies that presented at the 2019 event are:

- A new cybersecurity solution for industrial SCADA systems from EECOL Electric and Nozomi Networks;
- A new corrosion resistant epoxy powder coating technology from Saskatoon Custom Powder Coating Corporation and Akzo Nobel Coatings;
- A new to Saskatchewan mining technology for potential use in the potash industry from Continental Mine & Industrial Supply Ltd.;
- A new dust collection system suitable for underground potash mining from Continental Mine & Industrial Supply Ltd.; and
- A new battery electric truck for roof bolting from Prairie Machine & Parts Mfg. Partnership.

As a direct result of the presentations made to industry at DEMOday in both 2018 and 2019, IMII has several projects in the works with supply chain companies under the Operationalizing Innovations program to help to advance their innovation down the path to commercialization.

- Industrial Machine and Manufacturing;
- Croatia Industries;
- Continental Mine & Industrial Supply Ltd.; and
- Prairie Machine & Parts Mfg. Partnership.

Innovation Award

IMII awarded the 2019 Innovation Award for Best New Technology Product to Continental Mine & Industrial Supply Ltd.'s DC-54-UG Underground Dust Collection System on the evening of the 11th Annual Saskatchewan Mining Supply Chain Forum on April 3, 2019 in Saskatoon.

Selected from among applications submitted by Saskatchewan supply chain companies, this award for the best new technology product represents the most innovative new or applied technology emerging from the supply chain for the minerals industry in the province in 2019, as judged by a panel of subject matter experts from IMII's minerals company members and Innovation Saskatchewan.

Pictured from left to right:

Al Shpyth, IMII and Dwayne Howatt, CMI

Diversity & Inclusion Challenges

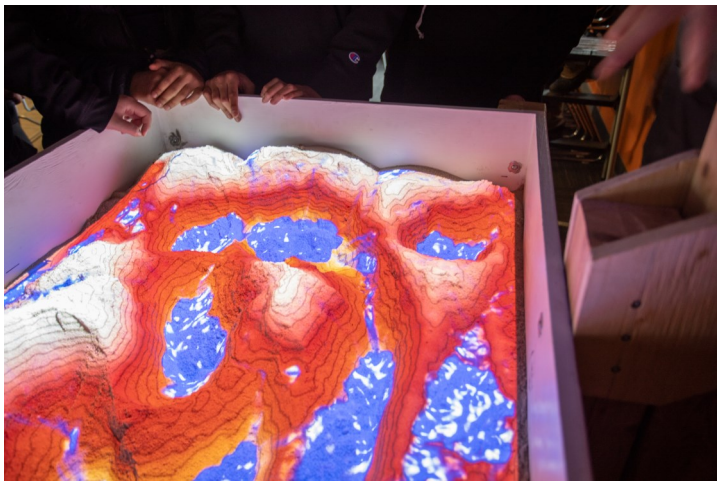
CREATIVITY

Girls in the Classroom, RESPEC

This **educational outreach pilot project** engaged with elementary and high school girls and young women to educate, debunk stereotypes and raise awareness around STEM-related career opportunities in the mining and mineral industry for women. With the support of innovative approaches and tools, the project connected classrooms with the diverse female mining and minerals workforce as applied examples of the learning outcomes in the public school curriculum. The ultimate aspiration of this project is to feed this key underrepresented group of the mining sector talent pipeline through inspirational interactions.

The program reached 158 middle-year students, 55 high school students, and 37 teachers and educational assistants. Activities included a debate (grade 7 SAGE), GPS field exercise (grade 4-8), building a small machine that is used in mining (grades 4-5), virtual potash mine tour and mine cycle discovery (grade 6-7), Girls Discover STEM weekend, and the trades and technology exploration event at Saskatchewan Polytechnic.

More information can be found The project's webpage http://www.girlsintheclassroom.org/iMii and their twitter account is @GITC_Mining.



Girls in the Classroom Trades & Tech Event
Saskatchewan Polytechnic, December 12, 2019

First Responders Boot Camp 2018

Junior & Youth First Responders Boot Camp, Saskatchewan Mining Association

This pilot project offered two week-long camps/workshops for both rural and urban Indigenous youth that included career awareness, first-aid training, fire-awareness training and safety, with related industry-recognized certifications along with site visits to emergency facilities (STARS – Shock Trauma Air Rescue Service) to provide first-hand experience and amplify interest in these occupations. The summer camps took place in 2018 and 2019.

Participants described the experience as "fun, awesome, enlightening, cheerful, social, educational, inspiring, informational, life-lasting, tiring, exciting, enjoyable, and best week ever!". The event provided positive teamwork and relationship building between urban and rural STC youth. This experience in the context of inclusion and diversity has changed lives.

35 Students

- **23 female**
- **12 male**

RESEARCH

Mine Your Potential Mentorship Program, Women in Mining/Women in Nuclear SK

The goal of the Mine Your Potential Mentorship Program was to change the preconceptions women have of the mining industry, and to educate and promote women into the mining and minerals sector as the great career choice that it is. The pilot also strove to retain and promote the women already in the mining industry to realize their full potential.

The program ran three cohorts with 130 mentees and 146 mentors signed up. Participants in the program came from a wide range of background and disciplines including engineering, safety, environment and geological sciences, and representation from human resources, legal and financial. Survey responses showed that the program did not only benefit the mentees, but mentors took away valuable lessons along the way as well.

MentorSTEP, University of Saskatchewan

With its official launch on October 16, Mentor STEP will provide a suite of mentorship, hands-on learning, industry-networked, and paid summer research internships to Indigenous girls and women learners. In this way it will pave the way to Indigenous women in the province of Saskatchewan choosing careers in Science Technology, Engineering and Math (STEM) and stepping into welcoming careers in the Mining Industry.

The Undergraduate Research Initiative at the University of Saskatchewan, in partnership with the Saskatoon Tribal Council and the Student Chapter of the Metallurgy & Materials Society of the Canadian Institute of Mining, Metallurgy & Petroleum, have partnered to offer a Research MentorSTEP program for female Indigenous students attending the University of Saskatchewan and Saskatoon Tribal Council high schools and training programs. This program focuses on providing a robust and rich mentorship and support system realizing networking, professional and skills development, and hands-on approaches that will be activated through research assistantships in industry during the summer months (May through August). MentorSTEP will provide pro-mining and pro-STEM career choices and opportunities for girls and women who are Indigenous.

12 mentees and

25 mentors have signed up in the first year

of the project

Gender Equity in Mining (GEM) Works – Saskatchewan – Mining Industry Human Resources Council (MiHR)

MiHR's Gender Equity in Mining Works (GEM Works) initiative is the only program that provides mining organizations with proven, industry-developed tools to help eliminate systemic barriers to gender inclusion in the workplace. GEM Works helps companies' foster workplaces where both women and men have the best opportunities for making great contributions and having rewarding careers.

The proposed format for this project is a facilitated GEM Works Industry Cohort, lead by MiHR's gender inclusion subject matter experts/practitioners. As part of this cohort, MiHR will support (up to) a 10-member Gender Champion Taskforce of leaders working in Saskatchewan mining operations, production and within supply chain companies, provide training for Gender Champions and applying proven tools to identify/mitigate systemic barriers in current organizational policies and practices.

Initiatives

Digital Mining Transformation Initiative

The digital transformation of Saskatchewan's minerals industry has been identified as a priority by the members of IMII — mineral companies, government, post-secondary and research institutions and supply chain companies. In 2018 the IMII had been charged by its members with developing and delivering on a special project – to help digitally transform their Saskatchewan mineral operations and facilitate the development of a vision for digital mining in the province in the form of a "framework" through which key partners and stakeholders design and establish platforms and mechanisms for collaborating with minerals companies and one another to realize a shared, long-term digital technology transformation goal.

The resulting Digital Mining Transformation Initiative (DMTI) concluded in June 2019 with the publication of a framework to allow IMII and its members to work through projects supportive of mining's digital transformation. The Framework represents a model through which desired outcomes can be mapped to both interventions (i.e., actions that would realize the outcomes) and functional areas which contribute to desired goals (e.g., future workforce and workplace, pre-competitive applied R&D).

The Framework and survey results obtained in parallel to the workshops can also be used to identify areas of common interest (e.g., technologies, use cases, capability development). The final workshop selected the future workforce and workplace as the highest priority area for follow up, and nominated three projects for demonstrated action:

- Defining 21st century competencies and skills;
- Developing a progressive experience to attract and inspire new workers; and
- Identifying future workforce supply and planning.

Mitacs MOU

One June 25, 2019, Mitacs and IMII announced a partnership to fund student internships to advance research and development into innovations in the minerals industry.

Mitacs and IMII will support Saskatchewan's major minerals companies by leveraging funding, connections, and academic research expertise. The partnership will help advance innovations that matter to mining by bringing together research collaborations between industry and academia, while also assisting in the development and recruitment of highly qualified technical students, graduate students, and postdoctoral fellows.

The potential value of initiatives under the partnership begins with a $1.2 million investment. Mitacs will contribute up to $660,000 over five years and IMII a further $540,000 with a target of creating the equivalent of 30 year-long internships. Both parties and industry partners may contribute more in response to industry need and outcomes of the partnership.

The partnership will be implemented based on an annual "request for researchers" issued by IMII and facilitated by Mitacs's connections with colleges and universities in Saskatchewan and across Canada.

.

Scholarships

IMII made a $1 million commitment in 2017 to a Diversity & Inclusion Challenge program to advance seven pilot and demonstration projects and increase the numbers of women and Indigenous people in Saskatchewan's minerals industry. In 2019, it made a further $1 million commitment through scholarship and internship programs over five years to provide new opportunities for women, Indigenous and other students to succeed in post-secondary education and become the highly qualified people the industry requires. The five-year initiative commits over $500,000 to establish two scholarship programs.

iMpowered Scholarship

College, polytechnic and university women and Indigenous students with financial responsibilities for the family, enrolled in a science, technology, engineering, mathematics or computer science program and interested in a career in the minerals industry. Two scholarships will be given out each year, and each student will be awarded $25,000 which may be used to cover any costs associated with their efforts to attain a higher education, such as childcare, tuition, books and transportation.

October 10, 2019 marked the inaugural awarding of the iMpowered scholarship to the first two recipients, Corine Strube and Mulaina Boissoneau.

Corine Strube, a Métis woman breaking into the science world, is enrolled in the Chemical Technology Program in the School of Mines, Energy and Manufacturing at Saskatchewan Polytechnic's Saskatoon campus. A career in science and mining will change the future for her and her daughter.

From an early age, Mulaina Boissoneau has been working odd jobs to help with the financial contribution to her family. A young Indigenous woman, she is enrolled in Chemical Engineering at the University of Saskatchewan and wants to be a part of the betterment of the mining industry, not just in Saskatchewan, but on a global level. She looks to defy the stereotype by excelling at what she sets out to do.

Pictured from left to right:

Corine Strube, Mulaina Boissoneau

The Mining Futures Award

Designed for undergraduate students currently enrolled in one of three Mining Engineering Options at the University of Saskatchewan, one student receiving this award will collect $12,000, covering most of the costs for tuition, books, instruments and fees.

Makayla Scheller, a 3rd year Geological Engineering student at the University of Saskatchewan enrolled in the mining option program, is the first recipient of the Mining Futures Award. Makayla is honing her organizational and leadership skills through the Geological Engineering Student Society, attending CIM Saskatoon Branch dinners, and taking on the role of VP External Communications for the CIM Saskatoon Student Chapter. Participating in these activities have increased her knowledge on the different aspects of the mining industry and practice networking with members of the industry.

Pictured from left to right:

Joe Gosselin - BHP, Murray Schultz - Mosaic, Makayla Scheller, Luke Protz - Nutrien, Al Shpyth - IMII

Let's Talk Minerals!

On May 24, 2019 the IMII held its 6th Annual Let's Talk Minerals. The theme this year was "Operationalizing Diversity & Inclusion" and reflects our members' commitments to having a workforce representative of the communities in which they operate.

New to the event this year was a panel discussion featuring a senior representative from each of IMII's three founding parties: industry, government and academia. The panel members are:

- **The Honourable Bronwyn Eyre,** Minister of Energy & Resources, Government of Saskatchewan
- **Susan Jones,** Executive Vice President & CEO, Potash, Nutrien Ltd.
- **Dr. Suzanne Kresta**, PhD, P.Eng., F.E.C., Dean & Professor, College of Engineering, University of Saskatchewan

The panel was moderated by **Tammy Van Lambalgen**, Vice President, Corporate Affairs & General Counsel, Orano Canada Inc. as Chair of the Saskatchewan Mining Association and IMII Board member.

A video of the panel discussion can be found at https://www.imii.ca/communications/videos/.

Industry and Students Talk Career Paths

Representatives from BHP, K+S Potash Canada, Mosaic and Nutrien met with students from the College of Engineering and Saskatchewan Polytechnic at a networking event on September 23, 2019 to talk about careers in the mining industry.

The evening featured presentations from industry on various topics including beneficial soft skills to develop, innovative research, diversity and inclusion, and geological, mechanical and process engineering. Networking and refreshments rounded out this informative event.

The three engineering disciplines discussed are represented in the Mining Engineering Options Program in the College of Engineering. The Mining Engineering Options Program was the first project funded by IMII receiving $1.2 M to develop the programming and recruit faculty to teach them. With funding wrapping up in 2018, industry committed to continue to support the Program and the students.

Innovation Videos

In 2019, IMII created five new videos in the Innovation series to promote innovations that matter to mining by showcasing the innovative nature of our industry members, projects and initiatives.

- Introduction to IMII
- K+S Potash Canada—Virtual Reality
- Girls in the Classroom
- Positioned for Change—Let's Talk Minerals! Panel Discussion
- DEMOday & Innovation Award (released January 2020)

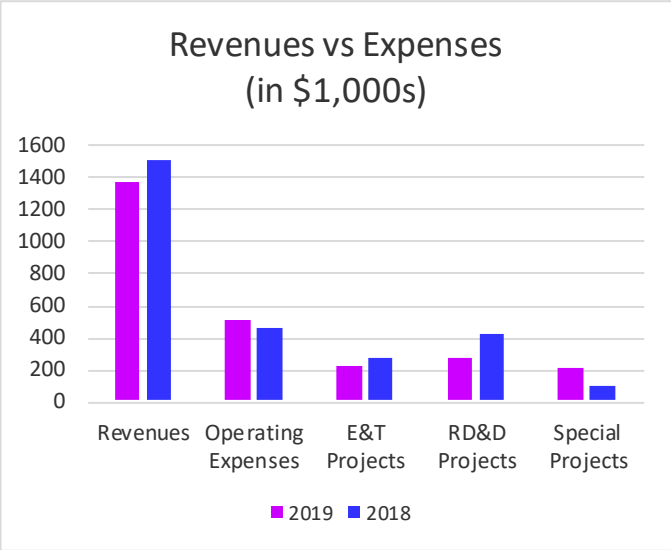
Our video series can be found at www.imii.ca/communications/videos/.

Financial Highlights

From its establishment in 2012, IMII has sponsored 34 industry driven projects valued at nearly $18 million and has leveraged almost $8 million in project funding from outside of its mineral industry and provincial government members.

In 2019, IMII has continued to grow its project portfolio spending:

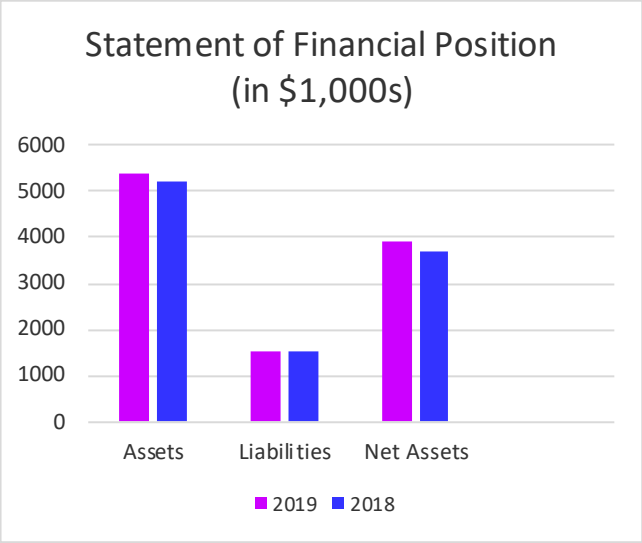
- $259,906 on research, development and demonstration projects
- $210,104 on diversity and inclusion projects
- $198,853 to advance and promote innovation through special projects



In 2019, IMII reported revenues of $1,367,956 with $785,693 from its industry members for operations and projects (57%), $492,797 from the Government of Saskatchewan through Innovation Saskatchewan (36%), and $89,196 (7%) from other sources.

IMII spent a total of $1,170,035 in 2019, including $501,172 (43%) on administration and $668,863 (57%) on projects.

Special projects for 2019 included the Digital Mining Transformation Initiative, the IMII Scholarships and some pre-work on a testbeds project concept.



$3.78 million of IMII's net assets at the end of 2019 was committed to fund approved projects and initiatives for 2020 to 2023.

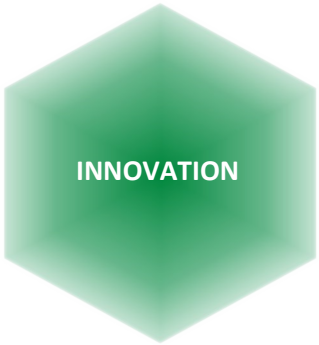
- $879,646 for education and training/diversity and inclusion commitments
- $1,007,405 for research, development and demonstration commitments
- $1,763,000 for special project commitments
- $125,000 held as a windup reserve

Partners

Our Members

Minerals Companies – "Company A" Category

- BHP
- Cameco Corporation
- K+S Potash Canada GP
- Nutrien Ltd
- Mosaic Company



Government of Saskatchewan

- Innovation Saskatchewan
- Ministry of Advanced Education

Post -Secondary Educational Institutions and Research Providers

- Canadian Light Source
- Cumberland College
- Genome Prairie
- Northlands College
- Prairie Agricultural Machinery Institute (PAMI)
- Saskatchewan Polytechnic
- University of Regina
- Carlton Trail College
- First Nations University of Canada
- North West Regional College
- Parkland College
- Saskatchewan Indian Institute of Technologies (SIIT)
- Saskatchewan Research Council (SRC)
- University of Saskatchewan

Associates

- Saskatchewan Industrial & Mining Suppliers Association Inc. (SIMSA)
- Saskatchewan Literacy Network
- Saskatchewan Mining Association (SMA)
- Saskatoon Regional Economic Development Authority (SREDA)
- Women in Mining and Women in Nuclear Saskatchewan Inc. (WIM/WiN-SK)

Innovations that Matter to Mining