



**YOUR LINK TO
TOMORROW**



What's your big idea?

Contact us at 1-866-467-4278 or applied.research@saskpolytech.ca
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President's message

Saskatchewan Polytechnic is the leading source for applied research expertise in Saskatchewan.

In addition to having exceptional facilities and equipment with knowledgeable faculty, staff and students, we offer our partners a wide range of supports, from access to industry connections to avenues for funding for research and development purposes.

Collaboration is important to all our research activities. As a polytechnic, we place great value on our ties with business and industry. Programming is based on industry demand and participation, giving us vital insight to the needs and challenges that businesses face. Moreover, as a member of Polytechnics Canada, an association of publicly funded polytechnics, colleges and institutes of technology across Canada, we have access to additional resources that can spur and speed innovation.

We are proud of our contributions to the business sector. Saskatchewan Polytechnic's talented graduates are employed in virtually every public and private industry, and are key contributors to the health and prosperity of western Canada's economy. We are hands-on and industry-driven.

Whether you need to validate a business process, develop a prototype or require assistance in testing or pre-marketing a product, we invite you to contact us to learn more.

The bottom line is that we can help turn your ideas into reality.

Dr. Larry Rosia
President and CEO

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**SASKATCHEWAN
POLYTECHNIC
IS THE LEADING
SOURCE FOR APPLIED
RESEARCH EXPERTISE
IN SASKATCHEWAN.**



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**SASK POLYTECH IS
HELPING EMPLOYERS
SOLVE TODAY'S
COMPLEX BUSINESS
CHALLENGES.**



Applied Research message

Applied research is innovative, flexible and agile. This publication is full of examples demonstrating how applied research at Saskatchewan Polytechnic drives economic growth and enhances social well-being. From cell phone apps that improve mental health and navigate farm expos, to 3D printing a farm-in-a-box prototype and using biocomposites to upcycle non-recyclable material for new buildings – Sask Polytech is helping employers solve today's complex business challenges.

Our faculty, researchers and students collaborate with employers on applied research projects. These projects take many forms including product development, process design, technology adoption and proof of concept. Using state-of-the-art facilities, equipment and faculty expertise Sask Polytech delivers solutions and helps employers to capture new opportunities. Applied research partners also may receive government funding, through organizations such as the National Research Council of Canada and Natural Sciences and Engineering Research Council of Canada, to assist in covering the costs for their research projects. Intellectual property for applied research projects at Sask Polytech is always retained by the employer, creating more incentive for future creative engagement and ongoing collaboration.

In 2018-19 Sask Polytech completed 59 applied research projects and had 43 paid student researchers. We are looking to increase the number of projects we work on annually and create more work-integrated learning opportunities for our student researchers. If you have a business challenge you need assistance with, please contact us. We can't wait to collaborate with you.

Dr. Susan Blum

Associate Vice-President, Applied Research





Finding your way

App helps visitors navigate farm expos

For farmers and the businesses that serve them, Ag in Motion: Western Canada's Farm Expo, can be overwhelming, with live demonstrations of field equipment, crop test plots, interactive agribusiness product exhibits and presentations.

"On 100 acres it would be very easy for people to completely miss things," said Kelvin Boechler. "They could wander through the event and miss exhibits or information that they're interested in."

Boechler is a senior research associate and project manager with the Digital Integration Centre of Excellence (DICE) at Sask Polytech's School of Information and Communications Technology. He explained that the show's owner, Glacier FarmMedia (GFM), approached the team about creating an app to help people get the most out of the Saskatchewan agriculture show as well as Canada's Outdoor Farm Show in Woodstock, Ontario.

Both events are extensive affairs. Ag in Motion takes place over three days in July, where about 450 exhibitors display their products and services to more 30,000 people at the show site near Langham, Saskatchewan. About 40,000 people attend the Woodstock event.

This makes for a lot of information to share and the perfect opportunity for an app.

Boechler explained a key feature of the app is a mapping function that tells you where you are, much like the GPS systems in cars and smartphones. This is integrated with the schedule, so if there is an upcoming presentation, the user gets a notification along with the quickest route to get there.

Visitors to the shows can download the app to their smartphones for easy access to event details, information on crop varieties and the inner workings of farm machinery – even how and when to catch a ride. One supplier used the show shuttle as a demo, equipping it with a tracker that is usually used to let producers know the location of their equipment on their farms. Through the app, they could actually try it out.

"After you walk that 100-acre site over and over again, that shuttle starts to look pretty good," Boechler said, adding that this try-it-out feature might be incorporated in other areas.

Another feature of the app uses augmented reality to link actual field examples to equipment. In 2019, farmers could visit two canola test plots seeded by two different equipment systems. By looking at their smartphone screens through the app, they could see the equipment in action overlaid on their screens and get directions to the equipment vendors' booths at the show.

Boechler and the DICE team also looked at other possibilities for augmented reality to add value for both farmers and vendors. They worked on a feature where users could point their smartphone at a machine (in this case, a combine) and see it overlaid with pictures or illustrations of its inner workings.

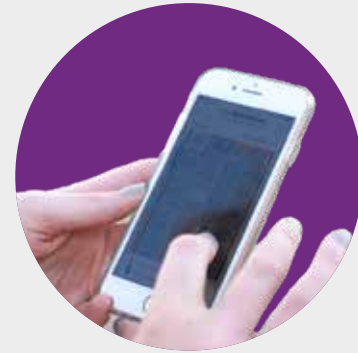
The app also helps GFM and their exhibitors, giving them valuable insights into the interests and behaviours of event attendees, such as how many people pass each booth, how many stop and for how long.

One of the challenges is that the GFM events are on rural sites. Adding 30,000+ users to an existing cell network can seriously slow down app performance, which means using minimal bandwidth is important.

"We're attacking the cell tower saturation problem for them," Boechler said. "One of the things we're looking at is using something called edge computing. This means our app doesn't have to go through the cell network."

THE APP PROVIDES VALUABLE INSIGHTS INTO THE INTERESTS AND BEHAVIOURS OF EVENT ATTENDEES.

Ag in Motion, Western Canada's
Farm Expo, July 2019.
Photo credit: Glacier FarmMedia



THE FARM EXPO APP TECHNOLOGY HELPS VISITORS:



NAVIGATE
THE AREA

BE NOTIFIED OF
PRESENTATIONS OF
INTEREST



KNOW WHEN AND
WHERE TO CATCH
A SHUTTLE

DEMO PRODUCTS
THROUGH
AUGMENTED REALITY



LEARN ABOUT SHOW EVENTS,
INFORMATION ON CROP
VARIETIES AND THE INNER
WORKINGS OF FARM MACHINERY.





A virtual walk in the woods aims to improve forest harvesting

A forest worker sizes up a new cut block, walking through dense forest, muskeg, rocks and hills. He is trying to figure out the best, safest, most ecologically sound routes to put in access roads to harvest timber.

It's a time-consuming and expensive task, one that frustrated Os-Arc Enterprises of Big River and drove them to Dave Halstead and Leila Benmerrouche to see if they could come up with a better solution.

"Even a half kilometre of un-needed road is a big expense," said David Halstead, research chair within the School of Natural Resources and Built Environment at Sask Polytech's Prince Albert campus. He added that companies strive to minimize roads for environmental reasons as well.

"Erosion is still the number one pollutant we face in North American waters, just through sediment," he said. "It's a huge concern. So we try to avoid creating as much road as possible and try to stay away from water bodies."

Backed with a grant from the Natural Sciences and Engineering Research Council (NSERC), Halstead and Benmerrouche got to work in early 2019, using satellite imagery and comprehensive high-resolution imagery from FlySask, a provincial collaborative. They worked on two of Os-Arc's cut blocks, one post-harvest and one pre-harvest.

David Halstead, research chair, School of Natural Resources and Built Environment (left) and Leila Benmerrouche, research technician.

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**YOU PUT ON THE
VR GLASSES AND
YOU CAN VIRTUALLY
WALK THROUGH THE
ACTUAL FOREST ...
YOU'RE DOING THIS
WORK WITHOUT
LEAVING YOUR OFFICE.**

David Halstead, research chair



Benmerrouche, a Sask Polytech research technician, worked with students to digitize the information, overlaying the forest map with terrain and other data. They then applied an automated pixel-by-pixel assessment process to evaluate environmental features and envision the most cost-effective road layout.

About halfway through the process, a new idea came to the forefront: what if they plugged the data into a gaming engine and presented the information in virtual reality?

“You put on the VR glasses and you can virtually walk through the actual forest,” Halstead said. “You can zoom back and look at the whole cut block, in a 3D model, or you can zoom right in so you’re standing beside a rock on the ground and be able to see the trees around you. You’re doing this work without leaving your office.”

Another benefit is that since the data are stored digitally, they can be later referenced for other management purposes such as reforestation or environmental studies.

Currently, companies such as Os-Arc have topographical maps in hand for basic information. Then they send out people to physically walk the woods and find good routes for access roads. It’s a time consuming and expensive process, in an industry pressured by transportation costs and the demands of environmental stewardship.

Halstead said the current grant and project has been completed and the first iteration of the virtual forest tool has been created and presented to Os-Arc. But more can be done.

“We’re not entirely where we want to be, but we’ve come a long way,” he said. “We’ve seen tremendous possibilities for this technology.”

THE OS-ARC APPLIED RESEARCH PROJECT INCORPORATES:



SATELLITE IMAGERY



COMPREHENSIVE, HIGH
RESOLUTION IMAGERY



VIRTUAL REALITY

David and Leila at the Os-Arc Enterprises field site north of Weyakwin, Saskatchewan.

Taking care

App aims to manage mental health in the workplace

Caroline Hoffart and her community partners are working to create tools to overcome workplace mental health hurdles and literally put them in people's hands via their smart phones.

Hoffart is a faculty member with the Sask Polytech Psychiatric Nursing diploma program and one of the principal investigators on a research project aimed at identifying mental health barriers, from both the employee and employer side, that can limit success. She and her colleagues hope to help people pursue and succeed at their careers — and help employers to tap the talent they need for successful enterprises.

Mental health hurdles come in several categories, Hoffart explained. Some people have a long-term mental illness that has kept them out of the workplace for a long time, making re-entry difficult.

“Then, we have those people that are working that become ill within the workplace because of the stresses within it,” she said.

The research project is a collaboration among Sask Polytech, the Canadian Mental Health Association (CMHA) Saskatchewan Division and Saskatoon marketing and tech innovation company Refresh Inc. It is funded through a two-year, \$240,000 NSERC grant through the College and Community Social Innovation Fund.

The project has been about four years in the making to create its community-driven, patient-centred approach. For example, a key component of the research are questionnaires developed in partnership with people with mental health challenges and their caregivers.

At the same time, Refresh is developing a wellness platform and app with Sask Polytech's Digital Integration Centre of Excellence (DICE). Much like physical health apps, the Refresh app is designed to help people monitor and nurture their mental health, create a supportive peer network and link to services in the community.

Refresh owner Naqsh (Nick) Kochar explained that the research participants will act as early adopters and beta testers for the app to ensure it helps the people it is intended to serve. There is great potential in the app's marriage of robust technology and patient-centred research. There's also a public call for beta testers – individuals can sign up at refreshinc.com, if interested.

“There are big data implications as well as significant implications in artificial intelligence,” he said. “As the app gets to know someone and learns more about who they are, the ability for it to provide recommendations is a big deal.”

Rebecca Rackow, the director of Advocacy Research and Public Policy Development at CMHA and part of the research team, said, “Overall, you can take care of your mental wellness much like you look after your physical fitness.”

CMHA Saskatchewan Division, associate executive director Dave Nelson said mental health issues are common, affecting about a quarter of employees. Many suffer in silence as they fear that it may affect their ability to keep or advance in their careers. Tools to help employers, unions and other stakeholders support mental health in the workplace are needed.

“Insurance companies seem to be finding it very challenging because it's the largest growing sector that they're having to support,” he said.

“THERE ARE BIG DATA IMPLICATIONS AS WELL AS SIGNIFICANT IMPLICATIONS IN ARTIFICIAL INTELLIGENCE.

Nick Kochar, Refresh owner

Beta testing the Refresh mental health app.



Ready to get started?

Sask Polytech's applied research partners have access to exceptional facilities and faculty expertise, funding for research and development and a wide network of connections. By partnering in innovation and testing Sask Polytech enables companies to capture new opportunities, solve everyday problems and contribute to economic growth and job creation in Saskatchewan.

Delivering solutions to industry problems

Applied research projects at Sask Polytech are steered by industry, business and the community. Through a collaborative applied research approach Sask Polytech can help industry adapt to technological advancements, respond to changing needs and contribute to creating a stable economy.

Involving students in applied research and innovation

Students participate in applied research projects that offer team work and problem solving experiences to solve real business challenges. The benefit of student participation is dual: businesses get access to an additional resource and students build their skills, ensuring graduates are ready to contribute on-the-job on day one.

Helping innovate and develop prototypes for industry partners

Sask Polytech has the in-house capacity to conduct experiential development, business validation and technology adoption and provides the resources industry needs to innovate. Faculty and staff combine their expertise with a wide spectrum of leading-edge technology such as 3D printers, cutters and computer numerical control (CNC) machines and genome sequencers to assist research partners with the capital-intensive components of the product development process.

Securing research and development funding

From start-ups to established industries, Sask Polytech knows where to find financial support. Whether you are looking to start a new project or take your business to the next level, Sask Polytech will put its knowledge to work connecting researchers and their industry partners with the funds they need.



Applied Research Centres

As an educational institution, Sask Polytech is committed to providing its students with the knowledge and skills relevant to the working world of today and the future.

One way of achieving this is through its five applied research centres, focused on manufacturing, digital integration, health care, bio-sciences and natural resource management.

These centres provide focus and foundation for Sask Polytech faculty experts. Here, they leverage the latest published research and use cutting-edge equipment to solve real-world problems and create valuable intellectual property for industry partners.

In the process, Sask Polytech students receive education and training grounded in current, relevant practice, together with experience gained while working with industry – an invaluable first step in their careers.

- **BioScience Applied Research Centre (BARC)**
- **Digital Integration Centre of Excellence (DICE)**
- **Hannin Creek Education and Applied Research Centre (HCEARC)**
- **Innovative Manufacturing Centre (IMC)**
 - **Research, Additive Manufacturing and Prototyping (RAMP)**
 - **Biomaterials Testing and Prototyping (B-TAP)**
- **Centre for Health Research Improvement and Scholarship (CHRIS)**

BARC receives next generation genome sequencers

The BioScience Applied Research Centre (BARC) is home to applied research expertise and a team of instructors and research personnel whose strengths include agricultural bioscience, analytical chemistry, analytical instrumentation, biochemistry microbiology and molecular biology.

BARC has recently received additional equipment to provide it with capacity to undertake genomic sequencing. Through Western Economic Diversification funding obtained in cooperation with Genome Prairie, BARC has received two next-generation sequencers that will provide Sask Polytech with the capacity to undertake research and data analysis, while training students in sequencing methods and equipment operation. The new equipment will enable a wide variety of applied research applications, allowing investigation of the DNA and RNA of any organism. While they are housed within BARC, it is anticipated that the new sequencers will be used to advance teaching and applied research in multiple programs, including BioScience Technology, Medical Diagnostics, Agriculture and Natural Resource Technology.



Sequencing is being integrated into multiple training programs and applied research initiatives.

DICE delivers business edge with big data

In today's increasingly digital economy, information is the common denominator for success for commercial enterprises from the automotive, agriculture and mining industries, to business, health care and not-for-profits.

Dr. Terry Peckham, director and research chair at the Digital Integration Centre of Excellence (DICE) explained that all organizations generate data. It's an extremely broad term that covers everything from sensor signals on agricultural and mining equipment, to business statistics or even results from counselling sessions to help a not-for-profit be accountable to their funding agencies.

"It's become a new form of economy," Peckham said. "People can generate the data, but then how do you find that magical secret that gives you that business edge?"

This is where DICE comes in. An industry partner - usually a small or medium-sized enterprise - comes to Peckham and his colleagues with a problem to solve. This can start from the basic level of how to identify usable data, to how it can be profitably harnessed. The team may draw on expertise from Sask Polytech programs such as Electronic Systems Engineering or Electrical Engineering to design and build brand-new sensors or other solutions. They also conduct a review of the latest scientific research and existing technology, whether it be hardware or software. Various government grants are available to support the work.

Intellectual property (IP) issues are left for the industry partner to resolve with appropriate licensing, but any brand-new solutions belong to them.

"Sask Polytech does not retain any intellectual property," Peckham said. "We sign all the IP back to the organization, so they own it all."

HCEARC grows as a hub for boreal research and education

Whether it's to create knowledge of the natural world or to share it, the Hannin Creek Education and Applied Research Centre (HCEARC) offers unique opportunities for researchers, students and the community.

Jointly owned by Sask Polytech and the Saskatchewan Wildlife Federation, the HCEARC is located at Candle Lake, about 90 kilometres north of Prince Albert, Saskatchewan, in the boreal forest. On-site resources include accommodations and most recently, a new research lab.

"As a research and teaching lab, it's used to educate students from a variety of programs," said Dr. Hamilton Greenwood, instructor of the Natural Resources program.

The HCEARC facility is also popular with people looking for forest-based training and activity, with more than two dozen groups using the education centre. These include both the provincial and federal government to train forest management and environmental workers and community groups for activities such as youth leadership and cultural camps.

Sask Polytech faculty come to Hannin Creek both for professional development retreats and to conduct research, both independently and in partnership with other organizations. For example, one project is looking at forest revegetation. Another, through the Global Institute for Water Security at the University of Saskatchewan, is installing monitoring stations along the creek and adjacent forest to study the hydrology of the southern boreal forest.

"The sky is the limit; it's whatever you can imagine," Greenwood said.

Applied Research offers services to complement projects that seek to understand and protect the natural world around us.



RAMP brings industry innovation from computer screen to reality

While 3D printing offers a way to translate ideas quickly from computer screen to tangible, durable products, it's tough to take the plunge and invest in expensive equipment whose potential is unknown.

“Before companies make that expensive purchase, we have the ability to work with them to ensure that they know what can be achieved. It helps them make an informed decision before they invest,” said Tim Muench.

Muench is program head of Sask Polytech's Mechanical and CAD/CAM Engineering programs and senior researcher for the Research, Additive Manufacturing and Prototyping (RAMP) facility at the Innovative Manufacturing Centre (IMC) at Saskatoon campus. He explained RAMP machines can print with various types of plastic and composites. The facility is also home to one of the only metal 3D printers in Saskatchewan.

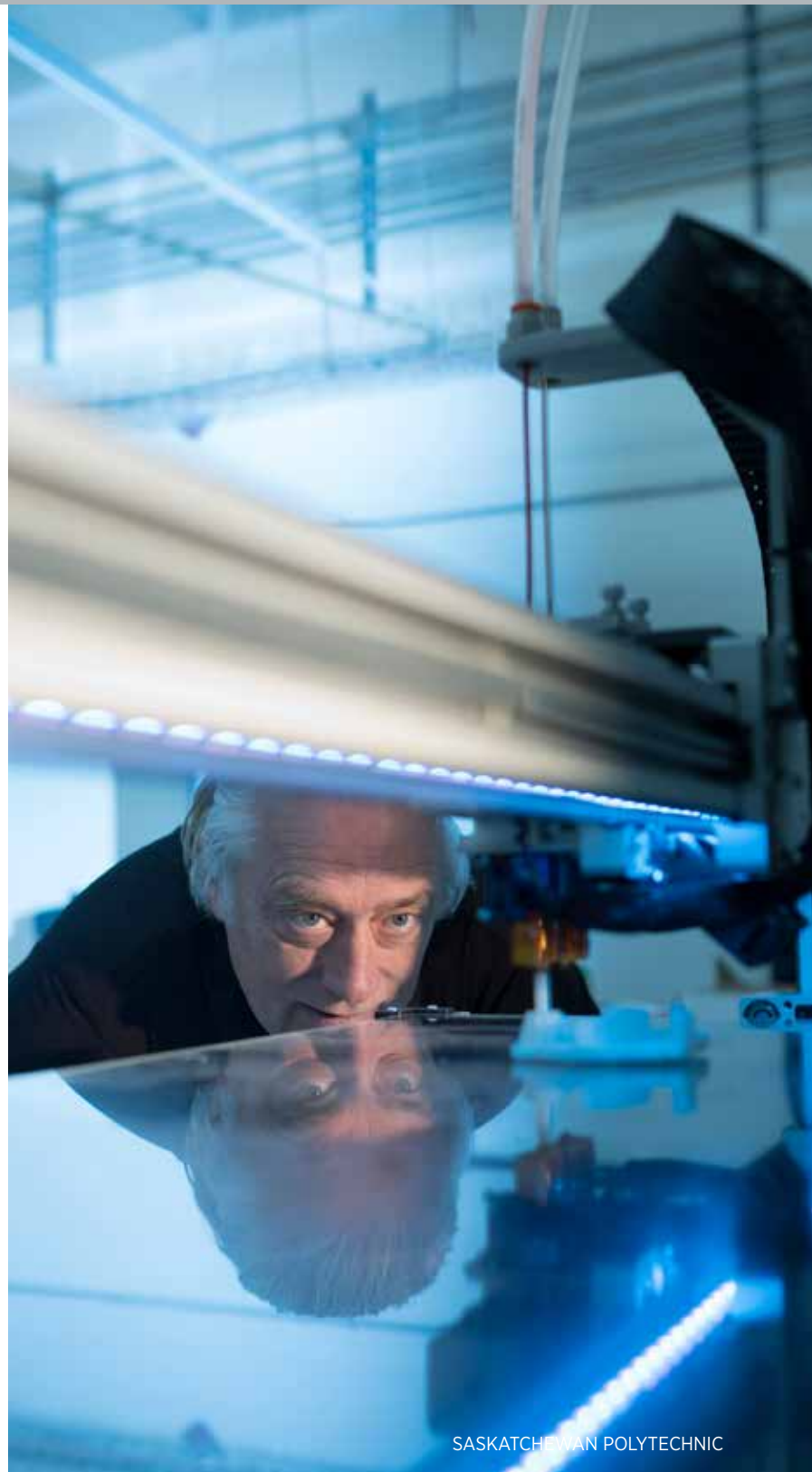
RAMP offers industry, including small and medium sized enterprises, the ability to bring in ideas created on their computers, then test them in the real world without extensive machining or creating special dies or molds.

“Rather than having to machine it, often times they can make a carbon fibre part or something similar that will get them the results they need,” Muench said.

Products made from the 3D printers can be extremely durable. For example, the carbon fibre printer quickly created an adapter to mate an electric motor to a machine to help a company meet an important deadline and the metal printer produced “fingers” for a robot gripper on a manufacturing line to replace less durable plastic originals.

“The output of these machines can be used to fully test prototypes or as production components,” Muench said.

Applied Research partners have access to leading-edge technology, such as additive manufacturing machines, which are also known as 3D printers.



B-TAP facilities nearing completion

Saskatchewan agriculture produces a wide variety of fibres, from flax and hemp to alpaca, goat and even bison – all of them resources to be explored at the Biomaterials Testing and Prototyping (B-TAP) Innovative Manufacturing Centre (IMC) at Sask Polytech's Regina campus.

Dr. Satya Panigrahi, has a PhD in Engineering and holds the Sask Polytech research chair in Innovative Manufacturing. He leads B-TAP, which includes a fibre processing facility at Hafford, about 100 kilometres northwest of Saskatoon. Panigrahi is an expert in biocomposite materials, such as plastics reinforced with plant fibres. The aim of B-TAP is to help produce innovations from Saskatchewan products – and train students to innovate.

“We want students in our Innovative Manufacturing program to see, if a technology comes along, how to analyze it and what we have to do so it can be brought to market,” Panigrahi said.

B-TAP's Regina facility is finalizing renovations to meet regulatory standards both as a manufacturing and a teaching facility. Equipment will include both injection and rotational molding machines to develop bioplastic composites. For example, one research project is looking at turning used grain bags – currently a recycling headache for farmers – into useful products such as pallets by combining them with fibres such as flax, another nuisance material.

B-TAP will also offer laboratory testing and product certification. The Hafford facility is operational and the lab is expected to open in January 2020; the rest will come online as renovations are completed.

While facilities near completion, Panigrahi and his colleagues are already working with the University of Saskatchewan and more than 30 industry partners and have trained more than two dozen people.

“We're working on 10 projects already.”

CHRIS expands scholarship and research mission

To ensure students benefit from the latest knowledge means faculty must not only teach it, but create it – a task championed by the Centre for Health Research Improvement and Scholarship (CHRIS).

CHRIS director Dr. Madeline Press explains the impetus for scholarship and research at Sask Polytech's School of Nursing goes back to at least 2003, beginning with a scholar-in-residence as a resource for faculty. Several iterations followed, with a significant push provided when the institution achieved polytechnic status.

“As a polytechnic, we need to show that our faculty are moving forward and doing research and scholarship and including that in their day-to-day work,” Press said.

CHRIS operates under the Boyer model of scholarship. This includes exploring and implementing new ways of teaching, bringing theoretical knowledge into application, integrating knowledge with other professions advancing the profession through active service and creating knowledge through research.

Over the past two years, CHRIS has expanded its reach from the School of Nursing to include the School of Health Sciences. This means more faculty have support through professional development such as workshops and mentorship. It also provides access to research grants both from CHRIS and through its partnership with the Saskatchewan Centre for Patient-Oriented Research. Finally, it connects faculty with Sask Polytech students interested in working as research assistants.

“Health Sciences can access money available through our grants and they can get support from CHRIS,” Press said. “They can start seeing some of the benefits of doing research and scholarship.”

COWESSESS FIRST NATION

Mapping First Nations for faster emergency services



Getting quickly to the scene of an emergency can be a matter of life and death, but on rural First Nations lands, the challenge for first responders is to first find the scene.

The issue came up when CJ Pelletier hosted a tour of Sask Polytech's Moose Jaw campus with Chief Cadmus Delorme and some colleagues from Cowessess First Nation.

Pelletier, the Geomatics and Surveying Engineering Technology program head, identified a practical solution to help with this unique challenge of mapping roads and properties.

Pelletier and Sask Polytech instructor, Abdul Raouf, created a procedure to map and update a geo-database of the roads and homes of the Cowessess First Nation community for the Saskatchewan Department of Highways to use for future 911 dispatches.

They pulled together partners from Saskatchewan's Provincial Emergency Communications Centre, Ministry of Highways and Infrastructure and industry partner CDK Drone Services, run by Cassandra Kowalchuk, a Sask Polytech alumnus.

Backed by a Seed Applied Research Project funding grant from Sask Polytech, Pelletier's team got to work. They mapped all roads in the community with survey-grade GPS equipment, then put this information together with house numbers and street names. At Cowessess, this was complicated in that houses are numbered by date of construction rather than location — and the streets had no names.

“The dataset required street names and since there were none in the community they had to create new ones,” Pelletier said. “I believe there was a naming contest where names were selected.”

Once the change to data was uploaded into the provincial base map, emergency responders had access to route management software to locate any given address. Systems such as Google Maps will update their services based on the provincial base map.

With the success of the Cowessess project under their belt, the team is seeking grants to build upon it.

“We're hoping to build a system of procedures that will allow communities like Cowessess to conduct a successful mapping project with the same end results,” Pelletier said.



Sask Polytech and Cowessess First Nation meeting on the mapping project.

**WITH THE COWESSESS SUCCESS
UNDER THEIR BELT, THE TEAM IS
SEEKING GRANTS TO BUILD UPON IT.**



CJ Pelletier, Geomatics and Surveying Engineering
Technology program head, and Abdul Raouf,
instructor, using surveying equipment.

Energy-efficient construction: how far to go to net zero?

Looking into the future of building construction poses a challenge: how efficient is the average Saskatchewan house?

“We wanted to try and quantify standard building practices right now and we could certainly describe that in terms of the materials we’re using, the practices we’re using,” said Angela Deans. “What we weren’t able to quantify was the energy performance of these buildings.”

Deans, program head for Sask Polytech’s Architectural Technologies program in Moose Jaw, teamed up with Ryan Hooyenga, program head of the Carpentry program, to do the research to find out. Hooyenga has long experience as a journeyman carpenter and is involved in the technical training of carpenter apprentices. He has provided an invaluable practical perspective to the research.

While a formal literature search turned up little current information on energy-efficient housing in Saskatchewan, Hooyenga and Deans did locate an industry partner in Saskatoon in the business of energy audits.

“They’ve been doing energy efficiency testing as part of various programs for a very long time; decades,” Hooyenga said. It was a start.

Saskatchewan’s residential building codes recently added mandatory energy performance benchmarks and the federal government has made a commitment that all new homes built in Canada must be net zero by 2030. This means the home must produce as much energy as it uses.

“So how do we know how far we need to go to get to net zero? We need to see if we can find more data,” Hooyenga said.

Deans explained students must be prepared with knowledge and skills for today and to be able to adapt to the workplaces of the future. It’s a delicate balance.

“We are careful not to move so far ahead of industry that when our students go out to the workforce they’re unprepared for the reality of where things are,” she said. “They are going to have long, 30-year careers, so we want them to be ready.”

This literature review was completed on behalf of Sun Ridge Residential.

Ryan Hooyenga, program head, Carpentry (left) and
Angela Deans, program head, Architectural Technologies.

**STUDENTS
MUST BE
PREPARED WITH
KNOWLEDGE
AND SKILLS FOR
TODAY AND TO
ADAPT TO THE
WORKPLACES
OF THE FUTURE.**





AI and data approach aims to mobilize wealth of knowledge at Keyleaf

THIS CONSTANT PROCESS OPTIMIZATION IS AN IDEAL APPLICATION FOR MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE.

For more than 40 years, Keyleaf has harnessed science to consistently and reliably identify and isolate high-value proteins, oils and other extracts from plants. The Saskatoon-based company is looking to Sask Polytech to harness this wealth of knowledge and bring it from the lab bench and pilot plant to full production.

Keyleaf (formerly POS Biosciences) has facilities in both Canada and the U.S., producing ingredients for products used in medical, pharmaceutical and food science applications.

Dr. Cyril Coupal, a digital integration research manager with DICE, said that Keyleaf is now ramping up its operations with new state-of-the-art equipment and is looking to do the same with their processes.

“I was talking to one of the researchers and he said they do small and large batch processing, but the next step is to go to stream processing,” said Coupal. “To transfer that into a live stream continuous product - with the ability to react in time to changes to ensure consistent quality - is a challenge.”

This means pulling together information on Keyleaf processes from numerous sources, some of which are legacy, ink-on-paper. The DICE team must build a framework for this data so Keyleaf personnel, from researchers to line operators, can access legacy data, add new information and get consistent directions on what settings, for example, should be used on each machine.

Coupal explained such processes are like recipes, but in Keyleaf’s case, not only does the system need to adhere to the recipe, it must do so on the fly, adjusting to variations in feedstocks or other factors.

“If plant product comes in, what do I have to adjust to compensate for the quality of the plants?” Coupal said. “What adjustments need to be made and when?”

This constant process optimization is an ideal application for machine learning and artificial intelligence. Ideally, such a system will be able to fine-tune itself.

“That’s our ultimate goal,” Coupal said.

Dr. Nalantha Wanasundara (Keyleaf) with Brian Dyck and Dr. Cyril Coupal (Sask Polytech) working on process optimization.

Dr. Satya Panigrahi, Innovative Manufacturing research chair, and Parmjot Maan, president of Innovative Stonecraft.



INNOVATIVE STONECRAFT

Innovative biocomposites providing solutions for Innovative Stonecraft

When Parmjot Maan, president of Innovative Stonecraft in Saskatoon, approached Sask Polytech with an idea to upcycle the non-recyclable, into material for new buildings, Dr. Satya Panigrahi was intrigued.

“It’s all non-recycled plastic,” he said. “This is actually a very interesting project with attention coming from provincial and federal governments, because they are using landfill plastics, which cannot be recycled, in their product line.”

Innovative Stonecraft manufactures veneer products made to look like stone or brick for use on residential and commercial buildings. The company wanted to expand their product line with eco-friendly, lightweight, water and crack resistant composite veneers – ideally ones that add R-value to buildings.

Panigrahi holds the Sask Polytech research chair in Innovative Manufacturing and is an expert in biocomposite materials, such as plastics reinforced with plant fibres.

Backed with seed funding from Sask Polytech, the National Research Council (NRC), as well as an investment from Innovative Stonecraft, Panigrahi explored composite material formulations

incorporating hard-to-recycle plastics, cement, flax and hemp fibres. Initial results are promising.

“They’re very happy with our project and are interested in going for an ARD. They want more,” he said. ARDs are Applied Research and Development grants offered through NSERC.

Panigrahi explained that Sask Polytech is providing access to facilities and expertise for research and development, but it is the business acumen at Innovative Stonecraft that is taking these made-in-Saskatchewan innovations to market.

“He has an engineering background, a very good sense of business and good connections locally and internationally,” Panigrahi said of Maan.

“ THIS IS ACTUALLY A VERY INTERESTING PROJECT WITH ATTENTION COMING FROM PROVINCIAL AND FEDERAL GOVERNMENTS. ”

Dr. Satya Panigrahi, research chair

FARM BOYS DESIGN

Farm Boys Design RAMPs up with home-grown innovation

Like many innovators, Farm Boys Design created their farm-in-a-box system by adapting existing technologies, but once they reached the limits of off-the-shelf components, they came to Tim Muench.

“What they’ve done is take some existing technology and re-designed it for a new industry,” said Muench, program head of Sask Polytech’s Mechanical and CAD/CAM Engineering programs and senior researcher for the Research, Additive Manufacturing and Prototyping (RAMP) facility. RAMP’s 3D printers can quickly produce fully-functional prototypes in various types of plastic, composites and even metal.

The company’s Aeropod system comes in fully portable, self-contained modules enclosed in modified shipping containers, designed to produce everything from fresh produce to cannabis. Each module contains stackable grow towers to provide water and nutrients for the plants and a structure on which to grow.

Improving the grow towers was a perfect example of where RAMP fits in, helping small and medium sized enterprises innovate. Muench explained Farm Boys Design was able to work with Sask Polytech to redesign, 3D print and test several versions of grow tower components before settling on a

prototype to 3D print and put into full production testing.

RAMP not only allows companies to avoid the high costs of building dies and molds for prototypes, it gives them access to government research and development funds. Examples include the National Research Council’s (NRC) Industrial Research Assistance program and Engage grants through NSERC.

“Funding for this project started with an NRC IRAP grant,” Muench said. “NRC developed a *Contribution to Organizations* program that provided us with small project and seed money to work with industry doing applied research.”

Muench said the focus on applied research, that is, activity with immediate application for companies, makes Sask Polytech an attractive partner for research and development. The institution’s policy on intellectual property also helps.

“All the IP stays with the company.”

THE FOCUS ON APPLIED RESEARCH MAKES SASK POLYTECH AN ATTRACTIVE PARTNER FOR RESEARCH AND DEVELOPMENT.



Pre-existing grow columns that were used by Farm Boys Design for research and development.
Photo credit: Farm Boys Design

Student showcase puts students' real-world solutions on display

Each year, young innovators get a chance to connect with industry, government and academic partners at the Sask Polytech Applied Research Student Showcase. In June 2019, 40 projects proposing solutions to real-world problems were on display at Innovation Place in Saskatoon. The top three shared \$1,500 in prize money.



40 PROJECTS



40 REAL-WORLD SOLUTIONS



Aleena James

Artificial recharge of groundwater by rooftop rainwater harvesting

First prize winner and Environmental Engineering Technology student Aleena James tackled a very urban problem: pavement, buildings and concrete don't absorb water like soil does, leading to water management challenges such as flooding in low areas. But many buildings have flat roofs that James theorized could be used to capture water which could be directed into the ground to recharge groundwater aquifers.

James gathered data from well drillers on surface and subsurface geology as well as climate and precipitation. If implemented, her system designed and proposed for Sask Polytech's Moose Jaw campus would divert more than 8.2 million litres of water annually in rainwater alone. James has completed her studies and currently works as an Environmental Project Officer at the Water Security Agency in Moose Jaw.



Neha Kaushik

A feasibility study to produce biogas energy from wastewater

Second prize winner, Neha Kaushik, was inspired by her studies on waste management in Sask Polytech's Environmental Engineering program and by a desire to contribute to efforts to combat climate change. Under the mentorship of her instructor, Kaushik consulted literature on biogas energy production from wastewater. She visited the municipal wastewater treatment plant several times, gathered information and hands-on knowledge from employees and analyzed 10 years of data.

Kaushik concluded that it is feasible to generate enough biogas from wastewater treatment to potentially be profitable. Saskatchewan's extreme weather is a wild card though and more research is needed. As she begins her career, she hopes to work in the environmental field and further develop her skills.



Ryan Krsacok

Hand gesture robot

Third prize and people's choice winner, Ryan Krsacok, was inspired by current wearable technology to wonder: would it be possible to do with a wave of the hand what is now done with a slide-and-click of a mouse? The Electronics Systems Engineering Technology student built a remotely driven car, controlled by a sensor and transmitter attached to the user's hand. Rotating the hand forward, back, or side-to-side controlled speed and steering.

Krsacok discovered human motion – at least hand movement – is not as smooth and predictable as expected. With every repeated movement the hand varies slightly in its acceleration and position. The project taught him the value of trouble shooting and problem solving which he expects will serve him well as he steers his career into printed circuit board design and eventually his own company.

Contact us

Do you have a research idea, prototype, or project that you need help with?
Contact us with as much detail as you can. This information will be kept confidential and will help us to determine which of our resources will best meet your needs.



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