GLOBAL FUTURES 2023

UNIVERSITY OF
WATERLOO
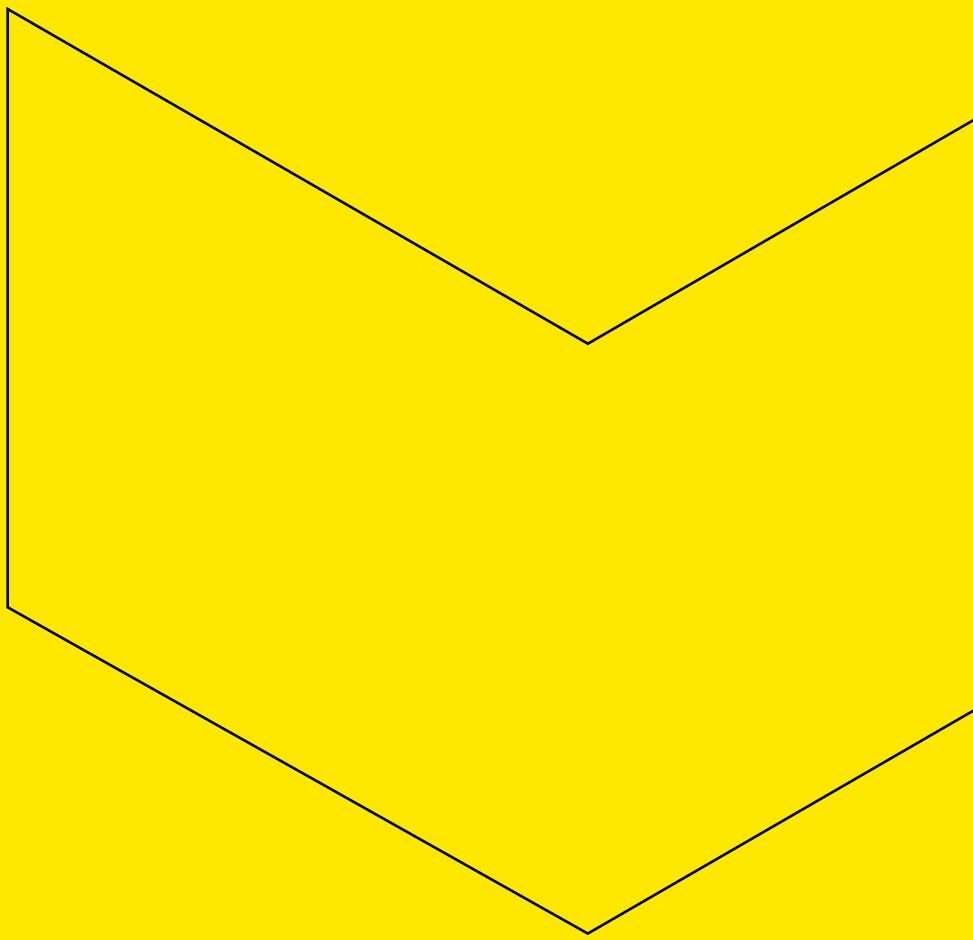
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INSPIRING OPTIMISM FOR THE FUTURE

The University of Waterloo was founded with the goal of addressing local and global challenges through unconventional means. Our unique approach to developing future-focused solutions – built on boundary-breaking research, experiential education and entrepreneurship – inspires innovation for real-world impact. Over the years, that goal has not wavered, but the challenges have evolved.

Dr. Vivek Goel

President and
Vice-Chancellor,
University of Waterloo

As a result, it is more important than ever for Waterloo to look toward the future and apply our unique strengths to inspire optimism as we continue to tackle the global challenges of today and tomorrow.

The Waterloo community is transforming societies, economies, technologies, sustainability and health for humanity to thrive in our complex future. Waterloo is already at the forefront of teaching, research and innovation in these five important areas. We will continue to build on our strengths in these interconnected areas while delivering new directions and solutions, whether they are new technologies, policies or practices, that are desperately needed for humanity's future.

Within these pages, you will read the inspiring stories of our students, faculty, staff and alums who are changing the world. From digitally transforming health care to creating space for under-represented voices in the environmental movement, the University of Waterloo provides a foundation to enable our people to impact their communities and the world for the better.

Waterloo has a wealth of leaders, changemakers and innovators who are imagining a bold new future. We continue to approach new challenges in unconventional ways and, as a result, we are uncovering ground-breaking solutions.

Together, our researchers, students and alums approach challenges differently. They unlock barriers by working together to develop creative approaches across disciplines. The futures they are transforming are not independent islands but an interconnected landscape of opportunities that represent a path for Waterloo to foster lasting, impactful global change.

OUR FUTURES

SOCIETAL FUTURES

The way societies govern and care for their citizens continues to transform rapidly, driven by new technologies and greater social awareness. Digitization and automation are changing how we work, learn and interact with one another. There is a deeper understanding of the global legacies of colonialism and social injustices that are being felt in our collective consciousness, but our social echo chambers are contributing to the spread of disinformation. How do we share and translate knowledge to positively advance society's future and ensure that communities and everyone within them thrive? **See page 3.**

SUSTAINABLE FUTURES

The sustainability of our quality of life is intricately connected to our social, economic and environmental well-being. The global climate emergency is the greatest threat to our collective future. Science and research play a critical role in moving us forward with sustainable solutions. How will we enact the social, economic and geopolitical changes required to ensure a prosperous future for humanity and the planet? **See page 11.**

HEALTH FUTURES

There is a growing knowledge of how the many physical and social determinants of health contribute to our well-being, but we face a resource crisis in addressing these needs in our current health systems. Escalating costs, shortages of health professionals and increasing needs from a diverse and aging population are putting strains on our systems. Gaps in patient care and experience are being filled by unexpected innovators from various fields and disciplines. How will we redesign our health systems through technological advances, virtual care and health data applications to create an equitable landscape of care? **See page 19.**

TECHNOLOGICAL FUTURES

From cybersecurity and finance to health and transportation, technology is dramatically transforming the way we work, live and connect. In a future where big data, artificial intelligence and new machines bring both promise and risk, innovators are designing breakthroughs for real-world solutions at a rapid pace. How will we lead the next technological transformation to ensure a safe and human-centred digital future? **See page 27.**

ECONOMIC FUTURES

Technology and automation play a central role in the future global economy. At the same time, labour shortages, disruptions to supply chains, and geopolitical and digital threats have shown us the vulnerabilities and risks inherent in our economy. When bold thinkers and entrepreneurs are given the right tools and resources for our ever-changing times and demands, talent leads the way to shape innovative ecosystems and grow local and global economies for social impact. How do we prepare talent to create resilient local and global economies to lead us into the future? **See page 35.**

SOCIETAL FUTURES

How do we share and translate knowledge to positively advance society's future and ensure that communities and everyone within them thrive?

Dr. Ashley Rose Mehlenbacher is the Canada Research Chair in Science, Health and Technology Communication and a leading expert on how communication practices shape the ways people engage with scientific and technical subject matter.

The growth of online platforms has changed how information is shared, leading to a rise in misinformation. However, informed societies are necessary in addressing critical issues that require collective action, such as pandemics and climate change. We asked Mehlenbacher how we should communicate and share knowledge to positively advance society and ensure communities thrive.

BUILDING TRUST FOR EXPERTS

TALKING ABOUT COMPLEX SOCIETAL ISSUES REQUIRES TRUSTED EXPERTS TO COMBAT DISINFORMATION

Dr. Ashley Rose Mehlenbacher

Professor, Faculty of Arts
Canada Research Chair in
Science, Health and
Technology Communication

Something is trending on social media, and you may not want to look. It doesn't take long for an online discussion about important issues to devolve into misinformation, bad-faith critiques and attacks on leaders, experts and expert consensus.

Sadly, this bad-faith content often spreads faster than good-faith content – often with devastating consequences.

We can't be experts in everything, so we need to rely on others to help us make informed decisions. It is vital for society to harness and share knowledge so that communities – and everyone in them – can thrive. How do we know who to trust when credible information is regularly undermined by disinformation, malinformation and misinformation?

A common theme I have encountered in my work in science communications and expertise is the importance of trust and communication when we talk about big issues that impact us.

It is important to understand why people's perception of experts is changing. There are many legitimate reasons for people to distrust experts and institutions, including that they have been harmed by them. Deliberations, decisions and actions happen in already-crafted systems, so understanding how inequities have been enacted by experts and institutions is crucial.

We also see illegitimate reasons like sexism, racism, antisemitism, transphobia and other prejudices used to attack an expert's credibility. Certain groups disproportionately face online attacks for participating in the public sphere, and we need to find better ways to support them. One way to do this is to identify how different bad-faith attacks operate and build anticipatory processes, policies and reporting structures to handle those situations and support those affected.

In another vein, there are attempts to discredit experts using bad-faith critiques. Research in climate change communications shows that such tactics are used to fuel disinformation. Such tactics might use the argument that a researcher is biased because of career ambitions. There are also "purity tests" that might suggest a climate scientist who uses commercial flights is a hypocrite.

> We can't be experts in everything, so we need to rely on others to help us make informed decisions. It is vital for society to harness and share knowledge so that communities – and everyone in them – can thrive.

Building trust happens through how we communicate

We need to share knowledge and its limitations in a transparent manner and demonstrate an understanding of the situations and audiences involved. We saw good examples during the pandemic when public health officials explained the evolving situation, the limitations of what was currently known and the reasons why they made certain decisions.

We can also recognize and include the many varieties of expertise in our world, not just technical and scientific but also local, traditional and Indigenous knowledges. Including different types of expertise is necessary to address complex issues such as climate change.

Every day it seems the world presents us with new challenges. Now more than ever, exploring communication strategies that acknowledge and understand the complexities of expertise in its various forms is a goal worth pursuing so we can make positive changes in our world.

TRUTH AND RECONCILIATION: A CALL FOR ACTION

WORKING TO IMPLEMENT INDIGENIZATION ON CAMPUS

SPOTLIGHT

Myeengun Henry

Indigenous Knowledge Keeper,
Faculty of Health

Myeengun Henry is the Indigenous knowledge keeper with the Faculty of Health and a former Chief of the Chippewas of the Thames First Nation. He has been instrumental in the recent push by the University of Waterloo to take up the Truth and Reconciliation Commission of Canada Calls to Action.

As institutions of learning, universities have an important role to play to advance truth and reconciliation in society. In 2022, the University hosted a unique Commitment Ceremony, during which Vivek Goel, Waterloo's president and vice-chancellor, officially committed to action to realize the aspirations of reconciliation and Indigenization.

"What we're seeing at Waterloo right now is unprecedented," Henry says. "It's a big task to come to terms with the history of what's happened to Indigenous communities. But we have the right people here, and I'm proud of the direction we are taking."

Henry points out that although Waterloo is a highly technical university, it has a unique opportunity to set itself on a path that marries technological progress with Indigenous understandings of stewardship for the land. The challenges the world faces today, he says, call for both approaches.

EST. 2021

Indigenous entrepreneurship program

⊕ BURNING SAGE AT A CAMPUS SUNRISE CEREMONY

Henry also sees another twinned approach to change within the University, at both the top and the grassroots.

"How we build a healthy university is to make the change at the top, with governance and administration, and also in the grassroots, with curriculum and content in the classrooms," he says. "It's as much about what students are learning as it is about decisions made in the Senate."

While he is optimistic and sees much to celebrate in Waterloo's approach to reconciliation, Henry also recognizes there are significant hurdles to overcome.

"The trust has to be earned. Whether that's governments or other institutions, Indigenous peoples have good reason to be cynical. But what gives me hope is seeing the steps that Waterloo is taking. Next, we need to put the plans and the intentions into concrete action."

Hear more about the Indigenization work happening at Waterloo

uwaterloo.ca/news/call-for-action

⊕ NATIONAL DAY FOR TRUTH AND RECONCILIATION

⊕ MEDINA NURSERY SCHOOL

INSPIRING OUR YOUTH, ADVANCING SOCIETY

THE YOUNG EYE FOUNDATION IS SUPPORTING YOUTH IN UGANDA TO GROW AND FULFILL THEIR PURPOSE

Darren Harry Baine

Student, Faculty of Science
President and Founder,
The Young Eye Foundation

SPOTLIGHT

Hear more from The Young Eye founder
uwaterloo.ca/news/young-eye

Darren Harry Baine knows that inspiring youth is critical for positively advancing society's future.

At 17 years old, Baine founded The Young Eye Foundation, which supports the social growth and development of youth-based institutions in Uganda. Along with a group of friends, Baine co-founded and hosts a youth motivational talk show, also called The Young Eye.

"Early development is important because it gives young people an opportunity to acquire the skills, knowledge and key competencies necessary to fulfil their purpose. This development allows them to express themselves and lead productive and healthy lives," says Baine, an undergraduate student in the Faculty of Science.

Baine founded The Young Eye in 2019 while completing the International Baccalaureate Diploma Programme in Uganda. It may have started as a school project, but Baine was hopeful to see this small initiative grow and positively impact the lives of others in his country. He partnered with various organizations to provide scholastic resources for

students and teachers at nursery schools. The foundation has continued to grow its outreach and works with multiple equity-deserving youth organizations across Uganda.

In 2022, Baine was recognized for his efforts and named to Uganda's top 40 under 40 list. He says he is humbled by the honour and that it confirms he is on the right track. Baine chose to study at the University of Waterloo because of the co-op program, which he says will allow him to develop his passions and learn real-world applications.

His guiding principle is, "I am an inspired work in progress." While Baine explores his academic journey at Waterloo, he continues leading through example and inspiring youth to think beyond themselves and create initiatives that advance society.
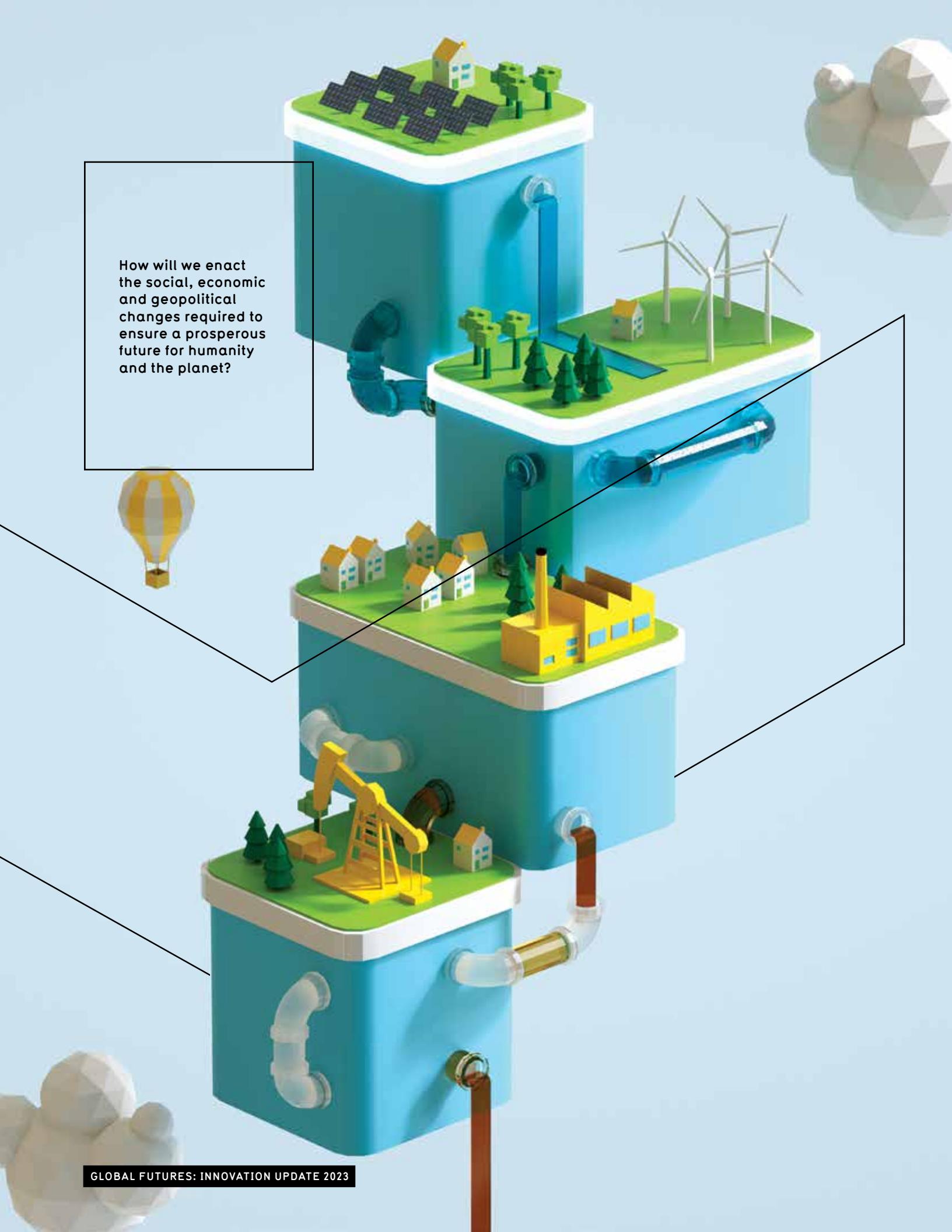
How will we enact the social, economic and geopolitical changes required to ensure a prosperous future for humanity and the planet?

Celine Isimbi

Student, Faculty of Environment
Racial Advocacy for Inclusion,
Solidarity and Equity (RAISE)

SUSTAINABLE FUTURES

Celine Isimbi is an undergraduate student in the Faculty of Environment and works to support equity, diversity and inclusion (EDI) initiatives across campus. She was formerly the environmental education co-director with Black Girl Environmentalist, a non-profit aimed at creating space for underrepresented voices in the mainstream environmental movement.

The sustainability of our quality of life is intricately connected to our social, economic and environmental well-being. However, the realities of the climate crisis have not impacted everyone equally. We asked Isimbi how we should enact the intersectional changes required to ensure a prosperous future for the planet and everyone on it.

MAKING SPACE FOR RACIALIZED VOICES

BUILDING A DIVERSE, SUSTAINABLE FUTURE SO HUMANITY AND THE PLANET CAN THRIVE

Growing up in South Africa, I saw the lasting impacts of apartheid-era policies. It had been years since the apartheid system ended, yet many Indigenous South Africans and racialized people still did not have access to basic rights and resources to sustain themselves. I constantly wondered how a country could be so abundant in nature while its residents could not easily access clean drinking water or green spaces without being racialized. Those years in South Africa played a significant role in shaping my academics today and my future goals of working towards sustainability and environmental liberation.

There are multiple ways we can rebuild our communities to become more diverse and sustainable. There are steps we can take to address social and political challenges such as addressing unjust government policies that continue the legacy of colonialism and segregation that harm racialized communities, and understanding how our institutions can redress the exclusion of Black, Indigenous and racialized people within academic spaces.
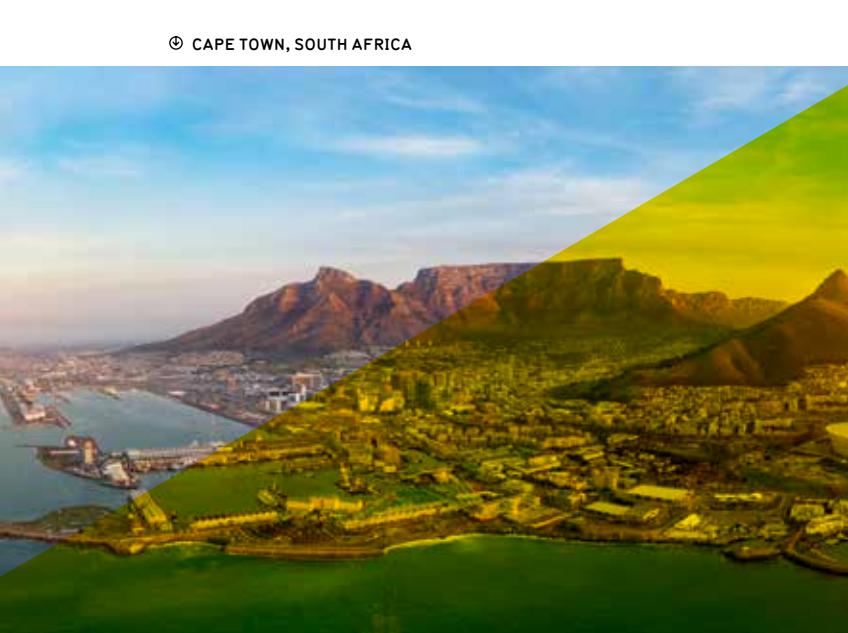
Community-centred and place-based solutions

During my co-op work terms, I worked at the University of Waterloo as an equity project lead in the Centre for Career Action, where I helped implement an EDI framework that centralized the services and resources offered to students. Then as an educational programming assistant in the office of Equity, Diversity, Inclusion and Anti-racism, I assisted with training and staff workshops on EDI and anti-racism in the workplace. Through both placements, I could understand how an institution plans, develops and executes policies and programs around EDI initiatives.

In the summer term of 2020, due to long-time student advocacy and organizing, we witnessed the University create the President's Anti-racism Taskforce (PART). At the height of the Black Lives Matter movement, students were able to encourage the University to take action. As a result, faculty members, students and staff have established a framework to engage the community and address systemic racism across Waterloo campuses. Our individual experiences and intersectional identities allowed us to address the issues on campus and make change happen. Now, the University holds a particular responsibility to students to build sustainable and diverse communities on campus.

I have learned the importance of community-centred and place-based solutions. Advocating for marginalized groups can start small by setting up community fridges and making housing more accessible in local areas.

It is imperative to make space for Black, Indigenous and other racialized students to break existing cycles of oppression.

It can allow students with multiple marginalized identities to contribute to EDI initiatives and policymaking. It is imperative to make space for Black, Indigenous and other racialized students to break existing cycles of oppression.

I envision a world where future generations will face fewer barriers in all aspects of life, and that begins with acknowledging how to make space for racialized voices in the sustainability movement. If we can understand the interconnectedness between humanity and nature and acknowledge the history of colonialism and systemic racism, I am hopeful we can finally move toward healing our relationship with nature to create sustainable, diverse communities. I believe hope sustains us in difficult moments while we strive to build a more sustainable future so humanity and the planet can thrive.

BOOSTING CLEAN– ENERGY ADOPTION

AQUA–CELL ENERGY IS BUILDING BETTER BATTERY TECHNOLOGY WITH SALTWATER

Keith Cleland

Student, Faculty of Engineering
Founder, Aqua-Cell Energy
Velocity

As someone born and raised in Calgary, Keith Cleland initially thought he would end up working in the oil industry. However, he decided to follow a different path and work for a sustainable future instead. "I really want to contribute to sustainability, cleaning the world up and transitioning the world away from fossil fuels," he says.

As an undergrad student, Cleland began researching different battery technologies. These insights led to him using a cheap and available resource – saltwater – to store renewable energy. He continued developing his technology as part of his master's degree in chemical engineering at the University of Waterloo. Cleland founded Aqua-Cell Energy Inc. with plans to commercialize his saltwater battery.

"We are in the phase of scaling up the technology to store a lot more energy," he says. "We know it works in the lab, but now we need to scale it up and build confidence in the technology."

Although the cost of solar technology has declined dramatically over the years, Cleland explains that lithium batteries are expensive and not designed to store much excess energy. This costly energy storage is a barrier to clean-energy adoption. If excess solar energy on sunny days could be stored and used to lower energy costs in the evening when electricity is most expensive, or on cloudy days, renewable energy would become much more cost-effective, attractive and widespread.

Aqua-Cell Energy recently accepted a coveted residence through Venture Ready at Waterloo's Velocity, which helps founders of early-stage companies get the expertise and connections they need to make their businesses successful. Cleland says working with Velocity will be a huge boost for Aqua-Cell Energy, providing the space to work from and creating mentorship and customer introduction opportunities.

"I believe we have the power to reduce fossil fuel emissions and be a catalyst for improving solar-energy adoption," Cleland says. "Expensive energy storage is a huge problem right now, but if we can bring those costs down and boost solar adoption, then we have a possibility to change the world."

See how Aqua-Cell Energy is building a better battery

uwaterloo.ca/news/aqua-cell

LEADING A CALL FOR CLIMATE ACTION

MITIGATION AND ADAPTATION STRATEGIES TO REDUCE GREENHOUSE GAS EMISSIONS

Dr. Sarah Burch

Professor, Faculty of Environment
Executive Director, Waterloo Climate Institute
Canada Research Chair in Sustainability
Governance and Innovation

The realities of climate change are being felt worldwide as extreme heatwaves, flooding and fires are becoming all too normal. It will take a global effort to adopt the mitigation and adaptation strategies needed to reduce greenhouse gas emissions and achieve a low-carbon future.

The good news is that we already have the technology and solutions to do it, says Dr. Sarah Burch, executive director of the Waterloo Climate Institute.
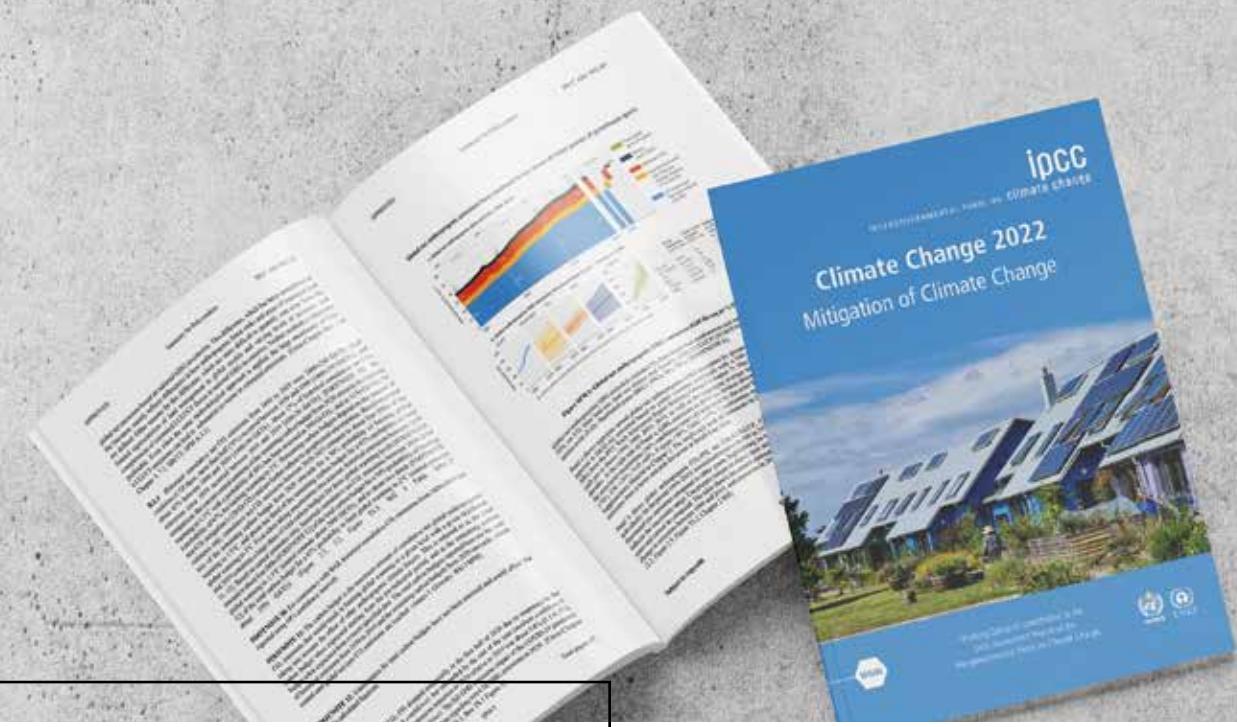
Home to

CANADA'S LARGEST FACULTY OF ENVIRONMENT

Read Burch's opinion on climate action

⊕ BURCH AT COP27 WITH PHD CANDIDATE ISRA SAEED

Burch is one of the lead authors of the 2022 report of the Intergovernmental Panel on Climate Change, the United Nations body that assesses the science related to our changing climate. The report showed that 2021 had the largest global annual increase in greenhouse gas emissions on record. However, Burch's optimism springs from the finding that about 20 countries showed sustained greenhouse gas reductions over the same period.

"Unfortunately, these reductions were swallowed up by the global increase, but they do show us that it is possible, and that good climate change policies and decisions are having a real effect in these places," Burch says. "What the report demonstrates very powerfully is the solutions we need are already available. Climate change is less of a technical problem, and more of a political and social problem."

As an expert in transformative responses to climate change at the community scale, Burch offers sustainability strategies to help governments and small businesses tackle this complex challenge. She currently leads the international partnership-based research project TRANSFORM, accelerating sustainability entrepreneurship experiments in local spaces, and is an advisor for Canada's National Adaptation Strategy.

"The solutions are already available. We need our decision-makers to use them."

How will we redesign our health systems through technological advances, virtual care and health data applications to create an equitable landscape of care?
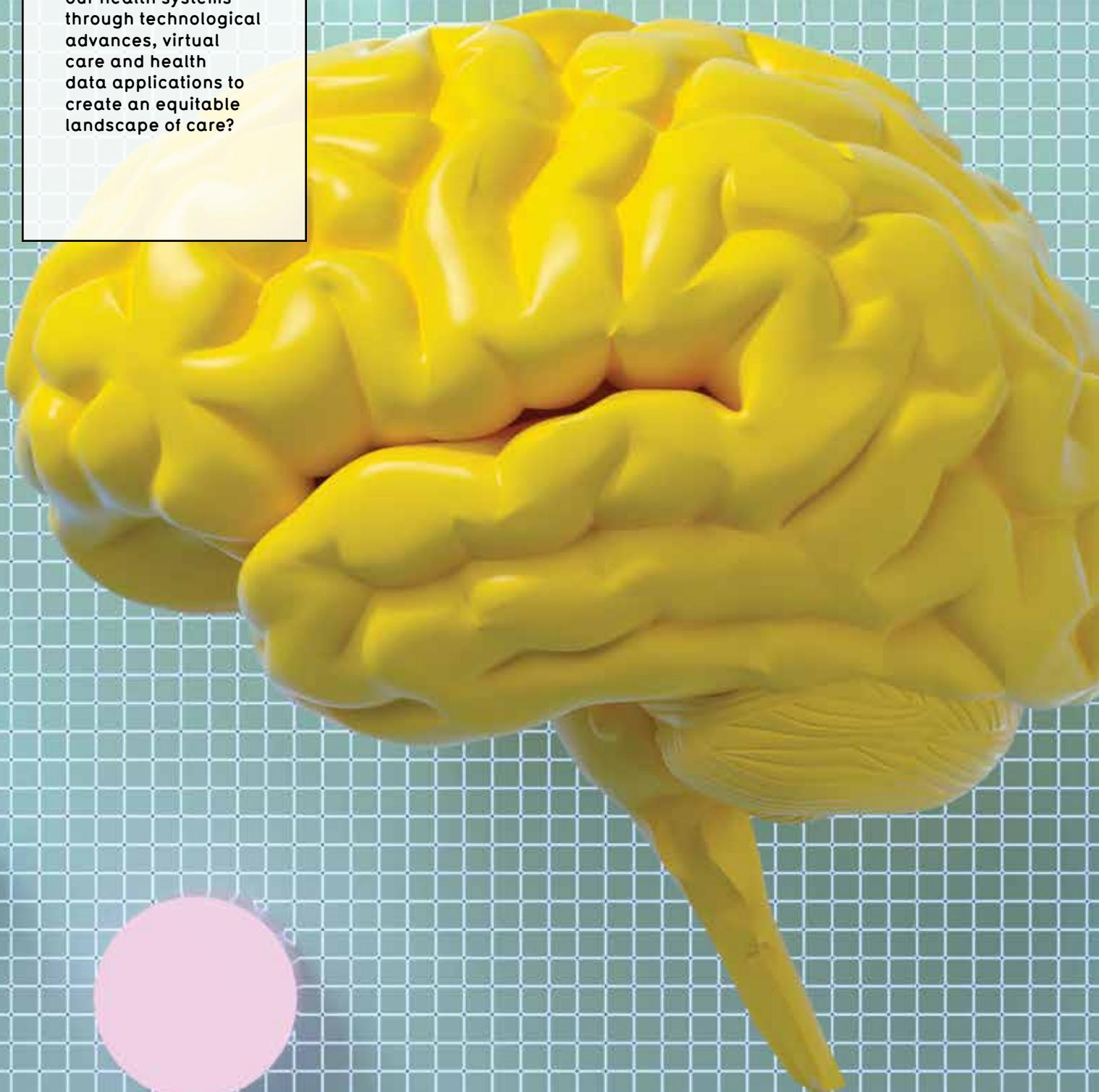
HEALTH FUTURES

Dr. Catherine Burns is the Canada Research Chair in Human Factors in Health Care Systems and leads the University of Waterloo's health initiatives. She is an expert in human-centred approaches to the design and implementation of advanced health-care technologies.

Burns also heads Waterloo's Transformative Health Technologies initiative, a collaboration spanning all faculties and the Northern Ontario School of Medicine. We asked her how we can redesign our health systems to create better patient outcomes and more equitable access to care.

CANADA NEEDS A HEALTH-CARE TRANSFORMATION

TECHNOLOGY CAN HELP SOLVE THE CHALLENGES OF OUR HEALTH-CARE CRISIS AND TRANSFORM THE FUTURE OF CARE
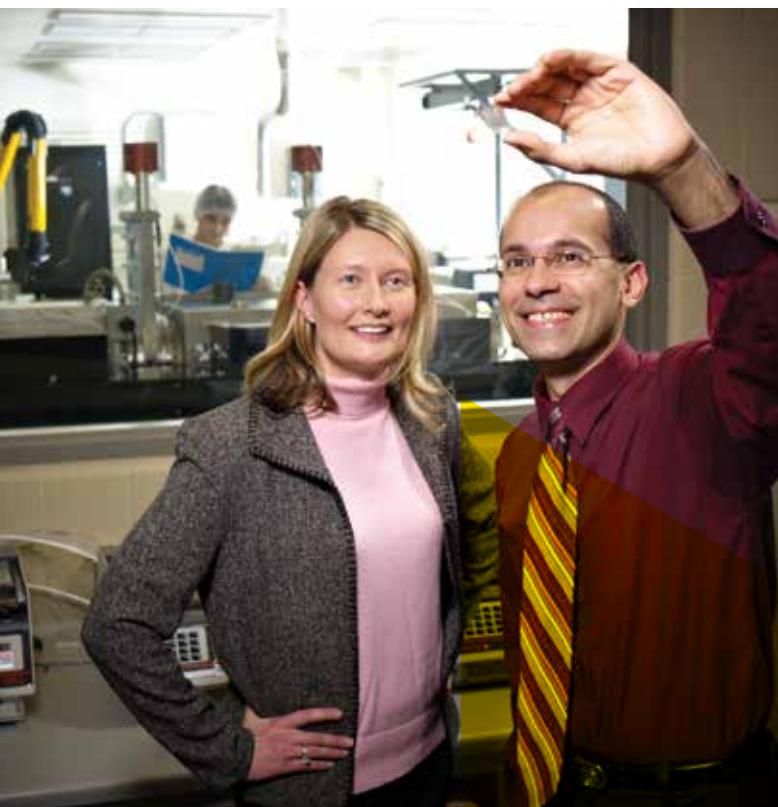
Canadian health care is facing a perfect storm of challenges including escalating costs, a shortage of health-care professionals and the increasing needs of a diverse and aging population. The COVID-19 pandemic merely exposed existing cracks in Canada's health-care system. The pandemic has been a stress test of this system – "a canary in the coal mine," the results of which should concern us all.

Reduced health services and the struggle to train and retain health professionals will become a chronic problem if not urgently addressed. As we look to build new hospitals, medical schools and long-term care homes over the next decade, a radical transformation is required now to support the health services and care Canadians need and deserve.

16 Research Chairs specializing in health technologies
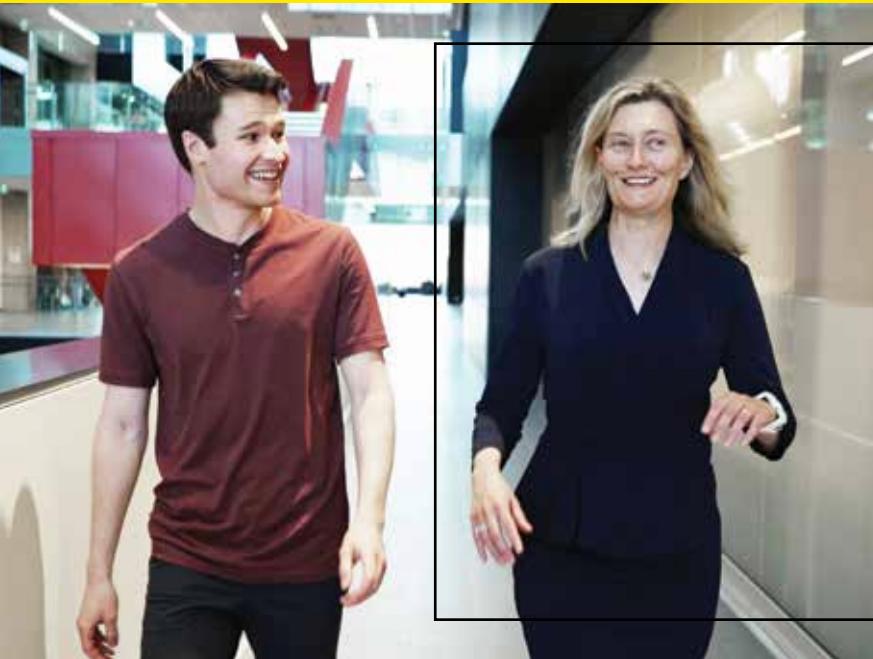
Catherine Burns

Professor, Faculty of Engineering
Associate Vice-President, Health Initiatives
Canada Research Chair in Human Factors in
Healthcare Systems

We have solutions available

Health technology provides a solution that is ready for exploration and can meet the faster timescale needed to solve the challenges of our health-care system. The good news is that many health technologies, such as virtual care, point-of-care diagnostics, remote patient monitoring and assisted living devices are already here and present a significant opportunity to relieve health service backlogs and improve patient care.

For example, remote health sensing and assisted living technologies are in trials today at the University of Waterloo and are being tested in collaboration with long-term care homes. The Velocity incubator supports health technology companies like Vena Medical and Membio to bring new medical devices into hospitals and operating rooms. Collaborating for impact is what we do best. Waterloo has partnered with local hospitals, care homes and the Northern Ontario School of Medicine University to advance research by taking it out of the lab and into the hands of health-care providers.

The path forward is not without challenges, but we have shown it can be done. Waterloo is a leader in developing transformative health technologies because we are not

only training the next generation of technologists and entrepreneurs, but we also work within a collaborative ecosystem that engages partners to bring new technology to bear. When the tech community works closely with health-care providers – listening and adapting to their needs – health innovation leads the way.

Our focus needs to be on investment and collaboration so that health technologies can be implemented for real-world impact. This requires an evolution in Canada's regulation and procurement pathways to allow innovations to demonstrate safety and efficacy – and ultimately be adopted.

We can have a future where technology empowers our health professionals in the care they provide through better monitoring and point-of-care diagnostics. And we can have a future that allows services currently only offered in hospitals to be available in people's homes and in the geographical locations where they are happier living. This technology is ready to change our world – we must work together to implement health innovations and transform the future of health care in Canada.

TACKLING A GLOBAL VISION CRISIS

NEW INVESTMENTS AND INNOVATIONS ARE CREATING BETTER ACCESS TO CARE

Dr. Ben Thompson

Professor, Faculty of Science
CEO, Centre for Eye and Vision Research

SPOTLIGHT

Home to

CANADA'S ONLY ENGLISH SCHOOL OF OPTOMETRY

The World Health Organization estimates that 2.2 billion people globally have a vision impairment. Dr. Stan Woo, director of the University of Waterloo's School of Optometry and Vision Science, views this statistic as a call to action – and one he and his colleagues are working to fix.

Waterloo has launched two new facilities to support this mission. The Waterloo Eye Institute is a state-of-the-art facility in Waterloo that will expand Optometry's delivery of essential care. The Centre for Eye and Vision Research (CEVR) has a global reach through its partnership with Hong Kong Polytechnic University. CEVR's CEO, Dr. Ben Thompson, says the facility is "Waterloo's first footprint into Asia and provides unique opportunities for the University to connect with that region."

These new facilities are an important step to tackling the vision crisis and, when combined with cutting-edge technology, are improving patients' lives.

Thompson uses the example of amblyopia, also called a lazy eye, to understand the impact technology can have on vision care. This condition was seen as untreatable in adults,

but new advancements are now making treatment possible. An innovation by Thompson and his collaborators uses video game technology to successfully treat adult patients and train their eyes to work together.

In Canada, Woo is working toward a new tele-optometry centre to deliver comprehensive remote eye examinations. Currently, Waterloo optometrists are working within remote Indigenous communities in British Columbia to provide care on the ground in these areas. However, due to weather, their access remains seasonal – typically limited to the summer and fall months. A tele-optometry centre will allow doctors to monitor patients year-round virtually. "It saves time, it saves money, it provides improved access."

Both Thompson and Woo are optimistic about the progress being made in vision care and note that Canada has shown valuable leadership in advancing optometry into a new technological era. Facilities such as CEVR and the Waterloo Eye Institute demonstrate technology's impact in creating better access to care.

See how Waterloo is tacking the global vision crisis

uwaterloo.ca/news/vision-care

SPOTLIGHT

Dr. Stan Woo

Professor, Faculty of Science
Director, School of Optometry
and Vision Science

A PASSION FOR HEALTH TECHNOLOGY

CO-OP LETS STUDENTS PURSUE THEIR ENTREPRENEURIAL PASSIONS

Hear more about McBay's co-op journey

uwaterloo.ca/news/co-op

**Madison McBay
(BSc '22)**

SPOTLIGHT

Alum, Faculty of Health
2021 Co-op Student of the Year

Like many students who choose the University of Waterloo, Madison McBay was attracted by its co–op program. The two years of meaningful work experience students gain through the program help prepare them for their futures after graduation.

When McBay enrolled as a health studies major in 2017, she had no idea co-op would lead her to become a co-founder of a startup in health management.

"Co-op gave me the confidence I needed to be successful, which led to my time at TAMVOES – an eye-opening experience with regards to the opportunities within my program of study," McBay says.

TAMVOES is an online platform for people to store and share their personal health information with family members and health-care professionals. During her first co-op term at the startup in 2019, McBay leveraged her health-care knowledge as a project manager. Jessica Lunshof, co-founder and president of TAMVOES, quickly recognized McBay's dedication and passion for health technology and promoted McBay to senior vice-president and co-founder.

Within the same year, McBay received an honourable mention for the 2020 Co-op Student of the Year for the Faculty of Health. She received the prestigious award in 2021 for her commitment at TAMVOES.

"Knowing that co-op was a huge part of the reason why I decided to go to the University of Waterloo, this award represents the completion of my undergraduate journey and validates my decision to pursue an education at the University," McBay says.

"I found my co-op placements and the Health Studies program helpful in pursuing an entrepreneurial passion in health technology. Being introduced to health informatics and then applying it in my co-op work terms was the perfect opportunity for me to get insight into a career in this sector."

How will we lead the
next technological
transformation to
ensure a safe and
human-centred
digital future?

Dr. Marcel O'Gorman

Professor, Faculty of Arts
University Research Chair
Founding Director, Critical Media Lab

TECHNOLOGICAL FUTURES

Dr. Marcel O'Gorman is a University of Waterloo Research Chair and founder of the Critical Media Lab. Strategically located in the heart of Waterloo region's tech hub, the lab is an interdisciplinary research initiative that explores the ethics and impact of technology on society and the human condition.

With innovations happening at a rapid pace, technologies are often adopted before the full impact on culture and human behaviours is understood. We asked O'Gorman how we should lead technological transformation to ensure an inclusive and ethical future.

COURAGEOUS INNOVATORS MUST BECOME CHAMPIONS OF TECH FOR GOOD

AN ETHICAL APPROACH TO TECHNOLOGICAL CHANGE IS GROWING IN WATERLOO'S INNOVATION ECOSYSTEM

A culture of responsible innovation needs to be rooted in sensitivity to human values, non-human stakeholders and a committed sense of care for the future.

The promise of tomorrow's tech has inspired the imagination of every generation. It is said that we shape technology, and thereafter it shapes us. It is an understatement then to say that the stakes of future tech innovation are very high. Now and in our future, we can't imagine our technological future without considering the broader social and environmental contexts of that future.

Waterloo has been a champion of innovation for years, and we continue to lead the way in Canada and beyond. Now we have a unique opportunity to be a champion – an exemplar, even – of responsible innovation.

A culture of responsible innovation needs to be rooted in sensitivity to human values, non-human stakeholders and a committed sense of care for the future. This is not just a technological challenge or a problem to solve. It's about persistently asking the right questions: What kind of world do we want to live in? And who is "we" in the first place? Can our future technologies avoid replicating the social and environmental problems that are embedded in our current tech ecosystem?
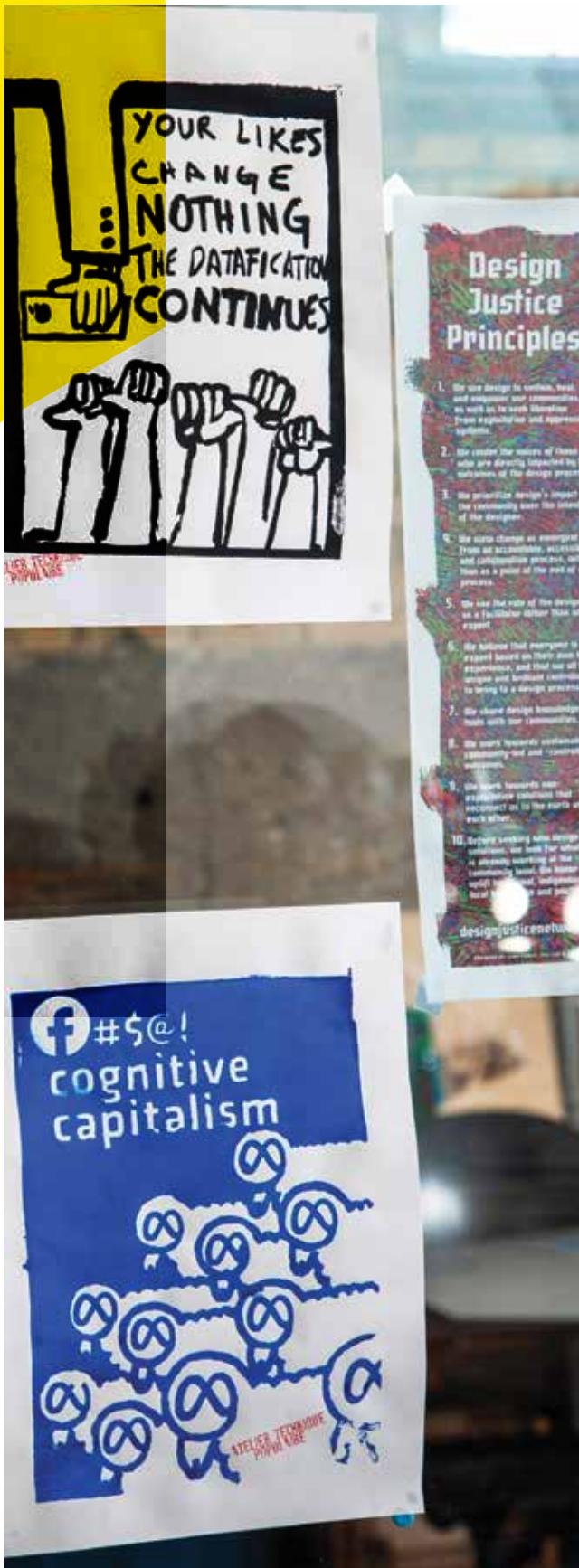
Tech for good

There are many reasons to be concerned about our technological present: facial recognition interfaces that misrecognize Black women; conflict minerals mined for circuit board components; the cloud's obscene energy consumption; predatory data-gathering; and targeted "fake news" that fuels the fire of political polarity.

The tech community can do better, but only if it resists a profit-at-all-costs value system. This sort of retooling is a lot to ask, but our community is up to the challenge.

The phrase "tech for good" might bring to mind humanitarian technologies such as tech that supports a specific cause. But a commitment to "tech for good" means that all technology should improve life on earth, keeping in mind that "good" is a relative term that changes according to context.

Embedding a respect for variable contexts into the tech design process is the first step toward establishing a culture of "tech for good," a culture that takes responsibility for the world it is building and carefully considers potential consequences of innovation – even if that might slow down the process. There is no room in responsible innovation for a "move fast and break things" mentality.

It's time to put words into action

The technological change incubated in Waterloo region is enormous. Taking responsibility for the social and environmental outcomes of that change requires purposeful interventions. The Tech for Good Declaration, which I helped develop with Communitech and other partners, is a good first step. It's time to put these words into action.

This is precisely why I founded the Critical Media Lab more than a decade ago. It provides a safe space to slow down and reflect on the impacts of technology. These projects range from the design of artistic "objects-to-think-with" that facilitate critical discussions, new policy formation and practical workshops in responsible innovation for startups, tech professionals and students.

We want to create a context for critical engagement, making room in the tech ecology for courageous innovators who will go beyond the design of good tech and strive to become champions of tech for good.

Jeremy C. H. Wang

PhD Candidate, Faculty of Engineering
Co-founder and COO, Ribbit
Velocity

Inspiring our technological futures – **we're on it.**

MAKING A TECHNOLOGICAL LEAP IN AIR TRANSPORTATION

RIBBIT'S PILOTLESS PLANES ARE SET TO MAKE THE FUTURE OF AIR MORE INCLUSIVE AND SUSTAINABLE

⊕ NUNAVUT IN THE CANADIAN ARCTIC

Taking to the skies and delivering goods by plane is going pilotless. Ribbit's new autonomous flight technology creates a more robust supply chain by deploying small autonomous airplanes that fly cargo shipments to provide just-in-time delivery, and they're prioritizing remote communities.

"Remote communities lack year-round road connections, so essential commodities like perishable foods must be flown in. The problem is that current airlines don't fly that often. As soon as one flight is delayed or cancelled – due to weather or maintenance issues – this creates massive backlogs and unreliable service," says Jeremy C. H. Wang, co-founder and COO of Ribbit.

Wang and his co-founder, Carl Pigeon, are passionate about transportation as a fundamental enabler of living standards and economic prosperity. With pilotless aircraft, Ribbit envisions a future where smaller planes serve more destinations at small airports, bringing shipments closer to the source of demand.

Ribbit was founded in 2019 while Wang was a University of Waterloo PhD student. Since then, the startup has grown with support from several investors, including Velocity. Within 14 months of its pre-seed round, Ribbit successfully tested its solution in-air with the approval of Transport

VELOCITY
$4.2B
raised by Velocity companies
since 2008 (2022)

Canada. The modified plane was able to taxi, take off, fly a circuit, land and perform collision avoidance manoeuvres, all autonomously.

Ribbit is now working with six major wholesalers spanning key destinations in Ontario, Manitoba, Nunavut and Labrador, and Wang says these remote markets are just the start. Wang envisions a future where this technology will be commonplace and enhance supply chain management.

"Future transportation systems will be faster, more reliable, more integrated, more inclusive and more sustainable."

Hear more from Ribbit's co-founder

uwaterloo.ca/news/ribbit

PREPARING BUSINESSES FOR THE QUANTUM ERA

QUANTUM CRYPTOGRAPHY OFFERS DATA PROTECTION IN OUR EVOLVING DIGITAL SPACES

Dr. Michele Mosca

Professor, Faculty of Mathematics
Institute for Quantum Computing
Co-founder and CEO, evolutionQ

SPOTLIGHT

See how Mosca is helping business become quantum safe

uwaterloo.ca/news/evolutionq
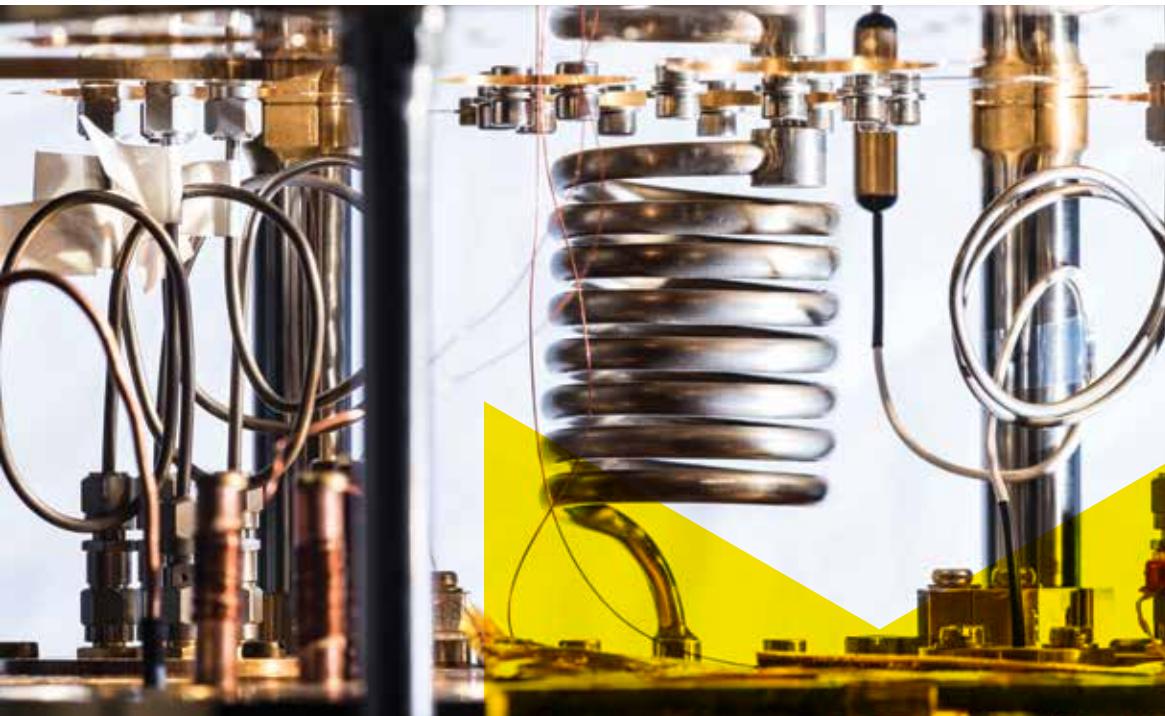
⊕ DILUTION FRIDGE IQC LAB

Cyberattacks and data breaches are an invisible but growing threat that's becoming more commonplace in a landscape of technological growth and development. Many of today's digital environments are still using outdated operating methods that were implemented in the early days of the internet.

To combat the risks posed by cybersecurity threats, research on quantum computers and cryptography has emerged as a vital tool for digital protection.

Dr. Michele Mosca is a professor in Combinatorics and Optimization at the University of Waterloo and a faculty member at the Institute for Quantum Computing (IQC). IQC is a world-leading facility that is not only dedicated to ground-breaking research but has spun out more than 17 quantum startups. The institute is a main driver for why Waterloo region is referred to as Canada's quantum valley.

Mosca is developing practical digital system cryptography that is secure against quantum attacks. In addition to cutting-edge research, Mosca is also co-founder and CEO of evolutionQ, an enterprise focused on preparing organizations for the quantum security attacks of tomorrow.

"Cryptography allows us to leverage the power of digital infrastructures and at the same time thwart attempts by adversaries to compromise the confidentiality or integrity of the information being handled by those infrastructures or to illicitly gain control of connected devices," Mosca says.

Quantum readiness is essential but requires companies to commit to a journey to be quantum safe sooner rather than later. His company is working closely with businesses to educate and support them to implement reliable cybersecurity products and services before it's too late.

"There's no perfect way to sound the alarm on this impending threat, but we need to get better at talking about it and taking action."
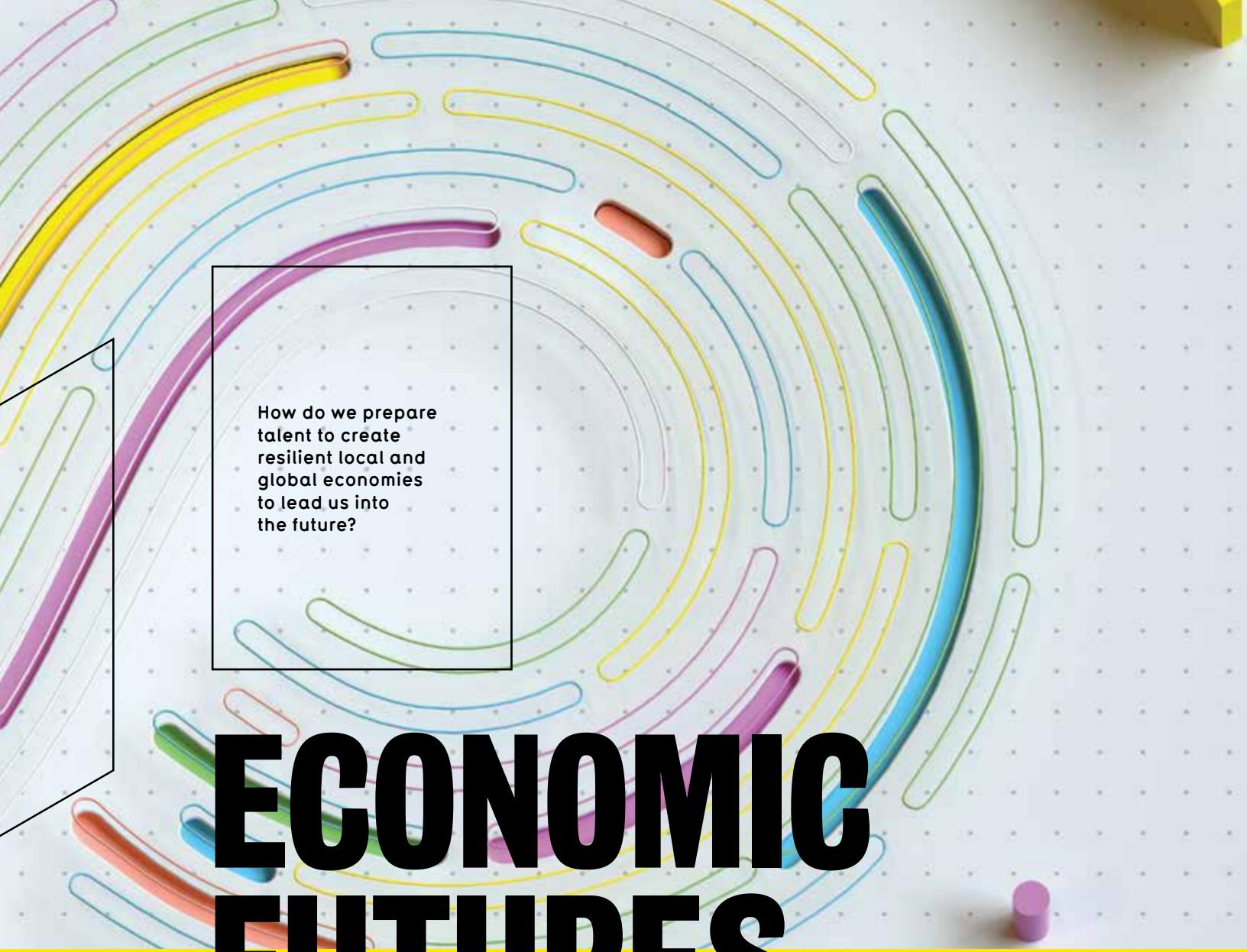
ECONOMIC FUTURES

Esteban Veintimilla is the CEO and co-founder of 1Mentor, a company using artificial intelligence to understand industry's evolving skills requirements. Veintimilla is also an advisor for students entering their first co-op work term at the University of Waterloo's Conrad School of Entrepreneurship and Business.

Talent leads the way in shaping innovative ecosystems that grow local and global economies. We asked Veintimilla how we should develop talent to support resilient economies for the future.

AI TO ENABLE A DYNAMIC WORKFORCE

EQUIPPING TODAY'S LEARNERS FOR TOMORROW'S WORK

#1

in Canada for graduate
employment rate
(QS Graduate Employability
Rankings 2022)

Entrepreneurship is about solving complex problems, and in a world of rapid technological advancement and unpredictable change, we need to reimagine how we prepare emerging talent. 1Mentor partners with higher-education institutions to better serve their students by providing tools to prepare future-ready talent.

When I started my undergrad in math and business at the University of Waterloo, I thought I wanted to go into finance. I discovered co-op and immediately saw how valuable these work experiences would be to my professional development. It allowed me to explore different careers while expanding my skill set. I did my first work placement in finance, then others in actuarial science, business analysis, project management, and finally in entrepreneurship where I found my passion. The vision for my company took shape when I was working at Waterloo supporting students in finding co-op placements. I realized how difficult it was to equip students with evolving industry demands and that there was a need to create agile partnerships between industry, government and academia to prepare students for the future of work.

Esteban Veintimilla
(BMath '18, MBET '22)

Alum, Faculty of Mathematics and Engineering
Conrad School of Entrepreneurship and Business
Co-founder and CEO, 1Mentor
Velocity

The 1Mentor platform is designed to equip students with the insights to understand what skills and competencies to develop to achieve their career objectives. Through support and investment from the University's entrepreneurial ecosystem and Velocity, as well as the ability to leverage guidance from a world-leading institution in co-operative education, we have grown rapidly in a short period of time.

Using data to drive insights

Our platform uses cutting-edge, proprietary AI to analyze higher-education data and more than 110 million job postings to understand industry requirements. 1Mentor lets students explore career paths, understand how prepared they are, and find upskilling opportunities to prepare for the jobs they are passionate about. Our goal is to be the go-to place for students to understand what skills and competencies they need and to prepare themselves to land jobs and be successful in those roles.

In addition to the clarity that data provides for students, it also supports colleges and universities. Our post-secondary partners understand that they need to adapt to a dynamic workforce. Our platform lets them see data on their programs and students to understand how they compare to the job market. They receive critical information on what fields students are interested in pursuing in today's economy.

At the pace that industry is evolving, students are entering disrupted fields and jobs that didn't exist a decade ago, and new opportunities will continue to appear. Career pathways are no longer linear, and we see students from all academic backgrounds pursuing fields like AI, fintech, data and blockchain. We cannot rely on traditional models of workforce development. Colleges and universities must adapt and prepare their students for this new reality, whether through courses, micro-credentials or work-integrated learning opportunities.

It is exciting to see that the challenge is being recognized globally. We get to work with innovative universities in the United States, United Kingdom, Latin America and Canada, including Waterloo, to ensure emerging talent is future ready. When I graduated from Waterloo, co-op helped me feel equipped to pursue my professional goals and take on the challenge of being a business owner. I want that feeling of empowerment shared by all students, and it is incumbent on post-secondary institutions to ready the next generation of talent.

WOMEN IN THE DIGITAL WORKFORCE

THE POST–PANDEMIC ECONOMIC RECOVERY WILL DEPEND ON EQUALITY FOR WOMEN

SPOTLIGHT

Dr. Nada Basir

Professor, Faculty of Engineering
Conrad School of Entrepreneurship
and Business

Zoom meetings are the new norm, even now that pandemic restrictions have been lifted. Employers are increasingly adopting artificial intelligence programs for many work tasks that humans once did. However, against this backdrop, there are also labour shortages in many sectors.

Dr. Nada Basir, a professor at the Conrad School of Entrepreneurship and Business, says there is an aspect to this conundrum that is rarely talked about: providing opportunities for women, particularly immigrant and racialized women, to get jobs or create new businesses amid this changing economy.

"We can grow the economy, we can recover, but we will need better participation and more inclusive environments," Basir says.

She is one of a group of interdisciplinary researchers at Waterloo focusing on women, work and the economy. Their research shows that many women were relieved when the pandemic forced a work-from-home trend. Women have busy lives, so not having to commute to work has been a relief for many of them. But it can be a double-edged sword, because women who work from home tend to take on more domestic duties.

Immigrant women also tended to be employed in service sectors of the economy such as restaurants and retail

#1 comprehensive research university in Canada (Research Infosource 2022)

stores, which were particularly hard-hit by the pandemic. Some of those jobs didn't come back. Yet the lack of digital literacy some women experience limits their ability to take advantage of the exciting new era of digitalization. "The reality is that many times it's women and especially racialized women, immigrant women, Indigenous women, who end up missing out," Basir says.

Ensuring that women have these opportunities is important to the economy, but Basir says it is also essential to the fabric of society. "You risk creating a social fabric based on so much more inequality when you don't provide these opportunities," she says.

"KEEPING UP WITH THE JONESES"

THE INEQUALITY GAP IS INCREASING AND SO IS CONSPICUOUS CONSUMPTION

Iuliia Nesterova

PhD candidate, Faculty of Arts

Our very human tendency to want to "keep up with the Joneses" is as apparent today as ever. In fact, research shows that over the past decade, conspicuous consumption has intensified in developed economies. While the impacts of economic inequality are complex, a negative social impact identified by a Waterloo graduate student is that it encourages consumer habits such as buying expensive clothing, cars, or personalized services at the expense of both essential consumption and savings.

Iuliia Nesterova, a PhD candidate in economics, has found that higher inequality is associated with more conspicuous consumption. Her research shows that people across income groups are spending more money on non-essential goods and especially services, regardless of their financial resources. To understand the impact on inequality, Nesterova explores how these consumer choices – spurred by social comparisons – lead to excess borrowing and insufficient saving.

"If I care about my social standing, I might be inclined to buy too much to improve my position relative to others," she explains. "Consuming more today improves my relative social position, but it also weakens my relative economic position in the future. It becomes a question of a rat race today versus a rat race tomorrow."

Nesterova attributes historically low interest rates and the rise of social media as key factors in this trend. The former encourages more borrowing and buying, the latter normalizes the consumption of expensive products and services. Importantly, she has found that the rise of the service economy – such as personal care, dinning out and other lifestyle services – is a significant contributing factor.

> Consuming more today improves my relative social position, but it also weakens my relative economic position in the future. It becomes a question of a rat race today versus a rat race tomorrow.

Considering the future of consumer economies in Canada and other developed countries, Nesterova anticipates a growing shift toward service economies. Her research suggests that policies that reduce inequality may lower conspicuous consumption and increase social welfare.

"If we implement the right policies, this shift can bring new opportunities and challenges to make sure that inequality is kept under control and innovation benefits all."

**Read Nesterova's proposed solutions
to mitigate this trend**

SHAPING THE NEXT ERA OF CO-OP.
WE'RE ON IT.

We're proud to be the world leader in co-op education and work-integrated learning, as we prepare our graduates to shape the communities and organizations of the future.

But being a leader today isn't enough at Waterloo. We're already planning for the next era of work-integrated learning.

Waterloo to host 2023 WACE world conference

Bright minds in education, government and industry will converge at the University of Waterloo to redefine the role work-integrated learning plays in preparing the workforce of tomorrow and to re-examine the impact work-integrated learning has on innovation, entrepreneurship and bolstering local, national and global economies.

From enhancing global learning networks and exploring new ways to deliver co-op and work-integrated learning to developing new strategies to improve inclusion and equity in learning, Waterloo will be at the forefront of the talent evolution.

Learn more at

waceinc.org

UNIVERSITY OF
WATERLOO