Faculty of Engineering

Research
Strategy

QUT

the university for the real world®

Our research strategy at a glance

External challenges

Climate change and sustainability	Population	Technology disruption
Decarbonisation, pollution, climate-related impacts	Ageing, growth, social inequities	Digitisation, job transformation, misinformation/trust

Research priorities and focus areas

Renewable energy	Technology-driven health and healthy living	Artificial intelligence and robotics-driven futures	Innovative manufacturing and circular solutions	Resilient and sustainable cities and regions
• Critical minerals processing, extraction and exploration • Energy production, storage and distribution • Sustainable energy solutions and use for Indigenous Australian and remote communities • Power systems/electronics, energy materials and infrastructure • Biofuels and bioenergy	• Tissue and micro-tissue engineering and regenerative approaches • Biomedical devices, implants and biomechanics interventions • Imaging and tools for diagnosis and treatment • Healthy living, assisted living and ageing in-place • Healthcare solutions for Indigenous Australian and remote communities	• Ethical and inclusive AI • Explainability and human-machine teaming • Fundamentals for positive automation and combating destructive AI • Physics-informed machine learning • AI and robotic-driven solutions and deployment in engineering applications	• Advanced materials, composites and biomaterials • Nanomaterials in additive manufacturing • Waste, recycling and circular solutions • Robotics and cobotics • Bio-based manufacturing and biofabrication	• Disaster resilience, secure and resilient infrastructure • Green and sustainable design, policy and planning for urban, regional and Indigenous Australian communities • Liveable and smart cities • Future mobility and transport • Water and wastewater management

Enabling technologies and research

- Control and automation, robotic platforms and sensing (ground, water, aerial and space)
- Digital twins, simulation and modelling
- Human-centred thinking and design-led innovations
- Indigenous Australian-led and co-designed solutions
- Sustainable materials

About the Faculty of Engineering

The QUT Faculty of Engineering shapes the world we live in through our expertise in engineering, built environments and advanced technologies. Our programs focus on teaching, research and building a better quality of life through advancements in robotics, manufacturing, AI, architecture and construction.

The faculty adapts and innovates infrastructure to meet real-world challenges resulting from population increases, natural disasters and climate change. We pursue high-level engagement with a range of sectors to deliver benefits across health, transport, aerospace, manufacturing, mining and agriculture.

Through long-standing partnerships, we facilitate strong industry connections to enable us to address complex challenges through research and innovation, as well as provide our higher degree research students with high-value research experiences and connections to industry.

The faculty's *Future Directions* articulates a shared goal to develop unique research capabilities, as well as grow our partnerships to ensure our innovations deliver excellence and impact for the communities we serve. To achieve internationally recognised excellence and impact in these domains, the faculty is committed to the consolidation and growth of our research capacity in priority and emerging areas.

FACULTY OF ENGINEERING

QUT

Future Directions

2024–2027

the university for the real world
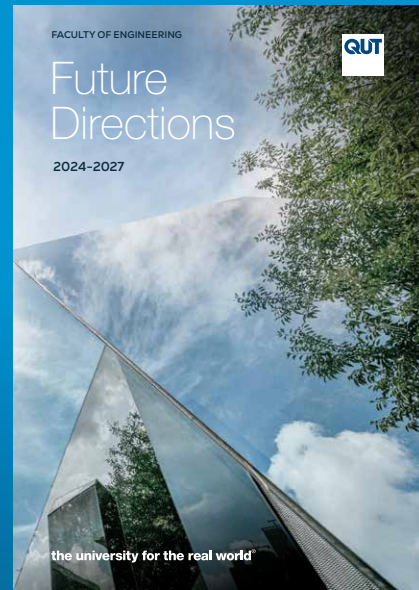
Our schools

Architecture and Built Environment (ABE) focuses on the social, economic, technical, health and safety, and environmental challenges in diverse architectural, construction, development and planning projects in urban and regional contexts. The school uses human-centred thinking and critical perspectives to engage stakeholders in emerging social, environmental and technical challenges in built environment research and knowledge creation.

Civil and Environmental Engineering (CEE) focuses on creating a liveable and sustainable society, as well as understanding how infrastructure development affects the world around us. By combining civil and environmental engineering, the school provides greater insight into ways we can mitigate the environmental impact of the infrastructure lifecycle. Our research spans structural, construction, geotechnical, transport and water engineering. This cross-disciplinary expertise allows us to focus on holistic approaches to safe, sustainable, efficient and resilient infrastructure—now and into the future.

Electrical Engineering and Robotics (EER) focuses on improving our understanding of the world we live in through sustainable energy solutions and intelligent technology. The school conducts high-quality, cross-disciplinary teaching and research in robotic vision, machine learning, video analytics, wireless power transfer, microgrids, renewable energy integration, pulsed power technology and superconductivity.

Mechanical, Medical and Process Engineering (MMPE) focuses on the design, manufacture and operation of biomedical, chemical and mechanical systems and processes. The school develops new technologies, equipment and methods that improve the quality of human health and the environment, and that provide real-world solutions for our partners. In particular, the school draws on extensive experience in the design and simulation of mechanical-based systems and processes, providing innovative solutions to complex engineering problems.

Our centres and research groups

The faculty is home to outstanding researchers of international renown that collaborate with partners to improve systems in robotics, medical, mechanical, mining, food and beverages, oil and gas, energy, water and sugar. Our university research centres, ARC-funded research centres and faculty research groups hosted by our faculty include:

- Centre for Biomedical Technologies
- Centre for Robotics
- Max Planck Queensland Centre
- Energy Transition Centre
- Australia-China Centre for Tissue Engineering and Regenerative Medicine
- Australia-China Joint Research Centre for Biofuels and Biorefining
- ARC Industrial Transformation Training Centre for Joint Biomechanics
- ARC Industrial Transformation Training Centre in Collaborative Robotics in Advanced Manufacturing (Australian Cobotics Centre)
- Sustainable Transformation of Resources for Advanced Technology Applications
- Sustainable Engineered Construction Materials
- Human-Building Interaction.

The faculty also contributes via its researchers to a range of other university research centres including:

- Centre for Agriculture and the Bioeconomy
- Centre for Data Science
- Centre for Materials Science
- QUT Resilience Centre
- ARC Industrial Transformation Training Centre for Automated Vehicles in Rural and Remote Regions
- Centre for Accident Research and Road Safety – Queensland.
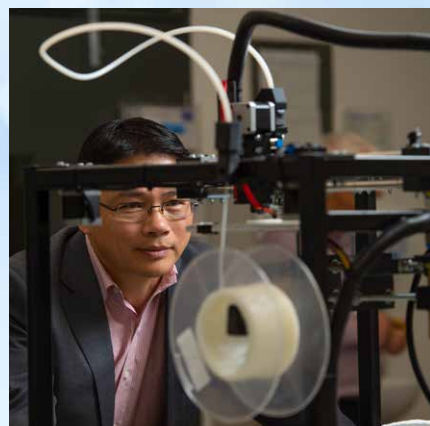
Strategic drivers and research challenges

The following research strategy provides context around our research priorities and the external challenges that we seek to collectively address. These research priorities are firmly anchored in tackling significant, complex and ongoing challenges that shape our global landscape. These include:

- **climate change and sustainability drivers**—recognising the urgent need for our society and industries to decarbonise, reduce pollution and grapple with climate-related impacts as part of developing solutions for a more sustainable future.

- **population-related drivers**—including demographic ageing, urban growth, supporting more with less and confronting social inequities, particularly Indigenous Australian communities.

- **technology disruption drivers**—recognising that while we as a faculty are leading transformational change with technology solutions, we must also confront and address disruptions driven by digitisation, including the transformation of jobs and proliferation of misinformation, and safeguarding our trust in an interconnected world.
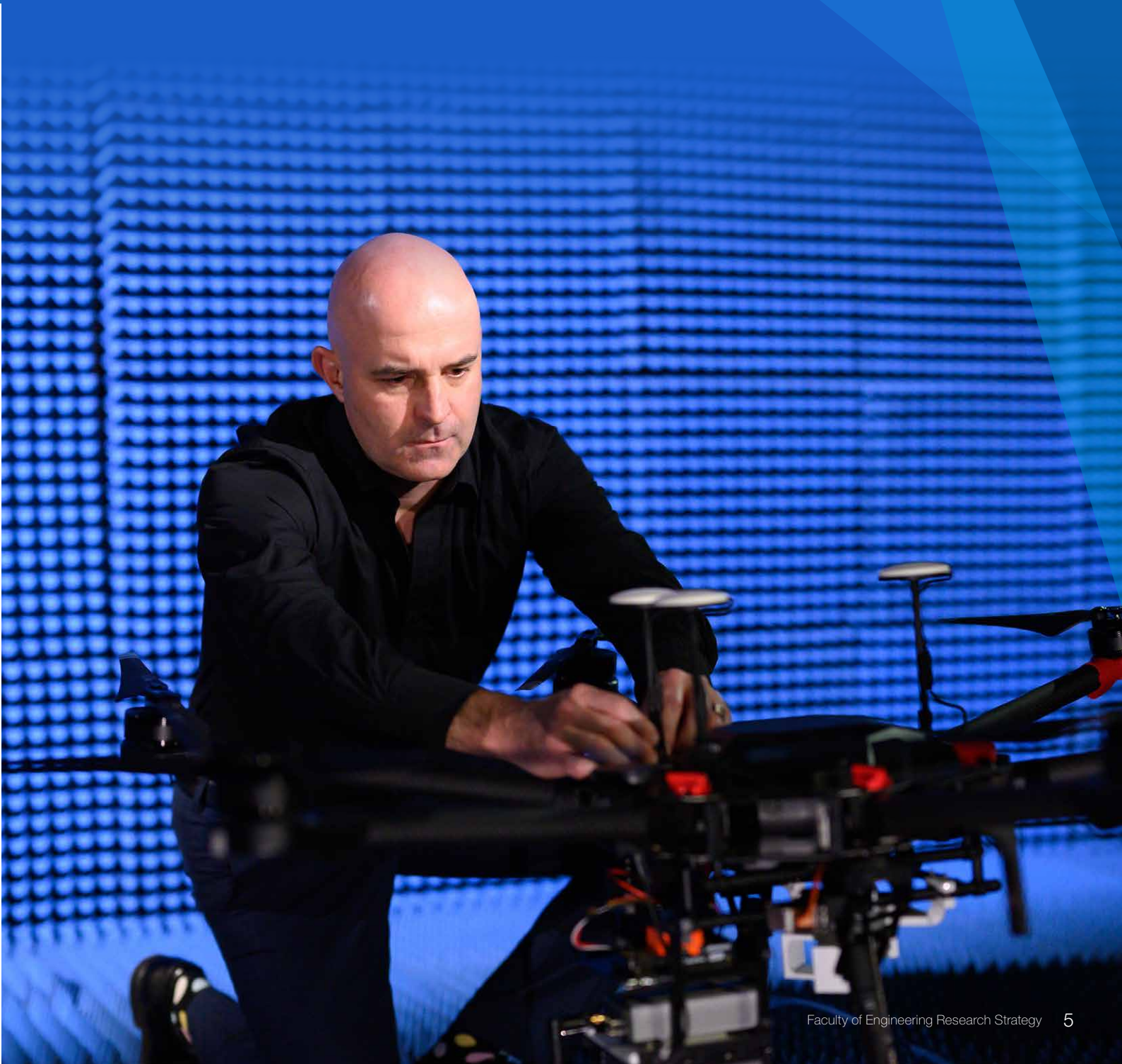
Our research priorities

To address the three global challenges of climate change, population and technological disruption, the faculty commits to consolidating research capabilities around six distinct research priorities. These priorities require a portfolio of solutions and interventions designed across multiple research disciplines, as no one discipline or solution can offer a single path forward.

Five of these priorities are externally facing and represent critical areas where there is a need to accelerate the design and development of new solutions. One priority represents enabling technologies and research which offer the potential to contribute to and support multiple identified research priorities and other faculty research agendas. These research priorities (outlined below and summarised in the full-page figure on page 1) cover disciplines and technologies that are essential to underpin new solutions and align to our faculty's current and emerging areas of research strength.

1.0 Renewable energy

Our future hinges on the rapid development of sustainable and renewable clean energy solutions, including an emphasis on the extraction and processing of raw materials and critical minerals which are essential inputs. This urgency is imperative to minimise impacts and disruptions via climate-related disturbance and to support our transition to a clean energy future. The five research focus areas within this priority include:

1.1 critical minerals processing, extraction and exploration

1.2 energy production, storage and distribution

1.3 sustainable energy solutions and use for Indigenous Australian, rural and remote communities

1.4 power systems and power electronics, energy materials and power infrastructure

1.5 biofuels and bioenergy.

2.0 Technology-driven health and healthy living

We aim to better human health in our lifetime by improving the way we treat complex medical cases stemming from injuries, infection and age-related issues, and advancing the capability of resources to support a technology-enabled healthcare system and aiding healthy living solutions in all aspects of society. The five research focus areas within this priority include:

2.1 tissue and micro-tissue engineering and regenerative approaches

2.2 biomedical devices, implants and biomechanics interventions

2.3 imaging and tools for diagnosis and treatment

2.4 healthy living, assisted living, and aging in-place

2.5 healthcare solutions for remote, rural and Indigenous Australian communities.

3.0 Artificial intelligence and robotics-driven futures

We know our future lives, vocations, and experiences will be drastically impacted by Artificial Intelligence (AI), robotics and related automation platforms. We aim to positively contribute to the future shaping of AI and robotics that can boost societal impact and minimise any potential harm or consequences of these transformative technologies. The five research focus areas within this priority include:

3.1 ethical and inclusive AI

3.2 explainability and human-machine teaming

3.3 fundamentals for positive automation and combating destructive AI

3.4 physics-informed machine learning

3.5 AI and robotic-driven solutions and deployment in engineering applications.

4.0 Innovative manufacturing and circular solutions

We aim to innovate technologies and processes to enhance the efficiency, sustainability, performance, utility and competitiveness of manufacturing. We also aim to provide new solutions for a sustainable society—including transforming the way we deal with materials and waste, as well as biowaste—to help address complex environmental impacts in sustainability.

The five research focus areas within this priority include:

4.1 advanced materials, composites and biomaterials

4.2 nanomaterials in additive manufacturing

4.3 waste, recycling and circular solutions

4.4 robotics and cobotics

4.5 bio-based manufacturing and biofabrication.

5.0 Resilient and sustainable cities and regions

We seek to develop urban and regional environments which are sustainable, intelligent, and support a high-quality of life for its residents, including equipping humans with advanced tools to aid in managing the increased prevalence of natural and human-made disasters, to enhance preparedness, response and recovery, to better manage transport and our key resources, and to improve our security and resilience.

The five research focus areas within this priority include:

5.1 disaster resilience, secure and resilient infrastructure

5.2 green and sustainable design, policy and planning for urban, regional and Indigenous Australian communities

5.3 liveable and smart cities

5.4 future mobility and transport

5.5 water and wastewater management.

6.0 Enabling technologies and research

QUT is the university for the real world. As the university's Faculty of Engineering, we pride ourselves on developing technologies that can make a tangible impact for people, industry, government and communities. In addition to our externally facing research priorities, we also develop a range of enabling technologies that can be used to support other priorities due to their unique opportunity to contribute to a range of applications and other faculty research agendas. The five research focus areas within this priority include:

6.1 control and automation, robotic platforms and sensing (ground, water, aerial and space)

6.2 digital twins, simulation and modelling

6.3 human-centred thinking and design-led innovations

6.4 Indigenous Australian-led and co-designed solutions

6.5 sustainable materials.

Connect with our experts

Our research capabilities are developed with, and for, Australian industries and communities. Talk to us about what kind of partnership might best suit your research needs.

Partner with us

Collaborating with our researchers can unlock access to a range of research funding opportunities designed to support skills and knowledge transfer, as well as enable your organisation to innovate.

Commission a project

We provide research solutions for industry, government, for-purpose and community sectors through research consultancy and commercial research.

Sponsor research training scholarships

Explore the feasibility of emerging technology or develop an initial prototype for your business by funding a student stipend and project expenses.

Host a research student internship

Internships for postgraduate research students are a great way to connect with some of the cutting-edge innovation occurring at QUT. Search for experts on the QUT academic profiles directory at qut.edu.au/about/our-people/academic-profiles
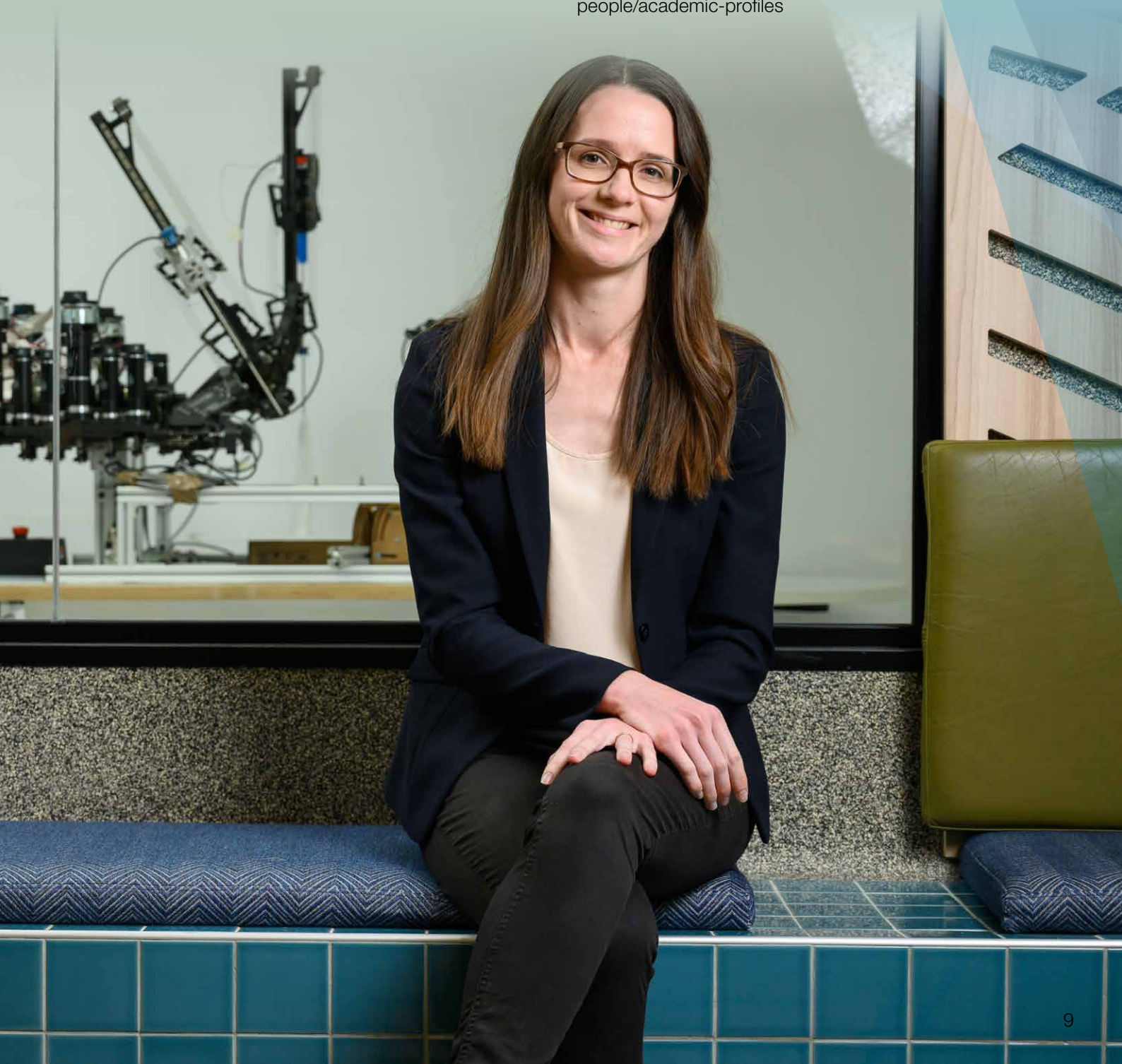
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QUT is committed to sustainability. The
paper on which these resources have been
printed has the following credentials: