IMPACT

RESEARCH AT CQUNIVERSITY

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RESEARCH WITH IMPACT
Professor Corneel Vandelanotte leads CQU’s Physical Activity Research Group and the hugely successful 10,000 Steps program which has attracted over 500,000 members, 17,000 organisations and has over 100,000 app downloads.
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CQUniversity is emerging as one of Australia’s great research universities.

Its success is largely due to its determination to meet the needs of the communities it serves. After more than half a century working with stakeholders in regional Australia, CQUniversity has emerged as a research powerhouse, committed to engaging and collaborating with communities and industry to achieve real-world research outcomes in our regions and beyond.

The University has a strong ethos of doing things differently, which is reflected in its research initiatives. With an applied research focus, CQUniversity aims to achieve real impact for its communities and stakeholders, with a vision to be one of the top applied research institutions in the country.

We aim to achieve complete relevance in our research efforts through strong links with industry, government and communities, as well as through close collaboration with national and international researchers and research networks. From agriculture to health, our research institutes and centres facilitate activity that involves our stakeholders and in turn makes a tangible impact to end-users.

As the only university in Australia with a physical presence across every mainland state, CQUniversity is uniquely positioned to establish and maintain networks and partnerships across the length and breadth of the country. This incredible power of place allows the University to engage deeply, thoroughly understand, and focus on the issues that matter to those we seek to support.

As a university with a strong engagement focus, CQUniversity is committed to conducting research that is innovative, creates impact, and drives positive change for the regions we operate in.

By working collaboratively with the communities and industries we serve, some remarkable feats are being achieved across a range of research fields.

At CQUniversity we place a focus on research that will deliver solutions to complex challenges. In particular, we focus on research in regional development and supply chains, growth in innovative industry (particularly for northern Australia), environmental management, healthcare and health promotion in regional and remote communities, social and human development, and equity and education delivery.

CQUniversity has around 600 research higher degree students and over 200 research projects currently underway, from research impacting the health and wellbeing of children and pregnant women, through to engaging with communities to solve complex agricultural, coastal and marine issues.

This engaged research agenda is vitally important because, more so than ever before, universities have a crucial role to play in influencing the growth, success and prosperity of Australia. They also have a specific responsibility to find innovative, sustainable, and accessible solutions to the complex economic, social, environmental and health challenges currently impacting the world around us.

Working with end users to understand problems and uncover solutions sets CQUniversity apart when it comes to the delivery of real-world research. This will continue to influence our research philosophy, guiding our researchers to deliver outcomes that truly make a difference and improve the quality of life for those living in our communities.
Dr Jaime Manning is using on-animal sensor technologies for the autonomous detection of disease and predation events in sheep.
ABOUT CQUNIVERSITY

Originally founded in Rockhampton in 1967 as the Queensland Institute of Technology (QIT) Capricornia, CQUniversity Australia was granted full university status in 1992 and now has more than 30 000 students studying online and on-campus across Australia.

CQUniversity is proud to be recognised as Australia’s most inclusive university with the highest ratio of students from disadvantaged, mature-age, Aboriginal and Torres Strait Islander, and first-in-family backgrounds. This inclusive approach and commitment to access and participation means the University defines itself by who it embraces, rather than who it excludes.

It is this strong focus on participation and accessibility, that has seen CQUniversity firmly establish itself as one of the largest universities based in regional Australia, and the only university with a campus in every mainland state of Australia. The University operates campuses in Adelaide, Brisbane, Bundaberg, Cairns, Emerald, Gladstone, Mackay, Melbourne, Perth, Rockhampton, Sydney and Townsville and also has a strong track record of working in partnership with regional university centres across the country. In 2020, CQUniversity also established an international presence with a delivery site in Jakarta, Indonesia.

CQUniversity is Queensland’s only dual sector university and delivers more than 300 education and training offerings, from short courses and certificates, through to undergraduate, postgraduate and research degrees. Study areas include allied health; business and accounting; creative, performing and visual arts; digital media, communication and arts; education, teaching and childcare; engineering, built environment and aviation; English and study pathways; information systems and technology; law, criminology and justice; nursing, paramedicine and health; psychology, social work and community services; safety sciences; science, environment and agriculture; service industries; and trades. As a pioneer in the delivery of distance education, CQUniversity continues to be a leader in online study with around one third of the current student cohort made up of students studying off-campus, many of whom are based in rural and remote areas. CQUniversity’s flexible approach to learning and teaching, and continued innovation in this space, has provided opportunities for thousands of students to complete qualifications, regardless of their geographical location or personal circumstances.

As a direct result of the challenges and health directives associated with the recent COVID-19 pandemic, CQUniversity showcased its flexibility and adaptability by quickly and successfully transitioning face-to-face teaching to online delivery for all course offerings. As industry leaders in online education, the University was well-placed to provide an excellent online service to students during this time, having the technical resources and expertise already in place to provide a rapid response to the crisis. CQUniversity’s success in this space also ensured confidence in its research endeavours and partnerships.

After more than half a century working with stakeholders in regional Australia, CQUniversity is now a renowned research institution in several key disciplines and the benchmark leader for how universities should engage and collaborate with communities and industry. The University’s applied research focus is oriented towards impact and real-world outcomes, with the purpose of providing solutions to challenges and identifying new opportunities for advancement in our regions and beyond.

This focus has seen CQUniversity achieve Excellence in Research Australia (ERA) results of ‘at’, ‘above’ or ‘well above’ world standard in 22 categories of research including Mathematical Sciences, Applied Mathematics, Horticultural Production, Engineering, Psychological and Cognitive Sciences, Psychology, Agriculture and Vet Sciences, Agricultural, Land and Farm Management, Public Health and Health Services and Nursing to name a few.

CQUniversity has a strong alumni community with more than 120 000 alumni across the globe. CQUniversity graduates also have some of the best employment outcomes in Australia, with recent data released by the Graduate Outcomes Survey indicating that 79.5 per cent of domestic undergraduate students find full-time employment within four months of graduation, compared to the national average of 72.3 per cent”. Data released by the Quality Indicators for Learning and Teaching (QILT) also shows that CQUniversity outperforms the majority of Australian universities when it comes to the overall student experience and graduate salary outcomes.
CQUniversity places a strong emphasis on social innovation and global outreach and fosters several key partnerships with communities, industry and government, both in Australia and overseas. This commitment to engagement and social advancement has led to CQUniversity being recognised as Australia’s first and only Changemaker Campus*** by Ashoka U, an exclusive global social innovation group made up of only 45 education institutions across the world.

CQUniversity’s unique vision for diversity, outreach, engagement, research, learning and teaching, and inclusiveness, combined with its growth aspirations and continued expansion of student success, research excellence, social innovation and community engagement, has led to it being recognised within several world university rankings, and among the world’s best ‘young universities’ by both the Times Higher Education**** and QS World University Rankings*****.

REFERENCES
** ComparED 2019
*** Ashoka U – AshokaU.org
**** Times Higher Education World Rankings 2020
***** QS World University Rankings

CQUniversity’s applied research focus emphasises the translation and uptake of research findings to meet stakeholder’s real-world needs. As one of Australia’s most engaged universities with an emphasis on globally relevant activity that benefits the regions we serve, CQUniversity is fast becoming one of the nation’s most respected applied research institutions.
RESEARCH AT A GLANCE

**RESEARCH IMPACT**

CQU’s research focus and engaged research agenda are already making positive impacts on individuals, communities and industries across the world. In coming years, this impact will continue to grow, expanding into new focus areas and transforming the way we think about current challenges.

The University’s research impact is apparent in improved industry processes, regional and economic development, business improvement, productivity and innovation, social advancement and equity and healthier communities.

**ENGAGED RESEARCH**

CQU’s research agenda is built around deep engagement with communities, industries and government. In particular, the University is focussed on delivery of research that is relevant to the northern Australia region. To deliver great research that is meaningful and relevant, researchers work directly with stakeholders to identify challenges and deliver solutions. The end user is involved throughout the entire research project. This approach ensures CQU’s research delivers direct benefit and long-lasting impact.

**SOCIAL INNOVATION AND SUSTAINABLE DEVELOPMENT**

CQU is officially recognised as Australia’s only Changemaker Campus by global social innovation group Ashoka U. The University achieved this reputation because of its strong engagement agenda and inclusive approach to the delivery of research, education and training.

Social innovation is about working with communities in a collaborative way, using a range of strategies, to find innovative and sustainable solutions to social needs or problems. Ultimately, the philosophy is driven by the simple need to improve lives and create positive change within the world around us.

CQU also recognises and is committed to alignment with the UN Sustainable Development Goals (SDGs) across a range of indicators. The University participates in the annual Times Higher Education (THE) Impact Rankings, and in 2021 was placed 29th in the world for SDG14, Life Below Water. In the THE Impact assessment, CQU was ranked in the top 200 universities in the world overall against the Sustainable Development Goals. This commitment to the UN SDGs underpins much of the University’s research endeavour and is demonstrated by the visible impact the University’s research has on the communities and industries the University engages with.
LEARNING AND TEACHING INFORMED BY RESEARCH

The research conducted at CQUniversity helps to guide the design and delivery of learning and teaching. CQUniversity strives to achieve a connected approach to research, learning and teaching, believing that ’real-world’ research impacts not only the community it operates in, but also a student’s experience across disciplines. This is evident in the way academics draw on their personal research in designing and teaching courses, where their research informs learning activities and academic discussion on contemporary issues. Research tasks are also embedded in many undergraduate coursework programs, providing students with opportunities to grow their understanding through knowledge creation.

RESEARCH CENTRES AND INSTITUTES

CQUniversity has two research institutes – The Appleton Institute and the Institute for Future Farming Systems – and seven research centres including The Centre of Indigenous Health Equity Research, Centre for Intelligent Systems, Centre for Railway Engineering, Centre for Research in Equity and Advancement of Teaching and Education, Centre for Regional Economies and Supply Chains, Queensland Centre for Domestic and Family Violence Research and the Coastal Marine Ecosystems Research Centre.

RESEARCH AT A GLANCE

CQUniversity’s Rory Mulloy collects data to score and grade the mud crab indicator for the Gladstone Harbour Report Card.

RESEARCH FOCUS AREAS

- Regional economies and supply chains
- Work, employment, regulation and governance
- Sustainable business and community justice
- Education
  - Open and distance education
  - Creative education in the arts
  - Learning and assessment innovation for educational equity
  - STEM education
  - Education for global competence
  - Transformative education practices in professions
- Railway engineering
- Artificial intelligence and machine learning
- Clean energy
- Biofuels
- Pavement engineering
- Big data analytics
- Aviation human factors
- Healthy behaviours at work, rest and play
- Psychology and well-being
  - Sleep and biological rhythms
  - Physical activity
  - Emergency and disaster resilience
  - Gambling and addictive behaviours
  - Regional health and health services
  - Human factors and safety science
- Agricultural systems
  - Agricultural management systems
  - Agricultural extension/translation
- Environmental systems
  - Environmental monitoring and management
- Exercise and sports science
- Applied medical health
  - Medical and applied physiology
  - Advanced clinical practice
- Quality and safety in healthcare
  - Patient safety and consumer experience
  - Clinician’s capacity building
- Health workforce
  - Clinical workforce
  - Models of care
  - Preparation for, and transition to, practice
- Safe communities
  - Gendered violence
  - Violence, abuse and neglect
- Psychosocial wellbeing
  - Aged care
  - Individuals, families, and communities
  - Mental health nursing
The Research Higher Degree (RHD) Training Academies aim to attract and train clusters of RHD candidates by specific discipline areas, by cohort profile (e.g. Indigenous) or by geographic cluster (e.g. offshore). Each Academy has been established through demonstrated ability to deliver a culture of research excellence, research impact and research engagement, particularly with respect to timely completions, publications, and partnership opportunities with industry.

**FIRST NATIONS ACADEMY**

The First Nations Research Higher Degree Academy is an Aboriginal and Torres Strait Islander research-focused community of practice jointly hosted by the Office of Indigenous Engagement (OIE) and the School of Graduate Research. The Academy is not restricted by discipline type and aims to build the research capacity of Aboriginal and Torres Strait Islander Research Higher Degree (RHD) candidates and academic supervisors.

The support provided by the Academy includes academic, cultural, pastoral, financial, publication, resource, and system support to assist First Nations RHD candidates towards the completion of their studies. It aims to achieve this by developing and undertaking Indigenous research projects and establishing partnerships in collaboration with Schools, Research Centres and Institutes.

This Australian-first academy responds to research indicating that First Nations people are under-represented in postgraduate research training programs in Australian universities.

With enrolment rates of Indigenous RHD candidates in this country being well under the population parity rate, CQUniversity’s First Nations RHD Academy aims to address that parity while being the first Australian university to do so.

The Academy aims to increase Indigenous participation in research and, more importantly, assist candidates in achieving strong levels of cultural, pastoral and academic support that is critical for the success of Indigenous research candidates.

The First Nations RHD Academy provides a supportive and culturally-safe learning environment for Indigenous research candidates to thrive and complete their research qualifications – no matter where they are based in Australia.

**HEALTH WORKFORCE ACADEMY**

Australia’s health workforce plays a vital role in providing effective, safe and quality care that improves the health and well-being of the Australian community.

To continue to develop sustainable research capacity in the health workforce, the Health Workforce Academy offers education and training that aims to enhance the applied research capabilities of higher degree candidates. It aims to share contemporary knowledge and innovative designs to upskill candidates and develop the vital skills to strengthen research performance.

The Academy is responsive to candidate needs by providing a platform to facilitate researchers, supervisors, mentors, national and international collaborators with health workforce expertise to share cutting-edge methodology, innovative research designs, pedagogy and theoretical conceptualisation to advance the learning of CQUniversity’s higher degree research candidates.

The academy is unique in that it develops the natural synergy between numerous research areas with the unified goal of addressing contemporary health workforce issues.

The Health Workforce Academy welcomes learners who want to be the catalyst for change and encourages potential national and international collaborators to partner with them in building the research capability for the health workforce.
Dr Qing Wu leads a number of rail research projects and has won more than $1 million worth of external research funding.
RESEARCH BITES

PLAY WELL TRIAL
A CQUniversity researcher is driving a unique program to help parents be positive on the sidelines of their kids’ sport. The Australian-first initiative sees CQUniversity and The University of Queensland (UQ) partner with the National Rugby League and Queensland Rugby League, in a proactive step to ensure children better enjoy and value their participation in the sport. Developed by researchers from CQUniversity and UQ’s School of Human Movement and Nutrition Sciences and Parenting and Family Support Centre, the Play Well Triple P program, focuses on parents becoming more positive, unpacks how to avoid common traps, and provides strategies to strengthen positive behaviour. Program co-developer and CQUniversity Psychology Head of Course Dr Cassy Dittman said the principles of staying positive on sporting sidelines are relevant to all parents.

SMART SLEEP STUDY
Disrupted sleep patterns can be deadly for Australia’s shift workers, but in a world-first study CQUniversity researchers are working with colleagues at Monash University and Washington State University to create a new model to manage and prevent fatigue. The research project which will model the timing of circadian rhythms, sleep and performance at the individual level, recently secured $552 254 in Australian Research Council funding, through the Discovery Projects scheme. Director of CQUniversity’s Appleton Institute, Professor Sally Ferguson is one of five investigators on the project, and said the approach could improve processes for measuring fatigue. This new project will focus on Australia’s shift worker population and could drive safer work environments for millions of shift workers, and better health outcomes generally.

POO KEY TO KOALA’S FUTURE
A Central Queensland researcher is delving into the chemical make-up of koala poo in key areas of Queensland to determine how stressed the species may be. Koala researcher Dr Flavia Santamaria said there’s mounds of information about the health of koalas that can be extracted from a few pellets of poo and this information could help secure koala populations into the future. She is currently looking at chemicals related to cortisol, also called cortisol metabolites, in the poo which can tell us about the stress levels of the animals. Dr Santamaria’s study of koala poo, collected from a wildlife facility in South-East Queensland over a 12-month period, will act as a baseline for future studies on stress in wild koalas.

MULTIMOVEMENT THERAPY
Multimovement Therapy (MMT), which allowed former world-champion boxer Johnny Famechon to walk and talk again after a shocking trauma, might be considered by practitioners and those affected by an acquired brain injury or other similar neurological issues, according to two CQUniversity academics. Neuroscience experts, Dr Ragnar Purje and Professor Ken Purnell have penned the paper, Multimovement Therapy and the Brain, which explains the benefits – and further potential – of the treatment. MMT involves complex and multiple body movements at the same time – up to six – under the guidance of a trained therapist. This ‘overloads’ the brain, stimulating new neural networks and re-igniting repairing others. Prof Purnell said the treatment’s fundamental purpose was to change a patient’s own neurology. The academics believe the process could also be used in education techniques to improve learning.

MAKING THE BEACH ACCESSIBLE
CQUniversity researchers exploring ways to make beaches more accessible are studying how older Australians and people living with disability or mobility limitations currently use the beach. The U-BEACH: Tides of Change study is led by CQUniversity Physiotherapy and Occupational Therapy academics, and will inform planning for improved beach accessibility throughout Australia, and the health and wellbeing impacts of beach-based therapeutic interventions. With one in five Australians living with some form of disability, there are a significant number of Australians who currently cannot get onto the beach due the challenges of the terrain, and inaccessible facilities. An initial U-Beach research survey in 2020, focused on experiences in Queensland’s Bundaberg Region. That data is helping drive the implementation of Bundaberg’s first accessible beach, at Neilson Park Beach in Bargara.

HARBOUR STUDY
The Gladstone Harbour may be known nationally as the gateway to the Southern Great Barrier Reef, but it is also Queensland’s largest, and Australia’s fifth largest, multi-commodity port. It is also where you will find CQUniversity Research Fellow, Dr Nicole Flint and her team monitoring the health of local fish and mud crabs. The Gladstone Healthy Harbour Partnership (GHHP) commissioned CQUniversity’s Coastal Marine Ecosystems Research Centre (CMERC) to develop mud crab, fish health, and social, cultural, and economic indicators. Dr Flint said these indicators are used to independently monitor, and report on, the health of the harbour against GHHP environmental goals, and inform annual Gladstone Harbour Report Cards. Report cards are used to communicate the condition of coastal and riverine environments to key stakeholders and the community, by synthesising complex data drawn from the indicators.
Associate Professor Nanjappa Ashwath has been researching Australian plants for over 40 years. He is currently exploring native species that have the potential to produce biofuel, including biodiesel from the beauty leaf tree.
What began as a concern around children’s healthy bowel functions has morphed into a commercially viable kit destined to impact the wellbeing of pre-school and school-age children throughout Australia.

The Poop-it Kit was designed by Emeritus Professor Kerry Reid-Searl, a CQUniversity researcher who is no stranger to leading research studies to the commercialisation stage. She is the founder of both Mask-Ed™ and Pup-Ed™ simulation programs and is the creative genius behind this latest project.

The Poop-it Kit includes a range of products that help children understand their bowel functions in an easy-to-digest way. The kit includes easy-read, humorous, animated story books with poo characters adapted from the Bristol Stool Chart, a wall poster, a colouring-in book, a whoopee cushion, a map of the digestive system, a Monopoly-like game and a user guide, all designed to enable children to identify the type of their stools, what they mean to the health of their digestive system, and how they can restore them to a healthy function.

With the support of Rolley Tickner and his graphic design skills and commercialisation support from CQUniversity, Professor Reid-Searl’s Poop-it Kit could soon be marketed to daycare centres, schools and hospitals to help educate children and wipe away bowel issues that plague up to 30 per cent of children in Australia.

Thanks to a donation of $10 000 from the Rockhampton Lion’s Club, Professor Reid-Searl has moved forward with the project and has recently undertaken a commercialisation feasibility study by Gemaker, with the kit being tested in schools and hospital settings.

The feedback has been collated and will now inform amendments to the kit before being marketed. Further research projects into the kit are also being planned.

What started as a small research project aimed at evaluating Professor Reid-Searl’s Poop-it Kit with CQUniversity colleagues Kate Crowley, Carina Anderson, Nicole Blunt and Rachelle Cole, has developed quickly into a commercially viable resource that potentially will impact the lives of children all over the world.

Professor Reid-Searl says she loved being involved in unconventional research projects where the outcomes have real-world benefits.

‘The aim is to get kids to aspire to eat healthy foods, drink plenty of water and exercise to promote healthy bowel functioning,’ she explains.

And what better way than to get children talking about their bodily functions.

‘Children love to talk about bums and poos and farts, so this kit is just as much about getting adults comfortable talking to them about bowel health.’

The poo characters have been developed and refined over time and now come complete with names and personalities to appeal to children aged four to eight.

‘Our ‘Poop-it Kit’ family of characters adapted from the Bristol Stool Chart represent the range of possible stool types, from Rabbita Dropping to Gravina Gravy with the hero being Sausagina Sausage.’

The beautifully illustrated books in the kit also contain cleverly structured narratives, that use rhythmical language to appeal to a young cohort.

Professor Reid-Searl says in her previous role as a paediatric nurse she encountered many children with constipation and other bowel problems and parents had reported the related psychosocial issues to be significant.
The Poop-it Kit has been designed to inform children about bowel issues in an easy to digest manner through books, posters, games and other educational resources that incorporate characters based on the Bristol Stool Chart.

**IMPACT**

The Poop-it Kit has the potential to improve the overall wellbeing of children aged four to eight by addressing their bowel issues through creative and innovative characters and narratives.

*Emeritus Professor Kerry Reid-Searl*

*Our core message to children is to gain an understanding of their bowel functioning and strategies to promote healthy bowel behaviour.*
For many Australian mango farmers across the horticultural sector, COVID-19 presented many additional disruptions to the harvesting season, on top of pre-existing labour force issues.

It is well documented that harvesting jobs are transient and picking in 40-degree heat, while working at heights and dealing with acidic sap, is not for the faint-hearted.

Over the years, the harvest labour force has shifted from domestic to international, however COVID-19 has proved that to be a risky business model. That is why CQUniversity’s world-first mango auto harvester is turning heads in the sector.

The prototype, developed by Professor Kerry Walsh and his research team, has achieved a 75 per cent efficiency rate in automatically identifying and picking fruit in view.

At three metres tall, the third iteration of the prototype moves a platform vertically, while sensors scan the mango orchard for fruit. Once identified, mechanical arms reach out to grab, retract and drop.

The CQUniversity group has previously delivered a near infrared spectroscopy (NIRS) measurement system into industry, where it is now used to assess the eating quality of mangos and predict the ideal harvest time.

Professor Walsh says the prototype harvester will help to mitigate the current labour force issues by providing mango farmers with an effective automated harvesting process.

‘At present, farmers use ‘harvest aid’ platforms that travel through the mango orchard. These can either be self-propelled with a driver or towed with a tractor,’ he says.

‘Up to eight pickers work around the platform. Workers have approximately three seconds between picking the fruit and placing it in an alkaline solution on the harvest aid, before the acidic sap that spurts from the fruit when picked can burn the skin of the fruit.

‘Our prototype is set to automate the pick and place process.

‘It will integrate with a harvest aid and is set to reduce farm harvest labour needs, while driving consumer demand by ensuring a top-quality eating experience every time.

‘Labour availability has always been an issue for the industry, but COVID-19 has accentuated this.’

Professor Walsh says the sector’s interest in the mango auto harvester is a sign that automation is here to stay. ‘People are adapting and they know they have to. What was commercially viable five years ago, is not now,’ he says.

‘The packhouse has become automated. Previously, fruit was hand sorted and hand packed. Now, you will see conveyer lines, bin loaders and pallet wrappers.'
‘Just like the industrial revolution in general, you decrease the number of manual jobs in one sector but increase the number of automation jobs in another sector.

‘For example, our prototype, once integrated with a harvest aid, will require technical, maintenance and operating support, across its life-cycle.

‘It is a trade-off between complexity and cost. The technologies that underpin the auto harvester have just become of age, and as a result, the cost has dropped. It’s timely to apply.’

Professor Walsh also says that despite the uptake of automation, it is important to remember that each fruit has different requirements.

‘There are several companies entering the apple harvesting space,’ he says. ‘However, if you are a farmer waiting for this technology to be adapted or changed to suit a mango harvest, you will be waiting a long time.

‘You can bulk harvest potatoes and nuts, but not soft fruits. Horticultural products are all a bit different, therefore, automated technology needs to be purpose built to suit the commodity.’

CQUniversity researchers are now working to take their auto-harvest technologies to commercial-ready deployment.

‘We are looking for a commercial partner to be involved in the research and development phase of the integration,’ Professor Walsh says.

‘If successful, we will hopefully be able to produce and commercialise the prototype by the end of the coming season.’

This research was funded by the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program through Hort Innovation, with support from CQUniversity, project ST19009.

**DESCRIPTION**

CQUniversity’s world-first mango auto harvester is turning industry heads with the promise of targeting labour force issues. At three metres tall, the third iteration of the prototype moves a platform of arms up and down, while sensors scan the mango orchard for fruit. Once identified, mechanical arms reach out to grab, retract and drop.

**PARTNERS**

This project is being delivered by Hort Innovation – with support from the Australian Government Department of Agriculture, Water and the Environment, as part of its Rural Research and Development for Profit program, and mango supply groups Pinata, Manbulloo, and Perfection Fresh.

**IMPACT**

The harvester, which forms part of an integrated system, will save costs, and improve productivity on farm, while driving consumer demand by ensuring a top-quality eating experience every time. It also has the potential to solve some of the major labour force issues that currently limit the industry.
The presence of the elusive kangaroo tick (*Amblyomma triguttatum*) is being brought into light in the Central Highlands, thanks to a partnership between CQUniversity researchers, the Outback Exploratorium and dedicated ‘citizen scientists’ from the local community.

Led by CQUni Agriculture lecturer Saba Sinai and Research Fellow Dr Amy Cosby, the *Parasites in the Wild* project, involves collecting and identifying ticks from farmland and community spaces in the Central Highlands region.

‘Despite its name, the ornate kangaroo tick, *Amblyomma triguttatum*, feeds on a range of domestic animals and livestock. *Amblyomma triguttatum* has four described subspecies, but there is some doubt on the taxonomic validity of these subspecies,’ says Saba.

‘Resolving this doubt requires tick collection at the zones of contact where two or more subspecies meet. Luckily for us, one of only three apparent zones of contact between these subspecies is located in the Central Highlands Region, which includes towns like Emerald, Blackwater, Springsure, Duaringa, and Sapphire.’

Funded by more than $26 000 from the Office of the Queensland Chief Scientist and in-kind contributions from CQUniversity and the Outback Exploratorium, *Parasites in the Wild* also aims to foster an admiration of science in the community.

Saba says the project team has been working with primary producers, kangaroo harvesters, interested community members and primary school-aged children to collect ticks.

The field collection is largely from the Central Highlands region, but some enthusiastic citizen scientists from beyond the region have also supplied samples, demonstrating the level of enthusiasm and eagerness that members of the public have for scientific research.

Primary school students predominantly engaged with the ‘Science Squad’ at the Outback Exploratorium, a local not-for-profit science education centre based in Emerald are a key group of participants in the project.

‘In addition to seeking to resolve the taxonomic uncertainty looming over these subspecies, the project also hopes to investigate the impact that participation in citizen science projects have on primary-school aged children and other community members,’ Saba explains.
The research also helps to reveal features of effective science engagement in rural and regional areas. By demonstrating the unique role that such communities can play in scientific research by collecting samples around them, it is hoped people will develop an interest and aspiration for further study and career endeavours in science.

The project is currently in its second stage, which is focusing on identifying the collected specimens to the subspecies level and analysing the qualitative data from surveys and interviews of participants.

‘Populations of adult *Amblyomma triguttatum*, which are the easiest to identify to subspecies level, tend to taper off at the end of summer/beginning of autumn,’ says Saba.

‘We are also analysing and describing the artistic works of the Science Squad participants that they produced during two weeks of sci-art workshops with Dr Anita Milroy. We will hold one or two more workshops for livestock producers again before the end of the project.’

Queensland Chief Scientist Professor Hugh Possingham recently visited Emerald to see the progress on the project. Flying scientists, Dr Anita Milroy, who is also on the *Parasites in the Wild* team and University of Queensland’s Dr Christina Zdenek, held a special session for the Science Squad participants at the Outback Exploratorium.

‘The Science Squad kids relished the opportunity to speak to the Chief Scientist about their work with *Parasites in the Wild*,’ says Saba.

‘The citizen scientists, whether they are livestock producers, kangaroo harvesters, pet owners or Science Squad students and their parents, have all contributed to the project through tick collection but also through participating in qualitative research which sheds more light on citizen science projects that embrace all age groups in rural and regional communities.

‘The citizen scientists have also made interesting observations, particularly about animal behaviour related to tick parasitism. This could provide the basis for further research, an unforeseen outcome from this project.’

While the data is still being collated and assessed Saba says one finding was that one subspecies, *Amblyomma triguttatum queenslandensis*, seems to be found in the Central Highlands, whereas previously only *Amblyomma triguttatum triguttatum* and *Amblyomma triguttatum ornatum* were reported in the region.

‘We hope to make a contribution to resolving the taxonomic doubt around these four subspecies and to identify strategies for effective citizen science approaches, particularly in rural and regional areas and with primary-school aged children.’

*Parasites in the Wild* is a citizen science project that engages rural students in collecting and identifying ticks, particularly the elusive kangaroo tick (*Amblyomma triguttatum*) from farmland and community spaces in the Central Highlands region.

**PARTNERS**
The Outback Exploratorium, Emerald, Queensland.

**IMPACT**
The *Parasites in the Wild* project will contribute to resolving the taxonomic doubt around four subspecies of the tick and to identify strategies for effective citizen science approaches, particularly in rural and regional areas and with primary-school aged children.

*Saba Sinai with Glenda Henry and Colin Valler*
ENGAGING COMMUNITIES THROUGH SEAGRASS

Associate Professor Emma Jackson

Researchers at CQUnderstanding the Coastal Marine Ecosystems Research Centre (CMERC), led by Associate Professor Emma Jackson, have been working with passionate citizen scientists to engage communities and regenerate ecologically important seagrass meadows.

CMERC experts have been doing this through a flagship citizen science project that involves engaging community volunteers to collect seagrass flowers so that seeds can be germinated and transplanted to regenerate existing meadows and establish new ones.

The Sea Flowers: growing community engagement for seagrass restoration project is being implemented at intertidal seagrass banks within Gladstone, Bundaberg and the Sunshine Coast.

Seagrass plays an important part in the ecology of marine environments especially within the southern Great Barrier Reef. Seagrass is referred to by many marine experts as ‘the kidneys of the Great Barrier Reef’ for its role in filtering nutrients and sediments from the water. Seagrass meadows also contribute an estimated $31.5 million a year to Australia’s fisheries through their role as a breeding habitat for everything from fish to turtles and scallops to dugongs.

However, at least 291 000 hectares of seagrass meadows have been lost around Australia since the 1930s – resulting in a massive disruption to marine habitats which is consistent with global trends – caused by rising sea surface temperatures, extreme temperature events, coastal urbanisation and agricultural run-off.

Associate Professor Jackson explains that seagrasses are disappearing at an alarming rate, but the Sea Flowers project will contribute to the restoration of this vital flora.

‘Through citizen science, we can involve local people, voluntary organisations and apprenticeship schemes to become involved in the non-destructive collection of seagrass flowers.

‘The seagrass flowers are then used in seed storage, germination, viability and restoration by seed studies while educating and promoting the value of these habitats to the local community,’ says Associate Professor Jackson.

Researchers from CMERC engage local stakeholders to recruit volunteers to participate in the harvesting of seagrass flowers so that seeds can be collected.

They do this through engagement with local organisations including schools and through media engagement and promotion ahead of the planned harvests.

CMERC also works closely with the Gidarjil Development Corporation as part of the Land and Sea Rangers program. The partnership with Gidarjil provides benefit to the overall project as it allows researchers to learn about and apply traditional ecological knowledge and practices and how they can combine them with western science.

The development of the project and recruitment of new volunteers, thanks initially to the Ian Potter Foundation and more recently through funding from the Queensland Government’s citizen science fund, has allowed the project to grow and it is now at a point where the project can collect enough seagrass flowers and seeds to run larger trials resulting in greater regeneration of seagrass meadows.

Associate Professor Emma Jackson
Researchers at CQUniversity’s Coastal Marine Ecosystems Research Centre (CMERC) have been working with passionate citizen scientists to engage communities and regenerate ecologically important seagrass meadows. Their flagship citizen science project involves engaging community volunteers to collect seagrass flowers so that seeds can be germinated and transplanted to regenerate existing meadows and establish new ones.

**PARTNERS**
Gidarjil Development Corporation.

**IMPACT**
CMERC’s *Sea Flowers* project is contributing to the restoration of the vital flora which is responsible for filtering nutrients and sediments from the water.

The project has also attracted several new postgraduate research students who are studying a variety of seagrass growth factors including genetics and adaptation, flowering triggers, and seed based restoration protocols to support seed germination and seedling growth.

Associate Professor Jackson says that the expansion of the project now means that the centre has a large collection of seeds and is using data findings and modelling to determine the best areas and timings for germination of seeds and transplanting of seedlings.

‘At the moment we are focused on upscaling our seagrass nurseries and providing people with the capacity to manage and run those nurseries, including the training of Indigenous Sea Rangers to manage and monitor restored sites.

‘By establishing a nursery system where we can produce seeds without large scale collection efforts, we will be better able to support the rehabilitation and mitigation efforts related to protecting our seagrass meadows and the ecosystems they support.

‘Essentially it will be a real game changer to get ‘industrial scale’ seagrass nurseries up and running to be able to produce seeds for dispersal by volunteers such as recreational fishers.

‘Usually, seeds are dispersed through dugongs eating the grasses and through natural tidal movements, but as meadows are depleted there is less opportunity for this to happen, so by creating nurseries and mechanisms including training for citizen scientists and modelling on where meadows aren’t growing and need support, we will be able to help improve seagrass environments,’ says Associate Professor Jackson.

‘Doing this work has enormous potential for transforming our coastal marine environments and improving the general health of these ecosystems because the successful transplantation of one seagrass seed has the potential to grow into one hectare of seagrass meadows.

‘Ultimately what we are trying to do is share the message of the importance of seagrass and the vital role it plays within our coastal environments.

‘Involving people in this allows us to create awareness and nurture advocacy for our marine environments.’

Another unique engagement activity has included combing science with art through the commissioning and exhibiting of marine and seagrass inspired artworks by well-known Gladstone artist Margaret Worthington. The exhibition allows attendees to immerse themselves in several interactive displays while learning about the powerful role of seagrass within the local environment.

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RESEARCH ON PHYSICAL ACTIVITY FOR PREGNANCY LEADS TO NATIONAL HEALTH GUIDELINES AND SCREENING TOOLKIT

Dr Melanie Hayman (CQU) and Professor Wendy Brown (UQ)

The Australian Government recently released a set of Physical Activity Guidelines for Pregnancy, which were co-developed by CQUniversity researcher Dr Melanie Hayman and eight others.

The aim of these guidelines is to provide evidence-based best practice recommendations on physical activity/exercise during pregnancy for Australian women and those who provide healthcare during pregnancy.

As such, these guidelines should be used to encourage women to achieve the levels of physical activity/exercise that are recommended for optimal health during pregnancy and in the postpartum period; and provide health professionals with evidence-based guidance on optimal physical activity behaviours during pregnancy and in the postpartum period.

Dr Hayman states that there is strong evidence that shows physical activity/exercise during pregnancy and the postpartum period is safe, has health benefits for the woman and her unborn child, and reduces the risks of some pregnancy related complications which is why Dr Hayman recommends that all women without contraindications should aim to meet the Australian national physical activity and sedentary behaviour guidelines.

AUSTRALIA’S NATIONAL PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR GUIDELINES

» Be active on most, preferably all, days every week
» Accumulate two and a half to five hours of moderate intensity physical activity or one and a quarter to two and a half hours of vigorous physical activity, or an equivalent combination of both moderate and vigorous activities, each week
» Do muscle strengthening activities on at least two days each week
» Minimise the amount of time spent in prolonged sitting
» Break up long periods of sitting as often as possible
‘Pregnant women should also do pelvic floor exercises during and after pregnancy,’ advised lead researcher Professor Wendy Brown from the University of Queensland.

Professor Brown also suggests that women who were active before pregnancy can continue with physical activity during pregnancy and if inactive before pregnancy, women should start slowly and build up their activity to meet the recommendations.

‘Doing any physical activity is better than none, and all physical activity counts,’ says Professor Brown.

In addition to these recommendations, the research team advises that modifications to physical activity may be required to accommodate the physical changes that occur as the pregnancy progresses.

The team recommends women who have any concerns (including warning signs and contraindications), seek advice from a qualified health professional.

The guidelines also acknowledge the important role health professionals play in the prenatal care of women by stating that they actively engage in shared decision-making about women’s physical activity during and after pregnancy and recommend that all health professionals who provide care during pregnancy be familiar with contraindications, signs and symptoms which suggest that physical activity should be modified or avoided.

In acknowledging the role of the health professional in prenatal care, Dr Hayman also led the development of an Australian physical activity/exercise screening tool.

The screening tool was created to help guide and support health professionals to provide physical activity/exercise advice to pregnant women.

This screening tool is evidence-based and aligns with the newly released Australian Department of Health Physical Activity During Pregnancy Guidelines. It is user-friendly and consists of a simple three-stage process. Importantly, the tool involves the screening of contraindications to guide exercise behaviours appropriately and safely among pregnant women.

The screening tool helps to guide the physical activity/exercise behaviours of pregnant women. It details how much and what types of physical activity a pregnant woman should or shouldn’t do, as well what intensity of exercise they should aim for. The tool provides indications for stopping exercise and for consulting a health professional as well as additional safety precautions.

Peak industry bodies including Exercise and Sports Science Australia (ESSA), Exercise is Medicine, Fitness Australia and Sports Medicine Australia (SMA) were involved in the screening tools’ development and have endorsed the tool.

Dr Melanie Hayman

**DESCRIPTION**

**Physical Activity Guidelines for Pregnancy**

Evidence-based Physical Activity Guidelines for Pregnancy with an aim to provide best practice recommendations for pregnant women on physical activity during pregnancy and in the postpartum period.

**Physical activity/exercise screening toolkit for pregnant women**

User-friendly, evidence-based resource to help guide and support health professionals to provide physical activity/exercise advice to pregnant women.

**PARTNERS**

**Physical Activity Guidelines for Pregnancy**

The Australian Government Department of Health, University of Queensland.

**Physical activity/exercise screening toolkit for pregnant women**

University of Queensland, Exercise and Sports Science Australia (ESSA), Exercise is Medicine, Fitness Australia and Sports Medicine Australia (SMA).

**IMPACT**

Very few women are currently sufficiently active for health benefits. These resources provide evidence-based recommendations that pregnant women and health professionals can rely on to offer safe and appropriate physical activity/exercise guidance. Physical activity during pregnancy has health benefits, for both the mother and child.

It is associated with fewer pregnancy conditions, including gestational diabetes and gestational hypertension. Active women are also more likely to gain an appropriate amount of weight during pregnancy and less likely to experience excessive gestational weight gain than those who are not active. These benefits have significant implications for the health of future generations.
FUTURE FARMING TECH FUELS STUDENT PASSION FOR SMART FOOD AND FIBRE CAREERS

Dr Amy Cosby

Jobs in agriculture go far beyond milking cows or planting crops – Australia’s $66 billion agriculture industry needs passionate and skilled people to fill growing numbers of high-tech roles. CQUniversity’s Agri-tech Education and Extension team is leading practical school outreach projects to connect and inspire students for future-proofed careers.

Rural Australia boasts some of the world’s most diverse and productive primary industries. But many Australians, and especially young people living in those regions, are increasingly disconnected from the origins of their food and fibre.

Researchers at CQUniversity are working to engage regional students with emerging technologies and careers in the agriculture sector, with innovative and hands-on programs showcasing the central role that STEM plays in primary production.

The Raising Aspirations in Careers and Education – Gippsland (RACE – Gippsland) project connects primary and secondary classrooms with career role models and potential employers from agribusiness, farming and processing companies.

Partnering with industry and education bodies across the Gippsland region of Victoria, project lead and CQUniversity Research Fellow Dr Amy Cosby says she has seen first-hand the disconnect between young people and their local agriculture industry.

‘People often think that it’s only city kids that don’t know anything about agriculture, but even in Gippsland with multiple ag industries in their backyard, students are still not aware of how their food and fibre is produced,’ she explains.

‘The questions we often get from students really highlight that they haven’t developed a basic understanding of information about agriculture. For example, we have been asked by a student from South Gippsland, one of the largest dairy areas in Australia, when dairy cows get shorn.

‘That may seem like a silly question, but it raises a serious issue that students are never connecting with a dairy farmer or anyone in the industry, to know simple facts like dairy cows don’t get shorn.’

Dr Cosby, who is also a dairy farmer, says the disconnect was also creating challenges for industry.

‘Our RACE – Gippsland industry partners are all dealing with skills shortages, and this project began with a comprehensive consultation about the prospects they could see for young people in the region, and how to get students aware of those opportunities, and excited about them.’

Launched in late 2020, RACE – Gippsland initiatives reached more than 800 primary and secondary students across the first half of 2021.

In primary and secondary classrooms, CQUniversity researchers deliver fun STEM activities as part of the Agri-tech Roadshow including:

» students using accelerometers and imitating cow behaviours, as other students track movement patterns via data livestreamed onto an ipad,

» comparing different potato varieties, cutting chips, and assessing which type generate the least waste, and are the most delicious,

» measuring sugar, protein, fat and calcium content of cow milk in comparison to alternatives such as soy, almond and oat.

RACE also facilitates industry-school partnerships where industry mentors visit classrooms and students visit agricultural workplaces, professional development workshops for teachers, online learning modules showcasing science and technology, and a Food and Fibre Social Entrepreneurship program where classes will design their own business to solve an issue facing their community.

With Victorian Government Department of Education and Training funding for three years, Dr Cosby hopes the project will encourage students to aspire to education and career pathways in the agricultural industry.
Growing skills and knowledge for students also had flow-on effects for the current agricultural workforce.

Dr Amy Cosby

Importantly, the project is conducting research to measure the extent that project activities raise aspirations for further study and careers in the agricultural industry, and have increased the knowledge and awareness of how food in the region is produced.

Interviews with teachers and industry professionals will also provide an insight into how project activities influence and support the education and agricultural sector to work together to provide students with authentic experiences in the world of work.

As CQUniversity's Agri-tech Education and Extension research lead, Dr Cosby works across Australia, and across numerous agricultural sectors.

'QUniversity's agricultural education and extension cluster is the only research team in Australia focused on increasing industry capability to adopt technology to make data driven decisions, but also attracting and retaining the next generation workforce and industry leaders,' she says.

Other projects include GPS Cows, a collaborative project funded by the NSW Department of Education bringing together researchers, industry professionals and educators in both Australia and the USA, to increase the knowledge and skills of high school students in emerging agri-tech, specifically tools and systems which provide animal location and behaviour data; and Educating Kids about Agriculture, a partnership between Commonwealth Department of Agriculture, Water and the Environment, AgForce Queensland and NT Farmers Association, providing the opportunity for primary school students to learn where their food and fibre comes from, and the importance of agriculture to Australia by visiting farms.

Dr Cosby says increasing skills and knowledge for students also had flow-on effects for the current agricultural workforce.

'I really enjoy hearing from teachers that parents of students describe how excited their child was about the new technology they used in our activities, and now because of this their parent is considering using it within their business.

'Young people are excellent agents of change, and a really untapped resource for agriculture.

'Technology is poised to transform the way we produce food and fibre in Australia and across the globe. So, if we can give young people the confidence and skills to use agri-tech and get them passionate about it, they will be the catalyst that revolutionises the agriculture industry.'
VIRTUAL SIMULATIONS ON TRACK TO IMPROVE RAIL AND ROLLINGSTOCK LIFE CYCLES

Professor Maksym Spiryagin

Maintenance activities on rails and rollingstock wheels are the main contributors to the cost of operating railway networks. The current wear rate measurements are costly, time consuming and not always practical.

CQU’s Deputy Director of the Centre for Railway Engineering (CRE), Professor Maksym Spiryagin’s research project focuses on identifying sections of track that are at a high risk of damage through the implementation of digital twin techniques.

The digital twin platform pairs the virtual and physical worlds by using different techniques to replicate train behaviour in a digital world with a high level of accuracy. It provides a comprehensive understanding of wheel and track wear and the service life cycle of Australian rail materials under various conditions.

Professor Spiryagin’s research is focused on the complexities of the rail vehicle/track nonlinear interaction, and the wear and damage that this causes on the wheel and the track components. The digital twin platform has allowed him to create a simulation of real trains and track conditions to perform testing under different operational scenarios without the risk of being in the railway corridor or disrupting the network.

‘Such an approach avoids any limitations connected with the costs of experimental programs, including interruption of train operational services,’ he says.

‘For example, a one-day interruption on a heavy haul railway corridor can cost an iron ore company tens of millions of dollars.’

As the wheel-rail interface is subject to environmental and operational conditions such as surface contaminants, lubrication and roughness, performing field testing can vary the results significantly.

The simulation set involves variations in traction, friction conditions, track irregularities, wheel-rail profiles, track layouts and vehicle type, among other parameters.

CQU’s High Performance Computing (HPC) facilities have allowed for accelerated simulation and results analysis processing.

Previous industry research projects run by the CRE team have been focused on rail wear and fatigue crack initiation and propagation, known as rolling contact fatigue (RCF).

An experimental program was conducted in Central Western Australia, the Pilbara and Victoria by the CRE team. This involved complex field measurements being performed for rail surface friction characterisation at different track locations, which improved the accuracy of their analyses.

Professor Maksym Spiryagin
In the CRE laboratory, the specially designed wear testing machine is in use to prove theoretical knowledge and behaviour observed in the field with particular focus on rail wear and fatigue crack initiation and propagation and to find details that cannot be obtained from the field measurements.

The research studies performed by Professor Spiryagin are supported by the research and technical team of Dr Qing Wu, Professor Colin Cole, Adjunct Professor Peter Wolfs, Mr Esteban Bernal Arango, Dr Shah Nafis Ahmad, Dr Yan Sun, Dr Sundar Shrestha, Adjunct Research Fellow Tim McSweeney, Mr Chris Bosomworth, Mr Ben Sneath and Mr Randall Stock.

In the lead-up to the development of this new technology, Professor Spiryagin led multiple projects, all contributing to identifying the numerous causes of rail damage. His previous and current projects funded by the Australasian Centre for Rail Innovation and its industry partners include studying and analysing the impacts that different locomotive designs and heavy haul rollingstock had on the tracks and developing new analysis tools and techniques to analyse his findings.

As a world-class expert in his field, Professor Spiryagin takes the lead on all industry-related projects and is heavily involved in locomotive traction, contact mechanics and rail vehicle dynamics and mechatronics research activities. This research, however, has required multi-disciplinary knowledge to cover such complex systems.

These research outcomes relied on the software development and implementation support obtained from Ingemar Persson (AB DEsolver, Sweden), Dr.ir. Edwin A.H. Vollebregt (CMCC, The Netherlands), Mark Hayman (Insyte Solutions, Australia), and Jason Bell (HPC, CQUniversity).

Professor Spiryagin and the CRE team are delivering accurate results with this new technology which will assist railway operators in making informed decisions on rollingstock operational limits and maintenance actions. This will promote good wheel and rail health, while maximising the performance that the materials can offer.

Professor Spiryagin says that increasing the knowledge of operational and maintenance requirements for the wheel-to-rail interface will deliver greater rail operation efficiencies.
An annual Australian youth survey has shown that 43.7 per cent of Indigenous youth feel stressed all or most of the time – in fact, according to the Mission Australia survey results, their top two personal concerns are stress and mental health issues.

These declining mental health rates of Indigenous Australians have been of particular concern to Aboriginal Community Controlled Health Organisations in diverse communities, who have partnered with CQUniversity researchers to develop new responses to the high and increasing rates of Indigenous youth mental health problems.

The CQUniversity researchers have been working to conceptualise, co-design and evaluate community-driven systems-level integration with the aim to promote the mental health and wellbeing of Indigenous school-aged children and youth aged five to 18 years.

According to lead researcher Professor Janya McCalman, there have been 16 Australian Government policy documents between 2013 to 2018 that outline the need for improved mental health and social and emotional wellbeing supports for Indigenous communities.

The Strategic Framework for Aboriginal and Torres Strait Islander mental health and social and emotional wellbeing outlined a vision for ‘the highest attainable standard of social and emotional wellbeing and mental health’ supported by ‘mental healthcare and related services that are effective, high quality, clinically and culturally appropriate, and affordable.

‘But the problem is that there is little evidence for what best practice Indigenous mental health care looks like, or how current services and systems can be improved to provide optimal care,’ she explains.

In response, Professor McCalman chose to take a place-based approach with Yarrabah, Cairns and Casino partners, where she hosted yarning circles (conversational focus groups) and consultations with 60 health, education, mental health, and other related human service providers and Indigenous youth.
Aboriginal community-controlled health organisations have recognised the need for improved mental health and social and emotional wellbeing supports for Indigenous youth. Prompted by this concern, a CQUniversity research team, led by Professor Janya McCalman, is working with Indigenous organisations and youth to co-design the improvement of current services to provide optimal care to Indigenous youth. The researchers held yarning circles with Indigenous young people and service providers to share their stories about the current state of mental health and wellbeing services and give their suggestions about how these could be improved.

**PARTNERS**

Gurriny Yealamucka Health Service – Yarrabah, Bulgaar Ngaru Medical Aboriginal Service- Casino, Deadly Inspiring Youth Doing Good (DIYDG) and Queensland Government (Advance Queensland).

**IMPACT**

This research responds to policy calls for Indigenous community-driven initiatives to improve extant mental healthcare for Indigenous youth. The findings have been fed back to the community service providers and Indigenous youth to inform the co-design of novel youth-guided and community-driven ways to support mental health services for youth wellbeing.
The drone must not die so the patient can live – that is the vision behind CQUniversity’s research on Unmanned Aerial Vehicle (UAV) flight-time extension.

Dr Jahan Hassan says more research is required to combat energy limitations of UAVs (such as drones) in order to support the ever-growing commercial applications.

‘In recent years, there has been tremendous development of the UAVs due to their integration with advanced technologies of robotics, sensing, wireless communication and AI, enabling them to autonomously interact with the physical world,’ lead researcher Dr Hassan explains.

‘Coupled with the falling cost of low-altitude commodity drones, drone-delivered services in the civilian and commercial sectors have seen an unprecedented growth – from emergency medical delivery to powerline monitoring, precision agriculture, and wireless communication provisioning.

‘However, UAVs’ reliance on the on-board batteries for power, limits their flight times which is around 20 minutes for commodity drones. This poses a significant challenge on the continuity of drone-delivered services, since the drones would frequently move away from the serving location to get their batteries replaced or recharged on a ground charging station.’

Imagine an emergency medical delivery drone turning back midway to replace its battery.

‘As such, we are developing solutions to combat the energy limitations of UAVs with both energy-efficient, intelligent algorithms for flight and communication optimisation, and the topping up of UAV batteries from in-situ, aerial wireless power sources using wireless power transfer techniques.’

Now in phase two of the research, the team is looking at how to enhance the efficiency of the proposed solutions from stage one of the research, as well as to investigate requirements for practical deployment.

‘The potential of innovative, drone delivered services is enormous,’ Dr Hassan explains.

‘This is reflected in a recent report by PricewaterhouseCoopers, which has estimated the commercial global market for drone-delivered services to be over $127 billion. This potential is limited by the short flight times of the drones which disrupts the service continuity. For these services to reach the true potential, the energy issue of drones must be addressed which is why we conduct this research.’

Dr Hassan says the research team, which also consists of CQUniversity’s Dr Ayub Bokani and Dr Sayed Amir Hosseini and Professor Salil Kanhere from the University of New South Wales, was currently in the theoretical phase.

Dr Jahan Hassan
This involves the development of intelligent algorithms for energy source placement, flight path, and wireless communication management. We use various machine learning techniques to optimise these solutions, and conduct experiments using MATLAB, she explains.

Dr Hassan says findings from the current research would benefit both governments and the commercial sectors.

'Governments would benefit from the findings of this research in applications of drones including disaster-monitoring, particularly in areas where communication infrastructure would currently be lost such as bushfire management and reef monitoring.

'Commercial companies in the business of goods delivery, infrastructure providers in powerline or bridge monitoring, aerial photography, emergency medical delivery, mobile communication provisioning would also greatly benefit from this research.'

'The potential of innovative, drone delivered services is enormous,' Dr Hassan explains.
A CQUniversity study shows technology is transforming how children participate in legal and illegal gambling activities, as opportunities for underage gambling explode.

Australian children as young as 11 are gambling for money, and more than a third are playing video games and apps that simulate gambling activities.

Those are some of the findings from CQUniversity’s Experimental Gambling Research Laboratory, in a groundbreaking exploration of youth gambling habits in the increasingly digital and diverse gambling sector.

The NSW Youth Gambling Study 2020 is based on surveys and focus groups with young people in NSW aged 12 to 17, and was commissioned by the NSW Government’s Responsible Gambling Fund, with support from the NSW Office of Responsible Gambling.

Although underage gambling is illegal within the regulated industry, about 30 per cent of the young people surveyed had bet for money in the past year.

CQUniversity Gambling Studies Research Professor Nerilee Hing led the project and says the prevalence of online and digital gambling was concerning.

‘About 40 per cent of NSW children aged 12 to 17 are playing video games and apps that very much look and feel like traditional gambling,’ Professor Hing explains.

‘Things like pokies apps, and lucky-dip ‘loot boxes’ in gaming, have similar addictive qualities as traditional gambling.

‘And we know gamers who buy loot boxes are more likely to gamble, including with some of the in-game items that they win in loot boxes.’

Study co-investigator, Dr Alex Russell, says online options were opening new gambling gateways to young people.

‘When going to a pub or club, underage people should have their age verified on each visit. But with online gambling, once you have an account, you can gamble all you like without further age checks.

‘Most parents understand the addictive issues around traditional forms of gambling, but they don’t understand how loot boxes work for instance, even though they’re often providing the credit card that kids are using to buy them.’

Professor Hing says, ‘This study paves the way to explain to parents and young people what a dangerous gambling product looks like, and for instance how buying loot boxes is something a player can do over and over at a fast pace, with no limit on the spend, much like a pokie machine.’

The study showed most respondents who gambled were using pocket money for their betting, and of the respondents 3.7 per cent were classified as at-risk or problem gamblers.

The most popular gambling activity was informal private betting, such as betting against each other on sporting matches. The most popular traditional gambling activities were bingo, keno, scratchies and lottery tickets.

Concerningly, a third of children who had gambled online had been able to set up an account in their own name.

Professor Hing says the study also showed that parents were the biggest facilitators of youth gambling, highlighting the need for parent education initiatives.
"Parents are often providing money to gamble, or access to online betting accounts, for instance, and also normalising gambling through their own gambling activities," Prof Hing explains.

"So parents also need to be aware of more harmful forms of gambling and gambling-like products, like social casino games, so they can identify and manage the risks."

Nearly 54 per cent of young people gambling with money were doing so with a parent or a guardian, and 20 per cent with grandparents. About 58 per cent of those who gambled came from homes where adults did so too.

Advertising was also a big influence, with nearly half of gambling respondents saying they frequently noticed gambling ads on TV during sports broadcasts.

Professor Hing says understanding emerging gambling trends was vital to reducing gambling harms.

"With technology, young people have so many options to gamble already in their hands – through research like the NSW Youth Gambling Study, we’re putting the latest trends and risks for young people in the hands of policymakers, so their response can be timely and effective."
ACCELERATING RAIL DRIVER TRAINING THROUGH NEW TECH

Associate Professor Anjum Naweed

A CQUniversity-led partnership with rail simulator company Sydac is developing an innovative display tool that will accelerate rail driver training and help avert the looming skills shortage in the industry.

The research, led by Associate Professor Anjum Naweed and Associate Professor Matthew Thomas, Deputy Director of CQUniversity’s Appleton Institute in Adelaide, aims to design a driver-display that is congruent with the way novice train drivers naturally encode their task and evaluate the extent to which the tool accelerates the acquisition of route knowledge in train drivers.

The project which commenced in 2013-14, is funded with $380 000 from the Australian Research Council (ARC) as part of the ARC Linkage Scheme and partner contributions. Sydac is a major supplier of driver training simulators in Europe, Asia and Australia.

Professor Naweed says that after developing a series of driver display prototypes, the Appleton Institute’s Human Factors and Operational Readiness team (including CQUni RhD student Ganesh Balakrishnan) has developed a final driver-display design.

‘Our rail industry has been growing to the point where demand outpaced the supply of drivers, creating a real shortage of skilled staff,’ Professor Naweed says.

With concerns about the expediency and efficiency of driver training Professor Naweed looked at psychology and human factors of driving trains in a bid to design a new simulator in conjunction with Sydac.

‘Although it may not look like it, train driving is actually an astonishingly complex task. You are responsible for moving many tonnes of weight down a guideway, using steel wheels on steel rails. It can feel slippery and all that weight is much harder to control,’ he says.

He says there were many factors a driver had to consider when operating a train and that improving route knowledge was the key to improved driver training.

‘The task of the train driver is very three-dimensional. Our research has shown that they tend to think of it in terms of its xyz coordinates … however when the information is presented to drivers in the cab it is generally done using two-dimensional analogues.

‘The big problem is that the two-dimensional analogues are not congruous with the basic profile of the task – as a result they can produce a lot of variability in the way drivers “encode” route information and create inconsistencies in the development of their competencies.’

Train driver training methods, which involved more experienced driver apprenticing new drivers was costly and overlong with learning period of up to 12 months for passenger trains, or 24-36 months for freight trains in Australia.

He says the COVID-19 outbreak has introduced more consideration for training, thrusting the simulator into the spotlight.

‘COVID-19 has introduced logistical challenges and lots of safety considerations which means training has had to occur virtually, and more emphasis has been placed on simulator capacity,’ he says.
An innovative driver-display is being designed to improve rail driver training. The new display will be congruent with the way novice train drivers naturally encode their task and will accelerate the acquisition of route knowledge.

PARTNERS
Sydac.

IMPACT
The research project has shown a need for change to pedagogy, as well as for new technology. One of the benefits of this project has been the understanding about how expert train drivers use cues from their environment to drive safely and efficiently. In the longer term, this research will address the looming skills shortage facing the industry.

Therefore, simulators continue to offer an improved experience for train driver instruction and the project has developed new simulations, including presenting CGI imagery with enhanced information specific to the trainees learning cycle.

Following many years of interviews with train drivers and driver managers across many different railways including Adelaide Metro, V/Line in Victoria and Transport for NSW, several design concepts for the new driver-displays were developed, tested and trialled on-site at the Appleton Institute.

Professor Naweed says that the project has shown a need for changes to pedagogy, as well as new technology.

'It is not just about technological innovation, rather, the new technologies need to be embedded within new processes for training and skills development – the real benefit of this project is that it has led to a much better understanding about how expert train drivers use cues from their environment to drive safely and efficiently.'

The cues in the real world might then be better conveyed in the simulator environment and embedded within a training framework that fast-tracks this knowledge and skill development. Through the innovative use of the simulator, the team has demonstrated efficiencies in training design that can really help the rail industry.

The project has completed data collection and analysis and lead researchers are currently preparing the results for publication. The final driver display design has been established and the researchers will be working with Sydac to promote it for use in future training.

Our rail industry has been growing to the point where demand outpaced the supply of drivers, creating a real shortage of skilled staff.'
PREPARING FOR THE UNIMAGINABLE

Dr Adele Baldwin, Dr Paul Duckett, Dr Anne Ferguson, Ms Joanne Harding, Associate Professor Clare Harvey, Dr Bree Kitt, Ms Stephanie Pasewaldt, Dr Robyn Preston and Dr Naomi Ralph.

Natural disasters are happening with increased frequency and ferocity that unleashes extreme weather on communities, but what happens when disaster does strike?

While you can’t stop a natural disaster in its tracks, a CQUniversity research team based in Townsville have been working with Queensland regional communities to understand the impact of disaster events and how they can be managed in the future.

Led by Dr Adele Baldwin, the team looked at ways employers could support their staff before, during and after disaster events to develop guidelines to help organisations provide the best support for their staff. The project specifically examined how people experienced Townsville’s devastating 2019 floods.

‘The Townsville floods was one of the worst natural disasters to ever impact the region. It highlighted to us the need for further research and investigate strategies on how to help prepare both business and individuals for these situations,’ says Dr Baldwin.

We saw first-hand how CQUniversity Townsville campus employees supported each other and received support from our colleagues at other campuses, but in both the literature and disaster management guidelines there was little information about employers’ support for employees or colleague support.’

While the researchers initially undertook a small internally funded project titled A sting in the tail, an initiative jointly funded under the Commonwealth/State Disaster Recovery Funding Arrangements allowed for further research in the wider community- specifically in Townsville City Council and McKinlay Shire Council areas.

The research consisted of two phases: social media analysis and local stakeholder interviews.

‘We can hear things anecdotally, but unless we research things systematically, we cannot make an impact on policy.

‘We began by looking at public social media postings during and after the floods. These publicly available social media sites gave us an insight into how people shared their experiences of the event. This included Facebook, Instagram, Twitter and LinkedIn.

‘Secondly, we interviewed individuals and some small groups to hear about their experiences firsthand. We interviewed 20 people in the McKinlay region and 15 people in Townsville who all had direct experience of the flood event.’

Dr Baldwin believes the new evidence-based policy and guidelines will inform future efforts for employers and communities with findings offering interesting key insights specific to the Townsville and McKinlay regions.

‘People mostly talked about their loss in relation to what other people had experienced. Sometimes people downplayed the impact the flood had on them by telling us about how others were more seriously affected. Irrespective of the level of destruction and difficulty experienced by the participants, everyone reported some degree of feeling anxious about such a disaster happening again.'
Dr Baldwin believes the new evidence-based policy and guidelines will inform future efforts for employers and communities with findings offering interesting key insights specific to the Townsville and McKinlay regions.

'We also found leaders emerged during the flood event, and these people were not necessarily in leadership positions. They were well-connected with members of their community, were respected and able to mobilise others to help their community get through the flood.'

Looking to the future, the project team have published the research results in a book of guidelines which was launched in June 2021 and is being disseminated to businesses across the state to inform future disaster efforts in North Queensland.

'Overall, these guidelines reflect that loss is a social rather than an individual thing – leaders emerge from places we perhaps don’t always expect and that it’s important we fully know the people we are trying to help during times of disaster.'
The Young Tall Poppy Awards recognise researcher’s achievements as emerging scientists, honouring their combined world-class research with a passionate commitment to communicating science.
YOUNG TALL POPPY AWARDS

AMANDA REBAR

2021 Queensland Young Tall Poppy Award recipient

Dr Amanda Rebar has been awarded a Queensland Young Tall Poppy award in 2021 for her excellence in research and enthusiasm for communicating science beyond the walls of the laboratory. Dr Rebar is an expert in behaviour change and habit formation. She regularly partners with shires, councils, community services and industries to develop effective approaches to help people change their behaviour to be happier, healthier (physically and mentally), and make the world a better place. She is a well-established researcher in measuring and intervening with people’s habit and motivation. Dr Rebar’s standing as a field leader in behaviour change and motivation science is exemplified by 140 authored publications, including nine invited editorials and reviews and 14 book chapters. She has demonstrated commitment to mentoring future researchers, especially those who have not considered science as a career because of perceived barriers such as current circumstances, gender or ethnicity.

ALEX RUSSELL

2020 New South Wales Young Tall Poppy Award recipient

Research into how technology is changing gambling led to CQUniversity’s Dr Alex Russell being named a 2020 NSW Young Tall Poppy Award recipient. The award recognises Dr Russell as a promising potential research leader. Based at CQUniversity’s Sydney campus, Dr Russell’s gambling research focusses on how technology is changing gambling, including how traditional gambling products are transforming. He is interested in what these changes mean for people, and how these changes relate to gambling-related harm. As part of the award, Dr Russell spent a year sharing his knowledge with school students, teachers and the broader community through workshops, seminars and public lectures, sharing about emerging forms of gambling and gambling-like content in video games.

GRACE VINCENT

2020 South Australian Young Tall Poppy Award recipient

Dr Grace Vincent’s achievements as an emerging South Australian scientist as highlighted by her 2020 South Australian Young Tall Poppy Award. The Award honours her combined world-class research with a passionate commitment to communicating science. Based at CQUniversity’s Appleton Institute in Adelaide, Dr Vincent’s research investigates novel ways to protect night workers. Two million Australians regularly work at night and are twice as likely to make an error, get injured, or have an accident, compared to day workers. Dr Vincent’s research explores how short bursts of exercise could be used in-shift and upon waking to improve the health and safety of emergency services personnel. This research will inform workplace policies and translate to a safer, more productive, shift-work workforce.
RESEARCH FELLOWSHIPS

SAMAN KHALESI
National Heart Foundation of Australia Postdoctoral Fellowship

RESEARCH PROJECT/S: Saman studies the links between dietary behaviours and physical and mental health. Currently, his SaltED (Salt Education) project aims to develop a low-cost, highly accessible and personalised web-based coaching program to reduce salt intake in Australian adults with increased blood pressure to prevent and manage hypertension and reduce the risk of cardiovascular disease.

RESEARCH IMPACT: Saman has more than 50 peer-reviewed publications that have attracted 880-plus citations. He has secured more than $900 000 in competitive external and $45 000 in internal research funds, developed industry collaborations, and supervised PhD, Master and Honours students.

CAREER HIGHLIGHTS: Saman’s career highlights to date include his work being recognised and translated to governmental/organisational guidelines and public communications. He also gains a tremendous amount of satisfaction from mentoring and supervising students and future researchers to develop their research ideas, complete and publish their studies and shape their research career. He also enjoyed making a cool two-minute animation on salt available on the Heart Foundation Twitter page.

CAREER ASPIRATIONS: Saman aspires to become a research leader in using innovative online technologies that are low cost and easily accessible to make a positive impact on the dietary behaviours and wellbeing of the population.

STEPHANIE ALLEY
National Heart Foundation of Australia Postdoctoral Fellowship

RESEARCH PROJECT/S: Stephanie investigates innovative methods using technology to increase physical activity in older adults.

RESEARCH IMPACT: Stephanie has published over 50 peer reviewed articles which have been cited over 1000 times. She has received over $250 000 in research funding.

CAREER HIGHLIGHTS: Her career highlights include working in multidisciplinary teams to explore innovative solutions to the problem of inactivity in older adults. She has also received positive feedback from older adults who benefited from Active for Life, a web-based physical activity program with tailored advice developed by Stephanie and colleagues.

CAREER ASPIRATIONS: Stephanie plans to develop more engaging and effective methods to support older adults in leading active lifestyles and to mentor emerging student researchers within active aging.
QING WU

ARC DEcRA Fellowship

RESEARCH PROJECT/S: Qing has led a number of projects about railway tracks, trains, track-train interactions and associated standards development. His DEcRA project aims to understand the contribution of railway train forces to a dangerous and high-cost track dynamic behaviour called buckling.

RESEARCH IMPACT: Qing has won more than $1 million worth of externally funded research projects. He has published 117 papers that have been cited more than 1100 times. Qing's research outcomes have established international benchmarking practices and been used in commercial software packages.

CAREER HIGHLIGHTS: Qing's PhD thesis received two best-thesis awards in 2017. In the same year, he organised the International Benchmarking of Train Simulators project which involved 12 participating institutions from six countries. In 2020, Qing was awarded an ARC DEcRA grant.

CAREER ASPIRATIONS: Qing wants to help facilitate the ongoing improvement of the safety and productivity of Australian railways, to leverage national and international impacts of CQU's railway research via innovative and practical research.

JAIME MANNING

Advance Queensland Industry Research Fellow (Early Career)

RESEARCH PROJECT/S: The focus of Jaime's fellowship is using on-animal sensor technology for the autonomous detection of disease and predation events in the Australian sheep industry. Additionally, she works on a range of agri-tech education and extension projects, highlighting the use of technology and science in agriculture with a focus on building capacity within the industry in the current and next generation workforce.

RESEARCH IMPACT: Jaime's research focuses on using emerging and current technologies to address current issues that are having a major impact on the sheep and cattle industry, ensuring real-world and practical outcomes are achieved for Australian livestock producers. Her research also contributes to industry sustainability by attracting and equipping those working in agriculture with the skills and knowledge to use data and technology to make evidence-based decisions.

CAREER HIGHLIGHTS: Being awarded an Advance Queensland Industry Research Fellowship to work on a research project that is having a direct and positive impact for the sheep sector. In particular, she is proud of working with producers in Western Queensland who have faced many challenges including drought and predation in recent years. Additionally, she enjoys being involved in projects which inspire young people through the use of technology to consider further study and careers in agriculture ensuring a capable and passionate workforce.

CAREER ASPIRATIONS: Jaime aspires to be a leader in developing agri-tech solutions for livestock producers in Australia to improve productivity, profitability and animal welfare outcomes. She also aims to build the capacity of livestock producers to increase adoption to bridge the gap between technology providers and end users.
Associate Professor Mark Trotter is a researcher in Precision Livestock at CQUniversity. His research interests include the development of sensors and management techniques that enable agricultural producers to increase production and efficiency.
ENGAGE WITH US

CONSULTANCY
Industry organisations can engage with CQUniversity Australia researchers and/or facilities to provide expertise and a range of testing services on a fee-for-service basis. CQUniversity consultants can also be engaged to undertake confidential research activities where the data and results are owned wholly by the commissioning industry party.

CONTRACT OR COLLABORATIVE RESEARCH PROJECTS
Contract or collaborative research projects range from small-scale, short-term projects to major multi-year collaborative projects. Industry partners may fully fund the direct research costs of the projects or partner with CQUniversity to leverage funding from agencies such as the Australian Research Council or state government programs such as Advance Queensland. Ownership of intellectual property arising from the research activities are negotiated on a project-by-project basis.

INDUSTRY STIPEND SCHOLARSHIPS AND TOP-UP SCHOLARSHIPS
Industry stipend scholarships and top-up scholarships can target dedicated full-time or part-time student research projects in particular areas of industry need. Research projects may range from two years (Master by Research) or three to four years (PhD). Scholarship stipends typically cover living expenses and associated costs for students. Scholarship awardees may commence at any time during the year.

TUITION OFFSET SCHOLARSHIPS
The Australian Government and CQUniversity fund a number of tuition offset scholarships for domestic and overseas research higher degree students. In addition, industry partners have the opportunity to sponsor offset places for nominated students to undertake research higher degrees in specified research areas. The industry sponsorship covers all or a part of the cost of a full fee-paying place for the student. Funded place-holders may commence their studies at any time during the year. Many of these students also enjoy the opportunity to work for the industry partner while undertaking their studies.

For further information about sponsoring research or consultancy at CQUniversity please contact the Research Division. Email research-connect@cqu.edu.au or call +61 7 4970 7330.