Engagement snapshot
UQ continues to place itself at the centre of global and local challenges in mining and chemical engineering. We partner with industry leaders around the world to drive the shift towards sustainable development and more equitable outcomes for communities affected by mineral resource extraction. UQ also offers access to world-class industry-facing researchers in the social, political, environmental, and earth sciences – disciplines that will shape the future of mining.
For more than a century, The University of Queensland (UQ) has educated and worked with outstanding people to deliver knowledge leadership for a better world.

UQ is one of Australia’s top research-intensive universities.

In 2016, UQ again topped the nation in the prestigious Nature Index, which rates institutions and countries according to the number and quality of research publications. Importantly, UQ continually builds on its global reputation in key areas of national and international significance such as energy, sustainability, water, health, food security, and social equity through an emphasis on high-quality, interdisciplinary global collaboration with public and private organisations.

With three major campuses – St Lucia and Herston in Brisbane, and Gatton in South-East Queensland – UQ is committed to developing state-of-the-art learning spaces that are in-step with industry demands and expectations.

UQ has established several research institutes across a range of disciplines:

- Australian Institute for Bioengineering and Nanotechnology
- Global Change Institute
- Institute for Molecular Bioscience
- Mater Research Institute – The University of Queensland
- Institute for Social Science Research
- Queensland Alliance for Agriculture and Food Innovation
- Queensland Brain Institute
- Sustainable Minerals Institute.
RESPONSIBLE RESOURCE DEVELOPMENT

UQ’s Sustainable Minerals Institute (SMI) is a world-leading research institute dedicated to finding knowledge-based solutions to the sustainability challenges of the global minerals industry.

Our purpose is to develop game changing people by working with our partners to co-create solutions to the big challenges facing the sector and to create change for responsible resource development.

SMI has a unique inter-disciplinary approach encompassing the expertise of scientists, engineers, anthropologists, sociologists, economists, and natural resource specialists with in-depth knowledge, at corporate and operational levels, built from years of practical experience and engagement. Our expertise is genuinely independent and objective.

Our work covers all facets of the life of mine from geology, to minerals extraction, water management issues, minerals processing, workplace health and safety, mine rehabilitation and closure, community engagement and social responsibility.

smi.uq.edu.au
UQ’s Faculty of Engineering, Architecture, and Information Technology (EAIT) has proud traditions of innovation and leadership in education and research.

EAIT’s research provides a rich and diverse flow of breakthrough technologies that are helping to improve communities around the world. From novel hydrogen storage and next generation polymers to biomedical engineering and mining safety, our research outcomes are solving problems for local and international communities, and our industry partners.

Creative problem solving – through great science, engineering and design – means faculties like ours have an increasingly vital role to play in the world’s future.

The faculty comprises six schools and research centres, including:

- **School of Chemical Engineering**
  Celebrating its 100th year in 2017, this School is an international leader with a reputation of excellence. The project-centred teaching programs form part of UQ’s undergraduate and postgraduate degrees in Chemical, Biological, Environmental, Materials and Metallurgical Engineering, Sustainable Energy, and Petroleum Engineering.

- **School of Mechanical and Mining Engineering**
  This School provides quality programs and leadership in engineering education, research and development, and expert consulting. Our comprehensive teaching program in engineering encompasses undergraduate and postgraduate degrees in Mechanical, Aerospace, Materials, Mechatronic, Mining, and Geotechnical engineering.

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### EAIT fast facts

- **6,768** students enrolled in 2017
- **1,875** international students enrolled in 2017
- **734** higher degree by research students in 2017
- **1,384** EAIT research projects since 2011 worth more than $448.8 million
- **359** full time equivalent academic staff including 101 professors and associate professors

### Research strengths

- manufacturing and resources
- water
- health
- energy
- designing smart communities
- information engineering
The School of Mechanical and Mining Engineering provides quality programs and leadership in engineering education, research and development, and expert consulting.

Our comprehensive teaching program in engineering encompasses undergraduate and postgraduate degrees in Mechanical, Aerospace, Materials, Mechatronic, Mining, and Geotechnical engineering. We have established an excellent reputation for the quality of our graduate training and research performance.

Research at the School of Mechanical and Mining Engineering tackles global challenges in energy, mining, water, health, infrastructure and transport. Research in mining covers geomechanics, planning, mining methods, energy and environmental factors, and mining equipment. Mechanical Engineering research spans themes such as machine automation, hypersonic aerothermodynamics, geothermal and solarthermal energy, manufacturing, combustion, nanomechanics, non-destructive testing and rail engineering.

The calibre of our Mechanical and Mining Engineers is recognised through two Fellows of the Australian Academy of Science and two Fellows of the Australian Academy of Technology, Science and Engineering.

Our research efforts are concentrated in the School of Mechanical and Mining Engineering, with additional research undertaken in the Faculty of Engineering, Architecture and Information Technology and the Sustainable Minerals Institute.

机械与采矿工程学院

国际排名强调昆士兰大学工程学科的卓越性，其相关领域在全球前100名内。

重要优势

超音速热力学

地热与太阳能热力学

制造

纳米材料与纳米制备

轻金属

聚合物

复合材料技术

近净成形材料加工
UQ is an international leader in transdisciplinary Chemical Engineering education and research, rated at the highest level possible, in the 2012 Excellence in Research for Australia (ERA) exercise.

We are engaged in pioneering research transcending traditional disciplinary boundaries, in diverse areas such as bioengineering, bioproducts, food, colloids and surface science, nanomaterials and nanoscale science and technology, high performance polymers, energy and environment, and waste and water resource management.

Our project-centred, teaching programs form part of UQ’s undergraduate and postgraduate degrees in Chemical, Biological, Environmental, Materials and Metallurgical Engineering and Sustainable Energy. Leading Australian metallurgy and minerals processing research and studies at UQ are devoted to scientific, engineering, and economic aspects of the preparation, separation, extraction, and purification of ores, metals, and mineral products by both physical and chemical methods.

Key Research Areas for the School of Chemical Engineering are:
- Coal and minerals processing
- Colloid/surface chemistry and electrochemistry
- Froth flotation
- Hydrometallurgy
- Pyrometallurgy

Key Strengths
- Leader in Metallurgical and Minerals Process Engineering
- Three industry-supported chairs and five industry supported centres
- Degree in Sustainable Energy available

Interdisciplinary research centres
- Centre for Coal Seam Gas
- Dow Centre for Sustainable Engineering Innovation
- Rio Tinto Alumina Centre for Alumina Processing
- The Baosteel-Australia Joint Research and Development Centre
- Remondis Centre for Solid Waste Bioprocessing
- Nanomaterials Centre

chemeng.uq.edu.au
FACULTY OF BUSINESS, ECONOMICS AND LAW

The Faculty of Business, Economics and Law (BEL) incorporates the UQ Business School, the School of Economics and the TC Beirne School of Law.

With 12,000 students including 5600 international students enrolled over three schools, and an alumni network of more than 67,000, the BEL Faculty offers students unparalleled opportunities in their fields.

We engage and build sustainable and mutually beneficial relationships with students, alumni, industry and government.

The opportunity to use knowledge to create change is a driving force behind our research. Our research in business, economics and law is helping to solve issues that face industry, policy makers, community organisations and people worldwide. Our aim is to continue to grow our collaborative research, with a strong emphasis on transforming research outcomes into practical solutions and create change around the globe.

At the Faculty of Business, Economics and Law we provide a transformative learning experience that inspires students to create change locally and globally. Our high-achieving students are taught by leaders in their fields, who are consultants and advisors to leading companies worldwide, many also at the helm of world-leading research.

Key Strengths

- Strong industry connections
- Extensive Alumni network
- UQ Pro Bono centre
- Applied and Theoretical Economics research
- Business, Management and Finance research
- UQ Law research
- Information Systems and Computational Science
- Tourism research
At the Faculty of Humanities and Social Sciences, we strive to give knowledge leadership in a wide and diverse range of research and teaching programs, including: anthropology, archaeology, art history, classics, communication, criminology, cultural studies, drama, history, international relations, journalism, languages, linguistics, literature, media studies, music, political science, philosophy, sociology, and world religions.

The relevance of the humanities has not diminished over time. Indeed, it is possible to make a persuasive case that they matter more than ever. That is why the disciplines that make up HaSS are critical drivers of the University’s mission to generate ‘knowledge leadership for a better world.’

Often knowledge leadership requires building partnerships with fields of inquiry outside of the immediate concerns of the Faculty – working with scientists to understand the impact of climate change, working with law specialists, working with economists to better grasp the relationship between private interests and the public good. These wider conversations are held by researchers in lively seminar programs, and are reflected in the joint programs offered in HaSS.
UQ’s Faculty of Science is recognised as a powerhouse for some of the world’s leading scientists, teachers, science programs and commercial outcomes. The Faculty is one of the largest Science groupings in Australia, with approximately 1100 (equivalent full-time) staff, and about 7500 (equivalent full-time) students.

The Faculty unites the disciplines of agriculture and animals, biomedical and biological sciences, chemistry, earth sciences, food sciences, geography, marine science, maths and physics, planning, the environment and veterinary science.

Our research across the Geological Sciences is internationally renowned and is of significant economic and environmental importance. The Geological Sciences encompass wide-ranging investigations of the phenomena that have shaped, and continue to shape, the Earth both at and below the surface including:

- Geochemistry, Geochronology and isotope systems
- Palaeontology, Geomicrobiology, Coral reef geology
- Mineral deposit and fossil fuel geology, Ore geology, Exploration geophysics
- Crustal studies and tectonics
- Quantitative geological modelling in the Earth Systems Science Computational Centre
- Climate Research Group

Environmental Science and Management research takes an interdisciplinary approach to environmental issues combining fields such as nature conservation, rural and urban environments, and cultural heritage management to understand and respond to industry/development issues at both the global and local level.
FACULTY OF HEALTH AND BEHAVIOURAL SCIENCES

Healthcare provision, clinical education and health and medical research are presently undergoing transformational changes locally, nationally and internationally.

As a research leader across a range of discipline areas such as rehabilitation, speech pathology, ageing, child and maternal health and sports science - we pride ourselves on translating knowledge into action.

We are committed to the development of evidence-based research and clinical innovations that benefits industry and the broader community, to help shape our world.

We recognise industry partnerships as central in turning research into real-life applications. With this in mind, we collaborate closely with government, not-for-profit organisations, international and national organisations, the private sector and the community to ensure our research addresses the ‘big picture’ issues.

We are committed to educating the next generation of researchers in preventative health and behaviour change. Our students benefit from our international reputation and the opportunity to study with nationally and internationally recognised researchers.

Within Australia’s health economy, we’re aiming, through integration of teaching, research and clinical engagement in the health and behavioural sciences to help ensure the kind of healthcare Australians expect: evidence-based, cost-efficient and effective.

Key Strengths

6 national teaching awards
1 national fellowship
~$21M Annual competitive research income
2 NHMRC Centres of Research Excellence
5 ERA Rankings well above world class

Key research centres

Centre for the Business and Economics of Health
Centre for Youth Substance Abuse Research (CYSAR)
Poche Centre for Indigenous Health
Queensland Alliance for Environmental Health Sciences (QAEHS)
Recover Injury Research Centre
The Global Change Institute (GCI) delivers high-impact, ‘game changing’ research that provides solutions to global change challenges facing the world. It does this through high-level engagement and partnerships internally using The University of Queensland’s expert knowledge base, and externally through national, regional and international collaboration.

A key component of the GCI’s role is to engage with government, industry and the community to promote research and discovery, to advocate the importance of coordinated and integrated approaches to finding solutions and to transfer knowledge and technologies to the public. With a unique mix of skills and expertise, it also acts as a think-tank in which new ideas can flourish and expand.

GCI employs a diverse range of staff from economists, social scientists, physicists and marine biologists to communicators, administrators and managers.
UQ ENERGY STRENGTHS

UQ energy initiative
UQ is one of the most research intensive universities in Australia, bringing together expertise from several world class institutes and faculties.
energy.uq.edu.au

IAET’s energy work
As global demands for energy increase, the world will be required to transform traditional energy technologies and systems, while supporting renewable energy technologies.
eait.uq.edu.au/energy

UQ Solar
UQ Solar began as a collaborative project to save on electricity costs, and showcase the university’s commitment to clean energy and carbon emission reductions.
solar-energy.uq.edu.au

Advanced engineering building
A unique facility designed to interact with the natural environment, dramatically reduce energy consumption and create an interactive learning environment for students.
eait.uq.edu.au/aeb

CEEC Energy Curve initiative
SMI is leading CEEC Energy Curve initiative, a tool which allows comminution circuit operators to benchmark the energy efficiency of their operations.
ceecthefuture.org/energy-curve-program
The International Centre of Excellence in Chile aims to fundamentally improve the Productivity and Environmental Signatures of Chilean Mining Operations.

The University of Queensland’s long and rich history of mining research and teaching is being exported to South America with the establishment of the International Centre of Excellence in Chile.

SMI-ICE-Chile’s mission is to create a new collaborative Global Mining Knowledge force in Chile that builds human capital, provides innovative research outcomes and realises effective technology transfer to Industry.

With a long and close association with the Chilean industry dating back 40 years, UQ’s Sustainable Minerals Institute’s research Centres have forged innovative strategies to increase the productivity, sustainability and safety of the industry in Chile.

In 2013, SMI and JKTech - SMI’s research commercialisation arm - applied to the Chilean Government’s “Attraction of International R&D Centres of Excellence for Competitiveness 2.0” to establish an International Centre of Excellence (SMI-ICE-Chile). This scheme is coordinated by the Chilean Government, through CORFO, and is part of their strategy to build Research and Development capability in Chile.

For this initiative, UQ partnered with the Universidad de Concepción (UdeC). UdeC has a strong capability in extractive metallurgy and these activities are delivered through UdeC’s Metallurgical Engineering department (DIMET) and Applied Economic Geology Institute (GEA). SMI has been working with UdeC since 2009, providing a range of undergraduate and postgraduate coursework degrees as well as continuing professional development for people from Chile. Our association with UdeC draws together our complementary strengths in research and technical capabilities.
The International Centre of Excellence in Chile

The International Centre of Excellence in Chile aims to fundamentally improve the Productivity and Environmental Signatures of Chilean Mining Operations.

For UQ the opportunity to establish an International Centre of Excellence signifies substantial progress in institution-wide efforts to collaborate more closely with Latin American communities, businesses and governments.

SMI-ICE-Chile will bring new skills, experience, expertise and networks into the Chilean innovation system. This is a priority area for industry where Chile has an opportunity to establish an international profile and world leadership position in the area of sustainable mining.

SMI-ICE-Chile will build upon extensive expertise that already exists in Chile in many areas of mining research and this collaboration and investment in industry-driven research has a very high potential for significant gains for the industry and therefore the economy. Its research will be at the forefront of developments within the mining sector and will lead to national and international recognition. It will also progressively attract an increasing number of highly skilled Chilean professionals, ensuring intellectual capital, which will not be lost overseas.

Contact

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smiicechile.cl

Prof David Mulligan
Executive Director of SMI-ICE-Chile
The Centre for Social Responsibility in Mining (SMI-CSRM) conducts social science research about resource development.

SMI-CSRM is a leading research centre committed to improving the social performance of the industry globally. Our focus is on the social, cultural, economic and political challenges that occur when change is brought about by mineral resource extraction. Since the centre was established in 2001, SMI-CSRM has contributed to industry change through independent research, teaching and by convening and participating in multi-stakeholder dialogue processes.

SMI-CSRM’s staff and students have in-depth knowledge of the mining and metals sector, at corporate and operational levels. Our multi-disciplinary orientation, our position within UQ, and our ability to conduct leading edge social science research, sets us apart. SMI-CSRM has expertise in communities, governance, agreement, development, cultural heritage, resettlement, artisanal and small scale mining, human rights, Indigenous people, mine closure, conflict and gender.

SMI-CSRM’s research with local communities spans a wide range of issue and geographic areas. Our researchers are leading, highly sought after, applied social scientists who work with community stakeholders to understand the local experience of mine-related activities. The SMI-CSRM team has extensive experience in working at the interface between mining, government and local communities – in local villages, along infrastructure corridors and on-site at some of the most challenging mining operations world-wide. SMI-CSRM’s researchers are experts at engaging in multi-disciplinary teams, and working cross-culturally and collaboratively with local universities, consultancies and community organisations.

SMI-CSRM has evaluated the design and implementation of major mining project agreements between companies and the state, host regions and local communities. Our team also conducts specialist research involving Indigenous peoples and complex negotiation processes. As recognised leaders in this field of applied research, SMI-CSRM has contributed to the development of leading practice guidelines through agencies such as the World Bank, Australian Department of Foreign Affairs and Trade (DFAT) and the International Council for Minerals and Metals (ICMM).

Governance arrangements in the resources and extractives industries are increasingly complex. Stakeholders from across the spectrum are demanding more effective regulatory mechanisms at all levels: international financiers, bilateral agencies, national governments and sub-national governments. Transparency, accountability and multi-stakeholder initiatives are on the rise. SMI-CSRM’s research is at the cutting edge of this global policy agenda. Our team is actively engaging in international review processes that ensure voluntary initiatives, such as the Extractive Industries Transparency Initiative (EITI) and certification schemes, lead to improvements in mining industry policy and practice literature.

smi.uq.edu.au/csr-expertise
The Minerals Industry Safety and Health Centre (SMI-MISHC) deliver excellent risk management education, consultancy, and research which improve the health, safety, and provide consultancy services to industry.

Established in 1998, the goals of the Minerals Industry Safety and Health Centre (SMI-MISHC) are to conduct research in occupational safety and health, risk management, and human factors; to integrate the results of this research into postgraduate and continuing education programs in safety and health risk management delivered to the minerals industry and provides consultancy services to assist industry. The backgrounds of SMI-MISHC staff are varied, and collectively cover the breadth of occupational safety and health related disciplines such as risk management (including principal hazard management and emergency response, risk management tools and techniques), occupational health (e.g., chemicals, dust, vibration), psychology (fatigue, stress), and physiotherapy, as well as human factors and ergonomics.

SMI-MISHC staff have extensive experience in coal and hard rock mines across Australia, as well as conducting research and educational programs in Africa (South Africa and Zambia); Asia (New Guinea and Philippines); South America (Chile) and India. SMI-MISHC staff and research students have a particular interest in the safety and health of artisanal and small scale mining in developing countries.

Major incidents at mines are rare due to the improved management of OHS. However modern mines are complex operations and when something goes wrong the management of the incident is also complex. SMI-MISHC staff have been actively involved in providing technical advice in managing major fires and explosions at mines as well as undertaking research to improve the management of emergencies. This research has focussed on the decision making process and the factors that can affect the capacity to make good decisions quickly. Historically the research effort has focussed on rescue teams and escape mechanisms for workers, but ineffective management of the incident can pose a major threat to successful outcomes. This work has been funded mainly by ACARP and undertaken in conjunction with SIMTARS and the Queensland and NSW Mines Rescue Services.

Effective safety and health management systems require continual vigilance to ensure that the systems are being implemented as designed and are achieving the desired outcomes. This monitoring and review process requires personnel, resources and management commitment. Reducing either effort or resourcing increases the health and safety risk. Where a low fatality rate breeds complacency, personnel can assume that the hazards are not real as they have not experienced them themselves. This in turn leads to underestimating the risk and the need for controls.

smi.uq.edu.au/mishc-expertise

Prof Deanna Kemp
Director, SMI-CSRM & SMI-MISHC
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With an outstanding international reputation as a leader in mining and mineral processing research, the Julius Kruttschnitt Mineral Research Centre (SMI-JKMRC) is noted for the widespread use of its innovative research outcomes by industry.

SMI-JKMRC has worked in close partnership with global mining companies and mineral processing research groups for almost 50 years.

SMI-JKMRC is the largest Australian research centre in this field and our research is sponsored by most of the major mining companies. The ultimate goal of all our research, spanning a range of commodities including metals, coal and mineral sands, is to maximise liberation of valuable commodities while minimizing the consumption of energy, water use, environmental and social impacts.

The Centre is known for the application of research outcomes to create modelling tools, analysis tools and instrumentation, and designs for new equipment. Our current scope of research extends from geomechanics and blasting to comminution and flotation. The integration of models and optimisation across the entire chain of operations is a distinctive feature of SMI-JKMRC research.

We are a multi-disciplinary group of mining engineers, mineral processors, computational mathematicians, and applied scientists who aim to apply good science engineering to mineral processing solutions.

We understand that research and education are imperative to the ongoing vitality and success of the minerals industry. SMI-JKMRC trains postgraduate students and also delivers specialised undergraduate courses.

The Julius Kruttschnitt Mineral Research Centre (SMI-JKMRC) aims to be a world class provider of postgraduate education and innovative applied research in mineral processing and geometallurgy.

smi.uq.edu.au/jkmrc-expertise
The W.H. Bryan Mining & Geology Research Centre (SMI-BRC) has a reputation for practical innovation and leadership in deep mine development and operation, with a diverse range of mining and ‘geo’ expertise.

The SMI-BRC leads change by developing new and improved methods for ore extraction and, most importantly for future mining effectiveness, in enhancing total deposit knowledge and predictive understanding of ore bodies.

Applied and strategic research innovation focus on:

- Improving discovery of major metalliferous deposits and reducing the time to production.
- Innovation in deeper mining environments (managing technical risk and improving predictive performance).
- Optimisation of capital investment in mine development.
- Sustainable reduction in operating costs.
- Data analytics/modelling, managing variability and uncertainty for improved productivity/return on capital deployed.

Our range of expertise is focussed on several of the significant development and operating challenges that are facing the world’s mining industry as it seeks to realise the opportunities that a rapidly increasing global demand for a diverse range of mineral commodities is offering.

The SMI-BRC comprises a research team of industry professionals (Geology and Mining Engineering) with applied research expertise. The SMI-BRC has access to a range of discipline experts within the broader SMI to facilitate delivery of multi-faceted research projects which span the mining life-cycle.

The SMI-BRC has three complimentary applied research programmes that draw upon expertise in geoscience, mine engineering, geostatistics and valuation; to provide solution-based outcomes to industry in mining and mining/exploration geoscience. The SMI-BRC has a collaborative network which includes industry partners, research institutions, and government.

smi.uq.edu.au/brc-expertise
The Centre for Mined Land Rehabilitation (SMI-CMLR) addresses the environmental challenges of the minerals industry by translating scientific results into practices that continually improve mine rehabilitation outcomes.

Formally established in 1993, the Centre for Mined Land Rehabilitation (SMI-CMLR) consists of a collaborative and multi-disciplinary group of research, teaching and support staff, and postgraduate students. SMI-CMLR is dedicated to delivering excellence in environmental research, education and awareness to the national and international minerals industry, relevant government departments, non-government organisations and local communities.

SMI-CMLR is widely recognised as the source of quality research at the cutting edge of issues in mining environmental management and sustainability, across the full spectrum of resource commodities. It has built a reputation for providing the science necessary to inform decision-making that can minimise risks and maximise opportunities resulting from resource exploration, extraction and processing globally.

The SMI-CMLR has core disciplinary strengths in the basic and applied biological, chemical and physical sciences, working at scales from the microbial to the catchment and regional.

The Centre builds on the strengths of the diverse backgrounds and disciplines of staff and students to address the environmental challenges of the minerals industry.

Over the years the SMI-CMLR has developed research expertise and knowledge that has spanned the realms of Environmental Geochemistry (“To understand and predict the source, transformations and fate of contaminants”), Landform Stability and Evolution (“To identify properties and processes which define stability of successfully-functioning landforms”), Soil-Plant Systems (“To develop technological solutions for rehabilitating anthropogenic soil-plant systems”), and Landscape Ecology (“To rigorously assess the long-term outcomes of mining activities on ecosystem function”).

More recently, these themes were further developed and built into three Programs, namely Ecosystem Assessment, Restoration and Resilience, Ecological Engineering of Soil-Plant Systems and the cross-disciplinary, Life Cycles of Mines and Metals.
The Centre for Water in the Minerals Industry (SMI-CWiMI) conducts research towards achieving sustainable water management in the mining industry.

Founded in 2004, SMI’s Centre for Water in the Minerals Industry (SMI-CWiMI) conducts research to achieve sustainable water management in the mining and gas industries. We aim to deliver world class scientific discovery in fundamental and applied research. The important role of water in many aspects of these industries means that SMI-CWiMI is contributing to solving a range of inter-disciplinary problems. We engage with a wide range of research organisations and mining, gas and water stakeholders to achieve maximum benefits from our work.

The water related challenges that the mining and gas industries face span operational, social and environmental considerations. Water is society’s most precious resource. It is vital for human existence and often has a social value that is difficult to measure. SMI-CWiMI, working with SMI’s Centre for Social Responsibility in Mining, creates the capability for the mining and gas industries to incorporate social considerations into its water management practices.

SMI-CWiMI has pioneered approaches that promote efficiency, transparency, reduced costs, and lower risks for mine water management. SMI-CWiMI promotes sustainable water management to help the minerals industry secure enough water for production and operate in appropriate locations, whilst minimising negative environmental impacts and maintaining a social licence to operate.

SMI-CWiMI is helping the mining and gas industries achieve effective management of water and protection of freshwater ecosystems. SMI-CWiMI’s goal is to understand water quantity and quality interactions in surface and ground water systems to promote ecologically sustainable development and to provide expert advice on catchment water management.

SMI-CWiMI’s goal is to accurately quantify and advise on surface and subsurface hydrological risks that can affect mine and gas operations.

smi.uq.edu.au/cwimi-expertise
SMI’s position within UQ and its ability to link research and practice across several disciplines adds unique value to its work. Researchers are currently working with industry across a number of cutting-edge initiatives, which span multiple centres, including the following programs:

Complex Orebodies
Accessing the mines of the future

Perhaps the greatest future challenge for the mining industry is that worldwide demand for raw materials is projected to continue to grow for the foreseeable future, and future new supply of raw materials will have to come from a combination of new mine discoveries, recycling and existing projects which have not yet commenced production. For new mine discoveries, the major challenge is that exploration costs are increasing and discovery rates are declining, so new discoveries alone will not meet future demand.

In currently operating mines, grades are decreasing, and are even lower in undeveloped mines, and the quest to overcome this by economies of scale is reaching the limit of effectiveness. In fact, most undeveloped deposits are either unviable due to low grades or other technical challenges or inaccessible due to political unrest, social outrage and/or environmental barriers.

The SMI, in conjunction with its UQ and external partners, is uniquely placed to lead a multidisciplinary effort to develop the step changes in social understanding, environmental innovation and mining and processing efficiency, which will be required to allow cost effective access to these complex orebodies in a way that also enables sustainable development.

Some of the key research questions to address this challenge include:

- How can we rethink the relationship between mining, social footprint, and policy in order to achieve equitable and sustainable development?
- How can we improve mineral processing to minimise water usage, waste footprint and deleterious elements?
- How can we improve the way we define orebody variability and develop the mining and processing flexibility to accommodate that variability such that we can viably treat the lower grade and more complex orebodies of the future?
- How can we develop new technology and improve existing technologies in order to lower mining and processing costs and achieve greater efficiency in the mining and processing chain?
Advanced Process Prediction and Control (APPCo) Program

Transforming process prediction for effective control APPCo aims to transform unit process modelling and simulation, moving on from the steady-state models previously developed at the JKMRC, to develop and apply new techniques that make greater use of data generated on-site and sensor technologies in combination with advanced process control, computational analytics and modelling techniques.

Research within the APPCo program focusses on the following foundation themes:

- Integrated process prediction
- Advanced ore characterisation for mechanistic modelling
- Dynamic process modelling
- Resource utilisation and sustainability metrics
- Advanced data analytics
- Instrumentation and soft sensors

Transforming process prediction for effective control
The Digital Mine

Unlocking the value of digital technologies through translating digital data to knowledge.

Digital technology has the potential to transform the way the minerals industry operates and could reduce capital intensity and cost of production, make production safer, and drastically reduce environmental footprint while enhancing social performance.

In the early 1800s, introduction of the steam engine transformed our industry from small-scale manual to large-scale mechanised complexes. Later disruptions include mass production in the 1900s, and advances in electronics and robotics in 1970s and 1980s, which led to the application of process control and automation. The digital revolution, which began from the late 1950s, has transformed mechanical and analogue electronic technology to digital electronics. Since 2000, the exponential evolution of digital technology is disrupting not only the industry but all aspects of human life.

Some leading companies have taken the disruptive path to build the architecture for a digital platform. However, recent surveys show that less than 10% of mining companies have a comprehensive digital strategy and are able to realise the value of digital technology.

Most companies are struggling with linking several digital data platforms implemented for different aspects of the value chain and finding it difficult to translate digital data into meaningful knowledge and to effectively apply that knowledge. Other barriers to implementation include geographical spread of operations in remote locations, access to the workforce trained to implement a digital platform, infrastructure for connecting operations and transferring digital data.

Intra-disciplinary collaboration

The Digital Mine will benefit from cutting-edge research currently underway in several UQ schools and institutes including:

- School of Mechanical and Mining Engineering (advanced capabilities in automation and digital technologies)
- Faculty of Humanities and Social Sciences (Digital Humanities and the Social Sciences initiative)
- School of Chemical Engineering (human interface and integrated risk analysis)
- School of Information Technology and Electrical Engineering (novel research in joint cognitive systems)
- UQ Business School (business analysis)
Throughout the past two decades of the Global Mining Initiative, and Mining, Minerals and Sustainable Development (MMSD) project, there has been a continued focus by governments, mining companies and other stakeholders on the question of how mining activities contribute to sustainable development outcomes for the local and regional communities where they operate. Mining companies have increasingly sought to engage in the debate around development, and a large number of policy frameworks and guidance documents have been produced on all sides. However, the practical implementation of these frameworks raises many challenges, particularly in the area of governance roles and organisation design when multiple objectives and disciplines are involved.

This program aims to develop a cross-cutting research agenda, which integrates different aspects of resource governance and focuses on building an evidence base of the effectiveness of different approaches to policy and regulatory issues, as well as company and collaborative management initiatives. It will actively seek to broaden the scope of previous work to include governance of all aspects of mining operations across the life-cycle.

In addition to the Sustainable Minerals Institute, potential UQ collaborators include schools and institutes relating to political science, social science, business, law, earth and environmental sciences, as well as the Institute of Continuing & TESOL Education (ICTE-UQ).

### Focus areas
- Factoring sustainable development into policy frameworks in government and industry
- Effective approaches the multi-stakeholder governance
- Designing organisations to better enable responsible decision-making

### Key questions include:
- What are the local, regional and global societal dimensions related to managing mining waste?
- What are the spatial and temporal geo-environmental impacts resulting from mining waste and how can potential liabilities be prevented or substantially mitigated?
- Which geo-metallurgical properties can unlock additional value and enhance environmental outcomes in waste from mining and mineral processing?
- How can the mining industry contribute, assess and quantify their contribution to the emerging circular economy?

The program of work offers the opportunity to collaborate with Schools and Centre within UQ including the Civil Engineering, Mechanical and Mining Engineering, Earth and Environmental Sciences, Business, and Social Science.
UniQuest

UniQuest is Australia’s leading commercialisation entity, specialising in commercialising the intellectual property of UQ.

UniQuest commercialises the innovation and expertise of UQ through four channels to market. We package the innovation and expertise into one or more of eight types of industry offerings.

Technology transfer

JKTech is an independent partner assisting mine sites to achieve future production targets.

As the technology transfer company for SMI, and proudly owned by UQ, JKTech offers practical solutions to the mining industry including advisory services, material characterisation, software, equipment, and professional development.

JKTech’s Mine-to-Mill™ initiative has delivered US$1.3 billion in economic value to its clients per annum in the past five years through process optimisation methodology that provides significant improvements in throughput, grade, and recovery from blasting through to flotation.
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