2012 ANNUAL REPORT

The University Of Queensland
AUSTRALIA

SMI Sustainable Minerals Institute

CONTENTS

Professor Peter Høj
President and
Vice-Chancellor,
The University of Queensland

PRESIDENT AND VICE-CHANCELLOR'S REPORT

2012 was a turning point for the Australian higher education sector. Our traditional reliance on government funding has been replaced by an understanding that the Australian university sector must work more closely with industry and the not-for-profit sector to diversify its funding model.

Since being appointed as Vice-Chancellor in October 2012, I have expressed my desire to build collaborations with global partners. I firmly believe that for an academic institution to be successful in the 21st century the adage 'publish or perish' must be replaced by 'partner or perish'.

When I look across the University, it is clear that the Sustainable Minerals Institute (SMI) is already ahead of the curve in this respect. Across more than a decade SMI has developed key partnerships with global resource companies and local non-government organisations alike. Its willingness to work closely with the sector has resulted in some commentary in the media and broader community, but has resulted in a research organisation that innovates, develops and delivers products that are genuinely improving the sector. These relationships stand The University of Queensland (UQ) in good stead, as it looks to build new relationships and enhance existing partnerships through an Industry Engagement Council from 2013.

UQ provides immense economic, social and environmental benefits to the community. SMI has impact in each of these areas – and it is impact that extends globally. From Chile to China, Papua New Guinea to Peru, the Institute's researchers are committed to ensuring a sustainable industry for the future. This approach very much aligns with my goal of UQ becoming the most globally connected university in Australia and positions the Institute well for the future.

Of course, there are many in academia who aspire to excellence in research, teaching and engagement. For UQ to be successful – the most successful – in this area, it must shift its thinking from 'excellence to excellence plus'. I know SMI researchers are up to the challenge and that their continued commitment will reap long-term benefits for the broader University.

It has been due to the hard work of many that SMI's successes across the globe have been possible. I thank everyone at the Institute for their ongoing contribution and dedication in having a positive impact on the resources sector over many years. I congratulate Chris and the team for helping UQ move closer to its ambitions of greater global connectedness and I look forward to watching what the Institute achieves in 2013 and beyond.

Professor Peter Høj
President and Vice-Chancellor,
The University of Queensland

Mr Charlie Sartain
Chief Executive, Xstrata Copper
Chair, SMI Advisory Board

BOARD'S REPORT

The SMI Advisory Board reflects the partnering nature of the Institute in that it draws together representatives from across industry, the Queensland Government and the University's Executive. The Board is in the fortunate position to be able to advise the world's most comprehensive research institute dedicated to sustainability in the minerals industry.

In recent years the SMI and its Centres have continued to strengthen their reputation across the resources industry, and the Institute has seen impressive year-on-year growth through volatile economic times, including 2012. In late 2011 the Institute further broadened its reach, through the formation of the Centre for Coal Seam Gas. This Centre, which has been successful in recruiting key researchers in a competitive market, has developed projects including water chemistry, coal permeability and cumulative socio-economic impacts.

Understanding and addressing the sustainability needs of the resources industry, related communities and governments are at the heart of the Institute's success. As a visionary organisation, SMI is pushing research boundaries and helping the resources sector to continually view its activities through a sustainability perspective. In 2012 SMI announced seed funding for two NextMine research projects. NextMine extends the SMI collaborative, inter-disciplinary approach to addressing industry challenges by integrating and better coordinating multiple disciplines in sustainability research projects. I have no doubt that this initiative holds enormous potential to revolutionise the industry and ultimately deliver real sustainability outcomes.

In 2012 the SMI Advisory Board began a process to strengthen links with the various Centre Advisory Boards that I believe will ensure that the Institute and its Centres remain focused on delivery against the SMI strategic plan.

The SMI organisation has now grown to more than 350 full-time equivalent staff and students from 35 countries, and 2012 also saw important changes in the SMI leadership team. I thank Chris Moran for providing ongoing strong leadership to the Institute during this period. I also acknowledge and thank my fellow Advisory Board members for their invaluable advice and support for SMI during the year.

Charlie Sartain
Chair,
SMI Advisory Board

Professor Chris Moran
Director, Sustainable Minerals Institute

DIRECTOR'S REPORT

2012 was a dynamic, challenging and ultimately rewarding year for the Sustainable Minerals Institute.

For the first time since the Centre for Water in the Minerals Industry was established in 2004, SMI developed a new research Centre. The Centre for Coal Seam Gas, with a focus on water, geophysics, petroleum engineering and social impact, has broadened the Institute's focus to include unconventional energy sources. There is an insatiable global appetite for energy so it is imperative the Institute – and the University more broadly – develops its research capability in this area.

UQ's decision to pursue coal seam gas industry funding for the Centre led to some criticism however I believe that through open debate and dialogue we have ultimately developed a stronger Institute. In 2012 SMI examined its research framework and integrity processes, to further ensure research independence was at the core of all SMI activities. This strong research ethic differentiates SMI from its industry competitors and, when combined with its unique life-of-mine capabilities, ideally positions SMI to build on its previous achievements and broaden its impact.

For more than 50 years the Julius Kruttschnitt Mineral Research Centre has developed technologies that advance the minerals industry. Its applied approach was evidenced when Anglo American committed $10 million over five years for the Anglo American Centre for Sustainable Comminution in November 2012. The Australian Coal Association Research Program (ACARP) has increased the Minerals Institute for Safety and Health Centre's RISKGATE program funding to $3.5 million, which is a strong indicator of the value this program adds to improving mine site safety.

In his first year as Director of the Centre for Social Responsibility in Mining, Professor Saleem Ali has been instrumental in diversifying funding and I congratulate him on securing World Bank and United Nations University grants. In late 2012 Professor Neil McIntyre was announced as the Centre for Water in the Minerals Industry Director. I look forward to his contribution to the Institute from early 2013.

Professor David Brereton moved into his new role of Deputy Director – Research Integration in mid-2012 and has greatly advanced the NextMine™ and NextWorkforce™ initiatives. SMI announced its first NextMine™ projects – *Rare Earth Minerals: Systems Solutions to Supply Constraints* and *Designer Tailings: Improving the Management of Tailings through Collaborative Research* – both of which are projects engaging researchers from across the Institute to solve industry challenges. You can read more about NextMine™ and NextWorkforce™ in the pages of this Annual Report.

Further, the Institute's research centres are increasingly working collaboratively on externally funded programs. The CSIRO Mineral Futures Collaboration Cluster is a prime example, with researchers from the Minerals Industry Safety and

Health Centre and the Centre for Social Responsibility in Mining involved in this project to implement economically sound and environmentally sustainable solutions for the minerals industry. Through the Cluster, these centres have contributed hugely to the body of knowledge around likely implications of automation in the resources industry.

SMI's Leadership Group is supported by many of the world's leading minerals and mining researchers. It is a testament to the dedication of these researchers that they choose to work in academia, advancing the minerals sector globally, and I thank them for this commitment. One of these researchers, the WH Bryan Mining and Geology Research Centre's Professor Gideon Chitombo, was acknowledged for his work in June when he received the 2012 ATSE Clunies Ross Award. This prestigious award recognises a career built on industry engagement, project delivery and innovation, and I congratulate Gideon for his efforts.

> There are many research and professional staff and students without whose hard work and dedication the Institute would not thrive as it does. I am extremely grateful to these people for their contribution. In particular, I acknowledge the University Executive, Institute Board members and Centre Directors for their on-going belief in SMI, support and guidance over the past year.

In 2013 the Institute will celebrate the Centre for Mined Land Rehabilitation's 20th anniversary, a demonstration of the Centre's on-going value to industry and the communities where it works.

Throughout 2012 momentum has built around the International Mining for Development Centre (IM4DC). Researchers across SMI have worked with colleagues from The University of Western Australia to deliver education and knowledge to over 800 resources stakeholders from more than 30 countries. IM4DC presents a remarkable opportunity for SMI to positively impact the resources sector in developing countries and, in partnership with AusAID, I expect the Institute will work hard to fulfill this vision in the future.

I look forward to working with the wider SMI team again in 2013 as we broaden our impact in the global mining sector and surrounding communities.

Professor Chris Moran
Director,
Sustainable Minerals Institute

SMI LEADERSHIP

Professor Chris Moran
Director
Sustainable Minerals Institute
Interim Director
Centre for Coal Seam Gas

Professor Ben Adair
Deputy Director—Technical
Sustainable Minerals Institute

Brett Cunningham
Deputy Director—Operations
Sustainable Minerals Institute

Professor David Brereton
Deputy Director —
Research Integration
Sustainable Minerals Institute

Professor Margaretha Scott
Director
WH Bryan Mining and Geology
Research Centre

Professor Wayne Stange
Director
Julius Kruttschnitt Mineral
Research Centre

Professor David Mulligan
Director
Centre for Mined Land
Rehabilitation

Professor Saleem Ali
Director
Centre for Social Responsibility
in Mining

Assoc. Professor Sue Vink
Acting Director
Centre for Water in the
Minerals Industry

Professor David Cliff
Director
Minerals Industry Safety and
Health Centre

SMI MISHC
Minerals Industry Safety & Health Centre

What is the Minerals Industry Safety and Health Centre?

The Minerals Industry Safety and Health Centre (MISHC) is an internationally recognised provider of risk, health and safety research and education for the global minerals industry. Researchers focus on leading practice systems and procedures to solve existing health and safety challenges. The Centre is working on a number of strategic research initiatives to facilitate resource sector growth and optimise safety. Further, education programs are instilling health and safety management practices as the guiding principle for industry professionals.

2012 Report

Improving health and safety has long been a focus for the resources sector – however the tightening fiscal environment has proven no part of the industry is immune from change. While the challenging environment has impacted MISHC's ability to develop new initiatives in 2012, the Centre has maintained significant funding that has further cemented its position as the world's leading health and safety research organisation for the mining sector.

In 2012 MISHC successfully assisted a number of Australian mine sites to improve their capacity to manage risk through effective identification of hazards and appropriate controls. This work was undertaken through its RISKGATE program, an online system researched, designed and developed to control unwanted events at mine sites including fires, collisions and isolation. Already granted $2.2 million by ACARP, RISKGATE was awarded an additional $1.3 million in 2012, making it the largest health and safety project ever funded by the Program.

The Centre also participated in the CSIRO Mineral Futures Collaboration Cluster. MISHC researchers identified several factors common across automation – such as poor operator acceptance of technologies and over-reliance on automation – that could impact mine site safety. Further, researchers found a lack of specialist skills in maintenance of automated equipment and cultural differences in responding to automation could multiply risks on mine sites.

In recognition that not all safety hazards are manmade, the Centre has also conducted significant research into natural phenomena. In 2012 MISHC Director Professor David Cliff was awarded almost $500,000 by ACARP to develop and apply computer models to evaluate the potential impacts of lightning strikes on underground coal mines. Results from this research are expected in 2013.

SMI BRC
WH Bryan Mining &
Geology Research Centre

What is the WH Bryan Mining and Geology Research Centre?

The WH Bryan Mining and Geology Research Centre (BRC) delivers integrated research across the mining value chain from mine to mill to assist industry move towards mines of the future.

Researchers focus on more efficient and effective mine practice including minimising loss and dilution in resource recovery, decreasing energy usage and new ways for optimal planning.

2012 Report

In 2012 BRC consolidated its research into three key themes:

- **Deep earth mining/ mass mining**
- **Geology and mine process optimisation**
- **Ore body driven decision science.**

These themes draw together BRC's varied geological research projects and have provided a platform from which the Centre can build capability in the future.

Within these themes, researchers successfully completed and delivered the Hybrid Stress Blasting Model Project (HSBM). This design, layout and analysis software enables miners to study the impact of different drill and blast design scenarios on blast results, thereby enabling better blast planning and optimisation. BRC anticipates the next phase of this project will result in the analysis and planning of more specialised blast techniques.

In 2012 BRC researchers also successfully completed the second phase of the Mass Mining Technology Project (MMT2). This project investigated the large scale caving methods of block, panel and sublevel caving to improve understanding of rock mass characterisation, caving mechanics, fragmentation and gravity flow. Ten sponsor companies of this research have committed to funding the three-year MMT3 project, expected to start in 2013.

In recognition of success in the Mass Mining Technology Project and previous research, Professor Gideon Chitombo was awarded the ATSE Clunies Ross Award in June 2012 for his contribution to improving the efficiency and effectiveness of mineral extraction.

SMI JKMRC
Julius Kruttschnitt Mineral Research Centre

What is the Julius Kruttschnitt Mineral Research Centre?

The Julius Kruttschnitt Mineral Research Centre (JKMRC) was borne out of the P9 research project, which celebrated its 50th anniversary in 2012. Since then the Centre has built an enviable reputation for its ability to maximise the efficiency of resource processing while minimising energy use and environmental impact.

2012 Report

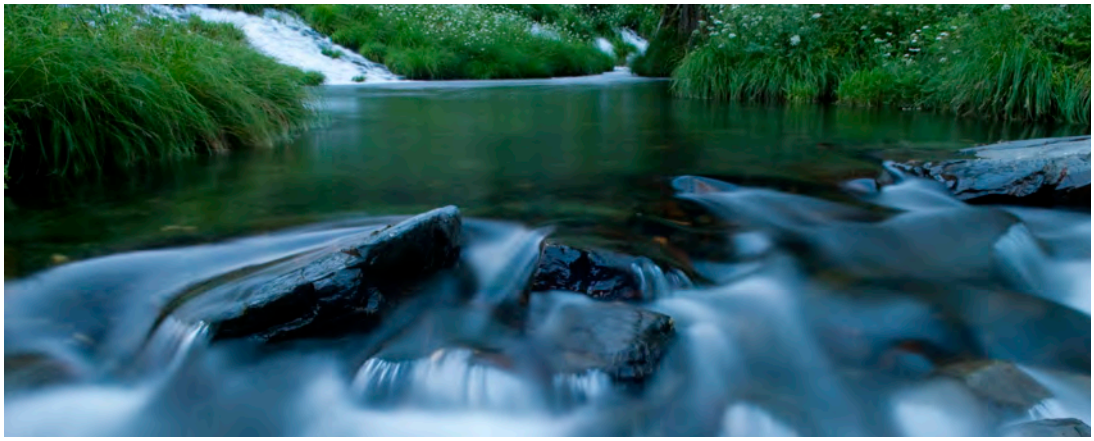
The world's largest mineral processing and geometallurgy research centre, JKMRC has delivered industry a toolset of design and operational improvements over the last 50 years. Professor Wayne Stange was appointed the sixth JKMRC Director mid-year.

In 2012 the Anglo American Centre for Sustainable Comminution was initiated. This five-year $10 million program consists of longer-term research objectives and site-based application studies. The Centre is underpinned by the formation of the Global Comminution Collaborative, led by JKMRC's Professor Malcolm Powell, which draws together the capabilities of five leading comminution research universities.

The P9P project is gathering momentum, with successful site surveys undertaken at Confluencia, Kennecott Utah Copper Corporation and Xstrata's Ernest Henry in 2012. P9P also achieved one of the highlights in its 50-year history with sponsors AMIRA and JKMRC agreeing to form a Strategic Advisory Committee that will develop a P9 roadmap with a 10-15 year horizon. This will significantly enhance sponsor engagement and improve efficiency of mobilising individual projects.

The development of the Integrated Extraction Simulator (IES) in collaboration with, and funded by, CRC ORE continues to progress well with the initial release due in September 2013. The IES is the next-generation simulation platform for JKMRC, its collaborators and sponsors. It supports multi-component simulation along the complete mining and processing value-chain and is Cloud-based.

JKMRC's engagement with service and equipment providers is developing rapidly as evidenced by the large-scale Metso Corporation stirred milling project. Based on research outputs and engagement with Metso Corporation staff at a users workshop, the sponsor stated the 'research outputs are already measurably impacting our bottom line'.



SMI CWiMI
Centre for Water in the Minerals Industry

What is the Centre for Water in the Minerals Industry?

The Centre for Water in the Minerals Industry (CWiMI) conducts research on the measurement, monitoring and modelling of water in the context of mine operations, their surrounding environments and regional communities to determine sustainable water management.

2012 Report

2012 was a transition period for CWIMI, where Acting Director Assoc. Professor Sue Vink bridged the gap between the departure of the previous Director Professor Damian Barratt and the appointment of Professor Neil McIntyre as the new Director in January 2013. During 2012, CWiMI continued to grow as one of Australia's leading centres for conducting aquatic ecological impacts analysis and toxicology studies, while maintaining its reputation and activeness in mine water management and geochemistry research.

The Centre's researchers undertook the first feasibility assessment of implementing salinity trading in the Fitzroy catchment. This project, undertaken for the Queensland Resources Council and the Queensland Department of Environment and Heritage Protection, has the potential to regulate mine water discharges to the catchment.

Separately, the Centre's salinity toxicology research, funded by ACARP, has been used to set mine water discharge limits for a pilot mine water release scheme. It is anticipated that these discharge limits will reduce future water issues and result in a positive aquatic legacy for the mine site.

CWiMI continued to enhance its international reputation throughout the year. For example, through the Public Sector Linkage Program that began in 2012 CWiMI researchers have the potential to be instrumental in improving the protection of rivers and environmental flows in Peru, and CWiMI contributed a keynote address to the International Mine Water Association Conference.

The Water Accounting Framework (WAF), developed by CWiMI, continues to benefit the mining industry and the communities where it operates. Following a pilot of the Framework across several of its sites, BHP Billiton announced in 2012 it planned to align its water reporting with the WAF across its global operations, demonstrating that environmental acumen can benefit broader business goals as well.

SMI CSRM
Centre for Social Responsibility in Mining

What is the Centre for Social Responsibility in Mining?

The Centre for Social Responsibility in Mining (CSRM) works with industry, communities and governments to improve social performance and deliver better outcomes for all mining stakeholders. CSRM has developed a unique team of anthropologists, sociologists, economists, natural resource specialists, political scientists, engineers and technical specialists who are committed to bridging the divide between technical, physical and social sciences.

2012 Report

The appointment of Professor Saleem Ali as Director in mid-2012 resulted in a significant diversification of CSRM research. The Centre now covers a broader range of development challenges in extractive economies that, combined with a renewed focus on research publication productivity, has resulted in the establishment of new funding sources including development donors and international aid agencies.

In 2012 CSRM established the Indigenous Enterprise Initiative in partnership with the United Nations University. This collaboration focuses on building Indigenous economic and employment opportunities within Australian communities impacted by the resources sector. Investigations into procurement practices; detailed analysis of local economies and demographic trends; and addressing business governance challenges are included in the program of activities.

Additionally, CSRM is leading the NextMine project *Rare Earth Minerals: Systems Solutions to Supply Constraints*. This project, in collaboration with the Julius Kruttschnitt Mineral Research Centre, the WH Bryan Mining and Geology Research Centre and the Centre for Mined Land Rehabilitation, will investigate ways to introduce an industrial ecological approach to the rare earth supply chain through engagement with the mining sector.

Late 2012 saw the completion of the CSIRO Mineral Futures Collaboration Cluster project, which investigated the social implications of resource industry automation and identified technology benefits that could be distributed amongst the broader community. A number of CSRM publications developed through the research have formed the basis for discussion in the lead up to the 2013 Australian federal election.

Further, CSRM celebrated the fifth anniversary of its Graduate Certificate in Community Relations. The program graduated its 200th student in 2012, enabling community relations professionals to put their CSRM learnings into practice in the resources industry across the globe.

SMI CMLR
Centre for Mined Land Rehabilitation

What is the Centre for Mined Land Rehabilitation?

The Centre for Mined Land Rehabilitation (CMLR) addresses the minerals industry's environmental challenges with quality science and translates research outcomes into practices that lead to continual improvement of rehabilitation and the protection of environmental values. CMLR's focus is preventing, minimising and remediating mining environmental impacts by providing research, education and professional development in the sustainability area and engaging with community, government and industry globally.

2012 Report

As the second oldest SMI research centre, CMLR has its roots firmly in delivering excellence in environmental research, education and awareness to the global minerals industry.

In 2012 CMLR researchers discovered 30 nickel hyperaccumulator plants in Borneo, including some of the strongest known to date. Separately, CMLR partnered with Skycam NZ to develop a customised Unmanned Aerial Vehicle flight platform, which will expand sensor options to collect images and data when monitoring impacts and rehabilitation.

On the eve of CMLR's 20th anniversary in 2013, the Centre demonstrated its progressive nature by undertaking a number of projects in emerging areas. Funded by Xstrata Copper, researchers have identified options and requirements that are contributing to the closure planning of the Mt Isa tailings storage facility. This involved prediction of seepage chemistry and understanding the environmental constraints of building an effective root zone for establishing native plant ecosystems.

The Centre also strengthened a partnership with Centennial Coal to conduct environmental and ecological research to improve understanding of risks and controls associated with longwall underground coal mining in the Newnes Plateau swamp communities.

CMLR is committed to developing solutions that have a positive outcome for the ecological communities potentially impacted by the resources sector. In 2012 it co-hosted the inaugural Life-of-Mine International Conference with the Australasian Institute of Mining and Metallurgy (AusIMM), attended by more than 220 industry, government, academic and consultancy delegates from 21 countries. Through this engagement, CMLR further cemented its position as a world leading research organisation as it plans for its next decade of operation.

SMI CCSG
Centre for Coal Seam Gas

What is the Centre for Coal Seam Gas?

The Centre for Coal Seam Gas (CCSG) draws together the research capabilities of The University of Queensland, which has been conducting research into coal seam gas for almost two decades. CCSG has four key research areas: water, geoscience, petroleum engineering and social impact, as well as a focus on education programs.

The Centre supports leading practice policy development and will enable Australia to become the primary source of new knowledge, technology and skilled graduates for the industry as it develops worldwide. CCSG aims to be the world leader in coal seam gas research within a decade.

2012 Report

2012 was the foundation year for the Centre for Coal Seam Gas, following its launch in late 2011. Developing a research portfolio, recruiting key research leaders and cementing strong governance and procedural frameworks were priorities for 2012, against a backdrop of conflicting views about the coal seam gas industry.

The Centre undertakes research that improves industry practice, addresses community concern and informs government policy. In 2012 four core research projects commenced: identifying and stimulating low permeability coals; managing solids production in gas wells; assessing and tracking cumulative socio-economic impacts; and managing research integrity and governance in a contentious policy arena. The Centre uses a collaborative research model, with all projects involving researchers from multiple UQ Schools and Centres. This will extend to national and international institutions during 2013.

Assoc. Professor Will Rifkin was appointed as the Chair in Social Performance in May 2012. He leads the cumulative socio-economic impacts research and manages research development activities in the diverse social arena. He has been instrumental in establishing the Gasfields Social Scientist Network to improve collaboration, develop strategies to decrease community consultation fatigue, and build researcher capacity in Queensland and New South Wales.

The Centre supports the new Master of Science in Petroleum Engineering offered by the UQ School of Chemical Engineering in partnership with the world-leading Institute of Petroleum Engineering at Heriot-Watt University, UK. The course aims to meet the growing demand for highly skilled oil and gas professionals in eastern Australia and globally.

SMI NextMine™
Innovation Through Connection

SMI NextWorkforce™
Professional development
for a sustainable future

What are NextMine and NextWorkforce?

NextMine™ is the transformational strategic initiative through which the Sustainable Minerals Institute will assist the minerals industry to address major challenges that have the potential to limit the responsible development of the sector. NextWorkforce™ is the complimentary training program that will enable industry professionals to meet the challenges facing the industry.

Deputy Director – Integration Professor David Brereton is leading the NextMine™ and NextWorkforce™ initiatives.

2012 Report

Across the minerals industry globally a number of major challenges are emerging for which there are no off-the-shelf solutions and the way forward is not always clear. Examples include:

- Deeper and lower-grade ore bodies
- Dealing with growing volumes of waste
- Difficulties in obtaining social and community acceptance of mining activities
- Geopolitical complexities in emerging mining regions
- Limitations on the availability and affordability of water and energy for mining and mineral processing
- Environmental impacts of mining activities and mine legacy planning.

Through the NextMine™ initiative, SMI is bringing its globally unique discipline breadth to these challenges. By working together across disciplines, SMI's collective knowledge and expertise will assist in the identification of new approaches to deliver step-wise, real-world improvements.

NextMine's™ focus is not just on new technologies, but also on the more effective utilisation of existing technology through better linkages between business functions, across the different stages of the mining process, and between mines and other stakeholders in the spatial environment.

SMI is using internal funding to seed projects under the NextMine™ umbrella with the aim of demonstrating that a connected approach is an effective way of addressing major challenges and opportunities faced by the industry.

ACCESSING SMI'S INTELLECTUAL PROPERTY

JKTech Pty Ltd strives to deliver economic and social value to the global resources industry for the benefit of The University of Queensland by providing products and services in all areas of the life-of-mine cycle including geology, mining, mineral processing, sustainability and social responsibility. As the technology transfer company for the Sustainable Minerals Institute, JKTech has access to cutting edge research outcomes. This association has led to many industry-leading innovations, such as JKTech's Social Responsibility expertise that draws directly on the latest research from CSRM and JKTech's Risk Management Services, incorporating the 'game-changing' safety outcomes from MISHC.

Office Launches in South America and Africa.

The 2012 establishment of a permanent office with training facilities in Johannesburg, South Africa, comes with the rapidly growing industry awareness and demand of the Global Minerals Industry Risk Management (G-MIRM) programs. JK Africa Mining Solutions (Pty) Ltd facilitates the delivery of the G-MIRM program to African based clients such as AngloGold Ashanti and Exxaro, along with offering JKTech's full suite of capabilities. JKTech's long-standing relationship with MPTech and the Chemical Engineering Department at the University of Cape Town will continue with MPTech remaining as JKTech's representative in relation to JKSimMet and JKSimFloat.

2012 also saw the opening of JKTech South America SpA – JKTech's office in Santiago, Chile. New projects with mining companies such as Barrick, Freeport McMoran, Antofagasta Minerals and BHP Billiton have been approved and there is a strong potential for continued growth in the region.

Social Responsibility in Malaysia

In 2012 JKTech's Social Responsibility team, in collaboration with the Centre for Social Responsibility in Mining, completed a socioeconomic diagnosis for Vale in Malaysia under the leadership of Dr Cath Pattenden.

Vale is constructing an iron ore distribution centre on the West Coast of the Malay Peninsula with completion scheduled for mid-2014. It is one of Malaysia's largest foreign direct investment projects to date and represents a long-term commitment by Vale to the region and the local communities. The communities in this case included small-scale fishermen and fisherwomen, small business owners and tourism entrepreneurs, local residents and service delivery enterprises. The socioeconomic diagnosis was well received by Vale, with further work secured for this project.

MetSkill®

JKTech launched a unique professional development program, MetSkill®, which was delivered to a total of 39 early-career metallurgists from Newcrest Mining, Barrick Gold Corporation and the Minerals and Metals Group. Throughout the year these young metallurgists participated in workshops, site surveys and site-based projects designed to improve their job skills, facilitated by SMI Knowledge Transfer (SMIKT), JKTech's training and professional development arm.

MetSkill® Telfer Plant Survey Team (March 2012)

SMIKT integrated the project sessions with specialist workshops on topics such as process mineralogy, gold metallurgy, flotation and comminution, and Newcrest took the opportunity to add a couple of sessions presented by their own specialists in process control, mineralogy and process optimisation.

JKRBT® Delivered in Lonmin

In April JKTech delivered a JK Rotary Breakage Tester® (JKRBT) to the new laboratory facilities in Marikana of South African platinum producer Lonmin. The JKRBT rapidly generates highly repeatable ore impact breakage data for use in the design of AG/SAG mills and crushers for new projects or for existing plant optimisation projects. JKRBT data also has value for geometallurgical applications such as contributing to resource valuation and mine planning.

JKTech specialist, Dr Steve Larbi-Bram, travelled to South Africa to commission the JKRBT and deliver specialist training in the device's operation and maintenance, the accompanying JKRBT software as well as all aspects of conducting the JK Rotary Breakage Test.

STUDENTS

Research Higher Degree Graduates

Education programs offered through SMI are recognised internationally for their rigorousness and relevance for mining professionals. In 2012, 10 SMI Research Higher Degree students graduated.

Dr Grant Ballantyne – Julius Kruttschnitt Mineral Research Centre
Application of Dielectrophoresis to Mineral Processing

Dr Anastasia Danoucaras – Julius Kruttschnitt Mineral Research Centre
Property-Based Modelling at Fixed Chemistry: The use of a back-calculated induction time for predicting recoveries in flotation

Dr Richard Hartner – Julius Kruttschnitt Mineral Research Centre
Integration and analysis of optical and MLA-based microscopy for optimisation of geometallurgical modelling and ore deposit characterisation

Dr Vladimir Jokovic – Julius Kruttschnitt Mineral Research Centre
Microwave processing of minerals

Mr Vinod Nath – Centre for Mined Land Rehabilitation
Investigation of poor vegetation establishment by comparison of two topsoils used in rehabilitation after sand mining

Dr Tam Pham – Julius Kruttschnitt Mineral Research Centre
Modelling of Breakage Phenomena in Rocks: Mathematical formulations and discrete element modelling of elastic and physical properties, fracture mechanism and mineral processing comminution applications

Dr Vladimir Rizmanoski – Julius Kruttschnitt Mineral Research Centre
The Effect of Microwave Heating on Ore Sorting

Dr Reyhaneh Hosseini Tabatabaei – Julius Kruttschnitt Mineral Research Centre
The Causes for the Poor Flotation Performance of a Double-Refractory Gold Ore

Dr Erico Tabosa – Julius Kruttschnitt Mineral Research Centre
The effect of cell hydrodynamics on flotation kinetics

Dr Hao-Liang Wang – Julius Kruttschnitt Mineral Research Centre
Use of High Voltage Pulses to investigate and optimize the mechanisms of mineral breakage and selective liberation

STUDENT AWARDS

Alumnus Awarded

JKMRC alumnus Erico Tabosa received one of 10 Young Author Awards at the 26th International Mineral Processing Congress in recognition for his contribution to the field of mineral processing.

Dr Tabosa, who graduated from JKMRC in April 2012 and now works for Metso Process Technology and Innovation, received the prize for his paper *Development and application of a technique for evaluating turbulence in a flotation cell*. The paper detailed his work in eco-efficient mining and processing, which formed part of his PhD research.

"The IMPC is considered the most important international event for the Mineral Processing discipline – some call it our 'Olympics' – with each congress taking on a strong flavour of the organising country. This year was no exception in India," explained Professor Dee Bradshaw.

"Part of the event is to acknowledge and honour contributions. JKMRC is proud to have a history of recognition at this event and 2012 proved no different."

Rewarding Research

JKMRC's Dr Grant Ballantyne completed his PhD in November 2012 – and received double reward for his efforts.

Dr Ballantyne was awarded the 2011 Zinifex Prize for the most outstanding postgraduate thesis in mineral processing and extractive metallurgy at UQ for his paper entitled *Application of Dielectrophoresis to Mineral Processing*.

He was also named the 22nd winner of the Ian Morley Prize, which acknowledges the best overall performance and achievements of a JKMRC postgraduate student.

Students Tackle Sustainable Transitions

SMI students gathered at Customs House in late November for the fourth Annual RHD Conference.

This year's theme, *Sustainable Transitions for the Future Mining Industry*, gave students the opportunity to showcase their research, as well as learn about industry developments.

Dan Hunt, Director-General, Queensland Department of Natural Resources and Mines and Bernie O'Neill, General Manager Newlands Coal, Xstrata Coal Queensland addressed how they believed the minerals sector would change in the future.

"I think the speakers provided great insight as to where the industry will be in the coming years and also allowed students to think about this with respect to their area of expertise," said Angela Werner, CWiMI/MISHC RHD student.

AWARDS

Professor Gideon Chitombo

The metalliferous mining industry is moving rapidly into a new and potentially much higher risk investment territory as 'easy' and near surface ore bodies with relatively high grades are consumed.

Given the continued demand for metals such as copper, molybdenum and gold, the industry must find new ways to cost effectively mine much lower grades at significantly greater depths and, in some cases, in very high temperature rock environments. Simultaneously, the industry needs to be cognisant of license to operate issues including environmental and surface impacts, energy and water management, and community impacts.

In June the Australian Academy of Technological Sciences and Engineering (ATSE) acknowledged Professor Chitombo's research into the future of mass mining methods with the prestigious Clunies Ross Award.

The Award recognised his work enabling the industry to meet the future demands for minerals given the new challenges it is facing.

> "I am driven by a desire to prepare the resources industry for a future in which minerals will not be as easily accessible and we need to work harder to extract them," Professor Chitombo said.

Established in 1991, the ATSE Clunies Ross Award promotes the development of science and technology in Australia's interest.

"Gideon's research has been fundamental in improving the efficiency of the mining industry, both in Australia and overseas. He is worthy of this recognition of his research," said BRC Director Professor Margie Scott.

In recent years, the focus of Professor Chitombo's research has moved from a purely production focus to one that also considers sustainability issues such as water conservation, energy consumption, rehabilitation and social responsibility.

"There is still a lot of work to do in this area but, with on-going support, we can make the minerals industry more sustainable, which will be to everyone's benefit," he said.

Professor Tim Napier-Munn

In early 2012 the Australasian Institute of Mining and Metallurgy presented JKMRC's Professor Tim Napier-Munn with the annual President's Award.

The award recognised Professor Napier-Munn's strong record in research leadership and management, as well as his commitment to the commercialisation of research outcomes throughout his career.

The citation read: "Tim has a proven ability to conceive research projects, secure industry support and manage the projects to completion. He has made extensive contributions to the development of mineral processing through research, publications, presentations and consultancy."

Professor Napier-Munn was acknowledged as having been an active member of AusIMM since he joined as a Fellow in 1985.

Dr Daniel Franks

CSRM's Dr Daniel Franks received one of eight 2012 UQ Foundation Research Excellence Awards for his research into sustainable development in the resources sector.

Dr Franks secured $81,000 to critically reflect on how the resources sector is addressing the challenges of sustainable development, and the role of communities, civil society, government and industry sustainability professionals. He will use the funds to support the writing of a book, to be published by Earthscan.

"By drawing on insights from change makers working both inside and outside the industry, the research will help us identify what has worked and to develop new approaches to improve the environmental and social outcomes from mining," Dr Franks said.

UQ Deputy Vice-Chancellor (Research) Professor Alan Lawson added: "By encouraging young innovators to continue careers in research, we help Australia foster the talent that will contribute to addressing global problems."

Bob Bryan

Bob Bryan has been recognised by the Queensland Resources Council (QRC) for his long and outstanding contribution to the State's mineral and energy development. Mr Bryan was one of SMI's first supporters and long-term advisers, and is currently a BRC Advisory Board member.

In accepting the QRC Medal Mr Bryan, who is known as the father of coal seam gas, said: "This is a tremendous honour and privilege that the QRC has bestowed on me. Any success that I have had is a result of focus, determination and a bit of luck to go with it. I have had a 40 year journey in this industry – it has been exciting and tremendously satisfying and I am so grateful for that."

Mr Bryan provided the initial funding to establish the BRC in 1991 in honour of his late father, who was Professor of Geology at The University of Queensland.

> "Mining and education are close to Bob's heart. He believes that innovation is essential for the industry to prosper and that creative thinking and research are crucial components," BRC Director Professor Margie Scott said.

"For him, advancing at BRC is about the imminent challenge of resource replenishment – getting more from existing operations and being able to progress the new frontier of deeper large scale mining. I congratulate Bob on this achievement."

It was a big year for Mr Bryan, who was named a Member in the General Division in the 2012 Australia Day Honours Awards. Mr Bryan was recognised for his service to the mining industry and to the community through philanthropic contributions to the arts, and heritage and educational organisations.

PROFESSIONAL SERVICE

Professor David Brereton

Memorandum of Understanding on Indigenous Participation in the Resources Sector Steering Committee, *Member*

Professor Robin Burgess-Limerick

Ergonomics Open Journal, *Editorial Advisory Board and Guest Editor Human Factors in Ergonomics for the Minerals Industry*
Human Factors and Ergonomics Society of Australia Inc, *Minerals Industry Special Interest Group Chair*
International Ergonomics Association, *Mining Technical Committee Chair*
International Ergonomics Association Melbourne 2015 Congress, *Organising Committee Member*

Professor Gideon Chitombo

I2 Mine (Innovative Technologies and Concepts for the Intelligent Deep Mine of the Future), *Advisory Board Member*

Professor David Cliff

Australian OHS Education Accreditation Board, *Academic Representative*
National Research Council Board on Human Systems Integration's Mine Safety: Essential Components of Self-Escape, *Member*
Queensland Underground Coal Mines, *Organising Committee Member for level one emergency simulation exercises*
Safety in Mines Testing and Research Station Advisory Board, *External Board Member*
Technical Steering Committee for the Coal Mining Abatement Technology Support Program, *Alternate Member*
OHSSc Program Advisory, *Committee Member*

Mr Robin Evans

AusIMM Sustainability Committee, *Member*

Dr Daniel Franks

United Nations Sustainable Development Solutions Network, Good Governance of Extractive and Land Resources Thematic Group, *Member*
International Association of Impact Assessment, *Co-Chair Social Impact Assessment*
Mining Business School, Universidad Católica del Norte, Chile, *Adjunct Professor*
International Conference on Social Responsibility in Mining, 2013, *Technical Committee*
International Symposium on Resettlement and Livelihoods, 2014, *Program Committee*

International Journal of Minerals Policy and Economics (Resources Policy), *Editorial Board Member and Guest Editor*
Asia Pacific Centre for the Responsibility to Protect, *Honorary Fellow*

Dr Deanna Kemp
Expert Review Panel for IPIECA (the oil and gas industry body for environmental and social issues) on the integration of human rights into Environmental, Social and Health Impact Assessment processes, *Member*
Expert Review Panel for the International Council of Mining and Metals New Member Review Process, *Member*
Expert Advisory Panel for the Responsible Jewellery Council, *Member*

Dr Gul Kizil
Society for Risk Analysis International and Australia and New Zealand regional membership, *Member*
Australasian Institute of Mining and Metallurgy (AUSIMM), *Member*

Ms Sue Leveritt
Simulation Australia, *Member*
Human Factors/Learning and Development Division of Simulation Australia, *Committee Member*

Professor Chris Moran
Expert Panel for Major Coal Seam Gas Projects, *Member*
Healthy Head Waters Coal Seam Gas Water Feasibility Study, *Advisor*
Interim Independent Expert Scientific Committee for Coal Seam Gas and Large Coal Mines, *Member*
Mine Water and Environment, *Associate Editor*
National Groundwater Technical Advisory Committee, *Member*
Resources Sector Supplier Advisory Forum, *Member*
Underground Coal Gasification Independent Scientific Expert Panel, *Chair*

Assoc. Professor Andrew Morrell
Coal Mining Abatement Technology Support Program, *Technical Steering Committee Member*

Professor David Mulligan
Bowen Abbot Point Community Consultation Group, *Chair*
Alligator Rivers Region Technical Committee, *Member*

Mr Cristian Parra
International Seminar on Social Responsibility in Mining Chile 2013, *Technical Committee*

Assoc. Professor Will Rifkin
Commonwealth Office of Learning and Teaching, *National Assessor for teaching awards*
Science and Mathematics Network of Australian University Educators, *Steering Committee Member (and Executive Manager)*

Professor Margaretha Scott
Queensland Exploration Council, *Academic Working Group - Member*
International Symposium on Mineral Exploration (an international activity run by the Division of Exploration Technology in Mining and Materials Processing Institute of Japan), *Organising Committee Member*

Assoc. Professor Sue Vink
Healthy Headwater Coal Seam Gas Water Feasibility Study, *Advisor*
Fitzroy Basin Association Partnership for River Health Science Panel, *Member*
Queensland Resource Council Water Group, *Science Advisor*

Coal Seam Gas water use proposals in the Queensland Murray-Darling Basin: Impacts on aquatic ecosystems, *Steering Committee Member*

Professor Rodney Wolff

Applied Stochastic Models in Business and Industry, *Editorial Board*
Computational Statistics, *Editorial Board*

Dr Alan Woodley

Minerals Council of Australia Water Working Group, *Member*

PUBLICATIONS

SMI BRC
WH Bryan Mining & Geology Research Centre

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Gavin Lind, Minerals Council of Australia
Mark Thompson, Newcrest Mining
Paul Harrison, QLD Dept of Mines and Energy
Paul Dewar, Rio Tinto Bauxite and Alumina

FINANCIAL STATEMENT

Income and Expenditure Statement

January 2012 to December 2012

Revenue	End of Year Actuals $
University	10,463,412
Research and Consulting	27,572,377
Other	5,907,595
Total Revenue	43,943,384
Expenditure	
Salaries	25,296,824
Non Salary	16,019,906
University Corporate Overheads	3,737,515
Total Expenditure	45,054,245
Operating Surplus/(Deficit)*	**(1,110,861)**

SMI Funding	%
Industry	58%
Research Funding Bodies (eg CRC ORE, CSIRO, AMIRA)	14%
Government	11%
Non-Government Organisations	8%
Industry Bodies (eg ACARP, MCA, QRC)	8%
Other Industry	1%

SMI Top 10 Company Contributors 2012	% of Total Revenue
Rio Tinto	7%
QGC	7%
Xstrata	5%
Anglo American	3%
Newmont Mining Corporation	3%
Arrow Energy	3%
Santos	3%
Alcan Gove	3%
Sibelco Australia	2%
Metso Minerals (Australia)	2%

** Deficit is due to research project revenue expected in 2012 now due to be received in 2013.*

University of Queensland Research and Innovation (UQRI) defines research as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.

Activities that do not meet the UQRI definition of research are considered consulting. Other revenue sources refer to those not covered by the above categories and include trading revenue and membership fees.