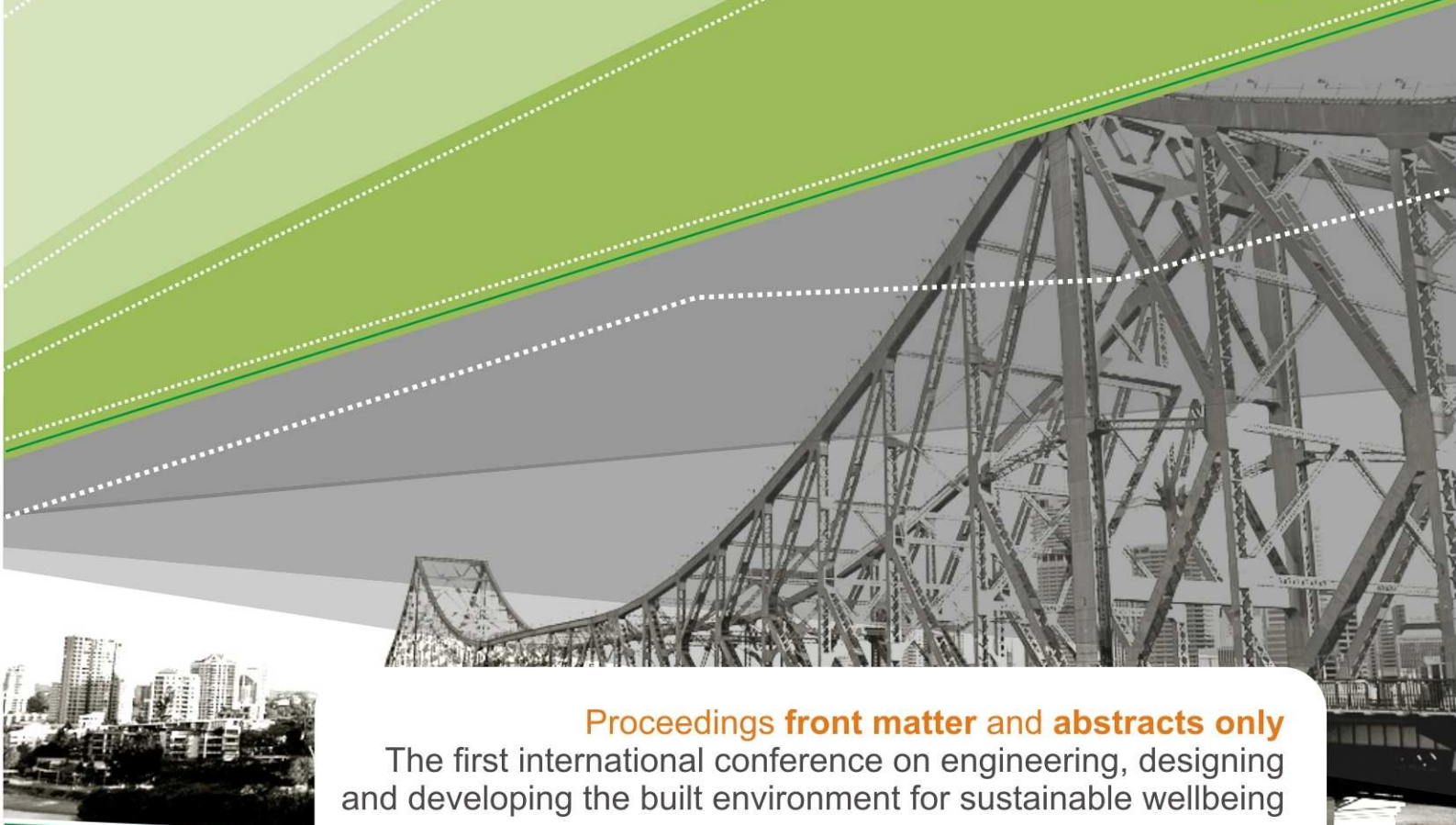


eddBE2011

sustainable wellbeing



Proceedings front matter and abstracts only

The first international conference on engineering, designing and developing the built environment for sustainable wellbeing

April 2011

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FACULTY OF BUILT ENVIRONMENT AND ENGINEERING
BRISBANE, AUSTRALIA

EDITED BY CRAIG J. L. COWLED
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**PROCEEDINGS OF THE
FIRST INTERNATIONAL POSTGRADUATE CONFERENCE
ON
ENGINEERING, DESIGNING AND DEVELOPING
THE BUILT ENVIRONMENT FOR SUSTAINABLE WELLBEING**

Edited by
Craig J.L. Cowled, Queensland University of Technology

eddBE2011 Proceedings

Proceedings of the first international postgraduate conference on engineering, designing and developing the built environment for sustainable wellbeing

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eddBE2011, originally planned to occur 7-10 February, 2011, was postponed as a result of disastrous flooding. The conference was held on 27-29 April, 2011, at the Gardens Point Campus of Queensland University of Technology, Brisbane, Australia.

Faculty of Built Environment and Engineering

Queensland University of Technology

2 George Street

Brisbane QLD

Australia 4000

Phone: +61 7 3138 1433

Fax: +61 7 3138 7701

Email: bee@qut.edu.au

Web: <http://www.bee.qut.edu.au>

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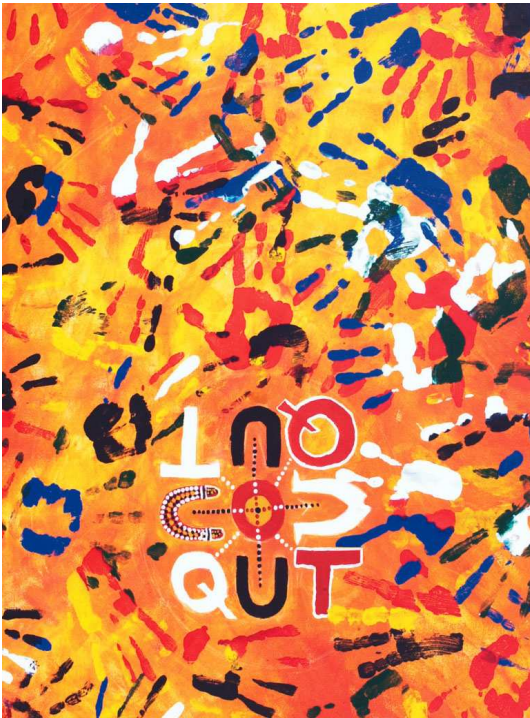
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QUT's goals of teaching and learning, research and community service, and its other activities, are all conducted in the spirit of reconciliation. For more information on QUT's commitment to Reconciliation and the practical steps QUT is making to facilitate Reconciliation, please visit the reconciliation website <http://www.reconciliation.qut.edu.au/>

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FOREWORD



Prof. Martin Betts

Executive Dean,
Faculty of Built Environment and Engineering,
Queensland University of Technology

Welcome to the inaugural Postgraduate Student Conference in the Faculty of Built Environment and Engineering. This conference, the theme of which is Sustainable Wellbeing, addresses an important issue of our time which will impact on all of us as researchers. The challenge for the future is to devise appropriate engineering and urban design systems to meet the emerging needs of society. We hope that this conference embeds in you the philosophy of sustainability in innovation to which QUT is committed.

Queensland University of Technology (QUT) is a highly successful Australian university with an applied emphasis in courses and research, with 40,000 students, including 6,000 from overseas, and an annual budget of more than AU\$500 million.

QUT has recently been acknowledged for its world-class research in the Excellence in Research for Australia (ERA) 2010 National Report by the Australian Research Council. The ERA initiative assessed research quality within Australia's higher education providers using a combination of indicators reviewed by internationally recognised experts. In a ratings table compiled by *The Australian*, QUT was ranked among the Top 10 Australian Universities.

The Faculty of Built Environment and Engineering is a major contributor to QUT's research and has enthusiastically embraced the challenge of increasing the quality and quantity of its research outputs in order to grow its research programs, strengthen its disciplinary areas and build capacity in areas of focus that are linked to national priorities. These focus areas of research are Aviation, Energy, Orthopaedics, Intelligent Transport and Complex Urban Systems Design. All areas are underpinned in part by computational modelling and visualisation techniques developed collaboratively within the research groups.

A key characteristic of our programs is collaboration. As part of this, we seek partnerships with industry, with other universities and with institutions, both within Australia and internationally. This conference provides the opportunity for further collaboration among you as postgraduate students, peers and supervisors, both at your respective Universities and QUT. I encourage you to use this opportunity to build your own ideas and directions, visit our facilities and get to know more about research in this Faculty, this institution and within the wider Australian research environment.

My thanks to our sponsors for their moral and financial support of this conference, and I encourage you to take the opportunity to meet with them.

I wish all a successful and enjoyable few days as you share knowledge, experience and build relationships.

Professor Martin Betts
Executive Dean
Faculty of Built Environment and Engineering
Queensland University of Technology

BIOGRAPHY:

Martin Betts's research activities and interests embrace: strategic management in construction, construction IT, construction project management, built environment and engineering education and construction futures. He has been directly involved in research projects funded to over UK£1.5 million. He has personally been responsible for obtaining career research funding from external sources of more than UK£3.5 million. Martin has also received AU\$415,000 in funding from the Cooperative Research Centre for Integrated Engineering Asset Management (CR CIEAM) for developing an Integrated Information Model for Community Infrastructure and Asset Management.

Martin is part of an award winning community engagement and research partnership with the Brisbane Airport Corporation which was recognised with the BHERT award of Australia's leading research and development collaboration. Martin has helped secure external funding for research chairs from: Queensland Health, Robert Bird Group, Queensland Rail, Queensland Department of Transport and Main Roads, Queensland Major Contractors Association, the Power Engineering Alliance, the Concrete Masonry Association of Australia and Brisbane Airport Corporation.

Martin has been working in his current role at QUT for eight years, following ten years at the University of Salford as a Senior Lecturer (three years) and Professor (seven years), and five years at the National University of Singapore as a Lecturer (three years) and Senior Lecturer (two years).

PREFACE

Welcome to the inaugural annual international postgraduate conference on **engineering, designing and developing** the built environment for **sustainable wellbeing**. The conference is proudly hosted by the Faculty of Built Environment and Engineering (BEE), Queensland University of Technology (QUT) and has been organised by a student committee.

Previous postgraduate conferences in BEE QUT have been organised around the individual research themes of Design, Infrastructure, Medical Engineering and Smart Systems. The most recent conferences in each of those themes were:

- Design Theme Postgraduate Student Conference: Diversity and Innovation, Sept 10, 2008;
- The Second Infrastructure Theme Postgraduate Conference, March 26, 2009;
- The Third Smart Systems Postgraduate Student Conference, October 16, 2009; and
- IHBI Inspires Postgraduate Student Conference 2010, November 25-26, 2010.
 - Please note that the annual “*IHBI Inspires*” conferences are organised by the Institute of Health and Biomedical Innovation at Queensland University of Technology and provide a forum for BEE postgraduate students in the former Medical Engineering research theme to present their work, as well as researchers from the Faculty of Health and the Faculty of Science and Technology. The “*IHBI Inspires*” conferences will continue to be held separately to the **eddBE** conferences. The next scheduled event is “*IHBI Inspires* Postgraduate Student Conference 2011”, to be held at the Royal on the Park, Brisbane, November 24-25, 2011.

eddBE2011 has emerged from the closure of the research themes in 2010 and provides a unique opportunity for postgraduate students from around the world and across a broad range of disciplines to:

- have their work peer reviewed by an outstanding panel of experts;
- present their work to other researchers;
- forge links with future leaders; and
- discover the work being done by researchers in your discipline and other disciplines as well.

In time, it is our hope to see **eddBE** conferences recognised throughout the world as a forum where inspired and innovative postgraduate researchers meet to proudly present their novel work.

As these proceedings were being prepared for publication, the host city of Brisbane was under threat of floodwaters and 75% of Queensland had been declared a disaster zone. QUT was shut down and communications were severely affected. Some members of the organising committee were displaced from their homes by the threat of rising water and no doubt many of the presenters and delegates of this conference were also affected by the floods. Our thoughts are with all those presenters and delegates who have been affected by the floods, particularly those from Toowoomba where some of the worst flash flooding and loss of life occurred.

(Ed. The January 2011 flooding in South East Queensland resulted in shocking loss of life as well as significant damage to property. Regrettably, the flooding caused damage to the planned venue of the eddBE2011 conference and also led to the disruption of supporting services that were required for the successful operation of the event. As such, the organising committee was forced to postpone the event until 27-29 April, 2011. We apologise sincerely for any inconvenience caused.)

Whether this flooding is a sign of the changing climate or not, sustainability is an issue which must be addressed by Engineers, Designers and Developers in the planning, designing and delivery of all aspects of the built environment. Solutions that balance the needs of the present with the needs of future generations are expected of Engineers, Designers and Developers and it is the work of researchers to provide sustainable solutions that make a positive difference in people’s lives. **eddBE2011** gives researchers a platform to demonstrate how their **sustainable** solutions will improve **wellbeing** for people.

Due to the broad range of disciplines represented at this conference, the papers have been divided into four sub-themes:

- Design, Practice, People and Systems;
- Energy, Environment and Sustainability;
- Infrastructure, Transport and Urban Development; and
- Smart and Intelligent Systems.

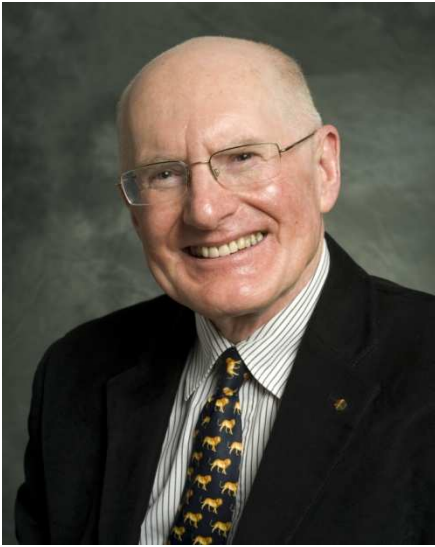
In addition to the papers being presented at this event, other highlights include Keynote Addresses from Adj. Prof. David Hood (Incoming National President, Engineers Australia, Adjunct Professor, Faculty of BEE, QUT, & Chairman, David A Hood & Associates Pty. Ltd.) and Mr. Stephen Dewar (Generation Technical Services Manager, Ergon Energy) and a Plenary Address from Prof. Acram Taji (Director International Graduate Research, QUT). There will be a poster competition as well as best paper and best presentation prizes. Social events include Welcome Drinks and a Buffet Dinner at Old Government House.

The student organising committee has worked very hard to ensure that this conference will be a success and that authors will be proud to see their work published in these proceedings.

The **eddBE2011** organising committee

Craig Cowled, Rebekah Davis, Gary Garner, David Lowe, Buddhi Wahalathantri, and Thedy Yogasara.

KEYNOTE SPEAKERS



Adj. Prof. David A. Hood

Incoming National President, Engineers Australia
Adjunct Professor,
Faculty of Built Environment and Engineering,
Queensland University of Technology, &
Chairman, David A Hood & Associates Pty. Ltd.

KEYNOTE 1:

CAN THERE BE WELLBEING WITHOUT SUSTAINABILITY?

Adjunct Professor David Hood, a civil and environmental engineer with vast experience across major civil and military projects, professional development in emerging economies, senior management in both the public and private sectors, and in engineering education, will discuss how mainstreaming sustainability is critical if we are to survive as a species.

The design, delivery, and operation of our built environment is currently a heavily polluting, resource depleting, and environmentally damaging activity. Despite government incentives, sustainability rating schemes, and guidelines, we continue to degrade natural and social capital through poor planning, bad design, and operation of buildings and infrastructure that considers only the financial bottom line. This paradigm can and must change. David will address the problems and tease out the need for changed thinking if we are to arrive at possible solutions.

Following a successful career in project management, David took over and commissioned Australia's then New Parliament House in Canberra in the mid 1980s - a life changing career episode. Since that project, David has become increasingly involved in fostering a culture of sustainability across all engineering disciplines, and in the built environment.

BIOGRAPHY:

David Hood is a Chartered Professional Engineer, registered on NPER to practice in civil and environmental engineering. David has over thirty five years experience in business, engineering, education, project management, and senior executive positions in both the public and private sectors.

David graduated in civil engineering from the University of Queensland in 1969, and spent ten years in the Royal Australian Air Force as a Commissioned Officer involved with the planning, development, and construction of RAAF bases throughout Australia. After a further seven years as an airport planner, and Project Director with the Federal Department of Aviation, David was appointed Senior Property Executive with the Parliament of Australia where he was responsible for the take-over and commissioning of Australia's then New Parliament House in Canberra. Following the successful start-up of Parliament House, David moved back to the aviation sector where he managed a number of technology IP commercialisation projects, including the establishment of joint venture companies to develop and market air traffic control related software and other products around the world. David then worked as National Manager Aviation and Defence with Maunsell Pty Ltd, before being appointed National Director Engineering Practice with the Institution of Engineers, Australia where he was responsible for technical standards, registration, and the delivery of the Institution's continuing professional development and education programs.

David was a Founding Director of the Australian Construction Industry Forum (ACIF), and of the Australian Council of Building Design Professions (BDP), and was for six years a Councillor, and for three a Director of Standards Australia International.

David is currently Chairman of his own consulting engineering practice specialising in the areas of sustainability in the built environment, "green projects", energy efficiency policy, engineering education and global engineering infrastructure. David has also directed a number of government and industry funded programs throughout South East Asia and Africa assisting the engineering profession in evolving economies with the development of competency standards and assessment processes, practice registration and education upgrading and accreditation systems. As an investor, Chairman, and Board member David led the successful turnaround of CBD Energy Limited, a small public company involved in energy saving technology and solutions for the property industry.

David is actively involved with industry and professional associations promoting the improved energy performance of buildings. David sits on a number of industry, community and university advisory boards where his extensive engineering background, and considerable involvement at a senior level in the built environment sector is influencing change in the "energy culture" of Australia.

David is an Adjunct Professor in the Faculty of the Built Environment and Engineering at Queensland University of Technology, past Chairman of the Australian College of Environmental Engineers, current Chairman of the Australian Green Infrastructure Council (AGIC), and is past Deputy President of the Australian Sustainable Built Environment Council (ASBEC). David is also an accredited presenter on Al Gore's Climate Project, and lectures widely on climate change and sustainability where his passion entuses others to make a difference and reduce the damage we are inflicting on the earth's systems.

David was elected as a Fellow of the International Society of Engineering Asset Managers in 2010. He was elected Engineers Australia's Deputy National President in November 2010, and will become the 2012 National President in November 2011.



Mr. Stephen Dewar

Manager, Generation Technical Services,
Ergon Energy

KEYNOTE 2:

CHALLENGES OF IMPLEMENTING RENEWABLE ENERGY

Ergon Energy supplies electricity to 97% of Queensland by area. The size and diversity of Ergon Energy's distribution network and generation assets provides unique challenges and opportunities for electricity supply. Ergon Energy has implemented demand and power conservation initiatives and renewable generation technologies.

Electricity supply is a major infrastructure commitment. Sustainable electricity supply in future will need to cater for an adequate response to climate change, higher quality and reliability levels for hi-tech loads, high levels of customer choice and stricter environmental and safety requirements. Ergon Energy has a number of leading edge projects in renewable generation, customer awareness and load profiling to use assets more efficiently.

The future holds many design challenges for electricity suppliers, especially in small isolated systems.

Ergon Energy looks forward to working with the community, industry and educational institutions in meeting these challenges and building its own capacity in this field.

BIOGRAPHY:

Stephen Dewar's diverse and successful career spanning 25 years in engineering, utility infrastructure and asset management has seen him involved in all facets of business management.

Stephen is currently manager of Generation Technical Services. He is an integral part of Ergon Energy's newly created Energy Sustainability & Market Development Group, where he is responsible for the delivery of a wide range of complex and time critical projects.

Stephen is also currently Project Manager on the Windorah Concentrated Solar and Birdsville Geothermal Power Station Projects. He has a unique understanding of the integration of renewable technologies as well as the many challenges associated with deployment throughout mainstream and isolated networks.

PLENARY SPEAKER



Prof. Acram Taji

Director International Graduate Research,
Queensland University of Technology

MY PERSPECTIVE ON MANAGING THE SUPERVISORY PROCESS AND RELATIONSHIP

The sink or swim style of PhD supervision, which was largely characteristic of the time I did my PhD in the 1970s, was neither efficient nor did it produce PhD graduates with appropriate attributes for becoming part of the global workforce. The 21st century model for successful PhD supervision is based on three key elements to build a co-learning relationship between supervisors and PhD students. These aspects are: establishing clear goals—usually framed in terms of finding a researchable question; developing partnerships—by encouraging students to be reflective about the skills and abilities needed to complete the project; and, managing the supervisory process—through regular meetings, writing circles and seminar presentations to provide critiques on progress of the project. Therefore feedback is a critical part of the supervisory relationship and providing feedback is an essential skill, which needs to be learnt and practiced by the supervisors. A key role of a successful supervisor is to promote integration of knowledge and development of higher-order critical thinking and analytical skills in their students.

In this presentation I will provide the audience with my perspective on key elements of successful supervision and managing the supervisory process based on my experience as an international higher degree research (HDR) student in the 1970s in Australia and as supervisor of a large number of HDR students, mostly international students, who completed their PhDs in my laboratory. Many of my former students are now leaders in academia, industry and government organisations around the globe.

BIOGRAPHY:

Acram Taji is a Horticultural Scientist/Crop Physiologist with a Bachelor of Agricultural Science (University Medal) from the University of Tehran, Iran, Graduate Diploma in Horticultural Science from the University of Sydney, PhD in Crop Physiology from Flinders University and a Certificate in Higher Education from Harvard. Acram has taught biology, agronomy, crop physiology, plant biotechnology, horticulture, floriculture and plant biosecurity in a number of universities in Australia, in the University of the South Pacific in Fiji (and its Tonga and the Solomon Islands Centres), the University of Colombo in Sri Lanka, at Osaka Prefecture University and Meiji University in Japan, at University of California-Davis and the University of British Columbia in Canada. She has supervised to completion the research of 45 Higher Degree Research students from 15 countries.

Acram has been the recipient of a number of national and international teaching and research excellence awards including the Australian Society for Plant Propagators' Medal, Japanese Prime Minister Senior Fellowship for foreign specialists, the Australian Award for University Teaching, the Australian Society of Plant Physiologists' Prize, the Australian College of Educators Quality Teaching Award, the International Association for Plant Tissue Culture and Biotechnology's Research Excellence Award, Flinders University Distinguished Alumni, Iranian government highest award of excellence in Science and Technology, International Society for Horticultural Science's Medal of Distinction and the Distinguished Professor Fellowship Meiji University in Japan.

Acram's research focuses on plant growth and development, *in vitro* propagation, and pollination biology and seed set of Australian native plant species. She is also involved in tissue culture for conservation of rare and endangered plants as well as the development of native plant species for floriculture using *in vitro* breeding techniques. She is the author of over 200 articles and the author or editor of 8 books, mostly in the area of plant tissue culture and *in vitro* plant breeding. To date her book "Plant Tissue Culture Practice" has sold over 10,000 copies (translated into Farsi, Indonesian and Arabic) and her video/ DVD "Basic Plant Tissue Culture" has sold over 1000 copies in 62 countries and dubbed into 4 languages (Farsi, Portuguese, Spanish and Arabic). The proceeds and royalties of her books are used to support postgraduate students' research activities.

Acram's administrative positions have seen her served as the Deputy Chair of the Academic Board, Dean of Studies, Vice-Dean of Rural Science and Agriculture, Program Coordinator for International students, Deputy Dean in the Faculty of Sciences, Head of the School of Rural Science, Faculty of the Sciences International Coordinator and the Associate Dean (Teaching and Learning). At present she works as the Director of International Graduate Research at Queensland University of Technology (QUT) in Australia where she oversees all activities with respect to recruitment, admission, progression, educational experience and graduation of international higher degree research students across QUT. Acram is a highly experienced university educator who is passionate about good educational experience for students. Her philosophy underpins her teaching and research. She believes that education is not just about job skills but is about: teaching people to be good global citizens; building cohesive societies; and caring for the environment and for each other.

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