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Editors

Sustainable Ecological Engineering Design

Selected Proceedings from the International Conference of Sustainable Ecological Engineering Design for Society (SEEDS)

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Preface

The issue of sustainable development, using our planet's resources, and the current approach and policies we have adopted over the past decades have far-reaching impact not only on the current generation but also on many future generations to come. The debate about a measured and well-planned set of global policies in developing our societies is no longer just at the heart of the forums of interested academic institutions and researchers but at the forefront of decision and policy maker's agenda across the globe.

While it is ironic that we still have those voices around that deny our history of deliberate and destructive impact on our environment over the past centuries, it is also refreshing that the weight of public opinion has forced significant changes in government behaviours across the world. Three weeks after we held the SEED conference here in Leeds, more than 150 world leaders attended the "UN Sustainable Development Summit" during 25–27 September 2015 at UN headquarters in New York to discuss the challenges faced by our planet, the fast disappearing natural resources, the unchecked and unplanned urbanisations and also to formally adopt an ambitious new sustainable development agenda for 2030. Calling it: "Transforming our world: the 2030 Agenda for Sustainable Development", the UN general assembly meeting clearly stated that the "*agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development.*"

It is generally accepted that the built environment has a greater impact on natural resources and produces more waste than any other industry. However, beyond the green rhetoric, research is being applied on the ground to address the balance between the built and natural environment.

Industrious endeavours mean that the capability to harness and shape resources for our needs has never been so great, but with this comes the capability to exert considerable change to the surroundings we inhabit and, importantly an increasing responsibility to ensure the ecosystem that supports us is sustained. As we increase

in our requirements and impact on the planet extra care is required to ensure that the demands of today don't have a negative impact on the generations of tomorrow, and especially the aspect of the ecosystem that humans have come to enjoy. Through research and innovation, progress is balanced against the need to sustain the planet and key fundamental resources.

There is a growing concern with regard to how we balance the formed built environment against the natural environment, so that order in the ecosystem is sustained.

The SEEDS Conference

The aim of the International SEEDS Conference is to foster ideas, through research and proven practice, on how to reduce negative impacts on the environment while providing for the health of society. The professions and fields of research required to ensure buildings meet user demands and provide many diverse healthy enclosures are considered, endevouring towards a better understanding of the whole system. The SEEDS conference addresses the interdependence of people, the built and natural environments, and recognises the interdisciplinary and international themes required to assemble the knowledge required for positive change.

The conference brought together experts from all around the world to focus on the impact of the built environment, the changes that are taking place in the industry, and the benefits and consequences of change that are being predicted and measured. The focus of discussion and debate was on understanding how buildings and spaces are designed and nurtured to obtain the optimal outcome. Along with addressing technical issues, measuring energy efficiency and modelling energy performance, emphasis was placed on the health and well-being of the users of spaces occupied. This holistic approach has drawn together the research themes of energy, building performance and physics while placing health, well-being and ecology as the heart of the conference.

The SEEDS international conference brought together its members and partners to present work addressing some of the key topics. The conference had a necessarily wide agenda, considering all aspects of sustainability as they are presented and also had a considerable focus on the built environment. Selected papers are presented in this publication which covers some of the following key areas:

- Building and environment design
- Energy-efficient modelling, simulation and BIM
- Integrating urban and natural environment
- Building performance, analysis and evaluation
- Thermal comfort, air quality and overheating
- Green spaces, enclosures and buildings
- Green technologies and IT
- Renewable energy

- Energy flexible buildings
- Energy behaviour and lifestyle
- Dampness, water damage and flooding
- Building surveys, thermography, building pathology
- Water quality
- Air quality
- Planning and sculpturing positive change
- Reducing consumption and waste
- Sustainability, ethics and responsibility
- Occupant behavioural change
- Community building and master planning
- Health benefits of alternative and natural materials
- Urban heat island and mitigation
- Building resilience
- Sustainable cities
- Zero energy and energy plus buildings
- Local producers and urban environments, edible
- Trees and green city landscape
- Designing edible urban landscapes

Mohammad Dastbaz
Chris Gorse

The International SEEDS Conference Scientific Committee 2015

Prof. Rajendra Akerkar, M.Sc., Ph.D. is Professor of Information Technology. Rajendra's research focuses on application of big data methods to real-world challenges, and social media analysis in a wide set of semantic dimensions.
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Prof. Karl Andersson, M.Sc., Ph.D. is Associate Professor of Pervasive and Mobile Computing and Director of Studies of PERCCOM Master programme.
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Dr. Pedro Pablo Cardoso Castro, Ph.D. gained a BA in Marine Biology from the Jorge Tadeo Lozano University (Colombia). After working in research for a couple of years he got a title Merchant Marine Officer and finished his M.Sc. in Environmental Auditing and Business Planning at the Center for Ecological Studies in Malaga (Spain). In 2005 he was lecturing at M.Sc. and MBA programmes, leading a research team exploring the internationalisation of hi-tech SMEs. Since 2012 he has been working as Senior Lecturer at the Leeds Beckett University leading research in hi-tech business and the use of complexity in management. His interests include the applications of organisational cybernetics, sustainability, innovation, technology management, dynamic networks and the study and development of management systems inspired by co-evolving and transition management principles.
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Professional in Residence Richard Cozzens is Director of TICE (Technology Intensive Concurrent Enrolment) Engineering and Technology Curriculum Development. Richard coordinates a consortium of educators in the state of Utah in web-based curriculum development. Courses taught by Richard are solid modelling and innovative design.
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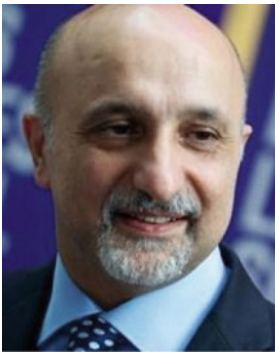

Prof. Mohammad Dastbaz is Pro Vice Chancellor and Dean of Faculty of Arts, Environment and Technology and Professor of Informatics at Leeds Beckett University. Professor Dastbaz's main research work over the recent years has been focused on the use and impact of emerging technologies in society, particularly learning, training and the development of "eGovernment". Mohammad has led EU- and UK-based funded research projects and has been the Symposium Chair of Multimedia Systems in IEEE's Information Visualisation (IV) Conference since 2002. He has over 50 refereed publications. His latest publication includes two edited collections: "Green

Information Technology: A Sustainable Approach" and "Building Sustainable Futures: Built Environment and Design". Professor Dastbaz is a Fellow of the British Computer Society and UK's Higher Education Academy as well as the professional member of ACM and IEEE's computer society. He is also a Fellow of the Royal Society of Arts.
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Prof. Aitor Erkoreka, B.Sc., M.Sc., Ph.D. is Professor of Thermodynamics and Heat Transfer. He is a Member of the ENEDI research group which is focused on energy in buildings with particular interest on the energy performance of building envelopes.
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Dr. Jean-Philippe Georges, B.Sc., M.Sc., Ph.D. is Associate Professor in Network Engineering. Jean-Philippe leads research at the Research Centre for Automatic Control into performance evaluation, green IT, QoS with dependability and sustainability, networked control systems, real-time networking as well as wireless communications.
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Prof. Chris Gorse, B.Sc. (Hons), M.Sc., Ph.D., MCIOB, MAPM, FHEA, Cert Ed, Dip Ed, Dip H&S is Director of the Leeds Sustainability Institute, Engineering Professors' Council Member, Vice-Chair of the Association of Researchers in Construction Management, Sub task leader for two groups within the International Energy Agency, and Head of the Low Carbon Sustainability Research Group CeBE, a research unit that has amassed one of the most comprehensive sets of actual building thermal performance data in the UK. Research has been undertaken for Department of Energy and Climate Change, Innovate UK, Engineering and the Physical Science Research Council, informing chages to Building Regulations and providing evidence to the House of Commons All Party Group for Excellence in the Built Environment.
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Dr. Anthony Higham, MCIOB, C.Build.E, MCABE is Senior Lecturer in Quantity Surveying. Anthony's current research focuses on the measurement of sustainable return on investment within the construction industry.
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Dr. Chung-Chin Kao, M.Sc., Ph.D. is Head of Innovation and Research. Chung-Chin takes a leading role in developing and managing innovation and research supports, promotions and scholarship programmes in the built environment.
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Dr. Alexandra Klimova, Ph.D. (Mechanical Engineering) is International project coordinator. She is highly experienced in development and coordination of international educational projects and dual degree programmes. She has extensive research experience in vehicle dynamics and FEA.

Her areas of interest include risk and change management, strategy, internationalisation of education and knowledge management.
ITMO University, International Research Laboratory "Modern Communication Technologies and Applications in Economics and Finance" Russia

Dr. Ah Lian Kor is Course Leader of Leeds Beckett M.Sc. Sustainable Computing and Sustainable Engineering, specialising in software development, web applications, and artificial intelligence. She is active in sustainable IT, intelligent systems, decision support systems and data centre research. She forges an industrial collaboration with Drax Power Station via a sponsored research project. Currently, she is the academic intelligent system advisor for a Knowledge Transfer Partnership (KTP) project between Leeds Beckett University and Premier Farnell (an international electronics manufacturing company).
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Dr. Mikkel Kragh is Head of BUILD Programme at Danish Architecture Centre (Dansk Arkitektur Center), Copenhagen Area, Denmark.

Prof. Richard Laing Since 1999 Prof. Laing has led a number of research commissions, including 'Streetscapes' (Scottish Enterprise), 'Greenspace' (ECFP5, Scottish lead) and 'Urban Connections' (Aberdeen City Growth). These projects provided techniques for assessing human responses to virtual built environments. In addition, he has recently led research and development projects for the Department of Health and the ESF, as well as participating as a co-investigator on work supported by the ESRC.

Professor Laing has extensive experience of research concerning holistic value assessment in the built environment, including studies on design evaluation, the use of computer games technology in design, building conservation and innovative housing. The research has produced over 50 outputs. Recent papers have appeared in leading journals including Environment and Planning B, Design Studies and the Journal of Building Appraisal.
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