



University of **HUDDERSFIELD**

University of Huddersfield Repository

Amaratunga, Dilanthi, Haigh, Richard, Ruddock, Les, Keraminiyage, Kaushal, Kulatunga, Udayangani and Pathirage, Chaminda

CIB International Conference 2014: W55/65/89/92/96/102/117 & TG72/74/81/83 Construction in a changing world: Book of Abstracts

Original Citation

Amaratunga, Dilanthi, Haigh, Richard, Ruddock, Les, Keraminiyage, Kaushal, Kulatunga, Udayangani and Pathirage, Chaminda (2014) CIB International Conference 2014: W55/65/89/92/96/102/117 & TG72/74/81/83 Construction in a changing world: Book of Abstracts. CIB International Conference, 2014 . CIB, Heritance Kandalama, Sri Lanka. ISBN 978-1-907842-54-2

This version is available at <http://eprints.hud.ac.uk/id/eprint/25408/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

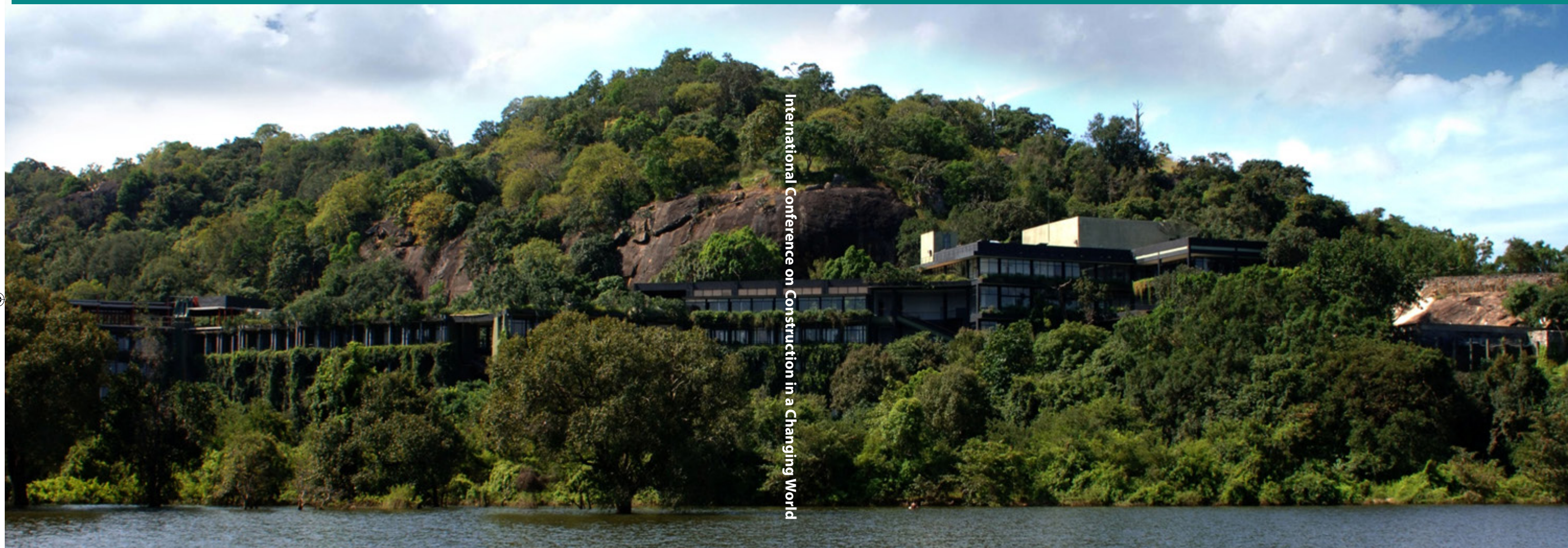
For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

<http://eprints.hud.ac.uk/>

This book brings together contributions from the International Conference on Construction in a Changing World, held at Heritance Kandalama, Sri Lanka, 4th - 7th May 2014. It includes 94 abstracts by scholars and practioners around the world. The full papers are available on an accompanying USB drive.

www.cib2014.org

International Conference on Construction in a Changing World Book of Abstracts



International Conference on Construction in a Changing World

Organised by

School of the Built Enviornment, University of Salford, UK
School of Art, Design and Architecture, University of Huddersfield, UK
CIB International Council for Research and Innovation in Building and Construction

In association with

CIB W55 Building Economics
CIB W65 Organisation and Management of Construction
CIB W89 Building Education and Research
CIB W92 Procurement Systems
CIB W96 Architectural Management
CIB W102 Information and Knowledge Management in Building
CIB W117 Performance Measurement in Construction
CIB TG72 Public Private Partnerships
CIB TG74 New Production and Business Models in Construction
CIB TG81 Global Construction Data
CIB TG83 eBusiness in Construction

ISBN 978-1-907842-54-2



9 781907 842542 >

Heritance Kandalama, Sri Lanka, 4th - 7th May 2014

In association with

CIB Working Commissions W055, W065, W089, W092, W096, W102 and W117
CIB Task Groups TG72, TG74 TG81 and TG83

Edited by

Professor Dilanthi Amaratunga, Professor Richard Haigh, Professor Les Ruddock,
Dr Kaushal Keraminiyage, Dr Udayangani Kulatunga and Dr Chaminda Pathirage



University of
HUDDERSFIELD
Inspiring tomorrow's professionals

University of
Salford
MANCHESTER

CIB INTERNATIONAL CONFERENCE 2014:
W55/65/89/92/96/102/117 & TG72/74/81/83
Construction in a Changing World

Book of Abstracts

Edited by

Professor Dilanthi Amaratunga, Professor Richard Haigh, Professor Les Ruddock,
Dr Kaushal Keraminiyage, Dr Udayangani Kulatunga & Dr Chaminda Pathirage

May 2014

Professor Dilanthi Amaratunga, Professor Richard Haigh, Professor Les Ruddock,
Dr Kaushal Keraminiyage, Dr Udayangani Kulatunga & Dr Chaminda Pathirage (*edited by*)
CIB International Conference 2014: W55/65/89/92/96/102/117 & TG72/74/81/83
Construction in a Changing World
Book of Abstracts

ISBN 978-1-907842-54-2
© 2014 CIB

All rights received. No part of this publication may be reproduced, stored and transmitted in any form, or by any means without prior written permission from the editors.

The views expressed in the papers are of the individual authors. The editors are not liable to anyone for any loss or damage caused by any error or omission in the papers, whether such error or omission is the result of negligence or any other cause. All and such liability is disclaimed.

The reader should verify the applicability of the information to particular situations and check the references prior to any reliance thereupon. Since the information contained in the book is multidisciplinary, international and professional in nature, the reader is urged to consult with an appropriate licensed professional prior to taking any action or making any interpretation that is within the realm of a licensed professional practice.

Copies may be ordered by contacting:

CIB International Conference 2014
School of the Built Environment
Maxwell Building 4th Floor
The University of Salford
The Crescent
Salford M5 4WT
UK

Enquiries:
Tel: +44 (0)161 295 4600
Fax: +44(0)161 295 5011
e-mail: admin@cib2010.org
web: www.cib2010.org

Contents

Preface	ii
About the Editors	iii
Acknowledgements	v
Conference Organisation	vii
Sponsors	xiv
Welcome Address and Keynote Speakers	xxix
Specialist Workshops	xxxviii
Awards	xliv
Special Issue of Journals	xlvi
General Information	xlvi
Social Programme	xlix
Additional Activities and Excursions	l
Post Conference Tours	lii
Book of Abstracts	1
<i>W055 Building Economics</i>	3
<i>W065 Organisation and Management of Construction</i>	13
<i>W089 Building Research and Education</i>	47
<i>W092 Procurement Systems</i>	59
<i>W096 Architectural Management</i>	71
<i>W102 Information and Knowledge Management in Building</i>	77
<i>W117 Performance Measurement in Construction</i>	83
<i>TG72 Public Private Partnership</i>	89
<i>TG74 New Production and Business Models in Construction</i>	95
<i>TG81 R&D Global Construction Data</i>	101
<i>TG83 e-Business in Construction</i>	105
Index of Authors	113

Preface

It is no exaggeration to say that CIB is the world's foremost platform for international cooperation and information exchange in the area of building and construction research and innovation. What takes place at CIB events is the very essence of CIB's raison d'être and, outside the triennial CIB Congress, an unprecedented number of CIB working commissions and task groups are represented at this Conference and we have worked to facilitate interaction with a rich mix of specialist streams, opportunities for informal networking and a series of challenging keynotes.

With its focus of "Construction in a Changing World", the Conference provides a forum for researchers worldwide to debate and exchange ideas and experiences on a broad range of issues. Driven by technology innovation, demographic growth, environmental change, a new economic order and a strong undercurrent of social and political desire for change, the world is changing quickly. Construction doesn't exist in isolation and, in a fast-changing world, the sector has the vital role of providing the requisite built environment to meet the challenges presented by these changes. In order to deliver value, maintain competitiveness and address the needs of society, the construction industry will need to develop its capabilities for managing innovation and technical change. The Conference will bring together resources and knowledge across different fields, technologies and disciplines to deal with the major challenges that construction professionals will be confronted with in the coming years.

The objectives of CIB are to be a relevant source of information concerning research and innovation worldwide in the field of building and construction and a reliable and effective access point to the global research community and a forum for achieving a meaningful exchange between the entire spectrum of building and construction interests and the global research community. Its underlying aims are to allow everyone working in the specific scientific area to present his or her work; to learn about the state of developments in all parts of the world; to update themselves on different approaches to problems on which they themselves are working and to initiate contacts with their peers from all over the world.

All of the papers to be presented at the Conference were selected on the basis of double blind peer review by the scientific committee members and paper reviewers to ensure a good quality standard. This book is intended both as a navigation tool for delegates at the Conference and as a summary record of the papers.

We hope that delegates will obtain useful feedback to their ideas, gain insights from the work of others and forge connections that will endure into productive joint activity after the Conference.



Professor Les Ruddock
CIB Board Member & Conference Co-Chair

About the Editors

Dilanthi Amaratunga is the Professor of Disaster Management at the School of the Built Environment, University of Salford, UK where she leads the University's Centre for Disaster Resilience. She is also the Associate Head of International Development for School of the Built Environment. An interdisciplinary background in Quantity Surveying, Facilities and Business Continuity Management, Education and Training, Gender and Disasters and Disaster Mitigation and Reconstruction provides her the opportunities to work across a broader construction and disaster management research agenda including developing partnerships of international research teams, government, NGOs and communities. She is the Co-Editor of International Journal of Disaster Resilience in the Built Environment, the only journal to promote research and scholarly activity that examines the role of building and construction to anticipate and respond to unexpected events that damage or destroy the built environment. She has secured a number of significant, high profile grants. She has presented widely at international conferences, has led international disaster management workshops and seminars and is working actively with the United Nations. She is an Advisory Panel Member of United Nations International Strategy for Disaster Reduction Campaign on Resilient Cities 2010 - 2015. She has supervised and supported a wide range of Post Graduate Research students. To date she has produced over two hundred publications, refereed papers and reports, and has made a large number of presentations in around 25 countries. Please visit www.dilanthiamaratunga.net for further information about Dilanthi.

Richard Haigh is a Professor at the University of Salford's Centre for Disaster Resilience, Joint Editor of the International Journal of Disaster Resilience in the Built Environment, and Co-Chair of the International Conference on Building Resilience series. His research interests include the conceptual understanding of resilience, the reintegration and rehabilitation of conflict-affected communities in Sri Lanka, and engagement of the private sector in the development of societal resilience. Richard is Principal Investigator of ANDROID (Academic Network for Disaster Resilience to Optimise Educational Development), a partnership of 67 institutions across 31 countries committed to promote co-operation and innovation to increase society's resilience to disasters of human and natural origin. Richard was also Principal Investigator of Conflict Prevention through Infrastructure Reconstruction, a 12-month intervention to enhance the capacity of local stakeholders to deliver conflict sensitive infrastructure reconstruction programmes within the North and East of Sri Lanka, and thereby to help prevent future conflict in the region. The project was funded by the UK Foreign and Commonwealth Office through the British High Commission in Colombo. Richard has published over 25 peer reviewed journal articles, 1 edited book, 7 book chapters, and 13 reports for a variety of stakeholders. A full list of Richard's publications, projects, and national and international activities can be found at www.richardhaigh.info.

Dr Kaushal Keraminiyage is the Programme Director for B.Sc. (Quantity Surveying) programme at the School of the Built Environment, University of Salford, UK. Kaushal's specific research interest is on the role of information and Communication Technologies (ICT) within the disaster management context and he leads the research theme 'ICT for Disaster Resilience' at the Research Centre for Disaster Resilience, University of Salford. Kaushal is a keen advocate of open source software educational resources. He is also an Editorial Advisory Board member of the International Journal of Disaster Resilience in the Built Environment and an Review Board Member of Journal of Financial Management of Property and Construction. With over 12 years of research and teaching experience in the higher education sector, Kaushal has published extensively in book chapters, research reports, refereed journal and international conference papers and has facilitated a number of research workshops in International conferences. He has also delivered several invited speeches at various international events. Kaushal is also the co-investigator of number of internationally funded research collaborations and an active contributor to postgraduate research training. To that end, he has facilitated a large number of international postgraduate research training programmes and workshops and he is delivering regular research methodology workshops for postgraduate research students in Salford.

Dr Udayangani Kulatunga is a Senior Lecturer at the School of the Built Environment, and is attached to Centre for Disaster Resilience at University of Salford. Udayangani conducts lectures for Quantity Surveying degree programme at the School of the Built Environment. She is also the Programme Director for BSc (Hons) Quantity Surveying affiliated degree programme delivered in Sri Lanka. She is a Fellow of the Higher Education Academy of the UK. Udayangani completed her PhD in year 2008 at the University of Salford in performance measurement in construction research and development. Udayangani's research interests include Disaster Management with particular reference to community based disaster management, construction waste management, performance measurement and management. Udayangani has been involved in managing and organising a number of collaborative research projects related to disaster management. Her contribution is significant for the British Council's INSPIRE strategic partnership project titled Community Engagement for Risk Erosion in Bangladesh to Enhance Life Long Advantage (CEREBELLA) with collaborative partner institute in Bangladesh. She has published a number of research papers in refereed journals and international conferences.

Dr Chaminda Pathirage is a Senior Lecturer at the School of the Built Environment, University of Salford, UK. He is also the Programme Director for MSc Project Management in Construction degree programme since 2009. Chaminda has developed his specific research interest on exploring the role of knowledge management within the disaster management context and he leads the research theme 'Knowledge Management for Disaster Resilience' at the Centre for Disaster Resilience, at University of Salford. He is also an Editorial Advisory Board member of the International Journal of Disaster Resilience in the Built Environment and an Editorial Review Board Member of International Journal of Knowledge-Based Organizations. With over 12 years of research and teaching experience, Chaminda has published several book chapters, research reports, journal papers and international conference papers and has facilitated a number of research workshops in International conferences. He has also delivered several keynote speeches at various international events. Chaminda leads a number of research collaborations, including a strategic partnership between the Institute of Disaster Management & Vulnerability Studies at University of Dhaka, Bangladesh and Centre for Disaster Resilience.

Les Ruddock is Professor of Construction and Property Economics in the Centre for Research and Innovation at the University of Salford, where he has formerly held the positions of University Director of Graduate Studies, Associate Dean for Research and Director of the 6* rated Research Institute for the Built and Human Environment. He holds the position of UK Member of the Board of the CIB (International Council for Research and Innovation in Building and Construction), the world's leading research organization for research collaboration in the built environment. He is also Joint Coordinator of the CIB Working Commission (W055) Construction Industry Economics. With over one hundred published outputs, he has written extensively on the economics of the built environment, with a recent book Economics for the Modern Built Environment on the consequences for the built environment of social and economic changes. He is a member of the editorial board of several research journals and is a former Editor of the Royal Institution of Chartered Surveyors (RICS) Research Paper series. In addition to his expertise in economics, he is also a Chartered Statistician and a Chartered Scientist. He has been a Principal Investigator on European Commission Framework projects on innovation (Innocons and Constrinnonet) and has recently been appointed to act as economics lead on the ECTP (European Construction Technology Platform) Task Group on the Ageing Society and the Economy.

Acknowledgements

As Chairs of the CIB 2014 International Conference on Construction in a Changing World we are delighted to have the opportunity to hold this conference.

The Local Organising Committee met regularly and together we made an array of, hopefully better, key decisions! All involved have provided a willing source of on-going support and guidance that is very much appreciated. We want to thank all the Coordinators of CIB Working Commissions and Task Groups that have joined the conference: W055, W065, W089, W092, W096, W102, W117, and TG72, TG74 TG81 and TG83. The Coordinators of these groups have worked closely with us by coordinating the paper review process. In addition they have provided leadership for the presentation sessions.

Our thanks go to the International Scientific Committee members who made extensive efforts in reviewing papers to tight time scales in ensuring the high quality of the conference. They have acted as paper reviewers and together have double blind refereed all the papers, so providing the academic backbone of the conference. The Coordinators and Reviewers involved are given in the Scientific Committee. Without the input of all of these individuals, the conference could not have happened and we are enormously grateful for their support.

We also thank the Keynote Speakers for their willingness to stimulate invaluable discussions and debate around the conference theme. We also thank Session Chairs for agreeing to ensure the conference is as challenging, exciting and rewarding as possible.

We have received exceptional help and support from a number of people, organisations and bodies in the work for this conference. We would particularly like to acknowledge the support of Professor Charles Egbu, Acting Head of School of the School of the Built Environment at the University of Salford. In addition to funding by means of a sponsorship, the School of the Built Environment at the University of Salford provided unwavering backing and encouragement.

Organisations that have acted at conference partners are especially thanked. The efforts involved with a conference of this scale are significant and it would not have been possible to organise this conference without assistance. We particularly thank: University of Salford and its School of the Built Environment, and the CIB. In addition Emerald Publishing provided support to the conference, including prizes, free access to papers and a special journal issue as a route forward for the cream of the papers.

The CIB 2014 International Conference on Construction in a Changing World is being held in conjunction with several partners. CADRE aims to address current and emerging labour market demands in the construction industry to increase societal resilience to disasters. CADRE will achieve this aim by: 1) Establishing a framework for ICU integration to address societal concerns; 2) Developing and testing an innovative professional doctoral programme that integrates professional and academic knowledge in the construction industry to develop societal resilience to disasters; 3) Creating world-class curricula and modules to support the programme and address current and emerging capacity gaps in the development of societal resilience to disasters; 4) Exploiting ICT to enable cross-border cooperation in the sharing and delivery of educational resources that support the professional doctoral programme. The University of Salford in the United Kingdom leads this project in partnership with 5 European higher education institutions and 2 institutions from Sri-Lanka. Accordingly, we acknowledge the financial support of the European Commission and the Lifelong Learning Programme of the European Union in facilitating the dissemination and exploitation of the research outcomes through various means including keynotes, presentations, publications, marketing and workshops in conjunction with the conference activities. The Conference also has formal links with CASCADE (Collaborative Action towards Societal Challenges through Awareness, Development, and Education) and Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area (CENEAST) projects.

Most of all, we want to thank our colleagues who worked very hard for the professional undertaking of the work involved in the tasks that are so often unseen and unrewarded for a conference of this scale. In any endeavour of this sort there are a few individuals who are absolutely crucial to bringing the initiative about. We thank Dr Kaushal Keraminiyage for all his efforts on the development and management of the conference database, Dr Chaminda Pathirage for being so careful with finances during these difficult times and also for managing the registration process, Dr Udayangani Kulatunga for her help in the management of the paper review process, and, Dr Menaha Thayaparan, Kanchana Ginige and Chamindi Malalgoda for being there whenever we needed help. To all of these friends, we give our heartfelt thanks.

Finally, we would not have been able to make this event without the support of our Events Manager based in Sri Lanka, Aitken Spence Conventions and Exhibitions. Ziyen Ameen & Nadeeka Leeniyagoda deserve special thanks from us for the professional way in which they have managed the complex accommodation arrangements for delegates, all internal transport, printing assignments, and coordination of our suppliers in Sri Lanka.

Professor Dilanthi Amaratunga, Professor Richard Haigh & Professor Les Ruddock
Conference Chairs, CIB 2014 International Conference on Construction in a Changing World

Conference Organisation

Organised by

School of the Built Environment, University of Salford, UK

School of Art, Design and Architecture, University of Huddersfield, UK

CIB International Council for Research and Innovation in Building and Construction

In association with

CIB W55 Building Economics

CIB W65 Organisation and Management of Construction

CIB W89 Building Education and Research

CIB W92 Procurement Systems

CIB W96 Architectural Management

CIB W102 Information and Knowledge Management in Building

CIB W117 Performance Measurement in Construction

CIB TG72 Public Private Partnerships

CIB TG74 New Production and Business Models in Construction

CIB TG81 Global Construction Data

CIB TG83 eBusiness in Construction

Conference Co-chairs

Professor Les Ruddock, University of Salford, UK

Professor Dilanthi Amaratunga, University of Salford, UK

Professor Richard Haigh, University of Salford, UK

Publication and Technical Directors

Dr Kaushal Keraminiyage, University of Salford, UK

Dr Chaminda Pathirage, University of Salford, UK

Dr Udayangani Kulatunga, University of Salford, UK

Organising Committee

Professor Dilanthi Amaratunga, University of Salford, UK

Professor Richard Haigh, University of Salford, UK

Dr Bingunath Ingirige, University of Salford, UK

Dr Kaushal Keraminiyage, University of Salford, UK

Dr Udayangani Kulatunga, University of Salford, UK

Chamindi Malagoda, University of Salford, UK

Dr Chaminda Pathirage, University of Salford, UK

Professor Les Ruddock, University of Salford, UK

Dr Menaha Thayaparan, University of Salford, UK

International Scientific Committee

Professor Akintola Akintoye, University of Central Lancashire, UK
Professor Mohammed Arif, University of Salford, UK
David Baldry, University of Salford, UK
Professor Peter Barrett, University of Salford, UK
Professor Martin Betts, Queensland University of Technology, Australia
Professor Paul Bowen, University of Cape Town, South Africa
Professor Jan Bröchner, Chalmers University of Technology, Sweden
Professor Richard Burt, Auburn University, USA
Professor Anita Ceric, University of Zagreb, Croatia
Professor Ranjith Dissanayake, University of Peradeniya, Sri Lanka
Professor Charles Egbu, University of Salford, UK
Cecilie Flyen Øyen, SINTEF Building and Infrastructure, Norway
Professor Bob Giddings, Northumbria University, UK
Kanchana Ginige, University of Salford, UK
Professor Bob Giddings, Northumbria University, UK
Professor Jack Goulding, University of Central Lancashire, UK
Dr Stephen Gruneberg, University of Westminster, UK
Professor Johannes Halman, University of Twente, The Netherlands
Dr Kim Haugbølle, Danish Building Research Institute, Denmark
Professor Makarand Hastak, Purdue University, USA
Professor Samantha Hettiarachchi, University of Moratuwa, Sri Lanka
Associate Professor, Herm Hofmeyer, Eindhoven University of Technology, The Netherlands
Pekka Huovinen, Tampere University of Technology, Finland
Dr Bingu Ingirige, University of Salford, UK
Professor Mike Kagioglou, University of Huddersfield, UK
Professor Kalle Kähkönen, Tampere University of Technology, Finland
Professor Arturas Kaklauskas, Vilnius Gediminas Technical University, Lithuania
Professor Dean Kashiwagi, Arizona State University, USA
Dr Kaushal Keraminiyage, University of Salford, UK
Dr Malik Khalfan, RMIT University, Australia
Daphne Koch, Purdue, USA
Assistant Professor Iva Kovacic, Vienna University of Technology, Austria
Dr Kihong Ku, Philadelphia University, USA
Dr Udayangani Kulatunga, University of Salford, UK
Professor Mohan Kumaraswamy, University of Hong Kong, Hong Kong
Professor Mel Lees, Birmingham City University, UK
Dr Tim Lees, University of Reading, UK
Professor Irene Lill, Tallin University of Technology, Estonia
Dr Champika Liyanage, University of Central Lancashire, UK
Richard Lorch, Building Research & Information, UK
Dr Jamie MacKee, University of Newcastle, Australia
Tarja Mäkeläinen, VTT Technical Research Centre of Finland, Finland
Chamindi Malagoda, University of Salford, UK
Professor Peter McDermott, University of Salford, UK
Professor Silvio Melhado, University of Sao Paulo, Brazil
Thomas Mills, Virginia Tech, USA
Associate Professor Marja Naaranoja, University of Vaasa, Finland
Rita Newton, University of Salford, UK
Professor Sid Newton, University of New South Wales, Australia
Dr Nirodha Fernando, University of Moratuwa, Sri Lanka
Dr Roshani Palliyaguru, Heriot-Watt University, UK
Dr Chaminda Pathirage, University of Salford, UK
Professor Srinath Perera, Northumbria University, UK

Professor Matthijs Prins, TU Delft, The Netherlands
Professor David Proverbs, University of West of England, UK
Jarmo Antero Raveala, City of Helsinki, Finland
Professor Stephen Rowlinson, University of Hong Kong, Hong Kong
Dr Steven Ruddock, University of Central Lancashire, UK
Professor Mônica Santos Salgado, Universidade Federal do Rio de Janeiro, Brazil
Dr Sepani Senaratne, University of Western Sydney, Australia
Professor Martin Sexton, University of Reading, UK
Associate Professor Sujeeva Setunge, RMIT, Australia
Professor John Smallwood, Nelson Mandela Metropolitan University, South Africa
Dr Hedley Smyth, University College London, UK
Dr Menaha Thayaparan, University of Salford, UK
Dr Niraj Thuraiajah, Birmingham City University, UK
Professor Chun-Ta Tzeng, National Cheng Kung University, Taiwan
Frans van Gassel, Eindhoven University of Technology, The Netherlands
Professor J. W. F. Wamelink, TU Delft, The Netherlands
Professor Clive Warren, University of Queensland, Australia
Professor Suzanne Wilkinson, University of Auckland, New Zealand
Aled Williams, Higher Education Academy, UK
Professor Wim Zeiler, Eindhoven University of Technology, The Netherlands

CIB Commissions

The 2014 International Conference on Construction in a Changing World is being held in association with CIB Working Commissions W055, W065, W089, W092, W096, W102, W117, and CIB Task Groups TG72, TG74, TG81 and TG83.

W055 Construction Industry Economics

The Commission will study, evaluate, disseminate, exchange and discuss issues based on the following objectives:

- to be the leading international research focus for the economics of the construction industry
- to stimulate the development of a theoretical base for the discipline of construction economics
- to support and develop the perception of the important role of the construction industry in the economy

The main areas of attention for the Commission's research include:

Characteristics of the Construction Firm: Strategic, managerial and production based theories; Transaction costs and contracting; M&A, market entry and international construction; Technology uptake models and construction firms.

Characteristics of Construction Markets: Identifying construction firms and markets; Imperfect competition in construction; Game theory in construction bidding and contracting; Auction markets and bidding for construction projects.

Applying Macroeconomic Theory: Use of input-output data for analysis of construction industry; Asset prices, monetary policy and building cycles; Stages of development and construction activity.

Theoretical Issues: Methodology in construction economics; The property market and demand for new building; Measuring construction productivity. Cost Studies and Design Economics: Cost modelling; Life-cycle costing and sustainability; Value management.

W065 Organisation and Management of Construction

The Objectives of the Commission are:

- to be the leading research and innovation focus for the organisation and management of construction
- to support the creation of construction practices and outcomes that equate to or exceed the best found in other industries, in terms of imagination, energy, effectiveness and efficiency
- to stimulate, facilitate and communicate research and innovation, stressing the integration essential for successful innovation in a complex environment

The Scope of W065 covers all aspects of the organisation and management of construction. In particular the following broad themes will pervade many of its activities: Projects, Companies, Policy and Processes.

W089 Education in the Built Environment

The Commission focuses on the broad discipline of the built environment and its constituent fields.

The Commission aims:

- to foster high quality academic debate about the way knowledge is generated, codified, taught and learnt
- to promote stronger links between research, scholarship, teaching and practice
- to promote the expansion of the international community of educators in the built environment
- to create and disseminate pedagogic knowledge throughout the community of educators and provide a stronger intellectual basis for practice
- to promote collaboration with other groupings of built environment educators.

W092 Procurement Systems

The objectives of the Commission are:

- to research into the social, economic and legal aspects of contractual arrangements, appointment systems and tendering procedures used in relation to construction projects
- to establish and comment upon the practical aims and objectives of contractual arrangements and to define the participants and their responsibilities
- to review areas of commonality and differences
- to formulate recommendations and the selection and effective implementation of project procurement systems
- to compare and contrast standard conventions for the various systems of project procurement generally and specifically
- to report and liaise with relevant CIB Working Commissions and Task Groups

W096 Architectural Management

The Commission focuses on the broad discipline of the built environment and its constituent fields.

The Commission aims:

- to determine where information related to architectural management lies and the means of retrieval, with particular regard to user requirements
- to establish the most effective ways in which designers may meet client needs
- to improve communication between procurement and implementation of the design process in order that supply may accurately reflect demand
- to seek to translate user requirements into architectural concepts and provision of tools for implementation
- to promote excellence in architectural management, practice and design to encourage the integration of design values in design and delivery practices.

W102 Information and Knowledge Management in Building

Information is an all-pervading ingredient in building, common to research and practice. By giving proper consideration to the flow of information, research results can be usefully translated into innovation and further adapted to provide the knowledge-base for best practice. In an environment in which the tools for making information available are developing at breakneck speed, it is necessary to manage the whole spectrum of information forms in a way that reflects the realities of decision-making in modern building practice.

In this context the objective for the Working Commission is to cover concerns that are related to information and knowledge management, both theoretical and practical. Special points of attention are the following:

- interface between general information and the building process and especially the dysfunction in the flow of information between researchers and practitioners
- the questions why research results are not put into practice, and how research results and feedback information can be converted and refined to be of practical use will be considered
- contemporary information systems bearing on the information needs of the building industry.

W117 Performance Measurement in Construction

The need to understand and appropriately benchmark and use performance data, together with the consequences of non and inappropriate use are essential for the development of the construction industry worldwide. Against this background the commission's objectives are:

- to explore the optimal uses of performance information in the built environment
- to create a worldwide resource center of knowledge of proven methods for implementing and sustaining performance metrics in an organization or in the industry
- to develop performance measurements as appropriate for different countries by engaging researchers and practitioners worldwide
- to support researchers, scholars and practitioners and like-minded individuals and organizations in their quest to improve their understanding and awareness of Benchmarking Construction Performance Data.

TG72 Public Private Partnership

CIB TG72 on Public Private Partnership addresses PPP at an international level by providing a forum to facilitate exchange and synthesis of research and development on the issues (social, economic, political, cultural, environmental, etc.) that underpin PPP. To achieve this, TG72 also identifies, analyses and makes sense of emerging international PPP practices through project lifecycles.

Our Task Group aims to develop a thriving international research community within the field of PPP, by also involving practitioners and experts in the field to collaborate on distinct scholarly tasks.

We also aim to identify champions from each continent to codify and co-ordinate PPP knowledge & practices in that region. A template is being developed for capturing knowledge & practices in PPP development across countries and regions.

TG74

If offsite production and manufacture is to make a positive contribution to society, research is needed to identify the issues associated with related cultural, societal, economic and business models. Against this background the Task Group will focus on the necessity for a strong, coherent international research strategy to address theories as related to production and business models within the built environment disciplines and will develop a comprehensive built environment innovative offsite research roadmap.

The Task Group's Work Program includes the following:

- to disseminate best practices
- to produce an annual paper based publication, first in cooperation with an existing journal and later as an independent, open access, free online journal
- to run a series of dedicated sessions in international conferences
- to develop a research roadmap as concerns aspects of new production and business models related to offsite production.

TG81 Global Construction Data

TG81 is a task group, set up within W055 Construction Industry Economics, to provide international construction data that could be used by researchers with an interest in all aspects of construction. The aim of TG81 is to measure the size and relative scale of construction activity in all countries, to inform policy, strategy and planning efforts and to indicate the relative importance and potential impact of construction on the wider economy and environment. This ambitious proposal for the task group needs to be approached in stages.

CIB TG83 eBusiness in Construction

Collaborative working in construction is gathering momentum as many construction activities are performed globally with project actors based in various geographical locations. Participants in construction such as the contractors, clients consultants, suppliers and project managers perceive a significant increase in collaborative activities in the future and the structure is set forth to develop with the Internet as the common platform. A steadily growing e-Business environment in construction, fuelled by the next generation web technologies, offer the potential to leverage this area so that the organisations both, individually as well as teams can gain improvements in their performance. Identifying strengths, weaknesses, maturity, barriers and knowledge gaps in this area can benefit and inform policy making in the UK, EU and globally elsewhere so that a programme of actions can be determined for effective investment and resourcing on a long term basis taking this initiative beyond the current technological perspective towards a knowledge-based perspective.

The Task Group objectives are:

- to conduct joint research with interested parties in the area of eBusiness in construction
- to appraise and promote the use of state of the art web-based technologies for collaboration and e-business in construction
- to provide a forum for discussion, debate and evaluation of technologies, research and concepts in the area of eBusiness in construction.

Further information is available at the following website: www.construction-ebusiness.org/.

Sponsors

We are very grateful for the generous support of our sponsors:

- School of the Built Environment, University of Salford, UK
- CIB International Council for Research and Innovation in Building and Construction
- Emerald Publishing Limited
- CADRE: Collaborative Action towards Disaster Resilience Education
- CENEAST: Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area
- CASCADE: Collaborative Action towards Societal Challenges through Awareness, Development, and Education

School of the Built Environment, University of Salford, UK



The School of the Built Environment (www.salford.ac.uk/built-environment) is a world leading, professionally accredited and life-long learning community of scholars of global reach, working in unison with learners across all levels of study and research, and lifelong learning professionals and organisations committed in making a difference to the sector. With very high employability successes and one of the largest global cohorts of PhD students, many of our graduates are already making a difference in industry and also in academia, by holding leadership positions in organisations and academic institutions across the world.

The School has been leading the research agenda in the built environment for more than 20 years, continuously rated top in the national Research Assessment Exercises.

We provide Continuous Professional Development (CPD) opportunities and we work closely with professional institutions such as RIBA, CIAT, CIOB and RICS in the provision of CPD and professional training in general. In addition we provide consultancy services of high value across a variety of sectors such as health, education, infrastructure, the public and the private sectors.

CIB International Council for Research and Innovation in Building and Construction



CIB is the acronym of the abbreviated French (former) name: "Conseil International du Bâtiment" (in English this is: International Council for Building). In the course of 1998, the abbreviation has been kept but the full name changed into:

INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION IN BUILDING AND CONSTRUCTION

CIB was established in 1953 as an Association whose objectives were to stimulate and facilitate international cooperation and information exchange between governmental research institutes in the building and construction sector, with an emphasis on those institutes engaged in technical fields of research.

CIB has since developed into a world wide network of over 5000 experts from about 500 member organisations active in the research community, in industry or in education, who cooperate and exchange information in over 50 CIB Commissions covering all fields in building and construction related research and innovation.

CIB Members are institutes, companies and other types of organisations involved in research or in the transfer or application of research results. Member organisations appoint experts to participate in CIB Commissions. An individual also can be a member and participate in a Commission.

CIB Commissions initiate projects for R&D and information exchange, organise meetings and produce publications. These meetings can be Commission meetings for members only or international symposia and congresses open to all. Publications can be proceedings, scientific or technical analyses and international state of the art reports.

CIB Past and Present

CIB was established in 1953 with the support of the United Nations, as an association whose objectives were to stimulate and facilitate international collaboration and information exchange between governmental research institutes in the building and construction sector. At that time an implicit objective also was to help rebuild the European infrastructure for building and construction research following the ravages of the second World War.

At the start 43 research institutes were members of CIB and by far the majority of these were European. And just as in the programmes of these institutes at that time, so in the CIB programme there was a strong emphasis on technical topics.

For selected topics CIB Commissions were established to which member organisations appointed experts from their staff to participate.

Along with all types of less visible activities, this collective participation resulted in many important international symposia and congresses and in a large number of publications acknowledged as of global standing. Indeed many of these formed the factual basis for developing international standards or were themselves used as such. Others were international state-of-the-art reports that for a long time provided an indispensable input to programming new research by the participating institutes and countries.

However, CIB has come a long way since 1953.

At present about 500 organisations are members of CIB from whom about 5000 individual experts participate in over 50 CIB Commissions. These extend over the whole area of building and construction research and innovation.

Amongst the CIB member organisations we can now find almost all the major national building research institutes in the world, as well as many other types of organisations in the building and construction sector who have joined us since. And although within the CIB programme considerable attention is still given to technical topics, there are now also activities focused on topics like organisation and management, economics of building, legal and procurement practices, architecture, urban planning and human aspects.

It is no exaggeration to say that at present CIB is the world's foremost platform for international cooperation and information exchange in the area of building and construction research and innovation. And we continue to increase our membership, to expand our scope, to initiate new activities while constantly striving to improve the quality of our products and services.

Emerald Publishing Limited



Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of over **290 journals** and over **2,350 books and book series volumes**, as well as providing an extensive range of online products and additional customer resources and services.

Dedicated to business quality is at the heart of our business

The highest quality of double-blind peer reviewed research is at the heart of what we do, working alongside some of the most prestigious contributors in their respective fields. Our commitment to quality and relevance is reflected by a growing network of more than 106,000 advisers, authors and editors and nearly 5,000 customers in 130 countries worldwide.

Emerald's Management collection features almost 100,000 articles from over 200 titles. The collection continues to disseminate the latest thinking from authors at all of the *Financial Times* Top 100 business schools and forms an essential part of the research library at most of these institutions. Our specialist collections in fields such as Library Studies, Education and Engineering build on this strength; offering focussed international research in a range of subject fields.

With titles featured in Thomson Reuters (ISI), Scopus and other relevant ranking systems, and new articles and chapters continually added, our output combines to provide academic communities with a full breadth and depth of knowledge across a range of subjects.

Passionate about service excellence

Our commitment to quality extends through the service and support resources it provides. This is why customers choose Emerald year-on-year.

Agility in a fast-changing environment

The scholarly publishing environment is one of continual change, presenting new challenges and opportunities daily. As an independent publisher, we offer the advantages associated with a global presence, whilst remaining agile enough to respond quickly to market and customer needs.

Creating impact

Emerald's philosophy has always been to help our communities create a meaningful impact that enhances knowledge, supports teaching, advances society and the environment, and influences government policy and business practice.

With this aim, we provide a host of resources and services, including guidance on citations and rankings, as well as a range of other innovative tools to help disseminate research to a wider readership, gain media attention and demonstrate professional achievement through publication.

Emerald communities – authorship, research, learning and teaching

Emerald provides online resources specifically designed for the professional development of its communities, including the Emerald Literati Network, an exclusive service supporting its extensive community of authors and editors, Emerald for Librarians and Emerald "Zones" for researchers, students and teachers.

Supporting education and research

Emerald is a member of the Globally Responsible Leadership Initiative (GRLI), and actively supports research and education worldwide with a number of awards and research grants. [View a list of awards.](#)

Partnerships and collaborations

Emerald works in close collaboration with a number of academic and corporate organizations and associations worldwide, including: the Association to Advance Collegiate Schools of Business (AACSB), the Academy of Management, the International Federation of Library Associations (IFLA), the American Library Association (ALA), the European Foundation for Management Development (EFMD), CEEMAN (Central and East European Management Development Association), amongst others.

Quick facts

- At the end of 2013 Emerald had 58 journals and 3 Book Series ranked by Thomson Reuters (ISI)
- In 2013, more than 25 million Emerald articles were downloaded
- In 2013, over 600,000 Emerald Book Series chapters were downloaded
- Over 100,000 researchers, academics and authors have contributed to Emerald content since 1994
- Emerald has customers in over 130 countries and contributors in over 160 countries demonstrating its commitment to providing international research.

See more at:

<http://www.emeraldgrouppublishing.com/about/index.htm#sthash.rCSmEpVr.dpuf>

CADRE (Collaborative Action towards Disaster Resilience Education)



CIB 2014 International Conference on Construction in a Changing World is being held in association with CADRE (Collaborative Action towards Disaster Resilience Education).

There are wide-ranging origins and causes to the many disasters that have affected communities across Europe and globally with ever-greater frequency. If construction researchers and practitioners are to be able to contribute to reduce risk through resilient buildings, spaces and places, it is important that capacity is developed for modern design, planning, construction and maintenance that are inclusive, inter-disciplinary, and integrative. In order to address this challenge, CADRE will develop an innovative professional doctorate programme that addresses the requirements for lifelong learning and actively promotes collaboration between European HEIs, industry and the community. This novel programme will address the career needs, and upgrade the knowledge and skills, of practising professionals working to make communities more resilient to disasters, and particularly those in, or who aspire to, senior positions within their profession. The candidates will undertake research aimed at making a contribution to the knowledge of professional practice and will involve applied rather than pure research. It will require candidates to establish the research problems from the viewpoint of industry and the community, thus encouraging healthy communication channels between ICU and establishing a strong platform for through life learning. In this context, the project, will improve the quality and relevance of higher education through active cooperation between Higher Education Institutes and partners from outside academia, including construction professional bodies, local/national/international bodies and social partners.

CADRE is an ERASMUS multilateral project supported by an EU grant. The project will run for three years and is led by University of Salford's Centre for Disaster Resilience, UK. The Salford team are working in conjunction with four European based institutions and two partners from Sri Lanka who will bring a much-needed international perspective to the project

Aim and objectives

CADRE aims to address current and emerging labour market demands in the construction industry to increase societal resilience to disasters.

CADRE will achieve this aim by: 1) Establishing a framework for ICU integration to address societal concerns; 2) Developing and testing an innovative professional doctoral programme that integrates professional and academic knowledge in the construction industry to develop societal resilience to disasters; 3) Creating world-class curricula and modules to support the programme and address current and emerging capacity gaps in the development of societal resilience to disasters; 4) Exploiting ICT to enable cross-border cooperation in the sharing and delivery of educational resources that support the professional doctoral programme.

Methodology

CADRE will achieve these objectives by: Managing partners to deliver outputs and achieve intended outcomes (WP1&2); Identifying market needs across a range of stakeholders (WP3); Developing a framework for ICU integration (WP3); Developing a professional doctorate programme based on a clear demand and involvement from industry and communities (WP3); Testing and validating the professional doctorate programme within the framework of lifelong learning and ICU interaction (WP4); Developing industry and community informed Open Educational Resources (OERs) for disaster resilience education (WP5); Planning to deliver the programme and sustain its impact beyond its initial funding (WP6); and, Raising awareness and promoting a common understanding among stakeholders of the importance of disaster resilience education and the essential role of European HEIs in improving society's ability to withstand the threat posed by hazards (WP7).

A constructive & developmental research approach has been selected as the overarching research methodology. This approach will begin with a detailed market needs analysis, capturing interdisciplinary needs across a range of stakeholders and countries. Alongside this, an ICU framework will be developed to identify how integration can take place and how the effectiveness of such integration can be measured. These two activities will culminate in the first milestone. To ensure that the proposed programme addresses a global, rather than just European perspective, input will also be sought from a third country partner. Based on these inputs, the development of the academic content of the joint professional doctorate programme and the associated processes will begin. This will involve the identification of the common and specific research areas, and potential for cooperation among partner organisations. This will also result in the second major milestone, the DProf programme specification (WP3). The next phase will involve development of Open Educational Resources (WP5), with a specific focus of imparting the knowledge and skills needed for undertaking doctoral research in disaster resilience in the built environment. In doing so, the programme will ensure that the specific specialities and expertise of disaster management and resilience in the built environment from the partner organisations will be integrated to the proposed joint doctoral programme. The final implementation phase will involve programme validation (WP4). The ICU framework will be a central tenet of this validation.

Exploitation and valorisation (WP6) will ensure that CADRE has a sustained impact on the target groups and achieves its intended outcomes. It will ensure that programme and learning resources are put to good use through project engagement with relevant stakeholders across Europe and beyond. Dissemination (WP7) will raise awareness and promote a common understanding among stakeholders of the importance of disaster resilience education and the essential role of European HEIs in improving society's ability to withstand the threat posed by natural and human induced hazards.

Consortium

The CADRE consortium is composed of 7 partners from 5 different countries, representing organisations involved in research and development of improving the resilience of society to catastrophic natural hazards. The team will work together to pool their results, build interdisciplinary explanations, discuss findings at conferences, write and publish papers, and inform policy development. List of partner institutions are given below.

University of Salford
Vilnius Gediminas Technical University
Tallinn University of Technology
Northumbria University
United Nations International Strategy for Disaster Reduction
University of Moratuwa
Federation of Sri Lankan Local Government Authorities

Further information

For further information, please contact:

Professor Dilanthi Amaratunga,
Principal Investigator, Centre for Disaster Resilience,
School of the Built Environment, University of Salford,
Salford, Greater Manchester,
M5 4WT, UK,

E: r.d.g.amaratunga@salford.ac.uk

W: www.disaster-resilience.net/cadre/

CASCADE (Collaborative Action towards Societal Challenges through Awareness, Development, and Education)



The European Union recognises a need to strengthen internationalisation through strategic policy action to tackle global challenges. According to the European Commission report (2012) on 'Enhancing and focusing EU international cooperation in research and innovation', global challenges are important drivers for research and innovation and the EU needs to strengthen its dialogues with international partners to build critical mass for tackling these challenges. The interim evaluation of Framework Programme 7 (FP7) stated that there needs to be an 'intensification of international cooperation' activities focused on 'engaging with partners outside of Europe on equal terms and in programmes and activities of high mutual interest'. Accordingly, three main objectives were set by the European Commission (2012) for International cooperation in research and innovation:

- Strengthening the Union's excellence and attractiveness in research and innovation as well as its economic and industrial competitiveness by creating win-win situations and cooperating on the basis of mutual benefit; by accessing external sources of knowledge; by facilitating access to new and emerging markets; and by agreeing on common practices for conducting research and exploiting the results;
- Tackling global societal challenges by developing and deploying effective solutions more rapidly and by optimising the use of research infrastructures;
- Supporting the EU's external policies through international cooperation in research and innovation as an instrument of soft power and a mechanism for improving relations with key countries and regions.

In this context, the project CASCADE was initiated as an 18 month supporting action to enhance the international cooperation in research and innovation between the EU and South Asia with the financial support from the European Union's FP7 Programme. The need for linkages with Asian countries has been highlighted given the region's rapidly growing research and innovation capacities and the urgency to address global challenges. South Asia in particular is home to more than 40% of the world's absolute poor, but will contribute nearly 40% of the growth in the world's working-age population in the coming decades. CASCADE is an opportunity for raising awareness of the potential for EU-Southern Asia cooperation and stimulating regional and international participation. With the active contribution of South Asian countries, the endeavour will be to pave the way for more advanced, inclusive and innovative societies.

The project CASCADE aims to provide the foundation for a future International Cooperation Network Programme (INCONET) targeting South Asian Countries, which will promote bi-regional coordination of science and technology cooperation. The specific objectives of CASCADE are to:

1. compile a regional position paper that identifies global challenges and research priorities;
2. map and develop an inventory of national and regional stakeholders related to global challenges;
3. raise awareness on research and innovation priorities for fostering cooperation and towards building mutual understanding on how to address common global societal challenges.

Methodology

The project comprises five work packages (WPs).

- WP1- The first work package coordinates the delivery of project outputs, ensure achievement of anticipated outcomes, and develop and manage project infrastructure.
- WP2- The second produces national position papers for each participating country and regional position papers for Southern Asia providing a consensus on the key societal challenges in the region
- WP3- The third work package identifies and maps key national and regional stakeholders that can influence and address the societal challenges based on the national position papers produced in the WP2.
- WP4- The fourth work package of the project targets to engage the key stakeholders identified, raise awareness of them about potential for cooperation between European Union and Southern Asia and stimulate their participation in Horizon 2020.
- WP5- The final work package uses the position papers developed in WP2 and stakeholder maps from WP3 to compile a policy brief with recommendations to the European Commission on how to promote bi-lateral cooperation with Southern Asia with a view to tackling key societal challenges of mutual interest.

Project partners

CASCADE is a consortium of seventeen project partners from EU and South Asia which is led by the University of Salford from the UK. It targets and has the participation of all seven South Asian countries specified in the call: Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka. The complete list of participants is as follows.

- University of Salford (USAL), UK (Coordinator)
- University of Central Lancashire (UCLAN), UK
- Tallinn University of Technology (TUT), Estonia
- Vilnius Gediminas Technical University (VGTU), Lithuania
- University of Bologna (UNIBO), Italy
- Fondation pour la recherche stratégique (FRS), France
- Nangarhar University (NU), Afghanistan
- Patuakhali Science and Technology University (PSTU), Bangladesh
- Royal Institute of Management (RIM), Bhutan
- Institute of Engineering, Tribhuvan University (IOE), Nepal
- Volunteers for Development Nepal (VFD), Nepal
- University of Peshawar (UoP), Pakistan
- Local Councils Association of the Punjab (LCAP), Pakistan
- University of Moratuwa, Sri Lanka
- Federation of Sri Lankan Local Government Authorities (FSLG), Sri Lanka
- Asian Disaster Preparedness Center (ADPC), Thailand (presence in all targeted countries)
- ECO CARE (ECO), Maldives

CASCADE and Horizon 2020

The CASCADE project also coincides with the launch of Horizon 2020, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. Running from 2014 to 2020 with a budget of over €70 billion, the EU's new programme for research and innovation is part of the drive to tackle global societal challenges, and create new growth and jobs. International cooperation in research and innovation is an essential element for meeting the objectives of Europe 2020.

By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation. Horizon 2020 aims to:

- Strengthen the EU's position in science with a dedicated budget of € 24.5 billion. This will provide a boost to top-level research in Europe, including an increase in funding of 77% for the very successful European Research Council.
- Strengthen industrial leadership in innovation with a budget of € 18 billion. This includes major investment in key technologies, greater access to capital and support for SMEs.
- Provide € 31.5 billion to help address major societal concerns shared by all Europeans; such as climate change, developing sustainable transport and mobility, making renewable energy more affordable, ensuring food safety and security, or coping with the challenge of an ageing population.

Recognising the global nature of producing and using knowledge, Horizon 2020 builds on the success of international cooperation in previous framework programmes and is fully open to participation from third countries. The funding will be more focused, allowing participants who bring exceptional cooperation skills and resources, and those from less wealthy countries, to benefit.

CASCADE project team of University of Salford

Professor Dilanthi Amaratunga, Professor Richard Haigh, Kanchana Ginige
Centre for Disaster Resilience
University of Salford
Salford, UK

Email: r.d.g.amaratunga@salford.ac.uk

Further details of the project can be read by visiting: www.cascade-inconet.eu

CENEAST (Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area)



CIB 2014 International Conference on Construction in a Changing World has formal links with Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area (CENEAST)

It has been observed that the energetically and ecologically sustainable, affordable and healthy built environment policy was not considered essential by the Russian, Ukrainian and Byelorussian universities. As such energetically and ecologically sustainable, affordable and healthy built environment policy has not been incorporated in the curricula of BSc/specialists, MSc and PhD programmes for building and civil engineering students. In this context, one of the key problems faced by Russian, Ukrainian and Byelorussian universities are the lack of the high-level educational and research literature in energetically and ecologically sustainable, affordable and healthy built environment. Due to insufficient demand for the energetically and ecologically sustainable, affordable and healthy built environment in these countries, graduates lack the multidisciplinary character of knowledge in built environment, including technical, technological, organisational, management, social, environmental, economic, cultural, psychological, political and other aspects.

Insufficient communication between universities and labour market and lack of compliance to Bologna practises have also been observed in the region. In order to solve the aforementioned problems, the EU funded CENEAST (Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area) research project aimed at upgrading the curricula on built environment in the universities of Belarus, Russia and Ukraine according to Bologna practices in order to increase their capacity to continually modernise, enhance the quality and relevance of education of the building and civil engineering students to the labour market needs and to ensure international cooperation. The project will achieve this aim in five objectives as detailed below.

Project objectives

- To upgrade curricula of BSc/specialists, MSc and PhD programmes with new modules on energetically and ecologically sustainable, affordable and healthy built environment in universities of Belarus, Russia and Ukraine in order to enhance the quality and relevance of education in PC universities to labour market needs;
- To transfer the Bologna practices in education (curriculum development, ECTS, innovative learning, etc.) from EU universities to PC universities;
- To develop a virtual interuniversity networked educational system (intelligent library, intelligent tutoring system, intelligent knowledge assessment system, access to the e-sources of the research and educational information) in order to ensure cooperation among the EU and PC universities in education and research;
- To assist the competence development of staff within the PC universities.
- To train at least 240 students during the pilot project.

Methodology

Planned activities in order to achieve the wider and specific objectives of the project are:

- Management (WP1);
- Upgrading of BSc, MSc and PhD degree programmes (WP2);
- Development and Exploitation of the Virtual Interuniversity Networked Educational Centre (WP3);
- Monitoring and Reporting of Results (WP4);
- Dissemination (WP5).

The project consist of 14 EU and Eastern neighbouring institutions which will develop modules for 9 BSc/specialists, 11 MSc and 2 PhD (in total 22 modules), including frameworks and teaching materials. In this context, the project will be benefited from cross-institutional knowledge sharing on module development. All modules will be developed jointly and each partner will contribute towards module development within their areas of expertise. The developed modules will be incorporated into excising curricular of BSc/specialists, MSc and PhD programmes for building and civil engineering students in universities of Belarus, Russia and Ukraine. As such, the partnering universities of Belarus, Russia and Ukraine will share the developed modules and teaching materials.

To facilitate cross-institutional module delivery, the project will develop an innovative virtual interuniversity-networked educational centre to enable the delivery of modules proposed within the project. In addition this centre will enable and promote lifelong learning at large within the society by making study material accessible outside traditional classroom environment to various parties within the society from students, teachers to practitioners and policy makers. Centre will ensure not only the feed-forward (information/knowledge from centre to the beneficiaries) but also feedback (from beneficiaries to the centre). It is expected that a spiral effect will be created to continuous improvement of the centre.

Four major components have been identified as the main elements of the centre:

1. Development of intelligent library.
2. Development of the intelligent tutoring system.
3. Development of the student knowledge assessment system.
4. Development of the virtual research environment.

Development of this centre will address regional and national higher education priorities such as development of international relations, enhanced quality assurance, management of teaching and student services and triangulated knowledge creation and dissemination with education, innovation and research.

Consortium

The project consortium consists of 14 partners, including 12 universities and 2 associations. The consortium is led by Vilnius Gediminas Technical University, Lithuania.

- Vilnius Gediminas Technical University, Lithuania
- Alma Mater Studiorum – Università di Bologna, Italy
- University of Salford, United Kingdom
- Tallinn University of Technology, Estonia
- Belarusian State Technological University, Belarus
- Yanka Kupala State University of Grodno, Belarus
- Moscow State University of Civil Engineering, Russian Federation
- Saint-Petersburg State Polytechnical University, Russian Federation
- Kaliningrad State Technical University, Russian Federation
- Moscow State Industrial University, Russian Federation
- National Technical University of Ukraine, Ukraine
- National Technical University "Kharkiv Polytechnic Institute", Ukraine
- SVIMAP NETWORK, Italy
- Association "INFOBALT", Lithuania

Further information

For further information, please contact:

Professor Dilanthi Amaratunga & Professor Richard Haigh
Centre for Disaster Resilience,
School of the Built Environment, University of Salford,
Salford, Greater Manchester,
M5 4WT, UK

E: r.d.g.amaratunga@salford.ac.uk

W: www.ceneast.com

Welcome Address and Keynote Speakers

Opening Plenary: Monday 5th May

08:30 – 09:45, Kathikawa Main Hall

Chair: Professor Richard Haigh



CIB Welcome Address and Chair's Presentation of the Conference Theme by Professor Les Ruddock

Les Ruddock is Professor of Construction and Property Economics in the Centre for Research and Innovation at the University of Salford, where he has formerly held the positions of University Director of Graduate Studies, Associate Dean for Research and Director of the 6* rated Research Institute for the Built and Human Environment. He holds the position of UK Member of the Board of the CIB (International Council for Research and Innovation in Building and Construction), the world's leading research organization for research collaboration in the built environment. He is also Joint Coordinator of the CIB Working Commission (W055) Construction Industry Economics. With over one hundred published outputs, he has written extensively on the economics of the built environment, with a recent book *Economics for the Modern Built Environment* on the consequences for the built environment of social and economic changes. He is a member of the editorial board of several research journals and is a former Editor of the Royal Institution of Chartered Surveyors (RICS) Research Paper series. In addition to his expertise in economics, he is also a Chartered Statistician and a Chartered Scientist. He has been a Principal Investigator on European Commission Framework projects on innovation (Innocons and Constrinnet) and has recently been appointed to act as economics lead on the ECTP (European Construction Technology Platform) Task Group on the Ageing Society and the Economy.

Construction in a Changing World

In the wake of the international financial crisis and the ensuing global recession, the construction industry must prepare itself now to address the new economic reality and the sustainability imperative. In many parts of the world, the global recession hit the construction industry hard. The recovery process may be slow but the aftermath of the recession is creating many new opportunities driven by technology innovation, demographic growth, environmental change, a new economic order and a strong undercurrent of social and political desire for change. Construction doesn't exist in isolation and this presentation explores the challenges facing the sector if it is to fulfil its role of providing the requisite built environment to meet the needs of a changing society.



Keynote Address by Professor Ghassan Aouad

Professor Ghassan Aouad is the Vice President for Academic Affairs at Gulf University for Science & Technology (GUST) in Kuwait. Prior to joining GUST he was the President of the University of Wollongong in Dubai (UOWD). During his time at UOWD, he led the development of the Strategic Plan 2013-2018 and the preparation of the documentation for the institution licensure renewal and the University achieved an increase of 13% in student recruitment. Professor Aouad was appointed as Vice President of the Chartered Institute of Building (CIOB) in March 2010 and will become President in 2014. During his time in Salford where he was Pro Vice Chancellor for Research and Dean of the College of Science and Technology, Professor Aouad successfully supervised 24 PhD students, externally examined 52 PhD students, authored 3 major research books and co-authored one book, generated more than £10M in research funding as Principal Investigator and £8M as Co-Investigator, and published 92 papers in top rated refereed journals.

Scenario Planning as a Strategic Tool in Construction

In this presentation, important aspects related to scenario planning as a strategic tool in construction will be discussed. In addition, real life examples will be demonstrated in order to enhance the understanding of this technique. Methodological issues associated with this approach which are at the heart of doing quality research will be addressed. Some particular emphasis will be put on the Gulf/Middle East as the construction industry is booming in this part of the world.

Plenary: Tuesday 6th May

08:30 – 09:45, Kathikawa Main Hall

Chair: Professor Les Ruddock



Keynote Address by Professor Charles Egbu

Professor Charles Egbu holds the Chair in Project Management and Strategic Management in Construction at the University of Salford, England, UK. He is a Fellow of the Royal Institution of Chartered Surveyors (FRICS); a Fellow of the Chartered Institute of Building (FCIOB), a Fellow of the Association for Project Management (FAPM), and a Fellow of the Higher Education Academy (FHEA). He is also a Director and Trustee of the Association for Project management (APM). He lectures supervises doctoral and post-doctoral researchers in varied areas of Project and Programme Management, Strategic Management in Construction, Sustainable Development as well as in Innovation and Knowledge Management. He has contributed over 350 publications in various international journals and conferences. He has also authored more than 10 books in Construction Management, Knowledge Management, Sustainable Development, Refurbishment Management, and Health & Safety in Construction. He is a Visiting Professor to a number of Universities in Europe, Africa, and Asia. He has supervised over 20 PhD students and examined over 50 PhD candidates world-wide. He has organized and led international conferences and workshops in the areas of project management and knowledge management. He is a co-ordinator of the Working Commission on “Information and Knowledge Management”, and Working Commission on “Performance Measurement in Construction of the International Council for Research and Innovation in Building and Construction’s Working Commission (CIB).

Good Governance in the Management of Projects, Programmes and Portfolios in Emerging Economies – Challenges and Opportunities

Projects, programmes and portfolio are getting ever more complex. The nature and complexity of project these days mean that the contradictory or diverging interests of different project stakeholders must be accommodated or mediated, with multiple actors sharing decision-making responsibilities. In the same vein, clients, customers and project owners are getting more aware and demanding of project outputs and outcomes. There is now increasing need for clients and project boards to be assured that appropriate governance arrangements are instituted allowing for clarity in relationships and responsibilities among project owners, and with clear provision of a framework for making and re-validating both decisions and expected behaviour, leading to successful project outcomes. Similarly, with complexity in projects come increased risks. Poor risk

management leads to poor project planning and outcomes. It impacts on cost, quality, project time, and overall satisfaction of project stakeholders, and wider benefits to communities. It is therefore important that there is a set of management systems, rules, protocols, relationships, and structures that provide the framework within which decisions are made for project development and implementation to achieve the intended business or strategic motivation. This is not straightforward from an emerging economy perspective, especially where there are other issues such as skills gap, skills shortages, cultural norms, and embedded practices at play. The key challenges which emerging countries face in developing and implementing good governance are explicated, together with good practices in this regard. A framework for improved insight on various aspects of good governance, including alignment; owning-organisation sponsorship; project management; disclosure and reporting; risk and reward; and governance changes is discussed. It concludes that effective project governance provides an important opportunity for government projects and programmes, as well as privately procured projects and programmes to meet project objectives and benefit communities. It offers recommendations for policy makers, clients and the construction sector.



Keynote Address by Professor Michael Pitt

Professor Pitt has been involved in property research and teaching since 1990. He is a Fellow of the Royal Institution of Chartered Surveyors has served on several Facilities Management committees over the years. He has been an advisor to the HCP Social Infrastructure Ltd team at the UK Ministry of Defence Main Building since 2008 and works closely with much of the HCP supply chain. He is Visiting Professor at the University of Malaya KL and Chulalongkorn University Bangkok and is also Editor of the Journal of Facilities Management. Professor Pitt works closely with industry on projects related to facilities management (FM) linked to productivity and efficiency in the workplace with a particular focus on the office environment. Recent projects have included an examination of the impact of interior planting on productivity, waste management trends, life cycle management, the development of sustainability strategies and performance measurement systems. At the current time a cluster of research projects are running within the PFI supply chain at MOD Main Building in Whitehall as well as several UK hospitals. These projects are all partly funded by the private sector jointly with either the UK Government or one of the UK research councils. In addition Professor Pitt is engaged in FM developmental work, particularly in Malaysia and Thailand.

Synopsis

The nature of University research is changing. Using various examples, some of which are presented as full papers elsewhere, the old and the new worlds of research will be examined. The talk interprets the new world and concludes that new ways of working must be embraced as much in the delivery of research itself as well as in the wider construction industry.

Plenary: Wednesday 7th May

08:30 – 09:45, Kathikawa Main Hall

Chair: Professor Dilanthi Amaratunga



Keynote Address by Jerry Velasquez

Jerry Velasquez is Chief of the Advocacy and Communications Section and Head of the Making Cities Resilient Campaign of the UN Office for Disaster Risk Reduction (UNISDR). Before moving to this function in Geneva in August 2013, he was for six years the UNISDR Regional Coordinator for Asia and the Pacific covering 37 countries and 16 territories from Central Asia to the Pacific Islands. The Regional Office is based in Thailand, with oversight for the sub-regional office in the Pacific in Fiji, and the Kobe liaison office in Japan. He previously worked for the United Nations Environment Programme (UNEP) in Nairobi, Kenya with the Division for the Global Environment Facility (DGEF) and the Division for Environmental Laws and Conventions (DELC), where he focussed on the promotion of cooperation among Multilateral Environmental Conventions. Prior to this he was the Coordinator of the Global Environment Information Centre (GEIC), a joint programme of the Ministry of Environment of Japan and the UN University, where he coordinated the Inter-linkages programme – promoting synergies among the work of Multilateral Environmental Conventions. He was also previously an Academic Officer at the United Nations University (UNU), and a Research Fellow at the United Nations Centre for Regional Development (UNCRD) where he focussed on environmental governance, social vulnerability to disasters and environmental capacity building. His published work includes edited books, UN reports, journal articles, interactive software, and policy briefs on Multilateral Environmental Conventions, environmental governance and disaster vulnerability and risk. His latest publication is titled "Reducing Vulnerability and Exposure to Disasters – the Asia Pacific Disaster Report 2012" published in October 2012.

Tackling Future Risks, Economic Losses and Exposure

This paper builds on the hypothesis that a successful post-2015 framework for disaster risk reduction (DRR) needs to better address underlying risk factors over a long time frame and engage directly more pertinent actors such as local government leaders and the private sector. The paper explores the possible priority issues (the "substance") that should be highlighted in the post-2015 framework for DRR, setting the parameters for who (the "actors") and how (the "form") the substance should be included and the actors engaged.

The paper first looks into the possible expected outcomes as a way to identify the substantive priorities for the post-2015 framework for DRR, proposing four reality checks, in light of which it considers three challenges: (i) tackling exposure, economic losses and future risks through land use, urban and spatial planning, post disaster recovery and reconstruction, global supply chain management, ecosystems management, building social demand for disaster risk reduction, and improve accountability by improving responsibility and ownership for reducing risks; (ii) scaling up vulnerability reduction and building of resilience through fast track vulnerability reduction, expanding social protection, improving building practices, and reducing the vulnerability of small economies; and (iii) the integration of climate change into disaster risk reduction. It then proposes ways forward for a post-2015 framework for DRR.



Keynote Address by Professor S.S.L. Hettiarachchi

Professor S.S.L. Hettiarachchi, Professor of Civil Engineering of the University of Moratuwa, Sri Lanka specialized in Coastal Engineering and obtained his PhD from Imperial College, London in 1987 and since then has been actively engaged in research in breakwaters and coastal structures. After the Indian Ocean Tsunami of December 2004, he has represented Sri Lanka on the establishment of the Indian Ocean Tsunami Warning System (IOTWS), under UNESCO/IOC, Paris since its inception in 2005 and is serving as Chairman of Working Group on Risk Assessment for Indian Ocean States for the Inter Governmental Coordination Group for the establishment of the IOTWS (UNESCO/IOC/ICG/IOTWS). As Chairman, Professor Hettiarachchi provided leadership for the preparation of Tsunami Risk Assessment Guidelines for the Indian Ocean (UNESCO/IOC Guideline and Manual No 52). He has also contributed to other guidelines on coastal hazards and mitigation developed by UNESCO and other international agencies. The Working Group also collaborated with Geo Science Australia to develop the Tsunami Hazard Map for the Indian Ocean. These two powerful tools will contribute to the safety of human life, ecosystems and infrastructure against the tsunami hazard within a multiple coastal hazard framework. Through UNESCO/IOTWS and UNDP –Asia Pacific Regional Centre-Bangkok Prof Hettiarachchi has spearheaded in providing training in Tsunami Risk Assessment for Indian Ocean States. He also serves as member of the UNESCO/IOC mission in conducting tsunami risk assessment and mitigation in Oman.

Coast at Risk - Role of Civil Engineer in Building Resilient Communities

The coastal zone comprising coastal communities, the built environment and eco-systems are exposed to a wide range of hazards arising from natural phenomena and human induced activities. Cities within this zone are centers of economic development with a heavy population density and are subjected to immense development pressure. On most occasions this has resulted in unplanned accelerated development leading to high vulnerability. Therefore, it is not surprising that coastal communities are increasingly at risk from coastal hazards. This was evident from the experience of recent disasters, notably the Indian Ocean Tsunami of 2004, storm surges resulting from hurricane Katrina in 2005, cyclone Nargis in 2008, Great Japanese Tsunami of 2011 and hurricane Haiyan of 2013. The events and subsequent assessment of human loss and damage exposed a lack of knowledge of hazards, vulnerability and deficiencies in preparedness and response as well as the impact coincident hazards. Recently there have been global initiatives to improve disaster risk reduction and in this respect UNESCO/ Intergovernmental Oceanographic Commission (IOC) have made a notable contribution in this field.

In the above context Civil Engineers have a crucial role in building resilient communities in areas of high risk. They are expected to understand not only the proneness of society and its full structure to be affected by hazards but also the needs of society and its development trends. This will enable them to ensure human security via measures which mitigate the impact of hazards, support communities in providing them with hazard resilient housing and infrastructure, early warning systems, evacuation routes, safe locations and buildings to accommodate large number of people. Such measure will ensure minimize human losses and damage to critical infrastructure and industries such as ports, fisheries and tourism and enable society to recover rapidly after a disaster. Following the Indian Ocean Tsunami of December 2004, the UNESCO/ IOC has been requested by the member states to provide leadership in risk assessment and mitigation and number of positive initiatives have been undertaken within a multi hazard framework by the four global tsunami warning systems. The presentation will cover numerous examples of innovative techniques adopted by civil engineers to provide security to humans and infrastructure outlining their contribution in developing resilient communities.

Specialist Workshops

CADRE (Collaborative Action towards Disaster Resilience Education) workshop

Please refer to the programme for venue and timing information

Workshop on capturing the current and emerging market needs for built environment stakeholders to increase societal resilience to disasters

CADRE is an ERASMUS multilateral project, which aims to address current and emerging labour market demands in the construction industry to increase societal resilience to disasters. The project will improve the quality and relevance of higher education through active cooperation between Higher Education Institutes and partners from outside academia, including construction professional bodies, local/national/international bodies and social partners. CADRE will make a contribution to both theory and practice in the development of societal resilience to disasters through the development of curricular and modules to update the knowledge and skills that employees have obtained in the past. It will develop an innovative professional doctoral programme (DProf) that integrates professional and academic knowledge in the construction industry to develop societal resilience to disasters. Accordingly a structured professional doctoral programme will be developed in order to reflect how the construction sector and its professionals can contribute to achieving resilience in the case of increasing threats from natural and human induced hazards. Development of the programme involves a substantial level of research activities to study and analyse market needs in order to capture the labour market requirements for disaster resilience and its interface with the construction industry and its professionals. As part of this activity, an industry requirement capture workshop will be conducted as part of 2014 CIB International Conference on Construction in a Changing World. Having the workshop as part of this international conference would bring vital knowledge and expertise to the project from an international perspective.

The aim of the workshop is to capture the current and emerging market needs for built environment stakeholders to increase societal resilience to disasters. Five built environment stakeholder groups have been identified for the study, namely the local and national governments; community; NGOs, INGOs and other international agencies; academia and research organisations; and private sector. During the workshop, market needs and competency requirements will be captured in relation to social, technological, environmental, economic and institutional factors. The workshop will also provide opportunity to validate the initial literature findings on competency requirements to increase societal resilience to disasters. It is expected that CIB 2014 conference will bring together large number of academics and practitioners who have strong links towards built environment and construction sectors. This will provide opportunity for CADRE to capture interdisciplinary needs across a range of stakeholders in the construction sector in developing societal resilience to disasters, which is one of the major objectives of the project.

CADRE is supported by an EU grant and will run for three years. The project is led by University of Salford's Centre for Disaster Resilience, based in the UK. The Salford team are working in conjunction with the Tallinn University of Technology (Estonia), Vilnius Gediminas University of Technology (Lithuania), Northumbria University (UK) and United Nations International Strategy for Disaster Reduction (Switzerland). These four European based institutions are joined by two partners from Sri Lanka who will bring a much-needed international perspective to the project: the University of Moratuwa and the Federation of Local Government Associations Sri Lanka.

Agenda for the workshop is as follows:

- Welcome and introduction to the workshop
- CADRE background and initial findings
- Brainstorming session
- Discussion and summary
- Future actions

Further information

For further information, please contact:

Professor Dilanthi Amaratunga,
Principal Investigator, Centre for Disaster Resilience,
School of the Built Environment, University of Salford,
Salford, Greater Manchester,
M5 4WT, UK

E: r.d.g.amaratunga@salford.ac.uk

W: www.disaster-resilience.net/cadre/

The Horizon 2020: Teaming up with the EU for Research Excellence

Please refer to the programme for venue and timing information

Horizon 2020 awareness raising workshop in collaboration with CASCADE (Collaborative Action towards Societal Challenges through Awareness, Development, and Education)

Horizon 2020, the new EU Framework Programme for Research and Innovation, has just been launched by the European Commission. . The Programme began in January 2014 and offers vast opportunities for funding and networking for organisations from around the world. The CASCADE (Collaborative Action towards Societal Challenges through Awareness, Development, and Education) project attempts to raise awareness and understanding of those areas of research and innovation that will benefit from mutual cooperation between Europe and South Asia. In association with the 2014 CIB International Conference on Construction in a Changing World, three workshops will be conducted to raise awareness on Horizon 2020. Two workshops will be held as pre conference workshops at National Science Foundation of Sri Lanka and at University of Moratuwa, Sri Lanka on the 2nd May 2014. The third workshop will be held as part of the 2014 CIB International Conference on Construction in a Changing World at Kandalama, Sri Lanka.

Goals of the event include: What is Horizon 2020?; What are the opportunities for you?; How can you be part of Horizon 2020 programme?; What are the opportunities for international collaboration?; What are the priorities in research and innovation for fostering cooperation and towards building mutual understanding?; How can you contribute to policy dialogue and implementation of joint strategic agendas for research, development and innovation?; What sort of support is available?

The content of the workshops will focus on the following areas.

- The Structure and goals of the Horizon 2020 programme
- Opportunities for South Asian Institutions in Horizon 2020 programme
- Guidance on how to find partners and how to participate in a Horizon 2020 proposal

Horizon 2020 is the largest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) in addition to the private investment that this money will attract. By coupling research and innovation, Horizon 2020 is helping to achieve the aim of securing Europe's global competitiveness with its emphasis on excellent science, industrial leadership and tackling societal challenges. Accordingly, the programme consists of three separate pillars, addressing key priorities where there is clear Union added value.

The three pillars are,

1. Excellent Science
2. Industrial Leadership
3. Societal Challenges

Horizon 2020 aims to solve some of society's biggest challenges, from ageing populations to the need for clean energy, and keep Europe's economy competitive over the long term. It provides €31.5 billion of research funding under societal challenges. Accordingly, the third pillar of Horizon 2020 is built upon the concerns of citizens and society combined with EU policy objectives.

Funding focuses upon seven societal challenges:

1. Health, demographic change and wellbeing
2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy
3. Secure, clean and efficient energy

4. Smart, green and integrated transport
5. Climate action, environment, resource efficiency and raw materials
6. Europe in a changing world - inclusive, innovative and reflective societies
7. Secure societies - protecting freedom and security of Europe and its citizens

The European Commission website contains detailed information about Horizon 2020 Societal Challenges: www.ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

Challenge 1 - Health, Demographic Change and Wellbeing

Responding to this challenge, research and innovation (R&I) under Horizon 2020 is an investment in better health for all. It aims to keep older people active and independent for longer and supports the development of new, safer and more effective interventions. R&I under Horizon 2020 also contributes to the sustainability of health and care systems. During the first two years (Work Programme for 2014/15), the EU will invest in Personalising health and care, and Coordination activities.

R&I supported by Personalising health and care will:

- improve EU's understanding of the causes and mechanisms underlying health, healthy ageing and disease;
- improve EU's ability to monitor health and to prevent, detect, treat and manage disease;
- support older persons to remain active and healthy and
- test and demonstrate new models and tools for health and care delivery.

R&I supported by Coordination activities will leverage Member State activities in areas including neuroscience, cancer, systems medicine). Several activities not included in the 2014/15 work programme will also be part of this challenge, notably the Innovative Medicines Initiative, the European and Developing Countries Clinical Trials Partnership (EDCTP), and the Active and Assisted Living Programme.

Challenge 2 - Food Security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research, and the Bioeconomy

The EU has recognised that a transition is needed towards an optimal and renewable use of biological resources and towards sustainable primary production and processing systems. These systems will need to produce more food, fibre and other bio-based products with minimised inputs, environmental impact and greenhouse gas emissions, and with enhanced ecosystem services, zero waste and adequate societal value. Agriculture, forestry, fisheries and aquaculture, together with the bio-based industries, are integral parts of the European economy and society. Relying on the use of limited natural resources, these sectors produce and process biological resources to satisfy the demand of consumers and a wide range of industries for food, feed, bio-energy and bio-based products. While they enhance Europe's self-reliance and provide jobs and business opportunities essential for rural, coastal and marine areas, these sectors are also facing significant challenges which require solutions based on research and innovation.

Challenge 3 - Secure, Clean and Efficient Energy

The Energy Challenge is designed to support the transition to a reliable, sustainable and competitive energy system. To make the transition to a competitive energy system, the EU needs to overcome challenges such as increasingly scarce resources, growing energy needs and climate change. The Challenge is structured around seven specific objectives and research areas:

- Reducing energy consumption and carbon footprint
- Low-cost, low-carbon electricity supply

- Alternative fuels and mobile energy sources
- A single, smart European electricity grid
- New knowledge and technologies
- Robust decision making and public engagement
- Market uptake of energy and ICT innovation

Challenge 4 - Smart, Green and Integrated Transport

This Challenge aims to boost the competitiveness of the European transport industries and achieve a European transport system that is resource-efficient, climate-and-environmentally-friendly, safe and seamless for the benefit of all citizens, the economy and society. The Challenge will contribute to four key objectives, each supported by specific activities. They are:

- a resource efficient transport that respects the environment
- a better mobility, less congestion, more safety and security
- a global leadership for the European transport industry
- a socio-economic and behavioural research and forward looking activities for policy making

Challenge 5 - Climate Action, Environment, Resource Efficiency and Raw Materials

Activities in this Challenge will help increase European competitiveness, raw materials security and improve wellbeing. At the same time they will assure environmental integrity, resilience and sustainability with the aim of keeping average global warming below 2°C and enabling ecosystems and society to adapt to climate change and other environmental changes. This Challenge funds research and innovation with the following specific objectives:

- to achieve a resource – and water - efficient and climate change resilient economy and society
- the protection and sustainable management of natural resources and ecosystems
- a sustainable supply and use of raw materials, in order to meet the needs of a growing global population within the sustainable limits of the planet's natural resources and ecosystems

Research and innovation under this challenge will cover the broad lines of activities of Fighting and adapting to climate change; Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems; Ensuring the sustainable supply of non-energy and non-agricultural raw materials; Enabling the transition towards a green economy and society through eco-innovation; Developing comprehensive and sustained global environmental observation and information systems; and Cultural heritage.

Challenge 6 - Europe in a Changing World - Inclusive, Innovative and Reflective Societies

Europe faces huge challenges in reducing inequality and social exclusion. Reducing inequalities and social exclusion in Europe (80 million people at risk of poverty, 14 million young people not in education, employment or training), overcoming the economic and financial crisis and tackling unemployment (12% in EU and above 20% of youth unemployment in 2012) are crucial challenges for the future of Europe. Supporting inclusive, innovative and reflective societies is a prerequisite for a sustainable European integration. In this context, this Societal Challenge of the Horizon 2020 programme aims at fostering a greater understanding of Europe, by providing solutions and support inclusive, innovative and reflective European societies with an innovative public sector in

a context of unprecedented transformations and growing global interdependencies. This will promote coherent and effective cooperation with third countries.

Challenge 7 - Secure Societies – Protecting Freedom and Security of Europe and its Citizens

This Challenge is about undertaking the research and innovation activities needed to protect citizens, society and economy of the EU as well as its infrastructures and services, prosperity, political stability and wellbeing. The primary aims of the Secure Societies Challenge are:

- to enhance the resilience of EU society against natural and man-made disasters, ranging from the development of new crisis management tools to communication interoperability, and to develop novel solutions for the protection of critical infrastructure
- to fight crime and terrorism ranging from new forensic tools to protection against explosives
- to improve border security, ranging from improved maritime border protection to supply chain security and to support the Union's external security policies including through conflict prevention and peace building
- and to provide enhanced cyber-security, ranging from secure information sharing to new assurance models

CASCADE project team of University of Salford

Professor Dilanthi Amaratunga, Professor Richard Haigh, Kanchana Ginige
Centre for Disaster Resilience
University of Salford
Salford, UK

Email: r.d.g.amaratunga@salford.ac.uk

Further details of the project can be read by visiting: www.cascade-inconet.eu

Awards

Emerald Publishing Limited generously donates awards for the Conference:



Emerald Group Publishing

BEPAM (Built Environment Project and Asset Management), a journal published by Emerald Group Publishing, has arranged for the following award: *BEPAM Best Paper Award at CIB 2014 International Conference* with a certificate and a prize of 6 months BEPAM subscription for the author(s). The CIB 2014 International Conference BEPAM Best Paper will be selected from among the shortlisted papers by BEPAM Editorial representative(s). Professor Mohan Kumaraswamy, Editor of the Journal and Dr Champika Liyanage, University of Central Lancashire, UK led this activity.

Construction Innovation: Information, Process, Management journal, which is published by Emerald Group Publishing, will present the *Construction Innovation Best Paper Award at the International Conference at the CIB 2014* with a certificate and a prize of 6 months journal subscription for the author(s). Professor Jack Goulding, University of Central Lancashire, UK led this activity.

Special Issue of Journal

A special issue of the Built Environment Project and Asset Management (BEPAM) journal based on selected papers from the CIB 2014 Papers will be selected and shortlisted by the Conference Scientific Committee from among good papers that address BEPAM's scope and coverage. BEPAM targets interface issues between project management and asset management of building and civil engineering infrastructure, but also includes papers that focus on either project management or asset management issues. Authors of shortlisted / selected conference papers, will be invited to develop their papers e.g. based on any other findings, expanded in some areas and drilling deeper into others, to justify a good journal publication; and to submit such rewritten papers for possible publication in a special issue of BEPAM, after the usual full double blind peer review process. BEPAM, being an internationally established journal, is encouraged by CIB, recognised by the Australian Business Deans Council and indexed in SCOPUS. For further information on the journal, please see www.emeraldinsight.com/bepam.htm.

Dr Champika Liyanage, University of Central Lancashire, UK will be the Guest Editor of this special issue of the journal.

General Information

Sri Lanka

Sri Lanka is an island situated in the Indian Ocean, at the base of the Indian Sub-Continent, 880 km north of the equator. It is a multi-ethnic, multi-religious country with a diverse and rich culture.

Sri Lanka's history is incident full, being an important trade port and oasis of nature for sea farers of China, Arabia and Europe of the ancient times. Sri Lanka has a fascinating documented history over 2500 years of Civilization. The most valuable source of knowledge for the legends and historical heritage of Sri Lanka is the Mahavamsa (Great Genealogy or Dynasty), a chronicle compiled in Pali, in the sixth century.

Sri Lanka is one of the first five gem bearing countries in the world (the other four gem bearing countries are Brazil, Myanmar, South Africa and Thailand). The principle gems of Sri Lanka are rubies and sapphires, while alexandrite, though not so profuse, is found only in Sri Lanka and in the ural mountains of the former Soviet Union.

Sri Lanka (formerly known as Ceylon) is about half the size of England and lies close to the southern tip of India and near the equator. From the coast, the land rises to a central massif more than 1500 m above sea level. The climate is hot and humid - monsoon from May to September and the north-east monsoon from November to March: rainfall, particularly in the south-west, is heavy. Sri Lanka was severely affected by the tsunami on 26 December 2004, which killed some 40,000 people and displaced 400 – 500 thousand people along two thirds of the north-east, south and south-west coastline. Half the fishing fleet was destroyed, and a quarter of hotels in the affected areas sustained serious damage.

Time: Sri Lanka's time zone is GMT +5:30 hours

Government: Unicameral Parliament with Executive presidency

Area: 25,332 sq miles (65,610 sq km)

Population: (2006 est.): 20,222,240 (growth rate: 0.8%); birth rate: 15.5/1000; infant mortality rate: 14.0/1000; life expectancy: 73.4; density per sq mi: 809

Commercial Capital and largest city (2003 est.): Colombo

Legislative and judicial capital: Sri Jayawardenepura Kotte

Main exports: Clothing and textiles, tea, gems, rubber, coconuts

Languages: Sinhala 74% (official and national), Tamil 18% (national), other 8%; English is widely spoken and is studied as a compulsory secondary language in school.

People: 73.94% Sinhalese, 12.7% Tamil, 7.1% Muslim, 5.5% Hill Tamil, and 1.5% other

Languages: Sinhalese, Tamil, English

Religion(s): Buddhist (69.3%); Hindu (15.5%); Muslim (7.5%); Christianity (6.9%), other (0.8%)

Currency: Rupee, divided into 100 cents



Literacy rate: 92% (2003 est.) The highest in South Asia and second highest in Asia.

Member of Commonwealth of Nations

Climate: Sri Lanka has a pleasant tropical climate: the average temperature of the low lands ranges between 25-30 degrees Celsius.

Conference location

Heritance Kandalama, located 170km from Colombo Airport, is an architectural masterpiece by Geoffrey Bawa, built overlooking the rock fortress of Sigiriya. The hotel sits at the heart of the cultural triangle of Sri Lanka, close to five UNESCO World Heritage Sites.

The unpaved road through the jungle gives no clue to what to expect – there are no views of the hotel on the horizon. Then suddenly, as you drive up a ramp, a cave-like entrance appears. And even as you step into another world of minimalist white pillars and cool curving corridors, enormous boulders intrude and birdsong hangs in the air.

The theme continues throughout the hotel. Heritance Kandalama is shaped like the outspread wings of a bird, following the line of the cliff from which it seems to emerge. The hotel is 1km from end to end, and rises up seven floors, yet appears to be a perfectly natural extension of the mountainside. The flat roof and timber pillars support a screen of vegetation that attracts local wildlife.

The abundance of real-life animals around the hotel is complemented by wonderful large-scale sculptures within it. A metal owl is suspended outside the main restaurant; wooden elephants inhabit the lounge; a stone cobra uncoils along the terrace overlooking the infinity pool.

However, while focussing on highlighting its enchanting natural surroundings, our venue in Sri Lanka gives priority to providing its guests with the finest comforts and service. The stylish bedrooms and suites offer wonderful views over Kandalama lake.

The hotel offer a wide range of activities and excursions to help you find out more about the local wildlife and community as well as some of Sri Lanka's amazing heritage.

Heritance Kandalama has won more than 50 awards for its architecture, environmental policies, food and service. They were the first Green Globe 21 certified hotel in Asia and, most recently, in June 2011, they won the Gold Award for Built Environment in the prestigious Green Apple Awards. Further details about the hotel can be found at the Heritance Kandalama website: www.heritancehotels.com/kandalama.

Kathikawa conference centre

With a stunning panoramic view of the Kandalama Lake, surrounding Ritigala mountainscape and the Dambulla Cave Temple, Heritance Kandalama is an ideal location for our conference. Observation elevators will usher delegates to the Kathikawa conference centre, newly opened in 2013, which houses 6 flexible meeting spaces totaling 5,685 square feet. The largest space, the main hall, is over 3200 square feet and 17 feet height can host up to 350 guests. An additional outdoor wooden cocktail deck where guests can be entertained under the stars is also available. Our 6 meeting rooms can accommodate from 20 to 350 in a variety of configurations, including an intimate boardroom setting.

Useful contact details

Mr Ziyen Ameen, a representative from our event manager, can be contacted on the following number (this is a Sri Lankan number): +94 (0)777788931.

Conference language

The official language of the conference is English. No interpretation will be provided.

Dress code

The dress code for the Conference Welcome Reception on the evening of the 4th May is casual. The dress code for all plenary and parallel sessions on the 5th, 6th and the 7th May is casual. This will allow participants to conduct discussions in a more comfortable environment, as well as limit the use of air conditioning and thereby reduce greenhouse gas emissions. The dress code for the evening programme is shown within the relevant section, along with details of each event. Please note that the hotel does not permit guests to wear shorts when in the restaurant.

Liability and insurance

It is recommended that participants and companions arrange personal health and travel insurance. The organisers will not assume responsibility for injury or damage to persons or property during the conference.

Social Programme

Welcome Reception

Date: 18:00 – 20:00, 4th May 2014

Venue: Katakatha Terrace (open air), Heritance Kandalama

Dress code: Casual

Price: Complimentary for all delegates and fee paying companions

The CIB 2014 Welcome Reception will be held on the hotel's Katakatha Terrace, overlooking Kandalama Tank and the range of Knuckles Hills. Delegates will be entertained by one of Sri Lanka's best known traditional dancing troops. Complimentary wine, beers and juices will be served, along with hot and cold canapes.

CIB 2014 Conference Gala Dinner

Date: 19:00 – 21:00, 5th May 2014

Venue: Dambulla Wing Garden (open air), Heritance Kandalama

Dress code: Smart casual - All delegates and companions will be provided with a traditional Sri Lankan top to wear in the evening. These will be issued during registration.

Price: Complimentary for all delegates and fee paying companions

The CIB 2014 Gala dinner will be held in the Heritance Kandalama's Dambulla Wing Garden. This beautiful setting will allow guests to reflect on this lush oasis hidden away amidst flowers and fauna, depicting the coming together of man-made structures and the natural world. Guests will be offered a range of Sri Lankan and International Cuisine. Complimentary wine will be served at the table. Traditional Sri Lankan music will accompany the evening.

Excursion to Minneriya Wildlife Park

Date: 15:00 departure, 6th May 2014

Meeting point: Heritance Kandalama Reception

Dress code: Casual

Price: Complimentary for all delegates and fee paying companions. Additional places may be available on request, priced £30.00. Please ask at the conference registration desk for more details. The Minneriya Park has been included in the list of important Asian Wetlands. Minneriya is a wonderful opportunity for wildlife enthusiasts and casual travellers to observe the social dynamics of elephants. Matriarchs lead their clans to water, the whole group taking care to safeguard the baby elephants that are always flanked by adults. Clans of related elephants will coalesce into herds when they converge into Minneriya in search of a common quest for food, water, cover and mates. As evening falls, the elephants, up to 150 in number, emerge from the scrub, in small herds of tens, coalescing into larger herds, sometimes numbering over a hundred. The gathering is one of the most unforgettable and fantastic events in the international wildlife calendar.

Sri Lankan Theme Evening

Date: 18:00 – 20:00, 6th May 2014

Venue: Kanchana Restaurant, Heritance Kandalama

Dress code: Casual

Price: Complimentary for all delegates and fee paying companions.

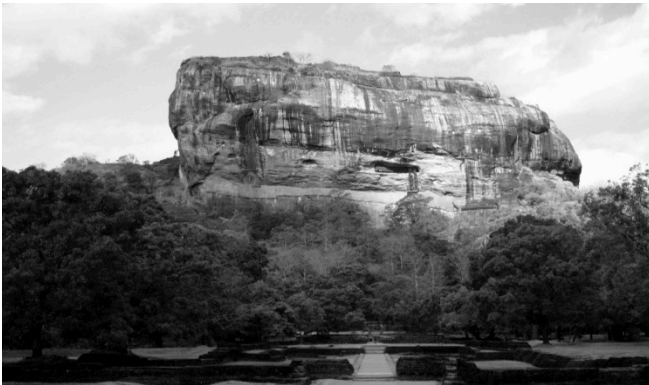
Guests will be offered a wide variety of local and regional Sri Lankan cuisine at Kanchana Restaurant, overlooking Kandalama Tank and Sigiriya Rock. Traditional Sri Lankan entertainment will accompany the evening.

Additional Activities and Excursions

The following activities and excursions are not included in the conference fee. Please contact the conference registration desk for further details.

Dambulla & Sigiriya UNESCO World Heritage Sites

Dambulla is the most impressive cave temple in Sri Lanka, with five caves under a vast overhanging rock, carved with a drip line to keep interiors dry. In 1938 the architecture was embellished with arched colonnades and gabled entrances. Inside the caves, the ceilings are painted with intricate patterns of religious images following the contours of the rock. There are images of Lord Buddha, bodhisattvas, gods and goddesses.



Sigiriya was built in the 5 century AC and this comprise of magnificent complex of geometrically laid gardens, pools, fountains (still working today) as well as oldest surviving murals of maidens. The summit of this almost inaccessible rock is 180m (600ft) above the surrounding jungle and was the setting for a courtly paradise of elegant pavilions amid gardens and pools. Built on top of a 200m high rock, the entrance to the climb once has been through a lion's head. Half way up the rock are beautifully drawn paints which should be the eighth wonder of the world, Sigiriya, is a must see item in Sri Lanka.

Spice identification competition

At the spice garden the group will be given a lecture on a wide variety of spices and also the opportunity to see and sample same. Thereafter, each member will be blindfolded and given a mix of 3-4 spices. They will be given a paper and pencil to identify and write the names of the spices purely by the senses of touch, smell and taste. The winner/winners will be given a package of spices as a prize.

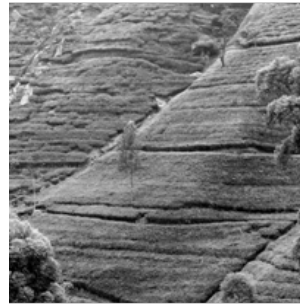


Visit to batik factory & handicraft center

A visit to a Batik (traditional Sri Lankan fabric painting method) and Handicraft centre factory will be organised as a part of this programme.

Post Conference Tours

The following activities and excursions are not included in the conference fee. Please contact the conference registration desk for further details.



Polonnaruwa

A UNESCO World Heritage site, Polonnaruwa was the medieval capital of Sri Lanka, and the ancient city is one of the most beautiful centres of this island's heritage. The archaeological sites of Polonnaruwa are preserved in their original form.

Anuradhapura

A UNESCO World Heritage Site, located in the North-Central part of the Island Anuradhapura was originally founded by a King's Minister called Anuradha in 500 BC. It is acclaimed as the greatest monastic city of the ancient world and has served as the royal capital of 113 Kings. In 1073 Anuradhapura was fought over and abandoned when the capital was moved to Polonnaruwa. The city was abandoned to the jungle that slowly enveloped it. The crumbling ruins were re-discovered by explorers in the 19th century and an effort at restoration and rebuilding began. It is an important historical and archaeological site and continues to draw both Sri Lankan and foreign visitors as well as pilgrims.

Tea plantations

Sri Lanka is one of the world's largest exporters of tea. Since the introduction of tea to Sri Lanka in mid 19th century country hill country has been the capital of the tea industry. For many miles prior to reaching Nuwara Eliya from either direction you will find acres and acres of tea plantations, in fact nothing but tea estates. There are many factories open for visitors which also have tea sales outlets.

Kandy

A World Heritage city, available historical records of Kandy suggest that Kandy was established during the period of his reign from 1357-1374 AD. Since its founding in the 14th Century, Kandy which remained the last stronghold of local kings had gone through many a vicissitude. Although Colombo represents the prime commercial and administrative centre, Kandy continues to remain the cultural capital of Sri Lanka with a rich heritage of living monuments.

Book of Abstracts

Introduction

This section contains the abstracts of papers submitted to, double blind peer refereed and accepted for the CIB International Conference 2014: Construction in a Changing World.

This book includes 94 abstracts by scholars, policy makers and practitioners around the world. The full papers are available on an accompanying USB drive.

Abstracts and papers are groups by the following CIB Working Commissions and Task Groups:

- W055 Building Economics
- W065 Organisation and Management of Construction
- W089 Building Research and Education
- W092 Procurement Systems
- W096 Architectural Management
- W102 Information and Knowledge Management in Building
- W117 Performance Measurement in Construction
- TG72 Public Private Partnership
- TG74 New Production and Business Models in Construction
- TG81 R&D Global Construction Data
- TG83 e-Business in Construction

Within each CIB Working Commission and Task Group, abstracts are listed by ID number.

An index of authors is provided at the end of the book.

W055 BUILDING ECONOMICS

Application of new institutional economics to construction management: literature analysis using keywords

Ceric, A., University of Zagreb, Croatia, anita@grad.hr

The New Institutional Economics has been playing an increasingly important role in the construction management literature. This applies especially to the transaction cost theory and the principal-agent theory, both of which have been recurrently applied to the research in the field since the onset of the new millennium. This analysis of the construction management literature uses keywords containing the most important concepts of this theoretical framework. Keywords have become important parts of academic papers, and they are crucial in the literature search. However, this literature analysis shows a rather superficial understanding of the New Institutional Economics in the field. Although both the principal-agent theory and the transaction cost theory are parts of this theoretical framework, the analysis of literature presented here shows that the construction management community favours the latter to the former by a wide margin. More important, the interconnections between the two appear to be poorly understood.

Keywords: new institutional economics, transaction cost theory, principal-agent theory, literature analysis, construction management

Theme: CIB W55 Building Economics

ID: 468

Supporting sustainable transportation by urban structure development

Ottelin, J., Aalto University School of Engineering, Finland, juudit.ottelin@aalto.fi
Heinonen, J., Aalto University School of Engineering, Finland, jukka.heinonen@aalto.fi

Vast amount of studies have demonstrated that denser urban structures lead to smaller GHG-emissions from transportation. As a consequence increasing the urban density has become one of the key means to mitigate the emissions from urban areas. However, many of these studies have been limited to private driving or the local ground transportation. Yet flying is becoming increasingly frequent and air travel habits also heavily depend on socio-economic as well as spatial issues. In addition many of the previous studies have not taken into account the potential methodological problem of self-selection, which may cause statistical bias to the results. In this study we illustrate the effect of one aspect of self-selection, the family structure, and the importance of including air travel in the GHG-emission assessments. Our results show that the urban form affects more strongly the single- and couple-households than larger families. We also found a clear trade-off relationship between motorization and air travel. This evens out, though does not reverse, the differences in the GHG-emissions of transportation between motorized and non-motorized households. The study uses data from the Finnish Transportation Agency's passenger traffic survey 2010-2011, which includes detailed information on one-day travel for over 12000 people and over 35000 trips. The scope of the study is the Helsinki Metropolitan Region (HMR). The main policy implication of our study is that urban densification has only limited possibilities to reduce the GHG-emissions and these limitations should be better understood. Furthermore in the transportation sector the technological development is much more rapid than the structural changes in the built environment, which should be taken in consideration when assessing the GHG mitigation potentials.

Keywords: social mobility, sustainable transportation, urban structure, life cycle assessment, lifestyles

Theme: CIB W55 Building Economics

ID: 523

The urban and the restless? Greenhouse gas effects of rural-urban migration of households

Ala-Mantila, S., Department of Real Estate, Planning and Geoinformatics, Finland, sanna.ala-mantila@aalto.fi
Heinonen, J., Department of Real Estate, Planning and Geoinformatics, Finland, jukka.heinonen@aalto.fi

Urbanization is on a continuous rise in nations both developing and developed. Often the direction is from less urbanized areas to cities and metropolitan areas, as the ever rising housing prices and rents in these most urbanized areas indicate. However, besides being just a transition from one place to another moving usually leads to behavioral changes as the surrounding infrastructure and the consumption and leisure possibilities it offers can be even essentially different. In addition, the rapid urbanization requires continuous development of the receiving urban areas, especially in the form of new construction.

Even if different kinds of footprint calculations are becoming more and more mainstream, the economy-wide greenhouse gas effects of a household moving from place A to place B are largely unknown. The purpose of the paper is to shed a light on the greenhouse gas impact of household moving from a less dense area to denser urbanization. We also analyze the difference of living in a newer and older urban apartment building and investigate what, if any, behavioral changes in i.e. personal travelling behavior are involved.

We employ statistical census data of Statistics Finland to estimate the average emissions of a dweller living in a dense metropolitan area and compare those to estimated average emissions caused by dweller living in a non-urban area. In addition, two groups of urban households are compared: those living in new building stock built in the 2000s and those living in the suburbs built in the 1960s and 1970s. The greenhouse gas emissions are assessed with consumption-based environmentally-extended input-output (EE I-O) model and further elucidated with regression analyses. Urban areas where at least 90 % of the population lives in urban settlements and non-urban areas, namely less densely populated semi-urban and rural municipalities, are utilized as case areas.

Our results facilitate the understanding of urban lifestyles and in particular lifestyle changes related to moving from non-urban to urban area or from an older building to a new one. We find out that the effect on the total greenhouse gas emissions of an economy depend on the affluence of the moving households and also the age of the building seem to have a certain role. We believe that our approach offers an important insight to the search for sustainable lifestyles. Also housing policies could benefit if also the climate change related externalities would be kept in mind.

Keywords: urbanization, life cycle assessment (LCA), greenhouse gas, household, consumption/behavior

Theme: CIB W55 Building Economics

ID: 524

Forecasting cash flow expenditure at pre-tender stage: case studies in New Zealand construction projects

Heaps, A., Massey University, New Zealand, Andrew.Heaps@nz.rlb.com

Domingo, N., Massey University, New Zealand, n.d.domingo@massey.ac.nz

Construction projects are extremely reliant on cash flow to survive. Cash flows from the client to the contractor and onto the subcontractors through monthly progress payments. Knowing the value of each progress payment in advance is essential for clients to arrange their sources of funding to ensure timely payments. The creation of a cash-flow forecast is a complex process, especially in the pre-tender stage of a project. There have been a number of past studies done in the area of cash-flow forecasts for construction projects at various stages. The 4th degree polynomial and the Logit model have been identified in the literature as the most effective methods of forecasting cash flows at the pre-tender stage. However, no significant study has been done in New Zealand to identify the most accurate model to predict cash flow at the pre-tender stage.

This research aims to develop a robust model to effectively forecast cash flows for construction projects in New Zealand at the pre-tender stage. Interim payment valuations in nineteen completed projects were analysed, using Logit model and 4th degree polynomial, to identify the best model to forecast cash flow.

The 4th degree polynomial was identified as the most effective model for modelling cash flows. However, due to the unique nature of construction projects, no standardised curve was identified to represent cash flow forecast. It was discovered that an idiographic approach is needed to forecast cash flows, by adding or subtracting the unique features of the project from the base model. The findings of the research would be of benefit to quantity surveyors and construction clients in predicting cash flow in construction projects at the pre-tender stage.

Keywords: cash flow, construction industry, forecasting, New Zealand, pre-tender stage

Theme: CIB W55 Building Economics

ID: 527

Assessment of financial and environmental potential of a real estate energy efficiency investment

Christersson, M., Aalto University, Finland, matti.christersson@aalto.fi

Säynäjoki, A., Aalto University, Finland, antti.saynajoki@aalto.fi

Vimpari, J., Aalto University, Finland, jussi.vimpari@aalto.fi

Junnila, S., Aalto University, Finland, seppo.junnila@aalto.fi

Energy consumption reduction in the real estate sector possesses significant possibilities in environmental point of view but also, interestingly, in economic point of view. Emerging interest in energy efficiency improvements is driven by the growing awareness of energy costs, increasing energy prices and recent technical development in means of improving buildings' energy efficiency. In the environmental point of view, energy efficiency improvements have significant potential in reducing energy consumption related greenhouse gas emissions, which continue to dominate the total life cycle emissions of the current building stock.

The study focuses on financial and environmental performance of an energy audit investment in Finland. The study consists of two phases. First, we assess financial and environmental returns of energy efficiency investments in office buildings. Secondly, we compare rate of returns of energy efficiency investment with initial property investment returns. Possibilities of reducing greenhouse gas emissions of the building by energy efficiency improvements compared to the current energy consumption of the same building are assessed as well.

The results of the study indicate that compared to the average property investment returns, investments in energy improvements tend to result in higher returns and simultaneously in reductions of greenhouse gas emissions of the building. Furthermore, energy efficiency investments have short or moderate payback periods in both financial and environmental perspective. Predicted rises in energy tariffs in the future further increase the relevance of this investment option.

The results of the study reveal genuine financial and environmental advantages of energy efficiency investments. Yet, the benefits of energy efficiency investments are currently not easily reached nor realized by investors. This is at least partly due to mechanisms of distributing the potential returns of an investment between stakeholders and in the case of net leases, the mindset, which considers the heating and electricity costs more as passing through cost elements, eventually paid by the tenant, thus not always directly offering greater interest to the property owner. However, by focusing solely on the energy improvement investments and absolute returns that they generate, there appears to be tempting investment opportunities. Consequently, demand for the development in practices in the industry remains.

Keywords: sustainable real estate business, life cycle assessment, energy efficiency, returns

Theme: CIB W55 Building Economics

ID: 546

Managing uncertainty to improve the cost performance of complex infrastructure projects

Newton, S., The University of New South Wales, Australia, s.newton@unsw.edu.au

Skitmore, M., Queensland University of Technology, Australia, rm.skitmore@qut.edu.au

Love, P., Curtin University, Australia, p.love@curtin.edu.au

There has been a recent spate of high profile infrastructure cost overruns in Australia and internationally. This is just the tip of a longer-term and more deeply-seated problem with initial budget estimating practice, well recognised in both academic research and industry reviews: the problem of uncertainty. A case study of the Sydney Opera House is used to identify and illustrate the key causal factors and system dynamics of cost overruns. It is conventionally the role of risk management to deal with such uncertainty, but the type and extent of the uncertainty involved in complex projects is shown to render established risk management techniques ineffective. This paper considers a radical advance on current budget estimating practice which involves a particular approach to statistical modelling complemented by explicit training in estimating practice. The statistical modelling approach combines the probability management techniques of Savage, which operate on actual distributions of values rather than flawed representations of distributions, and the data pooling technique of Skitmore, where the size of the reference set is optimised. Estimating training employs particular calibration development methods pioneered by Hubbard, which reduce the bias of experts caused by over-confidence and improve the consistency of subjective decision-making. A new framework for initial budget estimating practice is developed based on the combined statistical and training methods, with each technique being explained and discussed.

Keywords: uncertainty, calibration, school infrastructure, risk management

Theme: CIB W55 Building Economics

ID: 579

Innovation in the construction of mega-projects

Brockmann, C., UAS Bremen, Germany, christian.brockmann@hs-bremen.de

Brezinski, H., TU Bergakademie Freiberg, Germany, horst.brezinski@vwl.tu-freiberg.de

Often the construction industry is criticized for a lack of innovation. The same industry designs and builds the largest projects of the world, megaprojects such as large bridges, tunnels, dams, harbors and airports. This discrepancy begs the question whether the lack of innovation is a true description of the construction industry. We can distinguish between product (design) and process (construction) innovation. To find an answer, a design/build megaproject can provide the necessary details for a case study. As the industry accounts do not summarize and later publish innovation in projects - the associated costs are just project costs - only an inside perspective can uncover the full degree of innovation. Participant observation was accordingly used to detect, define, analyze and categorize innovations at the BangNa Expressway Project in Thailand, with 54 km one of the longest bridges in the world. The result is an impressive list of innovations of the product and the processes that were new at the time of construction on the world, sector or company level. One example is a doubling in the speed of superstructure erection. This process innovation was only possible because of the project size. In a highly competitive industry, process innovation must lead to a decrease in price and therefore only a sufficiently large project can carry the investment cost associated with some innovations. Many innovations in the construction industry cannot be implemented because non-innovative approaches are less expensive and will win a bid, squeezing innovation out. In addition, the analysis shows that many innovations are so small that they hardly can be detected although they are ongoing continuously.

Keywords: construction industry, innovation, megaprojects, product innovation, process innovation

Theme: CIB W55 Building Economics

ID: 598

Construction activity and built assets in emerging economies: Building for economic growth or fuelling a bubble?

Ruddock, S., UCLan, United Kingdom, sruddock1@uclan.ac.uk

Ruddock, L., University of Salford, United Kingdom, l.ruddock@salford.ac.uk

Evidence indicates the existence of a positive relationship between economic growth and the level of construction activity in developing countries but transformation from a developing to a mature economy will, at some point, be evidenced by a diminishing reliance on the construction sector. The term emerging economies has been used to describe those countries making this transformation, often at a rapid rate of growth. Based on an analysis of United Nations time series data, comparisons are made for three groups of countries, classified according to World Bank categorisation into three groups in order to investigate the relationship between rapid economic growth, urbanisation and construction activity. The analysis considers evidence for the view that there is a threshold of construction activity (a 'speed bump') beyond which a bubble in asset prices may develop.

The paper also deals with the question of what is the relationship between new investment in built assets and the rate of economic development? It is noted that emerging economies appear to be catching up to the built asset wealth of the more developed economies. Built asset data (residential and non-residential construction (including infrastructure)) for emerging economies indicates that they are bridging the gap in accumulated wealth and the implications of this are considered.

Keywords: built assets, construction activity, economic growth, emerging economies

Theme: CIB W55 Building Economics

ID: 642

W065 ORGANISATION AND MANAGEMENT OF CONSTRUCTION

Lessons learned - an essential aspect of improving project management in the UAE

Yuan, J., Heriot Watt University, United Arab Emirates, jy77@hw.ac.uk
Skaik, S., Heriot Watt University, United Arab Emirates, s.samer@hw.ac.uk

The failure of learning from our mistakes or those of others, has generated unnecessary waste of time and costs, in the construction industry, due to its project based, fragmented and unstable nature. Lessons Learned, as an important way of improving projects performance, is analyzed in this study, with the aim to explore the current practice of Lessons Learned in the UAE construction industry. A literature review has revealed what "Lessons Learned" is under different contexts, and focused on various factors influencing a Lessons Learned Programme. The research method of a series of structured interviews, followed by an on line questionnaire, is adopted in this study. It was found that although the concept of Lessons Learned is quite familiar by most of professionals in the project management in the UAE construction industry, Lessons Learned practice is mainly performed in an informal way (individually or ad hoc). As for barriers for Lessons Learned practice, Culture factors, such as "Afraid to be blamed for mistakes" and "lack of learning culture" (1st and 2nd rank) influence significantly in Lessons Learned practice. It is also found that a formal lessons learned programme does exist in some organizations. However, with the lack of a dedicated Lessons Learned repository and Lessons Learnt system, Lessons Learned has yet a long way to reach its potential.

Keywords: lessons learned, construction industry, knowledge management, project management

Theme: CIB W65 Organisation and Management of Construction

ID: 471

Quantification of concurrent delays for expert reports using Windows Method

Nair, K., Heriot Watt University, United Kingdom, kpn4@hw.ac.uk
Skaik, S., Heriot Watt University, United Kingdom, s.samer@hw.ac.uk

Nowadays, construction delay disputes often end up on the arbitration route where the delay experts appointed by the parties advise the tribunal on the extension of times entitlements of the parties. For this purpose, the identification and quantification of concurrent and pacing delays are integral aspects of resolving these disputes using a proper delay analysis methodology. The aim of the study is therefore, threefold. Firstly, the available literature on the concurrent and pacing delays are analysed in detail to establish the principles for the evaluation of the concurrency and pacing delays. Secondly, a robust delay analysis methodology called 'windows impact/update method' is explained often used by the experts for the effective quantification of concurrent and pacing delays. This methodology is an improved version of time impact analysis and normal windows analysis. For better demonstration, the explanation of the methodology is facilitated with the help of a typical case study analysis. Finally, the principles of concurrency and pacing, as explained in the literature review, are promptly applied to the case study results to show the applicability of the analysis method on any types of delay disputes. The study shows the effectiveness of the windows impact/update method for the quantification of the concurrent and pacing delays.

Keywords: concurrency, pacing, analysis, windows, expert, arbitration

Theme: CIB W65 Organisation and Management of Construction

ID: 472

Can BIM help overcoming barriers in claims, disputes and dispute resolution?

Koc, S., Heriot Watt University, United Kingdom, sk408@hw.ac.uk
Skaik, S., Heriot Watt University, United Kingdom, s.samer@hw.ac.uk

Many researchers consider disputes as part of the project lifecycle. Although preventative actions exist, it is not utterly possible to avoid them. Once the disputes arise, an appropriate resolution technique should be adopted. Common perception is referring to a resolution method either internally or via a third party; which may also be binding by law. The resolution process requires attention to the disputed claims. Hence, deep investigation of the claims and choosing the appropriate method is crucial for the successful project delivery and reputation of the industry.

Preparation of disputed claims and resolution process also faces many debates. Conducting To effective dispute resolution requires attention to proper preparation and presentation of the incurred events. All the required information should be acquired to estimate and present the claim, for a smooth settlement. As an integrated digital model of the project, BIM, stores all the information of the projects in detail. Retrieval of the required information for the disputed issues can easily be obtained from the model. It is also possible to embed the construction schedule, change orders and variations, specifications and financial data such as cash flow along with the multidisciplinary drawings. As this model stores all the information at every particular time and phase, disputes can be concluded quick and accurate.

In this research, using a case study and literature review, disputes and resolution processes are deeply studied. A BIM model is created to investigate benefits on overcoming the challenges; during claiming, and resolution of the disputes. It is seen that the claims are prepared faster and more accurate in a visualized environment provided by BIM. Furthermore, substantiating and presenting the disputes for the resolution purpose was incomparable to the traditional methods. The conclusions recommend that; even the project did not adopt a BIM model earlier; it can be created for a smooth process, during claiming and resolution of disputes.

Keywords: claims, disputes, dispute resolution, BIM, construction industry

Theme: CIB W65 Organisation and Management of Construction

ID: 473

Collaborative engineering facilitated through integrated project delivery

Jones, B., Cal Poly, USA, bkjones@calpoly.edu

The paper discusses a proposal for an integrating partnership for decision making at pre-construction stages of major construction projects. The environment proposed is one that fully utilizes the strengths of intelligent collaborative computer agents that interact with the multi-discipline pre-construction team to interrogate and refine the design solution before construction commences. Better opportunities therefore exist to concurrently view the effect of design choices that impinge on the many contributors in terms of cost and performance of the final built structure. All contributors are collaboratively drawn into the design and pre-construction process. IPD and BIM form essential tools and strategies in this decision environment. IPD linked to the “Big Room” concept will be discussed. Discussion of successful IPD projects managed by some of the largest contractors in California will be presented. A system of design-collaborate-document forms the model for refining the design solution to drive budget downwards whilst maintaining value. The author's investigation measured the views of practitioners in the main building professions; architecture, engineering and construction management before proposing the collaborative system that is called for. The conclusion of the work is a conceptual model of the system proposed, a definition of the contractors' construction management computer agents and a specification based on scenarios of how they would interact with design agents.

Keywords: sustainable, collaborative engineering, Integrated Project Delivery (IPD), virtual design and construction, knowledge based engineering, intelligent agents, BIM, big room

Theme: CIB W65 Organisation and Management of Construction

ID: 475

Green construction supply chains for supporting green buildings in Indonesia: initial findings and future developments

Abduh, M., Institut Teknologi Bandung, Indonesia, abduh@si.itb.ac.id

Developments of green buildings in Indonesia's big cities have been promising in the last 5 years. The Indonesian government has been preparing some needed regulations related on the implementation of green buildings since then - two of them have been sanctioned related to the green specification and certification. Yet, recent studies on the effectiveness of the implementations have shown the need of more holistic approach in delivering the green buildings, including the importance of constructors in delivering the green specifications as designed by the owners through the professional designers. The concept of green construction was introduced to the construction practice. Some of the Indonesian big contractors have already tried to practice what so called green behaviour and practices in construction. Yet, the delivery of construction has not been satisfactory to meet all green specifications with some notable weaknesses in producing the construction products efficiently and effectively due to lack of lean construction techniques and green supply chains. Nevertheless, without the availability of the construction supply chain in supporting the lean construction approach, the green value would not be delivered at all. This paper discusses a portion of an on-going three-year research project's initial findings conducted by surveys. The objectives of surveys are to define the structures of the important commodities' supply chains in supporting green construction, i.e., materials, subcontractors, equipment, labours, and also to identify the conducts of green construction supply chain's members. By knowing the structures and also the conducts of the green construction supply chains, further agendas could be determined in developing the green construction supply chains in Indonesia by Government as well as by practitioners.

Keywords: green building, green construction, green supply chains, sustainable construction

Theme: CIB W65 Organisation and Management of Construction

ID: 482

Managing innovation: a focus on prefabricated building in the Libyan construction industry

El-Abidi, K.M.A., Universiti Sains Malaysia, Libyan, idi2891975@yahoo.com

Mohamed Ghazali, F.E., Universiti Sains Malaysia, Malaysian, cefarid@eng.usm.my

Azman, M.N.A., Universiti Pendidikan Sultan Idris, Malaysian, mnazhari@fptv.upsi.edu.my

"Construction industry development is a deliberate process to improve the capacity and effectiveness of the construction industry in order to meet the demand for building and civil engineering products, and to support sustained national economic and social development objectives". The prefabricated building implementation in Libya is very limited. Most prefabrication projects in the country are handled by foreign companies, except for one governmental company that has been conducted from 1978 to 2006. Many developing countries lack prefabrication technologies but have proposed several policies for mechanization or prefabrication in their respective construction industries. However, prefabricated building is not yet embraced by the Libyan construction industry, the private sector must be encouraged by the government to participate in the development of such structures. Nonetheless, several studies have cited the difficulties involved in technology transfer, including lack of local knowledge on transforming to the prefabricated building successfully. This study conducts a series of semi-structured interviews to identify the best technology transfer practice for prefabricated building products in the Libyan construction industry, especially the precast concrete. The interview results indicated that the presence of foreign companies in Libya can expand the scope for technology transfer and for development of local firms through joint ventures.

Keywords: developing countries, ways to success, local contractors, Libya, precast concrete.

Theme: CIB W65 Organisation and Management of Construction

ID: 483

Managing international NGO projects- context, cultural competence and its impact on performance (A case study from Kenya)

Dale, J.M., British University in Dubai, United Arab Emirates, jorunnmdale@hotmail.com

Dulaimi, M., British University in Dubai, United Arab Emirates, mohammed.dulaimi@buid.ac.ae

The increased global awareness of poverty and inequality issues has increased demands for Non-Government Organisations (NGO) and their expertise in international development projects. However, despite higher requirements to accountability, improved project frameworks and a more professional management staff, too many international development projects tend to fail. This issue has raised concerns that such projects need a distinctive set of values, skills and competences for effective project management within the complex NGO context. The paper's aim is to explore the contextual factors and cultural competence that may influence project managers' ability to lead international development projects successfully. Due to limitations of existing theory, an empirical qualitative research was applied. In that regards, a case study approach was chosen where the researcher followed an international project manager amongst the Maasai people in Kenya for six weeks. Based on the literature review, field observations as well as 12 interviews 6 contextual factors were highlighted as most influential on project performance: the complex web of stakeholders, power balances, different cultures and traditions, inequality and limited access to resources, the community's motivation and willingness to change as well as the local decision-making process. Moreover, findings indicate that the cultural competence can support a process that may increase the awareness and knowledge of contextual factors that again may improve the project managers' ability to establish relationships, to communicate and approach challenges and opportunities more effectively.

Keywords: NGO, culture, project management, stakeholders

Theme: CIB W65 Organisation and Management of Construction

ID: 489

Innovation development for highly energy-efficient housing

Mlecnik, E., TU Delft, The Netherlands, e.mlecnik@tudelft.nl

Buildings account for 40% of EU final energy demand and policy developments like the Energy Performance of Buildings Directive are stimulating the innovation development for nearly zero-energy housing. However, businesses switching to innovative products for highly energy-efficient houses is a process that is poorly understood. To accelerate nearly zero-energy housing, all obstacles that currently restrict the distribution of innovation - experienced by end users, businesses and policy makers - must be defined and tackled simultaneously. These barriers and opportunities have been described in detail in a market study, three business innovation studies, three studies on end user experiences and three policy studies. These studies were recently assembled in a book.

The enterprise studies confirm that collaboration between companies is essential to innovation, even beyond the usual ad-hoc knowledge application and the individual collaboration during demonstration projects. One major obstacle is the transfer of the necessary technical knowledge and skills by the few pioneers to the other companies. Manufacturers, in particular, play a key role in the adoption of innovation and the transfer of new insights to small and medium-sized enterprises, which are a key target group for the market introduction of new concepts in the building sector.

Only a small group of occupants is interested in the energy savings and new forms of sustainable living. The study shows that end users can be motivated by low energy costs and improved living quality. They may be adequately satisfied with their homes, particularly with the high level of comfort.

The policy studies confirm that the government should play a more active part in getting energy-efficient housing off the ground, especially house renovations: the business community should be encouraged to develop more innovations which requires financial resources.

Manufacturers and suppliers switching to innovative products for ultra energy-efficient homes is not a standalone process of companies promoting technologies which consumers then use. Innovation is a diffuse process which must be approached from a policy perspective as well as the demand and supply perspectives.

Keywords: innovation, housing, low energy, passive house, policy

Theme: CIB W65 Organisation and Management of Construction

ID: 496

Beyond terminology - which contracting features promote innovation

Nyström, J., The Swedish National Road and Transport Research Institute, Sweden, johan.nystrom@vti.se

Nilsson, J.E., The Swedish National Road and Transport Research Institute, Sweden, jan-eric.nilsson@vti.se

Lind, H., Royal Institute of Technology, Sweden, hans.lind@abe.kth.se

Two opposing contracting forms in construction are DB (Design and build) and DBB (Design-bid-build). The first one provides the contractor degrees of freedom in design, which enables innovation. DBB is the safe and traditional contracting form, where the client is responsible for the design and the contractor build accordingly. There is a lack of empirical studies comparing these contracting forms on efficiency and innovation. A first step in comparing is to define and separate the contracts. The straightforward solution is to use the client instigated definitions at face value i.e. a contract is a DB or a DBB according to the client. This is shown to be problematic by using five road construction projects from Sweden. One of the DBB indicates more degrees of freedom in design than a DB contract and only one DB project invites new methods for construction. The paper concludes that contract labelling is not a good proxy for degrees of freedom in design, which is was theoretically drives innovation. This insight facilitates future studies to evaluate contracting forms.

Keywords: innovation contracting evaluation

Theme: CIB W65 Organisation and Management of Construction

ID: 498

Old-technology twist to sustainability innovation in the construction industry: case-study of an NGO's low-tech alternative for energy efficient housing in Finland

Pulkka, L., Aalto University, Finland, lauri.pulkka@aalto.fi

Junnila, S., Aalto University, Finland, seppo.junnila@aalto.fi

The built environment accounts for approximately 40 % of total energy use and anthropogenic greenhouse gas emissions in many developed countries. Increasing the energy efficiency of buildings and decreasing construction phase emissions are central to mitigating climate change. Sustainability innovations are seen as an integral part of the solution. The purpose of this paper is to explore how sustainability innovations may actually come about in the construction industry. This paper presents the results of a longitudinal case study of an unlikely innovator in the construction industry, the Finnish Cultural Foundation, and its K3 houses initiative. The three K's stand for the Finnish words for beautiful, sustainable, and affordable. In practice the initiative has resulted in five complete designs for industrially manufactured detached houses that are free for private and commercial use. By proving the economic and technical feasibility of a vapour-barrierless timber-frame structure and natural ventilation in meeting the strict energy efficiency requirements of the Finnish building code, the Foundation attempts to point out an alternative path to increasing technology-dependence in low-energy building. The data consists of interviews and archival material. The data is analysed using a visual mapping strategy and the case description is analysed using a model of the structural context of the management of innovation in the construction industry. The results reveal numerous challenges regarding inter-organizational interactions, some of which are context-dependant and others with generalizable implications. Especially the interplay between vision pull and regulatory push mechanisms as drivers of innovation is of interest to both academics as well as practitioners. The contribution of the study is twofold. First, the case serves as a revelatory example of a low-technology solution to increasing energy efficiency of housing. The plans are highly innovative, but do not rely on high-technology. Second, it offers a detailed account of the complex nature of innovation processes in the construction industry. Of special interest is how an NGO as an outsider to the sector manages innovation in the construction industry.

Keywords: innovation, detached housing, regulation, ecological modernization theory, low-technology

Theme: CIB W65 Organisation and Management of Construction

ID: 502

The distribution of absorptive capacity among road industry sectors – the story of suppliers

Manley, K., Queensland University of Technology, Australia, k.manley@qut.edu.au

Rose, T., Queensland University of Technology, Australia, tm.rose@qut.edu.au

Lewis, J., Queensland University of Technology, Australia, jo.lewis@qut.edu.au

The absorptive capacity of organisations is one of the key drivers of innovation performance in any industry. This research seeks to refine our understanding of the relationship between absorptive capacity and innovation performance, with a focus on characterising the absorptive capacity of the different participant groups within the Australian road industry supply chain. One of the largest and most comprehensive surveys ever undertaken of innovation in road construction was completed in 2011 by the Queensland University of Technology (QUT), based on the Australian road industry. The survey of over 200 construction industry participants covered four sectors, comprising suppliers (manufacturers and distributors), consultants (engineering consultants), contractors (head and subcontractors) and clients (state government road agencies). The survey measured the absorptive capacity and innovation activity exhibited by organisations within each of these participant groups, using the perceived importance of addressing innovation obstacles as a proxy for innovation activity. One of the key findings of the survey is about the impact of participant competency on product innovation activity. The survey found that the absorptive capacity of industry participants had a significant and positive relationship with innovation activity. Regarding the distribution of absorptive capacity, the results indicate that suppliers are more likely to have high levels of absorptive capacity than the other participant groups, with 32% of suppliers showing high absorptive capacity, ahead of contractors (18%), consultants (11%), and clients (7%). These results support the findings of previous studies in the literature and suggest the importance of policies to enhance organisational learning, particularly in relation to openness to new product ideas.

Keywords: Australian road industry, absorptive capacity, learning capacity, innovation activity, suppliers

Theme: CIB W65 Organisation and Management of Construction

ID: 506

Shared value creation in construction project - a case study

*Andelin, M., Aalto University, Finland, mia.andelin@aalto.fi
Junnila, S., Aalto University, Finland, seppo.junnila@aalto.fi*

The concern about climate change and the impact it will have on our living environments is driving built environment towards energy efficiency and sustainability. Built environment has significant direct and indirect impacts on social well-being, livelihood as well as affluence of local communities and individuals. Fast changing world, economic uncertainty and urbanisation call for new sustainable solutions. Built environment has a substantial role in sustainable development and noteworthy potential in shared value creation in changing world.

The focus in this research is to find out how shared value is created in built environment. Shared value creation can be defined as policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities it operates in. The aim of this paper is to examine shared value creation in a construction project and whether shared value creation improves quality, cost-effectiveness, sustainability and collaboration.

The research is based on case study and interviews. In order to understand actors' involvement and ambitions in a construction project semi-structured interviews were conducted. Interviewees were identified as persons who influenced design and execution of the construction project including authorities, designers, a developer, a contractor and users.

This paper is the first step in larger scale research that aims to construct a theoretical model for shared value creation in built environment. This paper describes the roles of different actors and the shared value creation process and the results in an office project. It is expected that later on the theoretical model will also have a boosting effect and applicability in other industries and business in general.

Keywords: shared value creation, construction project, case study, collaboration, sustainability

Theme: CIB W65 Organisation and Management of Construction

ID: 508

Decision support model for change management to enable sustainable outsourcing of building operations and maintenance

Sridarran, P., University of Moratuwa, Sri Lanka, psridarran@gmail.com
Fernando, N., University of Moratuwa, Sri Lanka, nirodhafernando@uom.lk

In this present globalised era, outsourcing has become a very popular and much sought after procurement strategy for building operations and maintenance. Where competitive business environment is concerned, outsourcing contributes towards reaping supplier specialisation that would either be unavailable or too costly for the organisations to procure. Generally, a sustainable procurement system should be capable enough to deliver the services free of disruptions. However, outsourcing can bring about changes in working patterns, organisational culture and management styles which can possibly disrupt the activities of an organisation. In order to circumvent such incongruities that may result from outsourcing, organisations need to adopt a measured approach towards this change. Accordingly, this research aims to investigate the importance of change management to enable sustainable outsourcing of building operations and maintenance.

Case study was selected as the most suitable research method for this study. The reasons being, the study needed to focus on in-depth decisions and behavioural attitudes of individuals and groups within and between organisations. The study was conducted through a multiple case study that included eight cases which had obtained the services by partial or full outsourcing. Furthermore, the primary source of data was collected through semi-structured interviews and content analysis was used to interpret and analyse significant findings from the interview transcripts. Case study findings revealed that, organisations prefer outsourcing in order to achieve cost benefits and to acquire external expertise. Moreover, if the changes emanating from outsourcing are not managed satisfactorily, it would result in possible disruptions. However, to make changes happen successfully is one of the most challenging tasks faced by the leadership and corporate management of the organisations.

Keywords: outsourcing, change management, decision support model

Theme: CIB W65 Organisation and Management of Construction

ID: 509

Characterisation and effectiveness of supply chain collaboration

Vrijhoef, R., Delft University of Technology, Netherlands, r.vrijhoef@tudelft.nl

Koolwijk, J., Delft University of Technology, Netherlands, j.s.j.koolwijk@tudelft.nl

Van der Kuij, R., Delft University of Technology, Netherlands, r.s.vanderkuij@tudelft.nl

Van Oel, C., Delft University of Technology, Netherlands, c.j.vanoel@tudelft.nl

Wamelink, H., Delft University of Technology, Netherlands, j.w.f.wamelink@tudelft.nl

In the Dutch building sector, and in the social housing sector in particular, supply chain collaboration between housing associations and their supply chain have been quite popular since last five years or so. Many associations and their supply chain partners have tested, and in many cases continued to apply various representations of supply chain collaboration. This has varied from newly built houses to maintenance of existing stock, and many other characteristics influencing the collaboration. In all cases the parties involved have aimed and hoped for better performance of projects as a consequence of applying supply chain collaboration. Two main issues have arisen amongst the associations and their supply chain partners: How do various representations of supply chain collaboration applied by different parties relate to each other characteristically? How does supply chain collaboration in projects of different kinds influence the performance outcomes of these projects, and thus give evidence of the appropriateness and effectiveness of supply chain collaboration. Therefore a supply chain monitor has been developed as an instrument to assess the levels of the resources and processes in projects, versus the performance outputs and outcomes of these projects. This paper presents the background, purpose, development and structure of the supply chain monitor and compares it to other models, in order to discuss the internal validity and usefulness of the monitor to characterise supply chain collaboration and measure its effectiveness in projects.

Keywords: supply chain collaboration, taxonomic characteristics, maturity levels, performance output, housing corporations

Theme: CIB W65 Organisation and Management of Construction

ID: 511

A holistic visual management method of planning and control on construction sites

Brady, D.A., University of Salford, United Kingdom, brady_denise@web.de

This paper focuses on the development and evaluation of a Visual Management Method (known as LCM in practice). The LCM method was originally developed in practice onsite in response to a practical problem, i.e. a lack of transparency in daily operations, which led to difficulties in communication, decision-making and general progress in daily work. The method also makes a theoretical contribution to areas of Visual Management and Production Planning & Control in construction. A review of the literature revealed that there is a lack of broader, holistic solutions when applying VM to construction projects. The literature also revealed that there are deficiencies in the area of planning and control of construction projects, stemming from the weak link between the functions of planning, execution and control (Koskela & Howell 2000, 2001, 2002a, 2002b). The LCM method contributes to these areas, since it is a method that applies a number of visual tools in a holistic way to construction projects to manage and link the information flow by making it transparent. By doing so, a means is provided to better link the functions of planning, execution and control. Since 2007, LCM has been applied and adapted to different types of construction scenarios from new construction projects to refurbishment and power plant construction. This paper explains the scope, main elements and characteristics of the LCM method. A summary of findings from an evaluation of the usefulness and applicability of the method to different types of construction projects is presented. Finally, a discussion on the use of visual tools to improve barriers experienced in production planning and control is also presented.

Keywords: lean construction, visual management, planning and control

Theme: CIB W65 Organisation and Management of Construction

ID: 512

Framework for a roadmap towards effective climate change adaptation in Dutch social housing

Roders, M., Delft University of Technology, The Netherlands, m.j.rodgers@tudelft.nl

Straub, A., Delft University of Technology, The Netherlands, a.straub@tudelft.nl

Housing managers are constantly confronted with the changing demands that their building stock has to comply with. One of the change agents is the changing climate, caused primarily by human induced greenhouse gases. Though, even if the emissions of all these gases could now be put to a hold, the process of climate change would not completely cease. Furthermore, the impacts of climate change would most probably be felt for many more years. In urban areas, the impacts are drought, flooding caused by extreme precipitation and heat stress caused by the urban heat island effect. Besides threatening the building stock, climate change is also threatening the quality of life of people in urban environments. In the Netherlands, housing associations are responsible for managing the social housing stock and maintaining their quality of life. Research has proven they are not yet aware of the challenge that lies ahead to adapt their dwellings to a changing climate. Considering the focus on the physical adaptations of the building stock, it was chosen to discuss in this paper the effectiveness of three types of governance strategies that housing associations can directly apply in their maintenance processes. The governance strategies are hypothesised based on research results of earlier studies on the implementation of climate change adaptations in social housing. The strategies are: S1. Take up climate adaptation in the policy developments that guide the overall management of the stock; S2. Involving actors that traditionally stand aside the construction process, such as insurance companies and water boards; S3. Emphasising performance-based procurement stimulating the execution of the projects in a partnering approach.

The effectiveness of the strategies was tested by means of a SWOT analysis per strategy with practitioners. Results are five scenarios, based on the combinations of strategies that are potentially feasible for the implementation of climate change adaptation measures in the Dutch social housing stock. A crucial factor in the scenarios is collaboration, because nowadays a housing association is not (financially) capable of assuming the responsibility of climate proofing its housing stock all by itself.

Keywords: adaptation, climate change, portfolio management, process innovation

Theme: CIB W65 Organisation and Management of Construction

ID: 513

SCM and extended integration at the lower tiers of the construction supply chain: an explorative study in the Dutch construction industry

Pryke, S., University College London, United Kingdom, s.pryke@ucl.ac.uk

Broft, R., University College London, Netherland, rafaella.broft.11@alumni.ucl.ac.uk

Badi, S., University College London, United Kingdom, s.badi@ucl.ac.uk

Several studies have underlined the potential of Supply Chain Management (SCM) in meeting the formidable challenges associated with fragmentation, adversarial relationships and insufficient customer focus in the delivery of construction projects (e.g. Dainty et al., 2001; Cox and Ireland, 2002; Gadde and Dubois, 2010). However, there remains a paucity of properly documented examples of successfully implemented SCM initiatives, particularly at the lower tiers of the supply chain. This study sets out to explore the enablers and barriers to the implementation of SCM at the lower tiers of the supply chain, particularly the problematic collaboration between main contractors and subcontractors. A SCM Maturity Model is developed based on Holti et al.'s (2000) seven principles of SCM organisation. An explorative study is conducted based on interviews from eight large main contractor and subcontractor organisations in the Dutch construction industry. Discouragingly, across the organisations, more barriers than enablers to supply chain management are identified. Organisations are found to be particularly struggling to compete through superior value, manage costs collaboratively, and develop continuous improvement within their supply chains. The findings also underline the low SCM maturity of main contractors and their inability to play the essential role of supply chain managers. Indeed the principles of integrating project activities and mobilising and developing people are found to be better exercised by subcontractors.

Keywords: SCM, construction supply chain, contractor-subcontractor relationship, extended integration, collaboration

Theme: CIB W65 Organisation and Management of Construction

ID: 516

The impact of organizational justice on job satisfaction and organizational commitment: the case of Turkish construction industry

Ulutaş Duman, D., Istanbul Technical University, Turkey, ulutasd@itu.edu.tr

Giritli, H., Istanbul Technical University, Turkey, giritli@itu.edu.tr

This research focuses on job satisfaction, organizational justice, and organizational commitment among professionals in the construction industry. Although there is a substantial amount of research demonstrating the importance of organizational justice and job satisfaction and their influence on organisational commitment, construction management literature lacks the empirical implications of the relationship between these organizational factors, which determine the success of an organization in a competitive environment such as construction. The present study aims to fill that research gap. In order to assess organizational justice, job satisfaction and organizational commitment of individuals in the context of construction industry, a questionnaire survey was utilized based on three well-known and widely accepted instruments. Research findings will be one of the initial studies that clarify the interrelations between organizational justice, job satisfaction and organizational commitment from the perspective of construction industry professionals.

Keywords: organizational justice, organizational commitment, job satisfaction, construction industry, organisational management

Theme: CIB W65 Organisation and Management of Construction

ID: 518

The relationship between corporate social responsibility and company competitiveness from the perspective of construction industry

Ulutaş Duman, D., Izmir Institute of Technology, Turkey, dilekulutas@iyte.edu.tr

Giritli, H., Istanbul Technical University, Turkey, giritli@itu.edu.tr

McDermott, P., University of Salford, United Kingdom, P.McDermott@salford.ac.uk

Corporate social responsibility (CSR) has evolved to an important agenda for many industries and its scope has been widened from the responsible business to strategic decisions. The increasing importance of CSR affects business relations because organizations tend to choose business partners in consideration of their CSR awareness and activities. Scholars have identified the reasons why companies develop CSR strategies, such as reputation improvement, government regulations, competitive advantage, stakeholder pressures, and top management pressures. Since the construction sector serves infrastructure for other industries and has great supply chain relations in its business process, construction organizations should need to adopt CSR in their business. However, it is hardly a new idea for the construction industry and there is limited research from the perspective of construction industry. This study is a part of the thesis, which aims to understand CSR awareness, implementation, and its relationship with company competitiveness.

Keywords: corporate social responsibility, construction industry, competitiveness, CSR, case studies

Theme: CIB W65 Organisation and Management of Construction

ID: 526

Stakeholders' preference towards the use of conflict management styles in dual concern theory in post contract stage

Gunarathna, C.L., University of Moratuwa, Sri Lanka, lakshika.gunarathna@yahoo.com

Fernando, N.G., University of Moratuwa, Sri Lanka, nirodhafernando@uom.lk

Conflicts often act as obstacles to the project success by wasting time, money and energy of the construction stakeholders; resulting numerous harmful effects to the project. Having conflicts is a natural phenomenon which is inevitable due to the unbreakable bond between the nature of the construction industry and the sources of conflicts. It is identified that the tendency of having conflicts is enormously high, especially in post contract stage of any construction project. Even though the conflict management found to be existing in the construction sector, still the construction stakeholders often have to face many unmanaged conflicts which subsequently convert into disputes, demanding expensive and time consuming dispute resolution. Therefore, the requirement of an effective conflict management should receive a prior importance. It was verified that the effective conflict management can be derived from the opinions of construction stakeholders since they are the personnel who create and experience the conflict situations. Therefore, the aim of this study was to develop a stakeholder preferred framework for effective usage of dual concern theory for conflict management in post contract stage. Case study was selected as the most suitable research approach due to the qualitative nature of the study. Twelve semi structured interviews were conducted; selecting three stakeholders representing each case. The collected data was analyzed using content analysis and conclusions were drawn and recommendations were put forward. The findings of this study proved that effective conflict management is a broad spectrum which should be fully followed from the commencement of the project till the end. Moreover, it was recognized that the main reason for increment of having conflicts is that the construction stakeholders ignore to follow the entire conflict management spectrum. Furthermore, the findings confirmed that inclusion of dual concern theory which manages conflict situations by providing consideration for both self and others at the same time yet in different degrees in the conflict management spectrum will provide more effective results. Hence, this study proposed a framework for effective conflict management with the usage of dual concern theory for post contract stage.

Keywords: conflict, construction industry, conflict management, dual concern theory, post contract stage

Theme: CIB W65 Organisation and Management of Construction

ID: 536

A method to explicate on-site construction processes and to extract operational strategies: a case in the asphalt paving industry

Bijleveld, F., University of Twente, Netherlands, f.r.bijleveld@utwente.nl

Miller, S., University of Twente, Netherlands, s.r.miller@utwente.nl

Dorée, A., University of Twente, Netherlands, a.g.doree@utwente.nl

Due to changing contracts, sometimes including design and maintenance, it becomes increasingly important for contractors to improve process and quality control during on-site construction. Improving on-site process control, however, requires understanding about current practices. This understanding is mainly lacking, because current practices lean heavily on the on-site experience and craftsmanship of operators and hardly any technologies are used during the on-site process for performance enhancement. Also, the guidelines for on-site operations are vague or even lacking. Therefore, it is near impossible for contractors to distinguish poor and good operational practices. To develop a deeper insight into the on-site construction processes, the on-site operations need to be made explicit. This paper takes the asphalt construction industry as an example, where the on-site operations of 29 projects in the Netherlands are explicated using technologies, such as D-GPS, a laser linescanner and infrared cameras. The results show there is substantial variability in key parameters and on-site operations, such as the roller types used for compaction, the number of roller passes undertaken and the time and temperature windows in which these passes are conducted, which are all key for the final asphalt quality. Also, a method is demonstrated to extract common compaction practices from this kind of data-set. The results are a stepping stone for a structured and systematic design of the on-site process including improved guidelines for on-site operations rather than current experience-based ad-hoc working methods. This is a starting point to distinguish good and poor operational practice and reduce process variability. This will help contractors to improve their understanding about on-site construction processes in order to improve process and quality control.

Keywords: asphalt, construction processes, operational strategies, tacit knowledge, technology introduction

Theme: CIB W65 Organisation and Management of Construction

ID: 540

Planning for sustainability: does the use of environmental assessment tools for urban development lead to adequate steering - a focus group study in Finland

Säynäjoki, E., Aalto University, Finland, eeva.saynajoki@aalto.fi

Heinonen, J., Aalto University, Finland, jukka.heinonen@aalto.fi

Junnila, S., Aalto University, Finland, seppo.junnila@aalto.fi

Environmental sustainability is increasingly recognised as one of the most critical challenges for the land use planning practices across the world. Sustainable communities are promoted as a desirable policy goal, local authorities are encouraged to contribute to climate change mitigation through land use planning, and international schemes, such as BREEAM for Communities and LEED for Neighborhood Development, are widely used for the environmental assessment of urban areas. However, there is a certain gap between rhetoric and action in the environmental governance at the city level, which stems from issues of institutional capacity and factors of political economy. A widespread political commitment has been recognized at a general discursive level, but agreement around its positive meaning in day-to-day decision-making is sparse. The purpose of this study is to examine how the professionals of urban planning and environmental sustainability in Finland experience the steering effect of increased environmental awareness on land use. The utilised material was recorded in three focus group sessions, where more than thirty Finnish professionals of land use planning, energy production, residential construction, architecture, urban development consulting, and environmental governance were present. The data is analysed qualitatively. It appears that Finnish cities have rather ambitious greenhouse gas reduction targets and the land use planners who conduct or subcontract the environmental assessment of urban development and new construction have essentially unlimited mandate to devise sustainable solutions. Nevertheless, short-term economical interests are found to constantly dominate decision-making, and the aforementioned actually dispirits urban planners such a way that the results of environmental analyses are seen somewhat vacuous. Rather surprisingly, even if a myriad of sustainability schemes is already available for urban planning, the planners still call for improved tools for assessing environmental sustainability. There is clear demand for a comprehensive numerical environmental analysis of urban areas to be separated from integrated sustainability assessment. Therefore, the results of this study can practically help engineers and consultants to re-design their services of sustainability assessment for the purpose of increasing their impressiveness to decision-making and thus improving their potential to facilitate sustainable land use and construction. However, we argue that in addition to addressing the technical challenges of environmentally aware urban planning, more research is needed on the factors of political economy that may be in conflict with the environmental agendas.

Keywords: sustainability, urban planning, evaluation tools, environmental assessment, decision-making

Theme: CIB W65 Organisation and Management of Construction

ID: 542

The futures of construction management research

Harty, C., Universtiy of Reading, United Kingdom, c.f.harty@reading.ac.uk

Leiringer, R., Hong Kong University, Hong Kong, roinel@hku.hk

Construction management has established itself as an internationally recognised area of research with an established and growing community of academics. It has grown from largely 'research consultancy' activities to attracting large amounts of academic research funding, and has partially moved away from its applied, engineering dominated origins to increasingly engage with, and contribute to, mainstream academic debates in business and management, economics and the social sciences. It has as such become an academic field in its own right. However, recent dynamics within both university institutions and national economies are now changing the landscape of construction management research. A global economic crisis, reprioritisation of research funding and increasing emphasis on national and international rankings lead to increased pressure on individuals academics. In this paper we ask what, in the face of a turbulent environment, might the futures of construction management research be? We outline four potential futures for construction management research, which are depicted as four potential scenarios; convergence, retrenchment, disappearance and hybridisation. Our intention is neither to predict the future, nor prioritise one scenario over another, but merely to begin an open debate on the institutional pressures we are facing, their possible outcomes and the future of our community.

Keywords: construction management research, futures, academic practice

Theme: CIB W65 Organisation and Management of Construction

ID: 548

Competitive advantages achievement in the Colombian AEC sector through the standardization of Project Management (PM) processes: a case study on a development firm

Prada, A., Universidad de los Andes, Colombia, prada.andre@gmail.com

Vargas, H., Universidad de los Andes, Colombia, hvargas@uniandes.edu.co

Ozuna, A., Universidad de los Andes, Colombia, ap.ozuna1442@uniandes.edu.co

González, R., Terranum TCP, Colombia, rgonzalez@terranum.com

The standardization of Project Management (PM) processes in organizations is often linked to diverse types of benefits. It was found in the literature review that “standardization may lead to the creation and enhancement of new competitive advantages for Architecture, Engineering, and Construction (AEC) organizations” (Polesie, 2013). The objective of this paper is to evaluate this statement based on the case study of a Project Management Office (PMO) in a real estate development firm in Colombia. This company is implementing a new management model called AXIS, that consists of new management processes for portfolios, programs, and projects according to the OPM3® standard. The research methodology includes: an analysis of how the organization case study adapted and adopted the OPM3® standard, an identification of organizational benefits obtained by this standardization process, interviews with members of the organization and other companies about gaining competitiveness through the implementation of PM standards, and an assessment of the local context using the "Porter's Diamond" model (Liu, et al., 2010). Results show that achievements obtained from the adoption of a PM standard in the organization case study have generated positive impacts on some conditions that can be directly related to competitive advantages gained by the company. These results contribute to the PM body of knowledge by providing empirical evidence on the critical role that standardized project management attributes and practices in a PMO can have for the strategic development of an organization.

Keywords: competitive advantages, Porter's diamond, PM standard

Theme: CIB W65 Organisation and Management of Construction

ID: 561

The viability of BIM for UK contractors

Elhag, T., UCL, United Kingdom, t.elhag@ucl.ac.uk

Al-Sharifi, M., EC Harris, United Kingdom, mohammed.al-sharifi@echarris.com

The UK Government Construction Strategy set out BIM level 2 as a minimum requirement for all government construction projects by 2016. According to Cabinet Office report, value gained and efficiency in public sector projects needed to be improved significantly. Therefore, this paper examines the potential benefits of BIM implementation for UK contractors and consulting organisations. Twelve significant benefits were investigated and ranked such as project coalition co-ordination; and clash detection particularly during the design stage. This study struggled to provide tangible evidence for cost savings through the use of BIM, but almost all participant contractors and consultants have a strong assumption that BIM does generate cost savings. The study also showed that the benefit, which BIM could bring to the commission/handover stage and facility management, has not yet materialised according to UK contractors' standpoint. This research emphasises the significance of the social/cultural factors rather than the less influential technical issues for BIM implementation. In contradiction to some literature, most organisations argued that no 'legal and contractual issues' have arisen with the use of level 2 BIM. However, it is unanimously agreed that level 3 BIM will give rise to many legal and contractual issues that will then need to be addressed. Most of the organisations involved in this study are already utilising BIM at level 2. However, it is revealed that there is a need for increased awareness down the construction supply chain and other relevant stakeholders. There is also a need for greater efforts and willingness to embrace process change and other consequences for introducing BIM within construction projects.

Keywords: BIM implementation, UK construction strategy, principal contractors

Theme: CIB W65 Organisation and Management of Construction

ID: 589

Accommodating new technology in construction projects

Boyd, P., University of Reading, United Kingdom, n.j.p.boyd@pgr.reading.ac.uk

Larsen, G.D., University of Reading, United Kingdom, g.d.larsen@reading.ac.uk

Schweber, L., University of Reading, United Kingdom, l.schweber@reading.ac.uk

The construction sector has a major role to play in delivering innovations to achieve UK low carbon energy targets and this research will contribute to understanding challenges that arise on building projects when new technology is included in the design.

Innovative, sustainable technologies are already available for use in the construction of buildings, but their integration within construction projects is patchy. One of the factors potentially holding back this integration is the complicated collaboration and adjustments required between the many actors working on a single project. This research seeks to explore the accommodations made by a network of project actors when interacting with a new technology.

The research presented is part of a larger project which uses a Social Construction of Technology approach (SCOT) to understand the challenges of incorporating new technology into buildings. Drawing on case studies, the research explores the different accommodations made to both building design and project practices by multi-firm actors as an innovative technology is included within a building project. The case studies follow Building Integrated PhotoVoltaic (BIPV) technology as it is incorporated within building projects. The research focuses upon the dynamic interactions between actors, innovation and the building as a whole.

Empirical data is gathered at key project stages from actors who are either directly involved with or affected by the introduction of the BIPV into the project. The paper situates the problematic in the literature of innovation diffusion and sets out the research objectives, theoretical lens and research design which inform this research. Although the research is on-going, initial emerging themes of the research are highlighted illustrating the complexity of the process. It is anticipated that the key findings of the research will illuminate how actors negotiate the challenges of adopting the new BIPV into the building project and what effects these have both on the final building and on the project actors working practices.

Keywords: accommodations, innovation diffusion, projects, socio-technical, sustainable technology

Theme: CIB W65 Organisation and Management of Construction

ID: 593

Understanding industrial practices of construction project data management

Kahkonen, K., Tampere University of Technology, Finland, kalle.e.kahkonen@tut.fi

Rannisto, J., Tampere University of Technology, Finland, jukka.rannisto@tut.fi

Makela, H., Tampere University of Technology, Finland, hannes.makela@tut.fi

Keinonen, M., Tampere University of Technology, Finland, marko.keinonen@tut.fi

The construction project management is heavily built around document control and relating events such as change orders, submittals, transmittals and requests for information (RFIs). These functionalities are usually forming the core of electronic data/document management systems (EDMS) that are widely used by contractors and construction management consultants. The content of EDMS, i.e. documents in the form of individual files and their details can have contractual role and implications.

Building information modelling (BIM) is gradually having its impact widely over construction practices and processes. Basically this means that a growing share of buildings construction projects are designed and documented by using BIM applications. BIM applications can form spatially organised access to project data and documents which, if widely applied, can change the world of EDMS solutions. However, still at present the well-established EDMS solutions and relating practices are a rather separated infrastructure from the world of building information modelling. It is worth noticing that a part of practical BIM interoperability is still file based. This means that digital building models are shared and accessed using files, and, in many cases it is EDMS solutions that are used for this purpose.

This paper shall present results of a research effort where the use of EDMS was studied in 20 building construction case projects. The gained results explain content and characteristics of current practice. It is considered that useful knowledge can be learned from the present use of EDMS in building construction projects. This understanding can help us to move towards more advanced solutions.

Keywords: construction project, project management, document management system, BIM

Theme: CIB W65 Organisation and Management of Construction

ID: 597

The implications of supply chain localisation for the evolving sustainable energy products market in the UK built environment

Onyido, B., Birmingham City University, United Kingdom, ben.onyido@bcu.ac.uk

Boyd, D., Birmingham City University, United Kingdom, david.boyd@bcu.ac.uk

Thurairajah, N., Birmingham City University, United Kingdom, niraj.thurairajah@bcu.ac.uk

This paper was written to explore the viability of supply chain localisation as a strategy for minimising possible adverse environmental and social impacts of large-scale economic activity surrounding the production of sustainable energy goods and services. Supply chain localisation here refers to the situation of production activities close to the geographical areas in which the sustainable energy products would eventually be installed. Sustainable energy products refer to technologies and other goods and services that minimize negative environmental effects of energy use in buildings throughout their construction and habitation. The paper dwells on the outputs of a major energy-efficiency project that focuses on preparing for the Green Deal – a UK-wide housing retrofit initiative – and the attendant increase in economic and industrial activities that it is expected to generate. As part of measures to ensure that these activities yield minimal negative environmental and social effects while optimising economic benefits, project participants recommended the localisation of the supply chain for the production, installation and maintenance of sustainable energy products. Based on the primary research conducted on the project as well as secondary research sources, the paper discusses the economic, social and environmental benefits and detriments of the supply chain localisation agenda. It also looks at the overall practicality of the implementation of supply chain localism within the context of mainstream business practices in the property, construction and energy sectors.

Keywords: supply chain, localisation, green deal, sustainable energy products, United Kingdom

Theme: CIB W65 Organisation and Management of Construction

ID: 625

Validating the impact of EVM on projects performance in the UAE

Skaik, S., Heriot Watt University, United Kingdom, s.samer@hw.ac.uk
Hawary, M., Heriot Watt University, United Kingdom, ms584@hw.ac.uk

With the inevitable increase in size and complexity of construction projects, the need for proper control is increasing. Considering the fact that each project strives for excellence, numerous studies have been conducted over the years to measure performance and investigate factors that are really critical towards project success. Earned Value Management is a project performance evaluation technique which enables industry professionals to closely monitor project performance in both time and cost. The aim of this paper is to examine the result of proper Earned Value Management (EVM) implementation on different project life cycle (PLC) and validate the impact on project success.

The study investigates different success factors in construction industry with special focus on previous researchers' work which studied the importance of cost control in project success especially in fragmented industry like construction, followed up with three different case studies to analyze the positive impact of EVM implementation on construction projects. Furthermore, for data triangulation purpose, case study analysis will be supported by interviews with specialists working in the UAE construction industry to cross check the outcomes of previous researches.

The research shows that EVM application on cost control in construction projects is not only a crucial management task which is a key to the success of the business but also its influence on project success depends on the time of implementation. It requires a number of up-to-date input data consistently throughout the construction phase. Assigning the right budgets, calculating accurate estimates and monitoring actual costs throughout different project stages are the three main drivers of an effective control through PLC starting from inception stage till completion. EVM proved to be of vital importance due to alarming escalation of construction costs which needs to be especially monitored and controlled. Senior management support and availability of professional staff to execute cost control systems are key factors towards successful implementation

Keywords: EVM, performance, earned value management, cost control

Theme: CIB W65 Organisation and Management of Construction

ID: 630

Nigerian quantity surveyors in an emerging market

Olanrewaju, A.L., UTAR, Malaysia, olanrewaju20002000@gmail.com
Abdul-Aziz, A.R., Universiti Sains Malaysia, Malaysia, arashid@usm.my
Anavhe, P., CDP Partnership Limited, Nigeria, panavhe@yahoo.com

The roles of the quantity surveyor has evolved from been a simple building accountant to a respected professional vocation. The roles played by quantity surveyors are expanding both in scope and size. The expectations of quantity surveyors have increased due to the increasing inclusion of new technologies, changing rules and regulations, increasingly sophisticated projects, diverse clients, and the emergence of related professions with job descriptions that overlap with that of the quantity surveyor. There are daunting evidences that the threats will continue to pose challenges to the existence of quantity surveyors. Therefore, in order to remain both relevant and competitive, quantity surveyors need to diversify their services. This paper examines the roles that 'modern' quantity surveyors play in Nigeria. Primary data is collected through questionnaires. Twenty three (23) roles played by modern quantity surveyors are identified and addressed to the respondents to rank the rate at which they perform each of the roles. Data obtained were analysed statistically. The results of the findings led to the conclusion that the quantity surveyors were performing the emerging services expected of quantity surveyors. The results of the study could be useful to quantity surveyors and other stakeholders in the construction industry in general.

Keywords: quantity surveying, services, built environment, Nigeria

Theme: CIB W65 Organisation and Management of Construction

ID: 640

Quantity surveying role and environmental influence in Saint Lucia

*Sonson, S., University of Salford, Saint Lucia, sjsonson@hotmail.com
Kulatunga, U., University of Salford, Sri Lanka, u.kulatunga@salford.ac.uk*

Professional Quantity surveyors (PQSs) play a vital role in the construction industry in terms of managing and controlling costs of projects, which has been documented in many studies in the construction field. The environmental influences or forces from the constantly changing construction business environment have caused PQSs to adapt and evolve their role over time in order to survive and prosper. The study aims to evaluate the changing role of the PQSs in construction business environment and the environmental influences impacting on their role and business performance.

The descriptive research method was used in the study, which involved the mixed methods approach for the primary data collection. Firstly, interviews of the experienced PQSs, which provided the qualitative data for analysis. Questionnaire was the next approach used which provides the qualitative data. This approach involved the widespread survey of the PQSs registered with the Institute of Surveyors Saint Lucia (ISSL), for which an overall response rate of 76.5% was obtained.

The findings of the research revealed the following: The PQSs in Saint Lucia confirmed that the quantity surveying (QS) profession and their roles are changing but albeit at a slow pace; PQSs are still deeply rooted in the traditional roles, with the quantification and costing of construction works and project financial control and reporting were perceived as the two most important roles; The evolved roles have been moderately accepted; and Future (growth areas) directions of the QS practice were perceived to be largely in the emerging roles, in particular Building Information Modelling (BIM) management and Whole Life Costing (WLC) Assessment. They considered the internal environmental influences to have the greatest impact on their role and practice. The study concluded that PQSs in Saint Lucia perceived that they are using mainly their traditional core competencies and some non-traditional competencies to respond to the demands of the rapidly changing business environment. The findings of the research provide an important contribution towards filling the significant gap in existing knowledge in the construction industry and have implications on service expansion and development and strategy development of the PQSs in Saint Lucia in the future.

Keywords: construction industry, quantity surveying role, business environment, environmental influences, Saint Lucia

Theme: CIB W65 Organisation and Management of Construction

ID: 664

Coping with extreme weather: strategies for construction SMEs

Wedawatta, G., Aston University, United Kingdom, g.wedawatta@aston.ac.uk

Ingirige, B., University of Salford, United Kingdom, m.j.b.ingirige@salford.ac.uk

Weather extremes have created a considerable impact on Small and Medium-sized Enterprises (SMEs) in the UK during the recent years, especially on SMEs in the construction sector. Evidence in relation to the recent weather extremes have demonstrated that SMEs are some of the worst impacted by the Extreme Weather Events (EWEs) and have confirmed them as a highly vulnerable section of the UK economy to the impact of extreme weather. This is of particular importance to the construction industry, as an overarching majority of construction companies are SMEs who account for the majority of employment and income generation within the industry. Whilst construction has been perceived as a sector significantly vulnerable to the impacts of EWEs, there is scant evidence of how construction SMEs respond to such events and cope with their impact. Based on the evidence emerged from case studies of construction SMEs, current coping strategies of construction SMEs were identified. Some of the strategies identified were focused at organisational level whereas others were focused at project level. Further, some of the strategies were general risk management / business continuity strategies whereas others have been specifically developed to address the risk of EWEs. Accordingly, coping strategies can be broadly categorised based on their focus; i.e. those focused at project or organisational level, and based on the risks that they seek to address; i.e. business / continuity risks in general or EWE risk specifically. By overlapping these two aspects; their focus and risks that they seek to address, four categories of coping strategies can be devised. There are; general risk management strategies focused at business level, general risk management strategies focused at project level, EWE specific strategies focused at business level, and EWE specific strategies focused at project level. It is proposed that for a construction SME to effectively cope with the impact of EWEs and develop their resilience against EWEs a rich mix of these coping strategies are required to suite the particular requirements of the business.

Keywords: construction, coping strategies, extreme weather, resilience, SMEs

Theme: CIB W65 Organisation and Management of Construction

ID: 669

Providing a lifelong social security system for operational workforce of construction industry in Sri Lanka

Wijewickreme, S., University of Salford, United Kingdom, s.p.wijewickreme@edu.salford.ac.uk

Pathirage, C., University of Salford, United Kingdom, c.p.pathirage@salford.ac.uk

Ekanayake, L., The University of Moratuwa, Sri Lanka, lesly@civil.mrt.ac.lk

Behaviors of Operational Workforce have been one of the challenges in the construction industry and construction sector is suffering from shortage of required human resources for its physical operations even though unemployment rate in Sri Lanka is about 4.2%. Despite all the other resources, management of Operational Workforce still determines the success or failure of construction projects. Operational workers represent a member of the working class who in generally performs manual labour and earns an hourly or output based remuneration. The main focus of this study was to explore what would happen to the industry, if it keeps neglecting the people who bring the desires of employers, blended with innovativeness of architects, strengthened by engineers, enumerated by quantity surveyors, documented by contract administrators into reality according to the sequence of planning engineers by builders and contractors, if no proper Operational Workforce is available. This paper is aimed towards identifying the barriers to attract workforce to construction industry and underline the steps to be taken for developing a responsible Operational Workforce.

Keywords: operational workforce, construction industry, retirement benefits, Sri Lanka

Theme: CIB W65 Organisation and Management of Construction

ID: 674

W089 BUILDING RESEARCH AND EDUCATION

Delivering postgraduate education to construction professionals in Zambia and Tanzania via distance learning: responding to a rapidly changing global education market

Copping, A.

Hancock, M., Education Consultant, Denmark, mrh@izzat.ea

'Globalisation is not only bringing diversity to countries' populations and especially to large cities, but also enhancing the number of potential students who 'shop' globally for the best higher education offerings. Just as marketisation has transformed entire sectors in the past three decades, so it is now transforming higher education, not just within countries, but globally' (Barber 2013). This swiftly changing global demand for higher education is driving Universities to rethink their business model and to start offering evermore creative teaching and learning strategies in the delivery of graduate and postgraduate programmes.

This paper will show case an example of an innovative postgraduate programme. Forty full-fee Commonwealth Commission Distance Learning Scholarships awarded to the University of Bath, has enabled a local partnership to be made with the National Construction Council in Tanzania and the National Council for Construction in Zambia to deliver a Masters programme in International Construction Management.

The construction industry is a critical player in the field of environmental sustainability and has a major impact on both countries ability to maintain a sustainable economy. With all future building and infrastructure projects in Zambia and Tanzania there is a critical need to reduce their environmental impact. There has never been a more critical time for the construction industries to be lead and managed by professionals who have a clear understanding of international best practice and the appreciation of cultural context to enable them to adapt that best practice to their own industry.

The programme combines in country residentials with paper-based materials taught through on-line e-tutoring using a virtual learning environment. All students continue to work full time during their studies enabling both the immediate application of the newly learnt skills and the opportunity for the empowerment of others within their organisations and communities. The on-line environment enables students to study and interaction with other students around the world without needing to leave their work or country. The partnership with the local organisations enables ready links to be made to other skills development initiatives. This is currently primarily in the area of continuous professional development for other construction professionals plus access to the best local academics and practitioners to contribute to the programme. This paper will highlight the successes and also the frustrations of delivering the programme and will debate how such a programme is responding to some of the challenges laid out in the recently published 'An Avalanche is Coming' report referenced below.

Reference

Barber M et al, 2013, An Avalanche is coming: Higher Education and the Revolution Ahead. IPPR

Keywords: distance learning, innovative programme delivery

Theme: CIB W89 Building Education and Research

ID: 466

A case study of establishing a center of excellence to conduct and promote construction safety research, education and training in Pakistan

Azhar, S., Auburn University, USA, salman@auburn.edu

Salman, A., Auburn University, USA, azs0072@tigermail.auburn.edu

Choudhry, R., King Faisal University, Saudi Arabia, rchoudhry@kfu.edu.sa

Safety is one of the primary concerns of the construction industry. The accident rate in construction is among the highest in comparison to other industries all over the world. In Pakistan, the enforcement of safety regulations on construction sites is very limited. Procedures for formulating, implementing and monitoring safety rules and regulations are weak and the implementation of safety management systems does not occur on most construction sites. The major obstacles include: lack of safety awareness and knowledge, unfamiliarity and lack of expertise with safety management techniques, lack of commitment by owners and constructors, absence of a safety regulatory framework and a low level of workers' cooperation. Realizing the strong need of construction safety research, education, and training in Pakistan, a 4-year capacity building project was funded by the Pakistan-US Science and Technology Cooperation Program. The major project objectives were: (1) to benchmark the current state of construction health and safety practices in Pakistan and to identify the data needs for continuous measurement of health and safety performance; (2) to develop health and safety guidelines for the Pakistani construction industry; (3) to develop adequate materials for conducting training on construction safety; (4) to conduct an international conference on construction safety in Pakistan; and (5) to improve the existing regulatory infrastructure for worker health and safety in the construction industry of Pakistan. A comprehensive research program was designed to collect relevant data for project objectives using mixed-method research techniques such as surveys, interviews, site observations and focus groups. On the basis of analyzed data, the state-of-the-art of construction health and safety was measured and detailed proposals and implementation plans were prepared for relevant regulatory and statutory bodies and ministries. From an educational perspective, comprehensive health and safety training material were developed and training workshops were conducted in major cities of Pakistan. Over 800 people benefited from these workshops. This paper highlights the project's major accomplishments. This project helped in capacity building of the construction industry and academic institutions in Pakistan. It is hoped that this research will yield positive social impacts in the long run.

Keywords: safety, planning, safety center, developing countries

Theme: CIB W89 Building Education and Research

ID: 487

A pedagogical framework for conceptualising the design and delivery of construction management courses through 'constructive alignment'

Gajendran, T., The University of Newcastle, Australia, thayaparan.gajendran@newcastle.edu.au

Tang, P., The University of Newcastle, Australia, patrick.tang@newcastle.edu.au

Brewer, G., The University of Newcastle, Australia, graham.brewer@newcastle.edu.au

Hilaire, T., The University of Newcastle, Australia, trevor.hilaire@newcastle.edu.au

Although the application of constructivism to learning encompasses number of different ideas these are connected by the need to associate the design of learning events with the students' ability to engage with the learning in a meaningful manner. Accordingly 'instructional design' literature emphasises the need for alignment between the 'course objectives' and 'assessment practice'. 'Constructive Alignment' (CA) proposed by Biggs, represents a merger between constructivism and instructional design, which employs constructivism as a framework to underpin all stages of instructional design. CA necessitates decisions regarding the strategic selection of appropriate student-learning behaviours e.g. meaning directed (deep learning) or reproduction directed (surface learning). There is limited discourse in the literature contextualising CA in the context of construction management education. The aim of this paper is therefore to describe a CA-based conceptual framework to drive the design and delivery of a construction management programme using blended delivery mode. Using this framework it thereafter describes the role of the educator (Director, Facilitator, Assessor) and strategies associate with these roles (design, delivery, assessment strategy).

Keywords: blended learning, cognitive processing, higher order learning

Theme: CIB W89 Building Education and Research

ID: 499

The influence of BIM on the responsibilities and skills of a project delivery team

Thurairajah, N., Birmingham City University, United Kingdom, nirajthurai@gmail.com
Gathercole, M., Birmingham City University, United Kingdom, michael.gathercole@mail.bcu.ac.uk

Building Information Modeling (BIM) is an emerging approach to construction that combines the use of virtual models and the principles of mutual information sharing to establish a collaborative environment in built environment projects. It is currently the subject of much discussion, among which is how it might affect the composition of traditional construction project roles. This study focuses on viewing the demand for positions that operate in a BIM setting to evaluate a set of roles that will be found in the BIM project teams of the future. By analysing over 300 job adverts and comparing the findings with observational and conceptual literature, the research determines a set of management, coordinating and technical role types that interact with BIM either directly or by proxy. This should provide an increased understanding of the changing shape of built environment project teams and the required future skills.

Keywords: skills, BIM, collaboration, project roles

Theme: CIB W89 Building Education and Research

ID: 624

What do we teach them when we don't even know what it will look like?

Tait, R., Department of Building Technology, Unitec, New Zealand, rtait@unitec.ac.nz

It has taken forty years for sustainability to become mainstream. Forty years ago the publication of 'Limits to Growth' forecast a collapse somewhere between 2010 and 2075. Our students are staring this in the face. The resources of the Earth are finite and the economic theories driving our economies are finite. We do not know what form business will take.

This paper looks at embedding sustainability into building trade related diploma and bachelor qualifications at Unitec. A sound base of fundamental building skills must be augmented with an understanding of ecological and technological skills. The traditional apprenticeship model, practice based and learning on the job supported with MOOCs.

Sustainability of buildings requires a building to be flexible in use and for longevity, built to a good standard. The main piece of legislation controlling this industry in New Zealand has in section 3 a purpose requiring 'sustainable building'. The traditional business model requires a profit and profit is only achieved in a growth model economy. There is only one planet and our industrial model uses one and a half, even more in some western counties. We are using our resources at an unsustainable rate and there is a case here for education to lead industry.

Sixty per cent of the buildings standing in 2050 are already in place. There is a worldwide population shift to urban environments and our students will live in these buildings. They will need the skills to determine what they want. The Built Environment uses 40% of the world's energy and there is a high possibility of being able to reduce that.

Future practitioners obtain the knowledge through their learning. The discussion will be around how this is done in the 'classroom' and some of the interesting results achieved.

Keywords: sustainability, learning, industry, finite

Theme: CIB W89 Building Education and Research

ID: 629

Electromagnetic pollution in power - supply systems of built environment facilities and its reduction

Valeriy, B., Russian Academy of Electrotechnical Sciences, Russia, vbeley@klgtu.ru

In built environment facilities (residential buildings, schools, hospitals, etc.) the use of equipment and devices with the latest electro-technologies is gradually increasing: energy-saving lamps for lighting, variable frequency drives in water-supply systems, heating, ventilation and air conditioning; welding machines for construction of built environment facilities, computers, video, household appliances, etc. On the one hand, the latest electro-technologies can significantly reduce power consumption (up to 10 times), as well as justify power-supply systems of built environment based on smart grids. On the other hand, implementation of new electro-technologies means using non linear power elements. While operating these elements create electromagnetic interference (EMI) in power-supply systems and become a source of electromagnetic pollution to the environment. EMI includes current harmonics with frequency spectrum from 1 to 2000 Hz emitted by equipment and devices into power- supply networks; pulsed nature of loads leading to fluctuations and voltage dips. As a result, quality of electrical energy deteriorates. Other users connected to this power-supply system have to consume low-quality energy which affects their performance. Apart from all mentioned, it has extremely negative influence on human body. It is well known that cardiac rhythm is about 1 Hz, oscillation frequency of nerve cells in the brain is about 8.7 Hz, at the frequency of 1000 Hz hearing sensitivity is sharply increasing. It should be noted that the source of EMI in power-supply systems is not only electrical facilities of built environment but also industrial facilities connected to this network. When operating a number of power consumers generate current harmonics and consequently voltage harmonics on a frequency close to 8.7 Hz. These low-frequency oscillations penetrate into lighting networks and create a luminous flux on a frequency of 8.7Hz additional to light emission of 50 Hz. These resonance phenomena cause irritation and headache. Possible solutions for reduction of EMI and electromagnetic pollution. Regulations in the standards for permissible level of EMI for electrical equipment and appliances at the stage of production. Design circuits: isolation of non-linear loads on a separate substation busbars system, filtering devices that are connected directly to the terminals of electrical equipment with a high level of EMI.

Keywords: built environment, electromagnetic pollution, ecology, electrical supply system, power quality, voltage

Theme: CIB W89 Building Education and Research

ID: 643

Minimising error: Artificial neural network architecture for a user overridable dynamic shading system

Nabil, A., UCL, United Kingdom, ucftamn@live.ucl.ac.uk

Pitt, M., UCL, United Kingdom, m.pitt@ucl.ac.uk

Hanna, S.

Tsigkari, M.

This research explores the possibilities of integrating environmental and human inputs to achieve precise architectural goals. Specifically, the aim is to create an adaptive façade, trained on historical data relating to human (an override capability) and environmental inputs to maintain optimal internal lighting conditions for inhabitants. The study was conducted using a physical louvered shading system constructed in the Bartlett School of Architecture, University College London. The historical data collected by the system provided a sample data set to train the Artificial Neural Network (ANN) for which the system would operate. A multi-layer perceptron was the neural network used in the study and a series of experiments allowed for the optimal network architecture to be ascertained. Based on the trained network, further testing was carried out to assess the accuracy of the results with regards to the louver angle suggested during system recall. It was found that the complexity derived from receiving both environmental and human data provided some confusion when recalling, however the system displayed a high level of accuracy, correctly recalling the desired blade angle over 70% of the time. Further testing found that the remaining recall error could be accounted for through environmental input data similarities. By physically building and testing the system this research suggests that a trained physical system based on computational principles can provide an adaptive architectural entity that considers building occupants behaviour and wants as well as the external environments natural imposition.

Keywords: artificial neural network, multi layer perceptron, adaptive façade, user interaction, envelope design

Theme: CIB W89 Building Education and Research

ID: 655

Determining demand for disaster resilience education from public authority capacity analysis

Witt, E., Tallinn University of Technology, Estonia, emlyn.witt@ttu.ee

Bach, C., United Nations University, Germany, bach@ehs.unu.edu

Lill, I., Tallinn University of Technology, Estonia, irene.lill@ttu.ee

Palliyaguru, R., Heriot-Watt University, United Kingdom, r.palliyaguru@hw.ac.uk

Perdikou, S., Frederick University, Cyprus, eng.ps@fit.ac.cy

Å-zmen, F., Firat University, Turkey, fozmen@firat.edu.tr

Over the past decade, annual global fatalities from natural disasters have averaged 106,000 and the estimated average annual losses have been US\$165bn. The long-term trend has seen both of these numbers rising. The built environment plays a key role - damage to it accounts for most of the economic losses and its failures often determine the level of fatalities whereas, it is the built environment to which people turn for safety and shelter when a disaster occurs and its continued functioning is essential for disaster response and recovery.

In order for higher education institutions to support disaster resilience efforts with capacity-building educational and research programmes, the priority areas for capacity development first need to be identified. To this end, the Academic Network for Disaster Resilience to Optimise educational Development (ANDROID) designed a survey of the capacity of European public administrations as part of an initiative to develop a roadmap for European education for societal disaster resilience.

This paper reports the theoretical framework and initial findings from a Europe-wide survey of the capacity of public authorities and the implications for disaster resilience-related education in the built environment. There is evidence of considerable demand for disaster resilience education from public administrations. There is a need for further advocacy for disaster resilience awareness and education both in general and for built environment professionals in particular.

Keywords: disaster resilience, built environment, education, ANDROID network

Theme: CIB W89 Building Education and Research

ID: 670

Knowledge transfer partnership: implementation of target value design in the UK construction industry

Kaushik, A., ICIOB, United Kingdom, a.k.kaushik@salford.ac.uk

Keraminiyage, K., University of Salford, United Kingdom, k.p.keraminiyage@salford.ac.uk

Koskela, L., University of Salford, United Kingdom, l.j.koskela@salford.ac.uk

Tzortzopoulos, P., University of Huddersfield, United Kingdom, p.tzortzopoulos@salford.ac.uk

Hope, G., MAPM, United Kingdom, gary.hope@infra-projects.com

Knowledge Transfer Partnership (KTP) are unique research programs designed to bring innovation by joint effort of academia and industry to produce innovation in technology, process and management for the UK Industry. This paper describes an undergoing research to bring collaborative management approach to increase the efficiency in the construction industry. UK Construction industry has always been criticised by the industry experts about its efficiency and lack of innovation to deliver client's value. The KTP research project aims implement Target Value Design in the UK industry. Target Value Design (TVD) is lean project management approach focused to deliver client's value and have better control over project cost. TVD has been only implemented in U.S. and this research focuses to develop a framework to implement TVD in the UK Construction Industry.

Keywords: knowledge transfer partnership, research, target value design, construction

Theme: CIB W89 Building Education and Research

ID: 678

Contributions of women managers to the UK construction industry

Thayaparan, M., University of Salford, United Kingdom, m.thayaparan@salford.ac.uk
Amaratunga, R.D.G., University of Salford, United Kingdom, r.d.g.amaratunga@salford.ac.uk
Haigh, R., University of Salford, United Kingdom, r.p.haigh@salford.ac.uk

Women are constantly underrepresented in the UK construction industry due to barriers they face in entering, remaining and progressing in the industry. Lack of women employees has become a prominent issue as the industry needs to tackle the shortage of skilled labour and manage equality and diversity issues in construction. In this context, this research explored the contributions women has made to the construction industry that could help to improve women's representation and to address the problems such as skills shortages, recruitment difficulties, equality and diversity issues in the industry.

Women managers were the focus of this study for three reasons namely; they have been in the industry for long enough to understand the context, culture and difficulties; they have already progressed in their career while in the industry, despite the barriers identified; and they have attained a position where they possess a certain level of power and authority to make influences and contributions.

This research adopted an exploratory, multiple and holistic case study research approach. In-depth interviews, personal attributes questionnaires, multifactor leadership questionnaires and a literature review formed the data collection techniques.

Contributions made by women managers at various levels of the construction industry have been explored, and during this exploration the research analysed the leadership styles and personal attributes of women managers. Mentoring and coaching; problem resolution; team management; collaboration; leadership; decision-making; being role models; career awareness and image campaign; and cultural improvement were identified as the major contributions made by women managers to the construction industry.

Keywords: women managers, contributions, construction industry, UK

Theme: CIB W89 Building Education and Research

ID: 679

Factors influencing the effective implementation of VET in Government vocational training centres in Oman

Al-Rawehi, M., University of Salford, United Kingdom

Ahmed, V., University of Salford, United Kingdom

Vocational Education and Training (VET) is an effective way of enhancing the knowledge and skills levels of trainees and it has become of prime importance in economic, employment and social integration strategies worldwide. In Oman, VET has a crucial role to play in meeting the socio-economic, demographic, environmental, and technological needs of Omani citizens today and in the years ahead, and the significance of VET is realised in order to deliver qualified and skilled human resources to counteract the shortages in the Sultanate's workforce and achieve its development plans.

However, despite the evident government support, figures indicate the level of unemployment graduates from the Government Vocational Training Centres (GVTC) in Oman is high, to an extent that these graduates require retraining because they do not have the appropriate skills and knowledge to work. Furthermore, some studies and government reports confirm problems facing the development of VET such as the mismatch between skill levels among young Omanis graduating from the GVTCs and the labour market requirements, and the predominance of expatriates occupying private sector jobs, especially within vocational work. These issues prevent VET from being effective in terms of promoting Graduate Employability (GE), and thus represent the rationale for conducting this research.

This paper will therefore elaborate of the role of VET in developed countries, deriving the measures that influence effective implementation of VET. The paper also shares the findings of qualitative methods employed to identify that challenges facing the implementation of VET programmes in the GVTCs in Oman, involving various VET stakeholders, including top and senior managers, trainees, graduates, and employers from the government and private sectors. The findings suggest a need for a radical change in the Omani VET programmes to address employability skills in order to meet the needs of the labour market requirements. Recommendations are thus provided to aid effective development and implementation of VET programmes in Oman.

Keywords: vocational education, vocational training, Oman

Theme: CIB W89 Building Education and Research

ID: 680

W092 PROCUREMENT SYSTEMS

Public sector approaches to sustainability in Ajman, UAE

Al Abdooli, A., Ministry of Environment and Water, United Arab Emirates, amalabdooli@moew.gov.ae

Dulaimi, M., British University in Dubai, United Arab Emirates, mohammed.dulaimi@buid.ac.ae

The public sector has a significant role to play in promoting sustainability due its regulatory role but also its significant spending power. Hence, it will be a key success factor for implementing sustainable procurement (SP) in the public sector and would also create opportunities for its adoption in the private sector. The aim of this dissertation is to investigate the extent that public sector organisations in Ajman/UAE have developed detailed understanding of SP. The research is also to investigate the drivers and barriers for the adoption of more sustainable products and practices. Detailed case studies in two major public departments have revealed good understanding of the concept of sustainability but weak understanding of SP. This would undermine any effort to have more systematic delivery of sustainable projects. The number of initiatives that were successful demonstrated readiness in Ajman public sector to accept SP implementation. Incentives and new regulations as well as support from senior management would speed up the implementation of SP.

Keywords: sustainability, sustainable procurement, public sector, UAE

Theme: CIB W92 Procurement Systems

ID: 488

Decennial liability under the traditional method of procurement: law and practice in the United Arab Emirates

Masadeh, A., TU Delft, United Arab Emirates, aymenmasadeh@hotmail.com

Decennial liability arises in cases of traditional construction procurement where the engineer or architect prepares the design and oversees the construction works. FIDIC Red Book and other standard contracts provide for the limitation of contractor's liability. Apparently, this will have some impacts on the cost due to the contractor's risk calculation. However, this paper shows that the enforcement of such provisions in the United Arab Emirates UAE is not straightforward.

In Dubai, most employers tend to sell premises on map (off-plan sales) or shortly upon completion. The question becomes whether the subsequent owners can benefit from decennial liability. If not, how can the employer benefit from such a liability in cases where the defective premises had been already sold out? The privity principle strictly applies under the law of United Arab Emirates UAE. The paper argues that subsequent owners may have similar rights against the employers who can shift the liability to the contractor.

Keywords: FIDIC red book, decennial liability, construction contract, construction procurement, Dubai construction law

Theme: CIB W92 Procurement Systems

ID: 495

Analysing governance categories used on project alliances in the construction industry

Manley, K., Queensland University of Technology, Australia, k.manley@qut.edu.au

Chen, L., Queensland University of Technology, Australia, le.chen@qut.edu.au

Lewis, J., Queensland University of Technology, Australia, jo.lewis@qut.edu.au

In Australia, collaborative contracts, and in particular, project alliances, have been increasingly used to govern infrastructure projects. These contracts use formal and informal governance mechanisms to manage the delivery of infrastructure projects. Formal mechanisms such as financial risk sharing are specified in the contract, while informal mechanisms such as integrated teams are not. Given that the literature contains a multiplicity of often untestable definitions, this paper reports on a review of the literature to operationalize the concepts of formal and informal governance. This work is the first phase of a study that will examine the optimal balance of formal and informal governance structures.

Desk-top review of leading journals in the areas of construction management and business management, as well as recent government documents and industry guidelines, was undertaken to conceptualise and operationalize formal and informal governance mechanisms. The study primarily draws on transaction-cost economics (e.g. Williamson 1979; Williamson 1991), relational contract theory (Feinman 2000; Macneil 2000) and social psychology theory (e.g. Gulati 1995). Content analysis of the literature was undertaken to identify key governance mechanisms. Content analysis is a commonly used methodology in the social sciences area. It provides rich data through the systematic and objective review of literature (Krippendorff 2004). NVivo 9, a qualitative data analysis software package, was used to assist in this process.

A previous study by the authors identified that formal governance mechanisms can be classified into seven measurable categories: (1) negotiated cost, (2) competitive cost, (3) commercial framework, (4) risk and reward sharing, (5) qualitative performance, (6) collaborative multi-party agreement, and (7) early contractor involvement. Similarly, informal governance mechanisms can be classified into four measurable categories: (1) leadership structure, (2) integrated team, (3) team workshops, and (4) joint management system.

This paper explores and further defines the key operational characteristics of each mechanism category, highlighting its impact on value for money in alliance project delivery. The paper's contribution is that it provides the basis for future research to compare the impact of a range of individual mechanisms within each category, as a means of improving the performance of construction projects.

Keywords: collaborative contracts, formal governance mechanisms, informal governance mechanisms, value for money, infrastructure projects

Theme: CIB W92 Procurement Systems

ID: 504

Learning strategies used by construction firms during alliance projects

Lewis, J., Queensland University of Technology, Australia, jo.lewis@qut.edu.au

Chen, L., Queensland University of Technology, Australia, le.chen@qut.edu.au

Manley, K., Queensland University of Technology, Australia, k.manley@qut.edu.au

Collaborative contracting has emerged over the past 15 years as an innovative project delivery framework that is particularly suited to infrastructure projects. Australia leads the world in the development of project and program alliance approaches to collaborative delivery. These approaches are considered to promise superior project results. However, very little is known about the learning routines that are most widely used in support of collaborative projects in general and alliance projects in particular. The literature on absorptive capacity and dynamic capabilities indicates that such learning enhances project performance. The learning routines employed at corporate level during the operation of collaborative infrastructure projects in Australia were examined through a large survey conducted in 2013. This paper presents a descriptive summary of the preliminary findings.

The survey captured the experiences of 320 practitioners of collaborative construction projects, including public and private sector clients, contractors, consultants and suppliers (three per cent of projects were located in New Zealand, but for brevity's sake the sample is referred to as Australian). The majority of projects identified used alliances (78.6%); whilst 9% used Early Contractor Involvement (ECI) contracts and 2.7% used Early Tender Involvement contracts, which are 'slimmer' types of collaborative contract. The remaining 9.7% of respondents used traditional contracts that employed some collaborative elements. The majority of projects were delivered for public sector clients (86.3%), and/or clients experienced with asset procurement (89.6%). All of the projects delivered infrastructure assets; one third in the road sector, one third in the water sector, one fifth in the rail sector, and the rest spread across energy, building and mining.

Learning routines were explored within three interconnected phases: knowledge exploration, transformation and exploitation. The results show that explorative and exploitative learning routines were applied to a similar extent. Transformative routines were applied to a relatively low extent. It was also found that the most highly applied routine is 'regularly applying new knowledge to collaborative projects'; and the least popular routine was 'staff incentives to encourage information sharing about collaborative projects'.

Future research planned by the authors will examine the impact of these routines on project performance.

Keywords: project alliances, collaborative contracting, Australia, project performance, project outcomes, learning, absorptive capacity

Theme: CIB W92 Procurement Systems

ID: 505

Comparing alternative procurement operations - the case of core Hospital FM services in England

Murray, A., University College London, United Kingdom, alex.m.murray@ucl.ac.uk
Mohammadi, A., University College London, USA, a.bton.mohammadi@googlemail.com
Ive, G., University College London, United Kingdom, g.ive@ucl.ac.uk

The following paper presents a study of the operational cost and performance of core soft FM services in English hospitals, grouped by procurement method applied. A more precise method for discerning the procurement used for cleaning and catering services was developed, allowing 2 important improvements on previous studies. Firstly, controlling for the approximately one third of PFI contracts which do not include core soft FM services within the scope of the contract. Secondly, this allows the inclusion of services that have been procured via separate outsourced contracts. Data for 2008 is analysed and findings suggest that private provision does improve value for money in some services, notably catering. Samples include facilities of varying age, as exploratory data analysis suggested age of facility was not a valid predictor variable, an issue discussed in within the paper. Theory is considered in terms of incentives and opportunities 'to invest in operations', specifically the idea that integrated procurement, such as PFI, can deliver lower overall whole life cost from returns in improved operations. Further, the paper provides insight on the variance in levels of cost incurred and performance achieved for large samples of operational facilities, providing an opportunity for further research into other non-procurement determinants of FM performance. Contextual statistics on the prevalence of healthcare facility procurement via PFI are presented, along with suggestions for improvements regarding how public clients might monitor and assess future performance of services.

Keywords: Hospital FM, value for money, PFI, outsourced, procurement

Theme: CIB W92 Procurement Systems

ID: 544

Does it make sense to apply project alliancing in a customary apartment renovation? – a case study

Amaral Fernandes, D., Técnico Lisboa - Instituto Superior Técnico, Portugal, daniellindgrenaf@gmail.com

Lahdenperä, P., VTT Technical Research Centre of Finland, Finland, pertti.lahdenpera@vtt.fi

Costa, A., Técnico Lisboa - Instituto Superior Técnico, Portugal, aguiar.costa@tecnico.ulisboa.pt

Frustration felt toward the opportunism inherent in traditional contracting has made the construction sector to develop new collaborative project delivery models globally. This is especially true in Australia, where Project Alliance has been introduced as a solution to the experienced problems. This model has been applied mostly in road, rail and water infrastructure projects. The building and real estate sector has hardly used the mode and exceptions include predominantly only few uniquely demanding landmark buildings involving a lot of uncertainty.

More recently, owners in Finland have started to utilise Project Alliance. In addition to a few infrastructure projects one relatively standard/common apartment renovation project has been implemented in accordance with alliancing practices. The study will focus on this building project and experiences gained from it. More precisely, the objective of the study was to find out whether it makes sense to use Project Alliance in more common projects and on what conditions it benefits building construction involving more parties (i.e. technical experts and subcontractors) than a typical infrastructure project. Interviews with project's participants had a role in the study and results from a survey to parties to the project were analysed broadly.

In the presented case, key features of the Project Alliance contributed for high levels of collaboration between participants and enabled achieving very positive results. Thus, this research work allows concluding that the alliance was definitely worth applying at this relatively small renovation project, although several suggestions for modifications could be identified and should be incorporated in future projects.

Keywords: project alliance, procurement systems, renovation, collaboration, survey

Theme: CIB W92 Procurement Systems

ID: 547

Sustainability non-price incentive and reward mechanisms

Kenley, R., Swinburne University of Technology, Australia, rkenley@swin.edu.au

Hampson, K., Curtin University of Technology, Australia, keith.hampson@curtin.edu.au

Bedggood, J., Swinburne University of Technology, Australia, jbedggood@swin.edu.au

Harfield, T., Swinburne University of Technology, Australia, tharfield@swin.edu.au

Sanchez, A., Griffith University of Technology, Australia, a.sanchez@griffith.edu.au

Construction scholars suggest that procurement processes can be used as mechanisms to change construction industry practices. This paper discusses industry changes as a response to the calls for integration of sustainability ideals into construction practices. Because major infrastructure construction has been identified as a key producer of greenhouse gas emissions (GHGE), this study explores collaborative procurement models that have been used to facilitate mitigation of GHGE. The study focuses on the application of non-price incentives and rewards that work together as a binary mechanism. Data were collected using mixed-methods: government document content analysis was complemented with data collected through focus groups and individual interviews with both clients and contractors. This report includes examples of greening procurement agendas for three Australian road authorities relating to collaborative procurement project delivery models. Three collaborative procurement models, Alliance Consortium, Early Contractor Involvement and Public Private Partnerships provide evidence of construction projects that were completed early. It can also be argued that both clients and contractors are rewarded through collaborative project delivery. The incentive of early completion is rewarded with reduction of GHGE. This positive environmental outcome, based on a dual benefit and non-price sustainability criteria, suggests a step towards changed industry practices through the use of green procurement models.

Keywords: procurement, non-price incentives, mass-haul, GHGE reduction

Theme: CIB W92 Procurement Systems

ID: 582

The application of Early Contractor Involvement (ECI) in different delivery systems

Rahmani, F., RMIT Univeristy, Australia, farshid.rahmani@rmit.edu.au

Khalfan, M., RMIT Univeristy, Australia, malik.khalfan@rmit.edu.au

Maqsood, T., RMIT Univeristy, Australia, tayyab.maqsood@rmit.edu.au

In Australia, the Commonwealth alongside the states and territory governments are committed to delivering effective and efficient infrastructure projects across the country. To date, over 340 economic infrastructure projects valued at \$20 Million or more, account for almost two-fifth of the total value of capital expenditure on major projects. The majority of these projects are delivered under a relationship-based procurement (RBP) method. Amongst various types of relational contracts, Early Contractor Involvement (ECI) is seen as one of the delivery systems and contracting arrangements that owns a number of these projects. Furthermore, the South Australian's Department for Transport Energy and Infrastructure (DTEI), and the Queensland's Department of Transport and Main Roads (TMR) have published a number of documents in an attempt to standardise the ECI contract as practiced in Australia. Despite the evident documents indicating the ECI as a form of binding contract, many academic and industrial professionals use the term as a concept too. From their perspective, ECI refers to engagement of the contractor at the early stage of project development and can happen through a wide range of methods. This paper, therefore, studies different delivery systems that incorporate the concept of ECI into their implementation process through a literary analysis on the existing scholars and contractual documents.

Keywords: early contractor involvement, ECI, realationship-based procurement systems, relational contracting

Theme: CIB W92 Procurement Systems

ID: 628

A systems approach to assessing organisational viability- the case of an O and G infrastructure delivery project based organisation

Awuzie, B., University of Salford, United Kingdom, b.o.awuzie@edu.salford.ac.uk

McDermott, P., University of Salford, United Kingdom, p.mcdermott@salford.ac.uk

Extant literature highlights the increasing inability of Project-Based Organisations (PBOs) to meet infrastructure client's expectations, particularly as it concerns the delivery of socio-economic outcomes during the delivery process. Viability is defined as connoting the ability of PBOs to withstand endogenous and exogenous influences to deliver on the client's objectives. As its central proposition, this study holds that the prevalence of unclear communication channels and adversarial relationships among parties within such PBOs was capable of negatively affecting their degree of internal cohesion; posing strong challenges to their viability. This study forms part of an on-going multi-case study, system-oriented doctoral research however only a single case is reported in this particular study. This qualitative study seeks to assess a particular infrastructure delivery PBO, situated in a developing country, with the aim of identifying where such gaps likely to affect the internal cohesiveness of the PBO, existed. Whereas semi-structured interviews and project documents were used as data collection tools, the collected data was analysed qualitatively with the aid of the Nvivo software. Pre-set themes were used and the data obtained was analysed qualitatively. A systems approach -Viable System Model – (VSM) was used to assess the PBO's viability. According the study's findings, an absence of a prevalent common identity was observed among the various parties to the PBO. Contractors' capabilities to deliver on time and to budget based on their expertise remained pivotal within the PBO thus abandoning the attainment of the Client's pre-defined socio-economic objectives. Cases of faulty and ineffective organisational architecture, functional and communication issues were observed. It was discovered that these observed anomalies impacted upon the internal cohesiveness of the PBO thus rendering it unviable. Based upon these findings, it was recommended that the VSM be adopted at the commencement of the PBO lifecycle and at intervals by project managers and other stakeholders for assessing the levels of organisational viability as is obtained in the use of AGILE in the IT industry.

Keywords: viability, viable system model, project-based organisations, infrastructure delivery, socio-economic benefits

Theme: CIB W92 Procurement Systems

ID: 648

Revisiting client roles and capabilities in construction procurement

Alharthi, A., Loughborough University, United Kingdom, aliharthi@yahoo.com

Soetanto, R., Loughborough University, United Kingdom, r.soetanto@lboro.ac.uk

Edum-Fotwe, F., Loughborough University, United Kingdom, f.t.edum-fotwe@lboro.ac.uk

The need to improve performance of procurement in construction has resulted in several structural changes and re-arrangements for the acquisition of the client's development scheme. Much of these changes have focused on the contribution and roles played by parties other than the client to the delivery of projects. The role of the client during these changes has evolved from one of a passive fund provider to an increasingly active participant and hands-on management in some of the procurement arrangements. However, there is little evidence that these evolving roles have been met with a commensurate progress in project delivery performance for client organisations. There is evidence that lack of progress is hindering project performance. Simultaneously, research has so far given less attention to the changes in client's roles over time. This does not only call for a clarification of contribution the client makes in delivery of projects, but also highlights the need to re-visit the client roles under different procurement systems, and at different project phases, including pre-construction, construction and operational.

This paper presents a review of common procurement arrangements in the construction industry and the changing roles of the client's organisation. The paper also explores the client's role in each of these arrangements to establish what capabilities enable effective project delivery and performance. The identification of the capabilities is achieved by mapping client roles against procurement arrangements. The analysis of mapping exercise shows that the client has two types of capabilities for the delivery of every project: a primary capability required by all clients; and secondary one that is specific to a particular procurement case. The primary capability could serve as the minimum threshold for self-evaluation by client organisations.

Keywords: revisiting, client roles, capabilities, construction, procurement

Theme: CIB W92 Procurement Systems

ID: 657

W096 ARCHITECTURAL MANAGEMENT

Designing healthy homes

Ewart, I.J., University of Reading, United Kingdom, i.j.ewart@reading.ac.uk

Recent research into the relationship between health and housing is dominated by two recurring themes: first, the influence of deprivation and poor housing conditions on measures of health (e.g. POST 2011; Thompson et al 2009; Easterbrook 2002), and secondly the political and technological agendas that are shaping notions of healthcare at home (Steventon et al 2012; Harris 2010). Both themes draw attention to the home as a place of sickness and care but ignore much of the socio-cultural literature on the notion of the home as a place of meaningful spaces and practices (e.g. Cieraad 2010; Daniels 2010; Manzo 2003; Easthope 2004). Investigating the links between the home and practices of wellbeing requires a more holistic understanding of how the home contributes to healthy living, beyond issues of sickness and care, to see how space is used, what practices are created and maintained and how they can be set into socio-cultural contexts. In the words of the World Health Organization, being healthy is “a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity” (WHO 1946:2). In line with that definition, this paper advocates the need to look more closely at issues of health and wellbeing inside the home, and considers ways that we might usefully investigate the domestic environment with a view to promoting health in the widest sense as a fundamental driver for the design of the homes of the future.

Keywords: health, wellbeing, design, homes

Theme: CIB W96 Architectural Management

ID: 551

Product integration and process requirements

Beider, S., ABC Nova, Netherlands, sander_breider@hotmail.com

Van Oel, C., TU Delft, Netherlands, c.j.vanoel@tudelft.nl

Prins, M., TU Delft, The Netherlands, m.prins@tudelft.nl

This paper reports on a primarily quantitative study into the relationship between process characteristics of collaborative design processes and the level of integration reached concerning a building's architectural and climate installation design. This study furthers previous work of Prins and Kruijne (2011). To strengthen further evidence, we first improved the assessment criteria to measure the concept of 'product integration'. Using experts, we were able to obtain a reliable measure of what may be considered 'soft' architectural quality. Secondly, several process characteristics like intensity of collaboration and the very nature of collaboration between architects and climate installation engineers were assessed using a questionnaire. Logistic regression modelling was used to analyse data from 168 respondents who were sampled through professional organisations of architects and climate installation engineers and consultants. The moment the engineer got involved into the project, significantly explained the level of integration of the architectural design, together with 2 other process characteristics. The latter were whether or not the architect was engaged as project manager during the initiative phase, and whether the client expressed an ambition towards the integrative quality of architectural and climate design of the building. These findings thus emphasize the importance of the initiative phase of building projects in achieving high levels of product integration. These results are relevant for designers, project and design managers and clients aiming at generating architectural quality from collaborative design processes.

Keywords: project management, design management, integration, architectural quality, value, collaboration

Theme: CIB W96 Architectural Management

ID: 568

The role of the architect in integrated contracts for social housing energy renovations in the Netherlands

Salcedo Rahola, T.B., Delft University of Technology, Netherlands, t.b.salcedorahola@tudelft.nl

Straub, A., Delft University of Technology, Netherlands, a.straub@tudelft.nl

The use of integrated contracts in the Dutch construction sector has increased in recent years. Integrated contracts presume facilitating a much more effective process than traditional delivery methods leading to reduced cost and time and higher quality. In first instance this type of contracts was only used for large and complex infrastructure projects and new buildings. In the last five years they have been used also in the social housing sector for renovation projects, giving positive project outcomes. In this kind of projects the supply-side actors work together in a team formed by an architect, consultants and construction companies; commonly referred as a consortium. There is a lack of knowledge about the formal and informal bindings between the consortium members, the specific roles of the consortium members and its influence on the project outcomes. The aim of the research project was to get an overview of the existing organizational typologies and the changes in the role of the architect (e.g. type of work, amount of work and work relations). The study is based on a series of interviews with architects working with integrated contracts in social housing renovations. The findings indicate that in the majority of the projects analysed, the architect is contracted by the main contractor rather than by the social housing organisation. The use of an integrated contract has no important effects on the relation of the architect with the social housing organization and improves the relation of the architect with the main contractor, consultants and advisors, and other specialized contractors involved. The architect is switching from a designer role to a technical and aesthetic advisor role compared to design-bid-build projects.

Keywords: architect, integrated contracts, renovation, energy efficiency

Theme: CIB W96 Architectural Management

ID: 574

Case study on the impact of information quality in industrial projects

Farssura Lima da Silva, T., Escola Politecnica - University of Sao Paulo, Brazil, tsa29v@hotmail.com

Carvalho, M., Escola Politecnica - University of Sao Paulo, Brazil, marlymc@usp.br

Melhado, S., Escola Politecnica - University of Sao Paulo, Brazil, silvio.melhado@poli.usp.br

The diversity of the industrial projects and market requirements increasingly demand design process improvement. The rising demand for speed in construction, lower costs and quality assurance generate complexity in managing the design process. For the design phase to be performed with the desired level of quality, the information provided to designers needs to be complete and reliable. For this, client engagement from the early beginning is crucial, creating a collaborative project in which every individual can participate in order to achieve the best results. Through a case study, this paper aims to identify needs and information requirements for design detailing and the design management practices performed by the company studied. The results will be evaluated in order to propose possible management improvements. It was observed that the information available to the design firm before construction had a degree of uncertainty too large, an issue that, adding to the client's lack of commitment with regard to collaboration in the process, caused severe financial losses.

Keywords: design management, information management, collaboration

Theme: CIB W96 Architectural Management

ID: 603

W102 INFORMATION AND KNOWLEDGE MANAGEMENT

Improving life cycle management by employing BIM in real estate management – case study

Ristimäki, M., Aalto University, Finland, miro.ristimaki@aalto.fi
Singh, V., Aalto University, Finland, vishal.singh@aalto.fi

BIM – Building Information Modelling (and Management) is generally used during the design and construction phase of the buildings life cycle. The applicability and added value of BIM in real estate management (REM) has received little attention and interest from investors and operators – implying the question; how can BIM be better utilized to create value for stakeholders in the maintenance phase and thus improve life cycle management?

The purpose of this research is to identify opportunities and challenges when employing BIM into REM. In particular this paper aims to identify the benefits of BIM for different stakeholders within REM in order to demonstrate added value and improved life cycle management within the building sector.

The reported findings are primarily based on a qualitative case study of a hospital PPP-project in the construction phase where BIM has been set high on the agenda. By conducting interviews with different stakeholders the results are analysed using a theoretical lens of technological frames in order to understand the underlying opportunities, challenges and benefits that stakeholders perceive regarding BIM.

The results indicate that in this particular case study life cycle management can be improved through employing BIM. The perceived benefits gained through improved information management are related to cost-, time- and resource efficiency in the buildings operational phase.

There are feasible opportunities to be considered and developed for FM operators and investors now and in the future. Findings suggest that by comprehensively extending and employing BIM into Real Estate Management, more value can be attained from a life cycle perspective.

Keywords: building information modelling, life cycle management, real estate management

Theme: CIB W102 Information and Knowledge Management in Building

ID: 510

5D building information modelling in the profession of Quantity Surveying in New Zealand

Karamaena, D., Massey University, New Zealand, dkaramaena@gmail.com

Domingo, N., Massey University, New Zealand, n.d.domingo@massey.ac.nz

Building Information Modelling (BIM) is a 3D building model represented by intelligent objects that reflect different elements of a building, and the data related to each of these objects. This data can be reused to simulate the construction of a building (4D BIM) or to provide quantities for cost estimating, frequently referred to as 5D BIM. BIM is having a profound effect on the construction industry, with an ever-intensifying focus on the profession of quantity surveying. As the capabilities of BIM appear to mimic the perceptions of quantity surveyors' (Qs) work, many have speculated that the growth of BIM will be the downfall of the quantity surveying profession.

This research paper examines perspectives on present and future uses of 5D Building Information Modelling in the quantity surveying profession in New Zealand; and by means of a postal questionnaire, investigates the norm in the New Zealand construction industry regarding the use of 5D BIM among Qs; understanding the use of 5D BIM within the quantity surveying profession; and barriers and recommendations to improve the use of 5D BIM among New Zealand Qs. It was found that New Zealand is very much at the beginning stages of utilising BIM to generate cost data, with a promising possibility of increasing BIM use in the future. Results also indicate that the cost data generated through BIM cannot be fully trusted without a quantity surveyor managing it and thus, BIM cannot take over the role of a quantity surveyor. They also highlighted the importance of new or amended forms of construction contract to provide assurances for any uncertainties over ownership of data, to increase the use of 5D BIM among Qs in New Zealand.

Keywords: 5D, building information modelling, New Zealand, Quantity Surveying

Theme: CIB W102 Information and Knowledge Management in Building

ID: 528

Condition based maintenance: identifying the key managerial and/or operational success factors and barriers for implementation whilst ascertaining the effectiveness of planned preventative maintenance

Amin, R., UCL, United Kingdom, ruhul.amin.11@ucl.ac.uk

Pitt, M., UCL, United Kingdom, michael.pitt@ucl.ac.uk

Reliability has been consistently an essential feature in the evaluation of industrial assets (products and/or equipment), as a result maintenance is a continuous process implemented by hard facilities management (FM) providers not only with the core goal of reducing downtime caused by unexpected failures, but also to reduce the associated energy usage whilst maximizing performance and asset life.

Maintenance policies are categorised into two main strategic streams: corrective and preventive. Condition Based Maintenance (CBM) is a subdivision of preventive methodology and is based on the belief that 99 per cent of equipment will evidence some sort of indicators prior a fault develops. Through utilisation of science and technology CBM exploits the operating condition of assets to diagnose faults at early stages of occurrence thus triggering proactive maintenance based on the need. Although the field of CBM is extensively researched, the studies appear to be technical, computer and information science or mathematical modelling orientated. Consequently, contradictions remain between literature and practice concerning the consequences of CBM implementation and the impact on the managerial and operational processes.

Concentrating on managerial and operational barriers and success factors, this study investigates centrifugal pumps and associated motors to ascertain the extent to which vibration provoked faults can be identified and diagnosed through the use of Vibration Analysis (for misalignment, looseness and imbalance faults) and Shock Pulse Method (SPM) (for bearing faults), albeit routine Planned Preventative Maintenance (PPM) is applied.

The study establishes that a PPM schedule based on original equipment manufacturers recommendations and best practice standards, is not sufficient at completely eliminating the investigated mechanical faults, thus CBM techniques should be utilized in conjunction to compensate. Moreover, the study recognizes key managerial and operational barriers and success factors for implementation, while drawing attention to the significant role of FM Supply Chain Management.

Keywords: facilities management, condition based maintenance, supply chain management, reliability

Theme: CIB W102 Information and Knowledge Management in Building

ID: 639

Big data and decision support system for climate change and resilience management of built environment

Bagdonavicius, A., Vilnius Gediminas Technical University, Lithuania, arvydas.bagdonavicius@registrucentras.lt
Kaklauskas, A., Vilnius Gediminas Technical University, Lithuania,
Garliauskaite, L., Vilnius Gediminas Technical University, Lithuania,

Every day, we create 2.5 quintillion bytes of data — so much that 90% of the data in the world today has been created in the last two years alone. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few (IBM 2013). Built environment, climate change and resilience management have similar situation. Best practices and intelligent systems utilization is a key factor in productively executing climate change and resilience management in built environment. The main purpose of this paper is present the Decision Support System for Climate Change and Resilience Management of Built Environment which the authors of this paper have developed.

Keywords: decision support system, built environment, climate change, decision making, regia

Theme: CIB W102 Information and Knowledge Management in Building

ID: 675

The widening knowledge gap in the built environment of developed and developing nations: lean and offsite construction in Nigeria and the UK.

Omotayo, T., University of Salford, United Kingdom, t.omotayo@edu.salford.ac.uk
Keraminiyage, K., University of Salford, United Kingdom, k.p.keraminiyage@salford.ac.uk

This paper assessed the knowledge divide between the UK and Nigeria construction industries in the area of lean and offsite construction. This study utilized literature review as a method of determining the extent to which lean and offsite construction has been identified as new knowledge areas in the built environment in Nigeria and the UK by using a benchmark of 15 literature materials from journals, books, published thesis and conference proceedings for each construction concept. The findings suggest that there are few published literary materials related to lean construction in Nigeria and there were no published materials related to Nigeria in the areas of offsite construction. The literature search for lean and offsite construction in the UK revealed that there were many materials about these topics. These literary materials have been in existence for several years in the UK. This exposes the knowledge gap which has been widening over the years between Nigeria and the UK.

Keywords: lean construction, offsite construction, the UK, Nigeria, construction

Theme: CIB W102 Information and Knowledge Management in Building

ID: 676

W117 PERFORMANCE MEASUREMENT IN CONSTRUCTION

Deficient housing: development of a new theoretical perspective on poverty traps

Salami, R., University of Newcastle, Australia, rafiulugbenga.salami@uon.edu.au
Von Meding, J., University of Newcastle, Australia, jason.vonmeding@newcastle.edu.au
Giggins, H., University of Newcastle, Australia, helen.giggins@newcastle.edu.au

The right to adequate housing for all human beings is universally acknowledged as not only sacrosanct but an inevitable ingredient for economic, political and social development. Regardless, hundreds of millions people in developing nations are presently without adequate shelter, leading to increased vulnerability to socio-economic inequality, poverty and hazard events. This study proposes a new way of framing the debate on poverty traps, specifically adding deficient housing as a significant trap to those already discussed in literature; conflict, dependence on natural resources, and bad governance among others. The paper takes an incisive look at the causes and effects of deficient housing on occupants and demonstrates, through the development of a strategic framework, how conditions of poverty cause deficient housing to be built in the first place but also how people living in poverty are mostly likely to build deficient housing. The paper concludes by advocating for specific measures, and providing guidance for policy makers, NGOs and other stakeholders for rapid implementation so as to significantly facilitate an improvement in standards of living for those caught in such poverty traps. This study contributes to knowledge in the area by proposing a novel perspective on poverty traps, bringing built environment professional expertise and innovations into the equation and targeting shelter as a vehicle of change.

Keywords: poverty, traps, deficient housing, developing nations, bottom billion, shelter

Theme: CIB W117 Performance Measurement in Construction

ID: 622

An investigation of the performance of Saudi Arabian higher education construction projects

Bannan, A., University of Reading, United Kingdom, a.f.bannan@pgr.reading.ac.uk

Elmualim, A., University of Reading, United Kingdom, a.a.elmualim@reading.ac.uk

There is a building boom in the higher education industry. The demand for construction labour and materials for higher education construction projects have started to rise again according to recent statistics. Many colleges and universities in Saudi Arabia are undergoing significant capital expansion, leading to major development and growth. Although many of these organisations hired some key resources to manage their construction projects, their infrastructure has not grown as quickly. There is a need today for better systems and processes to measure the performance of construction projects in order to drive improvements. The research method consists of the philosophical position of the research, the research purpose and instrument used to investigate the performance of Saudi higher education construction projects. The constructivist approach appears to be the best ontological orientation for the research purpose of exploration. The phenomenological approach is chosen as epistemological orientation for the research. The research focuses on mixed methods; both qualitative and quantitative. Semi structured interviews were chosen as the primary research instrument, because they help better understand how individuals construct meaning and significance in their situations from a personal point of view. Currently, there is a tool to measure the performance of higher education construction projects in Saudi Arabia. The tool includes key performance indicators such as time, cost, labour and material performance. A performance report is issued by the contractor on a weekly basis and discussed during a weekly performance meeting with the owner and consultant. Saudi construction performance is influenced by different internal and external factors. Availability of qualified personnel, financial resources, lack of opportunities for real-time control and proper study of project scope, are the main influencing factors on the performance of construction projects in Saudi Arabia.

Keywords: construction, higher education, key performance indicators, performance measurement, Saudi Arabia

Theme: CIB W117 Performance Measurement in Construction

ID: 634

The influence of organisational culture on sharing knowledge in small information communication technology firms in Libya

Allali, B., University of Salford, United Kingdom, b.allali@edu.salford.ac.uk

Keraminiyage, K., University of Salford, United Kingdom, k.p.keraminiyage@salford.ac.uk

Kulatunga, U., University of Salford, United Kingdom, u.kulatunga@salford.ac.uk

Knowledge is seen as a crucial factor behind sustainable advantage and success for Information Communication Technology (ICT) business organizations. Consequently, sharing knowledge (SK) has been considered as a main element of success, which is closely interlinked with organizational culture (OC), and OC is believed to have significant influences on the processes of SK. Such interrelationships between both concepts can be reflected in the fact that both concepts focus on people who share and interact knowledge as well as those who create and build up the organizational cultural values and meanings.

Accordingly, in the literature, although there is a considerable amount of research which concerns issues related to the influence of OC on the process of SK, there is a lack of research that proposes a coherent framework which assists firms to establish good practice for SK processes.

In this study, the influence of OC on the processes of SK in ICT organizations in Libya is investigated. This aim will be accomplished by applying a multi-case study approach to examine four different cases (two public and two private) ICT Libyan firms. Both quantitative and qualitative data will be collected using different data collection methods, namely questionnaire, in depth interviews and official documents. The outcomes of this research will be to establish a framework that assists ICT firms to perform better practices in SK processes.

Keywords: organizational culture, sharing knowledge, information communication technology firms, Libya, multi-case study

Theme: CIB W117 Performance Measurement in Construction

ID: 637

Investigation of relationship between results of work sampling and productivity measurement

Dasgupta, A., Indian Institute of Technology Madras, India, anupamdasgupta88@gmail.com
Varghese, K., Indian Institute of Technology Madras, India, koshy@iitm.ac.in

The use of lean tools and related concepts in the Indian construction industry is presently at a nascent stage, but is gradually gaining importance. Currently, productivity measurement system is the only predominantly used tool to monitor performance at micro level across large construction projects in India. However, without any established nationwide benchmark on productivity, it is difficult to assess and evaluate the performance using productivity rates alone. In such an environment, work sampling serves as a very effective tool to measure and monitor the performance of construction projects at micro level, along with productivity measurement. One of the key aspects of work sampling is its ability to provide timely information to the management about workforce efficiency. However, it is crucial to understand the relationship between the results obtained from both the techniques, before they are used to monitor project progress in complementary roles. In line with lean philosophy, work sampling is broadly classified into direct, supporting and idle category. This paper explores the relationship between various categories of work sampling and productivity rates. Earlier research studies in this field show wide variation, as some conclude that work sampling is a good predictor of productivity whereas others found no substantial correlation between them. Crew based work sampling and productivity measurements are conducted on shuttering gangs working on high rise building construction projects. Subsequently regression analyses on collected data, reveal that idle category component has a strong correlation with productivity rates whereas direct or supporting categories show no significant correlation. These results are discussed in the context of this study as well as broader applicability.

Keywords: productivity, work sampling, construction management

Theme: CIB W117 Performance Measurement in Construction

ID: 654

Organizational effectiveness of building project organisations and greenfields to develop

Koolwijk, J., Delft University of Technology, Netherlands, j.s.j.koolwijk@tudelft.nl

Vrijhoef, R., Delft University of Technology, Netherlands, r.vrijhoef@tudelft.nl

Van Oel, C., Delft University of Technology, Netherlands, c.j.vanoel@tudelft.nl

Van der Kuij, R., Delft University of Technology, Netherlands, r.s.vanderkuij@tudelft.nl

Wamelink, H., Delft University of Technology, Netherlands, j.w.f.wamelink@tudelft.nl

The purpose of this paper is to explore and categorise the different approaches used to determine organizational effectiveness of construction project organizations. First, the conceptualization of organizational effectiveness is reviewed. This resulted in three main approaches that are used to categorise the approaches used within construction literature. Then, based on a structured literature search in scopus, the main approaches applied within construction industry based research are categorised and potential areas for further development have been determined. It has been found that the use of the multiple constituencies approach to organizational effectiveness is very limited within construction literature, while it may deepen our understanding on the determinants of construction project success.

Keywords: effectiveness, performance, construction project organization

Theme: CIB W117 Performance Measurement in Construction

ID: 668

TG72 PUBLIC PRIVATE PARTNERSHIP

Identification of barriers to PPPs implementation in developing countries

Babatunde, S.O., Northumbria University, United Kingdom, solomon.babatunde@northumbria.ac.uk

Perera, S., Northumbria University, United Kingdom, srinath.perera@northumbria.ac.uk

Udeaja, C., Northumbria University, United Kingdom, chika.udeaja@northumbria.ac.uk

Zhou, L., Northumbria University, United Kingdom, lei.zhou@northumbria.ac.uk

Public Private Partnerships (PPPs) have become an increasingly important method of delivering infrastructure projects in the last decade and are now used in over 40 countries. The adoption and implementation of PPPs in less mature economies can pose different challenges to that of mature economies. Thus, successful PPPs are designed with careful attention to the context or the enabling environment within which the partnerships will be implemented. The growth of PPPs has in many countries increased the availability of resources, the efficiency, and sustainability of public services especially in the fields of transport, energy, water, telecommunications, and health. In developing countries a number of barriers influencing the implementation of PPPs caused diminishing interests of both local and foreign private investors. The purpose of this paper is to identify the barriers in implementing PPPs in developing countries. The paper adopted past research studies and documentary reports as a means of identifying the barriers to PPPs implementation. Thus, the identified barriers are subjected to a pilot survey. The barriers are categorized by using SLEEPT approach, that includes; social, legal, economic, environmental, political, and technological factors. The paper identified technological barriers, economic barriers, and social barriers as the most influential barriers to PPPs project implementation in developing countries. Therefore, recognition of the barriers and its elimination by the stakeholders in PPPs will allow the partnerships to function effectively and ensuring successful implementation of present and future PPPs.

Keywords: barriers, implementation, PPPs, strategies, stakeholders

Theme: CIB TG72 Public Private Partnerships

ID: 494

Risk and value management with real options in public private partnerships

Vimpari, J., Aalto University, Finland, jussi.vimpari@aalto.fi

Sivunen, M., Boost Brothers, Finland, matti.sivunen@boostbrothers.fi

Kajander, J.K., Boost Brothers, Finland, juho-kusti.kajander@boostbrothers.fi

Junnila, S., Aalto University, Finland, seppo.junnila@aalto.fi

Public Private Partnerships (PPP) have secured a position as an alternative to direct investment in construction projects in the municipal sector. The construction costs of PPP projects are often justified by stating that the quality of construction is better and the overall lifecycle costs are optimized according to the client's needs. Recently a need for flexibility in PPP contracts has emerged. In some cases the client demand for services may vary during the concession period. This generates a need to make flexible contracts between client and provider.

Providers in PPP projects have an increasing need to identify and manage uncertainty and risks related to contract flexibility. In order to do this effectively, the economic feasibility of risk management actions must be evaluated. In this paper real options analysis (ROA) is used to evaluate risk management actions related to PPP projects with long life cycle. A large Finnish healthcare facility PPP project is used as a case in the study. The key performance metrics used in the study is to secure high building occupancy and rental yield.

Three main sources of uncertainty were identified related to the flexible contract and long contract period. Accordingly, the risk management actions for coping with the uncertainties were proposed and examined with the developed ROA procedure. The provider stated to have received several benefits from the ROA analysis such as decision-making information directly applicable to investment decision and guidelines for developing briefing and design management documents; thus, potentially improving project profitability in later life-cycle stages.

The actual monetary values provided by ROA assessment were, for example, 680 000 € for flexibility designed in parking structure compared to the original design. The proposed physical flexibility for coping with the uncertainty in final space demand was found to have a value of 460 000 €. The building integrated on-site energy source production for addressing the uncertainty in raising energy costs was found to have an option value of 440 000 €.

The theoretical implication of the paper is that real options analysis can reveal opportunities and risks inside a PPP project that might remain unnoticed with the traditional investment analysis methods. The identification of separate investments as options can be used for managing risk and value inside a PPP project.

Keywords: risk management, real options, PPP, life cycle, valuation

Theme: CIB TG72 Public Private Partnerships

ID: 517

Using Public-Private Partnerships (PPPs) for the procurement of public hospitals

Jefferies, M., University of Newcastle, Australia, Marcus.Jefferies@newcastle.edu.au

Rowlinson, S., University of Hong Kong, China, hrecsmr@hku.hk

Kumaraswamy, M., University of Hong Kong, mohan@hku.hk

Ke, Y., University of Newcastle, Australia, yongjian.ke@newcastle.edu.au

Public-Private Sector Partnerships (PPPs) provide a means for developing public infrastructure without directly impacting upon Government budgets. Social infrastructure projects are generally smaller in scale than economic infrastructure projects, however, they tend to be more complex, mainly because of the on-going involvement with the community. Private sector tenderers for social infrastructure PPPs are often presented with a situation where operational complexity, including government policy towards risk allocation and the sharing of revenue, is a key difference in whether PPPs are as attractive for social infrastructure projects compared with economic ones. This paper focuses on the procurement selection process for healthcare infrastructure in Australia and the results are presented from a case study of a PPP hospital project in New South Wales.

Keywords: Australia, healthcare, public private partnerships, risk, social infrastructure

Theme: CIB TG72 Public Private Partnerships

ID: 605

A critical review on preparedness of Emirati energy sector for disasters

Alkhaili, K., University of Salford, United Kingdom, abu-mhra@hotmail.com

Pathirage, C., University of Salford, United Kingdom, c.p.pathirage@salford.ac.uk

Amaratunga, R.D.G., University of Salford, United Kingdom, r.d.g.amaratunga@salford.ac.uk

All disasters are said to follow a cyclical pattern referred to as the disaster cycle. The cycle is an overall view of stages within a continual loop of prevention, mitigation, preparedness, response and recovery. Disaster preparedness is one of the stages of disaster management cycle. Disaster preparedness is guided in a manner which adequately protects communities. It involves the identification of potential hazards and vulnerabilities through risk assessments, development of forecast and warning systems, modeling and training for a number of disaster scenarios of different hazards and at different magnitudes, development of insurance infrastructure and the growth of an intelligent community. The energy sector dominates in the UAE and consists of various assets - electricity, oil and natural gas that are geographically dispersed and connected by systems and networks. The protection of these systems and assets and within the energy sector especially, the safeguarding of oil and gas infrastructure from any and all internal and external threats should become top priority in the UAE. Threats to geopolitical and economic stability that need to be considered and prepared for include tectonic activity, climate change, nuclear energy, terrorism and war.

This paper, using both primary and secondary data, discusses the current level of resilience in the Emirati energy sector and what can be done to improve it. The secondary data was taken from various academic and professional sources whilst the primary data, which constitutes 35 questionnaires with both qualitative and quantitative data, were collected on site at two electricity generating plants, one in Abu Dhabi and one in Dubai.

Keywords: disaster, preparedness, UAE, energy sector

Theme: CIB TG72 Public Private Partnerships

ID: 673

**CIB TG74 NEW PRODUCTION
AND BUSINESS MODELS IN CONSTRUCTION**

Profit, risk and value: the business model renewal in the real estate and construction sector

Rajakallio, K., Aalto University, Real Estate Business, Finland, karoliina.rajakallio@aalto.fi

Ristimäki, M., Aalto University, Real Estate Business, Finland, miro.ristimaki@aalto.fi

Junnila, S., Aalto University, Real Estate Business, Finland, seppo.junnila@aalto.fi

This paper suggests that the identified challenges of REC sector to deliver end-user value and sustainability over the life of buildings may lay in the poor configurational fit between REC sector business models. The purpose of the research is to analyse how the business models in REC sector are aligned in terms of customer value creation and their own value capture. A single case study of a large PPP-project was chosen as research approach.

Through a series of interviews and documentation analysis the value creation and value capture of the project networks is analyzed from the perspective of profitability, sustainability and innovation. The analysis resulted six key value drivers within the case project: 1) Ability to implement, 2) Risk management, 3) Operational efficiency, 4) Financial optimisation over the life cycle, 5) Functionality and 6) Innovations.

It could be concluded there was a high configurational fit between the value creation drivers and value capture mechanism of project network participating companies. According to the interviewees, the project is expected to have higher-than-standard-market-practice profitability, supporting Storbacka's (2012) suggestion that effective business models are characterized by the configurational fit of their elements. Risk management and risk taking capability of the project network was the most visible value creation driver linked to the value capture mechanisms of the project. This seems to be different compared to the standard industry practices and calls for further research.

Keywords: business model, value creation, value capture, risk

Theme: CIB TG74 New Production and Business Models in Construction

ID: 537

Location based thinking: alternative concepts for monitoring and controlling construction project management structures

Kenley, R., Swinburne University of Technology, Australia, rkenley@swin.edu.au

Harfield, T., Swinburne University of Technology, Australia, tharfield@swin.edu.au

The evolution of construction Project Management (PM) practices is linked to the development of PERT, a network based control system for product completion. PM practices aim to control cost and time based on a hierarchy work breakdown structure (WBS). The work to be done on a project is defined in work packages. However, for construction projects, current use of WBS creates a significant amount of data redundancy, because all of the work is location specific. This paper argues that location is a more appropriate unit of analysis and thus the obvious conceptual framework for construction projects. Built environment production is explained in the Location Based Management System (LBMS). The LBMS components are unified and location allows the integration of many data mechanisms into a knowledge-base for a project. Location provides the container for all project data and is used as the primary work division through a location breakdown structure (LBS). The LBS provides the opportunity, used in conjunction with the WBS, to limit excessive location specific data repetition. This paper outlines the application of a WBS/LBS matrix as one method for improving construction project productivity. The WBS, once freed of location-repetition, can more efficiently describe the work being done which permits increased administrative productivity.

Keywords: productivity, location based thinking, project management structures

Theme: CIB TG74 New Production and Business Models in Construction

ID: 581

Success factors related to industrialized building

Hjort, B., Halmstad University, Sweden, bengt.hjort@hh.se

Lindgren, J., Halmstad University, Sweden, John.Lindgren@hh.se

Larsson, B., Halmstad University, Sweden, bengt.larsson@hh.se

Emmitt, S., Loughborough University, United Kingdom, s.emmitt@lboro.ac.uk

During the last decade there has been intense discussion in Sweden about industrialization in construction. The discussion has focused on industrialization in connection with erection of multi dwelling houses. It has been argued that industrialization is a key factor as regards obtaining affordable high-quality dwellings. During the last ten years some new industrialization concepts have been developed and tested. Even though some concepts have failed others have been more successful and are under further development. Industrialization is a reality within the Swedish construction sector and can be assumed to play an important role in the future as regards obtaining affordable high-quality dwellings. In this paper success factors related to four industrialized building concepts/methods are described and discussed. The review is based on available literature relating to each of the concepts/methods/producers, from which it was possible to ascertain success and failure factors.

Keywords: industrialization, prefabrication, dwellings, affordable, success factors

Theme: CIB TG74 New Production and Business Models in Construction

ID: 616

The water-energy nexus: a review of recent trends and applications

Hewage, K., University of British Columbia, Canada, kasun.hewage@ubc.ca

Sadiq, R., University of British Columbia, Canada, rehan.sadiq@ubc.ca

Reza, B., University of British Columbia, Canada, bahareh.reza@ubc.ca

Umer, A., University of British Columbia, Canada, engr.adilumer@gmail.com

Sustainability of urban communities is intricately linked with water and energy conservation. The recognition that there is a complex relationship between water and energy forms a complex nexus of urban resource flows. On one hand, water is withdrawn and consumed throughout the life cycle of an energy source (e.g. hydroelectricity); on the other hand, energy is consumed for extraction, distribution, and end-use of water resources. During the past ten years, the “Water-Energy Nexus” has emerged as an important way forward to sustainable policy development. The so-called water-energy-climate change feedback loop has significant implications for sustainable water and energy policies in general but specifically in urbanized areas. Since water and energy resource use are tightly joined with urbanization and population growth, there is a need for their integration in policy and research. This paper reviews research on water-energy nexus in the context of sustainability evaluation for urban development and related construction and infrastructure management. Moreover, this study summarizes innovation and technical changes for improved utility management under various competing water and energy demands and develops deep understanding of water, energy and urbanization nexus.

Keywords: water-energy nexus, sustainability, lifecycle

Theme: CIB TG74 New Production and Business Models in Construction

ID: 638

Emergence of the business models in the building and construction literature

Abuzeinab, A., University of Salford, United Kingdom, a.abuzeinab@edu.salford.ac.uk
Arif, M., University of Salford, United Kingdom, m.arif@salford.ac.uk

Business models play a key role on successful businesses since they describe how an organisation creates and delivers value for its customers and subsequently captures value. A good business model can separate a company from its rivals by creating a competitive edge. However, there is limited research on business models in the building and construction field. This paper aims to contribute to this limited literature by exploring how the business model concept is understood and conceived by the building and construction literature to shed some light on the concept and its associated benefits, establish a common language, and help position future enquiries. Yet, it becomes vital to cover the literature in the business and management field where business models originated. This approach helps gaining thorough understanding and seeing the big picture of business models. The findings suggest that there is a growing interest in the use of business models concept in the building and construction disciplines but most articles refer to business models without explicit definition which can lead to uncertainty on using the concept. Furthermore, recent studies provide explicit definition of business models and seek to develop an understanding of the concept with reference to the construction context. As suggested by the literature, business models concept can be relevant for sustainability studies since it helps companies converting their abstract environmental strategies into viable business concepts thus creating value for customers and capturing this value. Moreover, concentration on the business model can facilitate better evaluation of current construction companies' business models and assess their future suitability of sustainability aspects and competitiveness. To benefit from business models in the building and construction context, they need to be considered and developed at the level of field of operation with clear explanation on what they mean.

Keywords: business models, construction, competitive advantage, strategy, and value creation

Theme: CIB TG74 New Production and Business Models in Construction

ID: 650

TG81 GLOBAL CONSTRUCTION DATA

The reflections of construction and the urban form in the carbon footprints of consumers in California

Heinonen, J., Aalto University, Finland, jukka.heinonen@aalto.fi

Mandel, B., University of California Berkeley, USA, benjamin.h.mandel@gmail.com

Zenkin, S., University of California Berkeley, USA, lana357@gmail.com

Le Floch, C., University of California Berkeley, USA, caroline.le-floch@berkeley.edu

Quesada, E., University of California Berkeley, USA, emilyq@gmail.com

Horvath, A., University of California Berkeley, USA, horvath@berkeley.edu

The traditional production-based greenhouse gas (GHG) assessments tend to point fingers at the less urbanized areas where agriculture and the most GHG intensive production are often located and where transit distances are longer than in more dense settlements. This, however, may give a very biased basis for decision-making, since the consumption-intensive lifestyles and the heavy emissions from infrastructure development following rapid urbanization in the more affluent urban settlements may actually result in higher emissions caused by urban residents. In this study we tackle this issue by developing a hybrid life cycle assessment (LCA) model for assessing the consumption-based carbon footprints of the residents of the U.S. and the state of California. We utilize the most recent U.S. Consumer Expenditure Survey data of the Bureau of Labor Statistics and amend the model with several external data sources. Compared to the earlier assessments with similar methods and geographic scopes, our assessment includes a couple of advancements. Firstly, we utilize significantly more recent and more disaggregated input data. In addition, traditionally the carbon footprint assessments have not been able to sufficiently capture the GHG impacts of buildings and infrastructure development as well as purchases of certain long-term durable goods. In the developed model we propose a new way to incorporate these impacts into the assessment. With our assessment we depict how the carbon footprints in California appear as significantly lower than in the rest of the country due to lower power generation emission intensities and traffic-related emissions. We also discuss how this type of analysis could later be used in designing more effective GHG mitigation strategies and more sustainable urban societies.

Keywords: life cycle assessment, urbanization, carbon footprint, consumption, construction

Theme: CIB TG81 Global Construction Data

ID: 532

A review of the 'smart technology' currently being explored globally and its potential impact upon the construction industry on a micro level

Mulholland, K., UCL, United Kingdom, kieran.mulholland.13@ucl.ac.uk

Pitt, M., UCL, United Kingdom, michael.pitt@ucl.ac.uk

The following paper will review literature that covers the use of 'Smart Technology' and 'Big Data' in the context of Smart Cities currently being explored globally. By investigating into the perceived benefits of implementing the digital economy in to essential infrastructure the paper will look at how the construction industry can benefit. The literature covered found that through the adoption of Smart Technology within a Smart City framework there are benefits available for all industries; such as greater efficiencies and forecasting ability, resulting in savings. However the integration of real time data on-site could possess great potential for construction managers as they look to make more informed and accurate decisions. However the extents of the benefits are unclear as many pieces of literature state that the potential use of Big Data is almost unimaginable currently. Urbanisation is forcing city authorities to adopt more strategic approaches to their decision making processes which has resulted in the emergence of 'Smart Cities'. Case studies around the globe have shown promising and innovative potential for a range of stakeholders. These are promising signs for the industry as it still seeks considerable investment and testing before it can be scaled up. However further work should look to investigate first-hand how construction managers could benefit from open source 'Big Data' collected by city authorities. This would add evidence to the many theoretical benefits that are possible.

Keywords: smart cities, M2M interactions, urbanisation, ICT infrastructure, Sensor and Actuator Networks (SAN)

Theme: CIB TG81 Global Construction Data

ID: 647

Analytical assessment of standard contractual forms to the construction industry in the Middle East- overview and recommendations

Sadek, S., University of Salford, United Kingdom, sadek.samer@gmail.com

Kulatunga, U., University of Salford, United Kingdom, u.kulatunga@salford.ac.uk

Despite the fact that there exist several construction forms of contract that aimed at standardizing the contractual clauses in relation to the construction industry, the adoption of the same was being subject to major modifications and alteration endangering the overall spirit and consistency of the contractual forms.

Knowing that the middle East region is and will be subject to major construction projects during the upcoming years, it is of major importance to consider that well figured contractual clauses would play major role in simplifying part of the complexity associated with the construction environment. The problem is that the project parties would be focusing on the contractual aspects governing the project rather than technical and execution issues which would eventually flag hindrance in the project original schedule and certainly an escalation to the project original budget notwithstanding the project works atmosphere. Furthermore, and if the contractual clauses were not drafted clearly, contracts negotiation and signature would be a time consuming challenge and would take considerable time from the total originally allocated. During project execution, the problem may become worse if the contractual terms and conditions were not clear enough i.e. the contracting parties do not have a clear understanding of what they have agreed upon, accordingly, any claim may be considered as a fertile ground for contractual disputes.

The above issues represent a challenge to any project manager whose aim is to finish his project within the given time frame and allocated budget constraints. Hence, it would be of great importance to have the conditions of contracts responsibly drafted. The same would assist in alleviating disputes that do relate to contractual terms and would support the contracting parties to jointly read from the same book. This paper focuses on Standard construction contracts current practices in the Middle East with their corresponding conditions. The final section of this paper highlights the major modifications being witnessed to the Standard contractual clauses.

Keywords: standard contractual forms, Middle East

Theme: CIB TG81 Global Construction Data

ID: 661

TG83 E-BUSINESS IN CONSTRUCTION

Construction process categorisation towards developing an e-business maturity model

Rodrigo, A., Northumbria University, United Kingdom, anushi.rodrigo@northumbria.ac.uk

Perera, S., Northumbria University, United Kingdom, srinath.perera@northumbria.ac.uk

Udeaja, C., Northumbria University, United Kingdom, chika.udeaja@northumbria.ac.uk

Zhou, L., Northumbria University, United Kingdom, lei.zhou@northumbria.ac.uk

The rapid pace of change in technology coupled with global economic and environmental changes has had considerable impact on all business sectors. Consequently, organisations are forced to drive towards efficiency savings, productivity improvements and increased collaboration to cope with current demands. This has resulted in execution of electronic ways of conducting business activities increasingly becoming a key strategic approach for many organizations. Electronic business (e-business) processes have taken businesses to new dimensions and organisations are moving away from traditional processes to modern ways of working through the use of electronic media. These new approaches create new pathways to gain competitive advantage and they guarantee valuable rewards for organizations. Even though the possibilities afforded are evident, compared to other industries the level of e-business implementation within the construction industry is not widespread and robust as anticipated. This indicates that there is a need for advancement of construction e-business practices. Hence, for construction organisations currently using e-business tools and for those who have yet to utilize and seek to adopt e-business tools, there is a need to undertake an analysis of their business processes and working methods to ensure a productive and beneficial implementation of these tools. This necessitates undertaking an analysis of current construction e-business processes to ensure productive implementation in order to develop their e-business capabilities and levels of maturity. This paper acknowledges the niche for research into e-business capability and maturity of e-business processes and presents a protocol for categorizing the construction processes for the development of a construction e-business capability maturity model. Process classification methodology comprised of two stages; initially an archival analysis to identify and categorise construction processes followed by expert interviews to review and refine the categorisation. Results of this classification aided in developing a construction e-business capability maturity model which can use to identify the status of their current e-business process implementation.

Keywords: construction processes, process classification, e-business, maturity models, construction industry

Theme: CIB TG83 eBusiness in Construction

ID: 515

Reducing building information fragmentation: a BIM-specifications approach

Utiome, E., Queensland University of Technology, Australia, e.utiome@qut.edu.au

Drogemuller, R., Queensland University of Technology, Australia, robin.drogemuller@qut.edu.au

Docherty, M., Queensland University of Technology, Australia, m.docherty@qut.edu.au

The world of Construction is changing, so too are the expectations of stakeholders regarding strategies for adapting existing resources (people, equipment and finances), processes and tools to the evolving needs of the industry. Building Information Modelling (BIM) is a data-rich, digital approach for representing building information required for design and construction. BIM tools are instrumental to current approaches by industry stakeholders aimed at harnessing the power of a single information repository for improved project delivery and maintenance.

Yet building specifications, which comprise information on material quality, and workmanship requirements, remain distinctly separate from model information typically represented in BIM models. BIM adoption for building design, construction and maintenance is an industry-wide strategy aimed at addressing such concerns about information fragmentation. However, to effectively reduce inefficiencies due to fragmentation, BIM models require crucial information contained in building specifications.

This paper profiles some specification tools which have been used in industry as a means of bridging the BIM-Specifications divide. We analyse the distinction between current attempts at integrating BIM and specifications and our approach which utilises rich specification information embedded within objects in a product library as a method for improving the quality of information contained in BIM objects at various levels of model development.

Keywords: BIM, specifications, bimspecs, information fragmentation, integrated specifications

Theme: CIB TG83 eBusiness in Construction

ID: 558

Conceptualising e-business in project based construction SMEs: product and services perspective

Gajendran, T., The University of Newcastle, Australia, thayaparan.gajendran@newcastle.edu.au
Brewer, G., The University of Newcastle, Australia, graham.brewer@newcastle.edu.au

E-business can be as simple as using the Internet to send emails to communicate with customers/suppliers or to establish complex network relationships with trading partners. A business can be considered an e-business even if it doesn't buy and sell products over the Internet, as the term refers to business activities that are assisted by the Internet. Since early 2000, considerable literature has explored e-commerce/e-business in the context of construction enterprises. They have looked at enablers and barriers of business, issues associated to, implementation processes/models, technical platforms/architecture, supply chain integration etc. However, there is limited discourse into conceptualising the role of e-business in SMEs in Architecture, Engineering and Construction (AEC) firms. It is essential to understand the business of an SME, especially the nature of their core business, in the form of product, service or a mix of both, to evaluate the role of e-business. This is critical as mainstream literature suggests that while there are common processes relating to product or service innovation, a significant difference is also evident. In this context, understanding the nature of the core business provides the basis to conceptualise the intra organisational connections, through a product-service mix, that SMEs have with their trading partners, and to evaluate how e-business becomes relevant to specific dyadic and/or network connections. The aim of this paper is therefore to conceptualise e-business in construction SMEs, in terms of product-service mix, based on the extent of online driven connectivity between trading partners. The research aim is approached through qualitative review of literature. This research method is underpinned by constructivist paradigm, which accepts multiple realities of the world, enabling construction of pluralistic arguments. The concluding remarks suggest that e-business models can be conceptualised via the fusion of 'Strategy Model', 'Resource Model' and 'Network model'.

Keywords: product, service, fragmentation, supply chain, ebusiness models

Theme: CIB TG83 eBusiness in Construction

ID: 570

Improving the technological capacity of the local contractor through e-business technology transfer – the case of the local Ghanaian contractor

Adzroe, E.K., University of Salford, United Kingdom, e.k.adzroe@edu.salford.ac.uk

Ingirige, B., University of Salford, United Kingdom, m.j.b.ingirige@salford.ac.uk

Technology transfer (TT) within construction has emerged as an important business activity across many developing countries across the globe including Ghana. For several years TT from developed countries has been viewed as a key element in addressing the low levels of technological development and know-how in developing countries construction industries. TT according to many writers and researchers involve mostly cross-border initiatives with the main purpose to improve the capacity of the local contractor. This paper therefore, considers TT as a mechanism for improving the capacity of the local contractor in developing countries. In this regard, TT could be viewed in the form of knowledge (soft technology), skills and tools (hard technology) which usually come from developed countries to developing countries through construction project activities. Therefore, the objective of this paper is to assess the influence of foreign contractors in supporting transfer of e-business technology to the Ghanaian construction industry. In view of this, a total number of five (5) semi-structured interviews were conducted as follow: one (1) foreign firm, two (2) expert interviews and two (2) local contractors (collaborators) representing one case study out of a total of three. This research involved an interpretivist approach based on qualitative data in order to have an in-depth understanding of the objective of this paper and have insight into how practitioners perceive the roles of foreign contractors in the transfer of e-business technology to improve performance in the construction industry in Ghana. This paper reports that content analysis shows the important role that foreign contractors play within the context of e-business technology transfer. The results also show that foreign firms undertake TT in an ad hoc manner and this exercise need to be streamlined. They further indicate several arguments on the need to address the identified barriers to enable the industry to harness the full potentials of e-business.

Keywords: e-Business technology, technology transfer, construction industry, developing countries, foreign firms

Theme: CIB TG83 eBusiness in Construction

ID: 580

Cross discipline knowledge transfer for concurrent BIM adoption in an engineering organisation

Gerrish, T., Loughborough University, United Kingdom, t.gerrish@lboro.ac.uk

Ruikar, K., Loughborough University, United Kingdom, k.d.ruikar@lboro.ac.uk

Cook, M., Loughborough University, United Kingdom, malcolm.cook@lboro.ac.uk

The use of Building Information Modelling (BIM) in the design environment has been widely discussed within the field of construction. However, its effective use requires that all contributing designers meet the technical capabilities necessary to use this environment. A reliable development process utilising BIM to its full potential requires concurrent advancement of multiple disciplines working collaboratively. An investigation into how different disciplines are advancing their BIM capabilities within a multidisciplinary engineering consultancy is carried out to identify where improvements in this process may be made. New technology and process implementation are discussed and the construction industry's silo mentality is identified as a significant factor impacting this. The consultancy's BIM capability is evaluated through semi-structured interviews with discipline representatives involved in its implementation, outlining their experiences with implementation so far, and highlighting opportunities for greater knowledge transfer. Building Services and Physics were found to require most development as a result of the complexity of modelling within these disciplines and the lack of projects involving all disciplines equally. Other disciplines were found to be more BIM capable, but these capabilities are often lowered due to reliance on external stakeholders. This study contributes to the justification of BIM implementation within building design development and identifies the need for more effective adoption across the industry as a whole, not just within discrete areas.

Keywords: BIM adoption, knowledge transfer, multidisciplinary organisations

Theme: CIB TG83 eBusiness in Construction

ID: 621

e-business use in the Ghanaian construction industry: the drivers

Adzroe, E.K., University of Salford, United Kingdom, e.k.adzroe@edu.salford.ac.uk

Ingirige, B., University of Salford, United Kingdom, m.j.b.ingirige@salford.ac.uk

This paper reports on a questionnaire survey undertaken to evaluate e-Business use in the Ghanaian construction industry. The views of construction professionals and local construction firms in Ghana were consulted in this questionnaire survey. Additionally, the survey is intended to show evidence of e-Business activities and professional groups within the industry likely to use e-Business. The initial result shows that, there are different levels of e-Business initiatives and understanding within the industry. Further, e-Business related activities are done in haphazard manner due to low technological capacity. This evaluation provides a unique opportunity to assess the capacity of contractors and other professional groups for e-business technology transfer either through joint ventures or collaborations, considering the significant amount of investment and foreign construction firm activities within the Ghanaian construction industry.

Keywords: e-Business, construction industry, professional groups, technological capacity

Theme: CIB TG83 eBusiness in Construction

ID: 644

Index of Authors

A		Domingo	7, 79
Abduh	18	Dorée	34
Abdul-Aziz	43	Drogemuller	107
Abuzeinab	100	Dulaimi	20, 60
Adzroe	109, 111	E	
Ahmed	58	Edum-Fotwe	69
Al Abdooli	60	Ekanayake	46
Ala-Mantila	6	El-Abidi	19
Alharthi	69	Elhag	38
Alkhaili	93	Elmualim	85
Allali	86	Emmitt	98
Al-Rawehi	58	Ewart	72
Al-Sharifi	38	F	
Amaral Fernandes	65	Farssura Lima da Silva	75
Amaratunga	57, 93	Fernando	26, 33
Amin	80	G	
Anavhe	43	Gajendran	50, 108
Andelin	25	Garliauskaite	81
Arif	100	Gathercole	51
Awuzie	68	Gerrish	110
Azhar	49	Giggins	84
B		Giritli	31, 32
Babatunde	90	González	37
Bach	55	Gunarathna	33
Badi	30	H	
Bagdonavicius	81	Haigh	57
Bannan	85	Hampson	66
Bedggood	66	Hancock	48
Beider	73	Hanna	54
Bijleveld	34	Harfield	66, 97
Boyd	39, 41	Harty	36
Brady	28	Hawary	42
Brewer	50, 108	Heaps	7
Brezinski	10	Heinonen	5, 6, 35, 102
Brockmann	10	Hewage	99
Broft	30	Hilaire	50
C		Hjort	98
Carvalho	75	Hope	56
Ceric	4	Horvath	102
Chen	62, 63	I	
Choudhry	49	Ingirige	45, 109, 111
Christersson	8	Ive	64
Cook	110	J	
Copping	48	Jefferies	92
Costa	65		
D			
Dale	20		
Dasgupta	87		
Docherty	107		

Jones	17		
Junnila	8, 23, 25, 35, 91, 96		
K			
Kahkonen	40	Olanrewaju	43
Kajander	91	Omotayo	82
Kaklauskas	81	Onyido	41
Karamaena	79	Ottelin	5
Kaushik	56	Ozuna	37
Ke	92		
Keinanen	40	P	
Kenley	66, 97	Palliyaguru	55
Keraminiyage	56, 82, 86	Pathirage	46, 93
Khalfan	67	Perdikou	55
Koc	16	Perera	90, 106
Koolwijk	27, 88	Pitt	54, 80, 103
Koskela	28, 56	Prada	37
Kulatunga	44, 86, 104	Prins	73
Kumaraswamy	92	Pryke	30
		Pulkka	23
L			
Lahdenperä	65	Q	
Larsen	39	Quesada	102
Larsson	98		
Le Floch	102	R	
Leiringer	36	Rahmani	67
Lewis	24, 62, 63	Rajakallio	96
Lill	55	Rannisto	40
Lind	22	Reza	99
Lindgren	98	Ristimäki	78
Love	9	Ristimäki	96
M		Roders	29
Makela	40	Rodrigo	106
Mandel	102	Rose	24
Manley	24, 62, 63	Rowlinson	92
Maqsood	67	Ruddock	xxx, 11
Masadeh	61	Ruikar	110
McDermott	32, 68		
Melhado	75	S	
Miller	34	Sadek	104
Mlecnik	21	Sadiq	99
Mohamed Ghazali	19	Salami	84
Mohammadi	64	Salcedo Rahola	74
Mulholland	103	Salman	49
Murray	64	Sanchez	66
N		Säynäjoki	8, 35
Nabil	54	Schweber	39
Nair	15	Singh	78
Newton	9	Sivunen	91
Nilsson	22	Skaik	14, 15, 16, 42
Nyström	22	Skitmore	9
		Soetanto	69
		Sonson	44
		Sridarran	26
		Straub	29, 74

	T				
Tait	52	Vargas		37	
Tang	50	Varghese		87	
Thayaparan	57	Vimpari		8, 91	
Thurairajah	41, 51	Von Meding		84	
Tsigkari	54	Vrijhoef		27, 88	
Tzortzopoulos	56		W		
		Wamelink		27, 88	
	U	Wedawatta		45	
Udeaia	90, 106	Wijewickreme		46	
Ulutaş Duman	31, 32	Witt		55	
Umer	99		Y		
Utiome	107				
		Yuan		14	
	V		Z		
Valeriy	53				
Van der Kuij	27, 88	Zenkin		102	
Van Oel	27, 73, 88	Zhou		90, 106	

