LEEDS SUSTAINABILITY INSTITUTE

International Sustainable Ecological Engineering Design for Society (SEEDS) Conference 2018

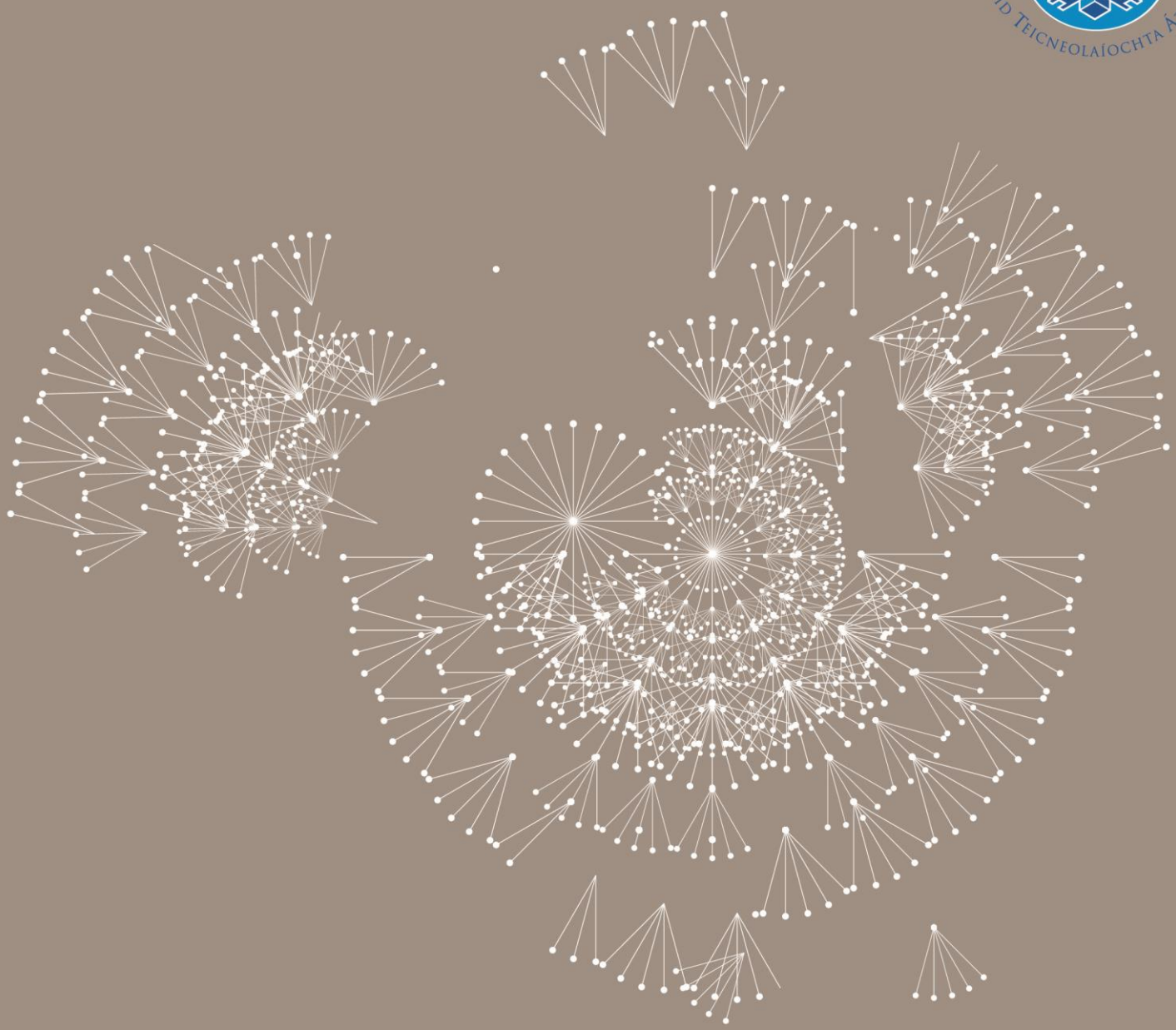
Abstracts

LEEDS BECKETT UNIVERSITY

Leeds Sustainability Institute

DUBLIN INSTITUTE OF TECHNOLOGY · INSTITIÚID TEICNEOLAÍOCHTA ÁTHA CLIATH ·

D·I·T



Sustainable Ecological Engineering Design for Society (SEEDS)

Fourth International SEEDS Conference

6th and 7th September 2018

Dublin Institute of Technology
Ireland

ABSTRACTS

Conference Sponsors

THE FOURTH INTERNATIONAL SEEDS CONFERENCE 2018

Enabling Sustainability – Re-engaging stakeholders

Grangegorman Campus, Dublin Institute of Technology, Ireland – 6th and 7th September 2018

The built environment has a greater impact on natural resources and produces more waste than any other industry. However, beyond the green rhetoric research is being applied on the ground to address the balance between the built and natural environment. The International SEEDS Conference, now in its 4th year, brings together experts from around the world focusing on the changes that are taking place and the benefits or consequences that are being predicted and measured regarding the built environment's impacts. As well as addressing technical issues, measuring energy efficiency and modelling energy performance, emphasis is placed on the health and wellbeing of the users of spaces occupied and enclosed. Understanding how buildings and spaces are designed and nurtured to obtain the optimal outcome is the focus of discussion and debate. This holistic approach draws together the research themes of energy, building performance and physics while placing health, wellbeing and ecology at the heart of the conference.

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

The 4 main conference themes

Energy and Buildings	Environment
Design for the 21st century	Sustainability education

Conference Sub Themes

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

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

Conference Chairs

Professor Lloyd Scott
Professor Chris Gorse

Preface

Sustainability and the associated issues are expected to be considered at a very integrative and holistic way in addressing the three key pillars of sustainable development, namely the environment, technology and the associated economics, while taking into consideration the macro and micro contexts. This event provides a platform to discuss the recognized and important problems affecting sustainable built environment. Specialized practitioners and researchers have the opportunity to share their research and views in a range of topic related to Sustainability, Engineering, Ecology and Design for Society. Interested policy makers, researchers, practitioners and educators whose interest lies in the subjects of sustainability, design, engineering, energy and education will be more effective if they integrate their efforts in order to share and influence governments, the greater society at large and academic institutions in this topical areas. This conference provides the opportunity for researchers and practitioners to share emerging research, best practice, develop and promote a network of experts who are passionate about a sustainable future.

SEEDS 2018

Greetings and a warm Dublin welcome! It has been our honour to chair this 4th Sustainable, Ecological, Engineering, Design for Society (SEEDS) Conference. It is my pleasure to welcome you to the wonderful city of Dublin; a vibrant cosmopolitan city that is home to three universities, soon to be four when, in January 2019, DIT, ITB and ITT will merge to become Ireland's first technological university, the Technological University Dublin. Dublin is home to some of the most enduring writers in the English language, and retains its prestige as one of the vibrant literary capitals of Europe, and its tradition is proudly maintained in museums, walking-tours, and heritage sites of all kinds. Of course the tradition of music is alive and well too!

It is a special pleasure to welcome you to the SEEDS conference at the fast developing Grangegorman campus of Dublin Institute of Technology. This is the fourth SEEDS conference but the first to take place outside of the UK and so I would particularly like to extend a warm welcome to Dublin. The conference has grown over the last four years and as well as being associated with it I have been privileged to take on the role of conference chair. While on a day-to-day basis we tend to focus on our own distinct areas of research, an occasion like SEEDs provides the opportunity to reflect on where our work fits in to the complex environment in which we exist.

Climate change, resource efficiency, greater demands on social care, urbanisation and immigration, an ageing infrastructure, the need to stimulate economic growth, as well as constrained budgets: these are challenges faced by society as a whole. An innovative and growing built environment is a crucial component for tackling these issues that confront us. There are increasing global concerns related to climate change and sustainability in the built environment. Buildings contribute some of the largest environmental impacts. For instance, in many developed countries nearly half of total carbon dioxide emissions come from energy use in buildings, more than half of all public water supply in the developed world is for household use, building construction and demolition waste still accounts for 32% of all waste, with 13% of products delivered to construction sites being sent directly to landfill without being utilised. The emergence from the current economic recession, have challenged the industry to explore effective ways of achieving sustainability. There is both a need and an opportunity for research in the disciplines relating to sustainability in the built environment. Research that can lead to, for instance, a better understanding of the concept of sustainability and the measurement and management of sustainable construction etc.

The contributions to the four themed areas of Energy and Buildings, Environment, Design for the 21st century and Sustainability Education have been impressively positive. We have been particularly driven to create a unique programme that truly represents the SEEDS mission: to collaborate and to share! To collaborate as academic peers, and to collaborate with our industry partners.

It is with great excitement then that we will see some 85 conference attendees from more than 50 different countries come and exchange ideas, research and practices both formally in the parallel sessions, and informally over coffee, lunch, dinner, or drinks. Just like the city

itself, this conference series is diverse and exciting, and promises the opportunity to expand professional networks and research partnerships; engage in new, and consolidate old, friendships; and to be challenged and inspired.

The past few months have been an exciting time for the organising committee, as we have collaborated on a number of stimulating interdisciplinary projects and initiatives. What is more, we have recently launched Twitter (#SEEDSDUBLIN 2018) and Instagram (SeedsDublin 2018) accounts for you to share your experiences – please join in and get involved.

I would like to thank the members of the SEEDS Scientific Review Group, the conference Organising Committee members, our keynote and featured speakers, but most notably the Dublin Institute of Technology, and Leeds Sustainability Institute, Leeds Beckett University. Last, but not least, I would like to thank the delegates from around the world, who make this conference possible, and this organisation come alive.

This SEEDS conference is focused on sustainability in the built environment with the purpose of helping researchers to develop the area and highlight some of the research approaches being taken. The themed emphasis includes the five papers being presented (and another two that were submitted but could not be delivered at the workshop for a variety of reasons). All of these papers, together, present a useful insight into the current research in addressing sustainable, ecological, engineering design for the society in which we live. It is interesting to see the diversity of research covered in this two-day gathering. Possibly, such diversity is a reflection of the wide-ranging attempts to define sustainability and measure sustainable development. However, the themes of Energy and Buildings, Environment, Design for the 21st century and Sustainability Education that are embedded in the papers of these proceedings will certainly be relevant to future debate in the wider community. We are particularly pleased to have such a great response in the themed area of Sustainability Education.

We look forward to two eventful days where discourse, sharing and building up new relationships in charting a 'sustainable' future is the imperative! We have so much to learn from each other and I am confident that you will come away from the conference inspired!

Have a wonderful time in Dublin, enjoy the conference, and enjoy the discourse and camaraderie of the SEEDS community.

Professor Lloyd Scott
Professor Chris Gorse

SEEDS conference chairs

SEEDS Conference Scientific Committee 2018

Chairs: Professor Lloyd Scott, Dublin Institute of Technology
Professor Chris Gorse, Leeds Beckett University

Dr Emmanuel Abogye-Nimo - University of Brighton
Mr Martin Adlington - University of Derby
Dr Dominic Ahiaga-Dagbui - Deakin University
Dr Saheed Ajayi – Leeds Beckett University
Associate Professor Patricia Aloise-Young - Colorado State University
Mr Zaid Alwan - Northumbria University
Associate Professor Karl Andersson - Lulea University of Technology
Ms Giham Badi - Leeds Beckett University
Professor Sodagar Behzad - University of Lincoln
Dr Adrian Bown - Leeds Beckett University
Mr Matthew Brooke-Peat - Leeds Beckett University
Associate Professor Martine Buser - Chalmers University of Technology
Dr Talib Butt - University of Wales, Trinity St David
Dr Pedro-Pablo Cardoso-Castro - Leeds Beckett University
Mr John Cavanagh - University of Aberdeen
Professor Anita Ceric - University of Zagreb
Dr Paul Chan - University of Manchester
Dr Udeaja Chika - University of Salford
Dr Nicholas Chileshe - University of South Australia
Dr Ang Mei Choo - Universitii Kebangsaan Malaysia
Dr Alex Copping - University of Bath
Professor Richard Cozzens - Southern Utah University
Professor Mohammad Dastbaz - University of Suffolk
Professor Olaf Droegehorn – Harz University of Applied Science, Germany
Professor Mohammed Dulaimi - Leeds Beckett University
Mr James Durrant - Leeds Beckett University
Dr Aitor Erkoreka - University of the Basque Country
Professor Fidelis Emuze - Central University of Technology, Free State
Dr Richard Fitton - University of Salford
Dr Cormac Flood – Dublin Institute of Technology
Dr Roberto Garay Martinez - Technalia Research and Innovation
Dr Jean-Phillipe Georges - University of Lorraine
Professor Putrus Ghanim - Northumbria University
Professor Barry Gledson - Northumbria University
Dr David Glew - Leeds Beckett University
Professor Anatoliy Gorbenko - Khal National Aerospace University
Professor Christopher Gorse - Leeds Beckett University
Professor Rajat Gupta - Oxford Brookes University
Ms Tahira Hamid - Leeds Beckett University
Mr John Heathcote - Leeds Beckett University
Dr Paul Hirst - Leeds Beckett University
Dr Max Hope - Leeds Beckett University

Dr Ornella Iuoria - University of Leeds
Professor Arnold Janssens - Universiteit Gent
Dr Carlos Jimenez-Bescos - Anglia Ruskin University
Professor David Johnston - Leeds Beckett University
Mr Allan Jones - Leeds Beckett University
Mr Hadi Kazemi - Leeds Beckett University
Dr Andrew King - Nottingham Trent University
Dr Alexandra Klimova - ITMO University, Russia
Dr Ah-Lian Kor - Leeds Beckett University
Professor Mikkel Kragh - University of Southern Denmark
Professor Richard Laing - Robert Gordon University, Aberdeen
Professor Tim Lang - City University London
Dr Alfred Leung - Leeds Beckett University
Dr John Littlewood - Cardiff Metropolitan University
Professor Martin Loosemore - University of New South Wales
Professor Peter Love - Curtin University
Dr Shu-Ling Lu - University of Reading
Mr Andy Maguire - Dublin Institute of Technology
Professor Phebe Mann - University of East London
Dr Wilfred Masuwa Matipa - Liverpool John Moores University
Dr Angela May-Banbury - Sheffield Hallam University
Ms Chrissi McCarthy - Constructing Equality Ltd.
Professor Tamer McCuen – University of Oklahoma
Dr Henrik Medsen - University of Reading
Ms Janet Mulcrone - Leeds Beckett University
Dr Mark Mulville - Dublin Institute of Technology
Mr Darryl Newport - University of East London
Mr Killian Ngong - Leeds Beckett University
Professor Brian Norton - Dublin Institute of Technology
Dr Conor Norton - Dublin Institute of Technology
Dr Sunny Nwaubani - Anglia Ruskin University
Ms Justine Oakes - University of Suffolk
Dr Edward Ochieng - Cranfield University
Dr Oladapo Adebayo - University of Central Lancashire
Dr Alex Opoku - University College London
Mr Emeka Osaji – Leeds Beckett University
Dr Mohamed Osmani - Loughborough University
Dr Alice Owen - University of Leeds
Professor Parneet Paul - Leeds Beckett University
Dr James Parker - Leeds Beckett University
Professor Colin Pattinson - Leeds Beckett University
Dr Poorang Piroozfar - University of Brighton
Dr Francesco Pomponi - Edinburgh Napier University
Professor Jari Porras - Lappeeranta University of Technology
Dr Martin Pritchard - Leeds Beckett University
Professor David Proverbs - Birmingham City University
Dr Ani Raiden - Nottingham Trent University

Professor Christine Raisanen - Chalmers University of Technology
Professor Ahmed Rashed - The British University in Egypt
Professor Gustaaf Roels - University of Leuven
Professor Eric Rondeau - Université de Lorraine, France
Ms Josie Rothera - Leeds Beckett University -
Professor Mushatat Sabah - University of Wolverhampton
Assistant Professor Dirk Saelens - Katholieke Universiteit Leuven
Dr Ajayi Saheed - Leeds Beckett University
Professor Jose Maria Sala Lizarraga - University of the Basque Country
Professor Lloyd Scott - Dublin Institute of Technology
Dr Jennifer Seavers - Leeds Beckett University
Dr. Mark Shelbourn, University of Salford
Dr Fred Sherratt - Anglia Ruskin University
Professor Alan Simson - Leeds Beckett University
Professor John Smallwood - Nelson Mandela Metropolitan University
Dr Robby Soetanto - Loughborough University
Dr John Spillane – University of Limerick
Dr Lisa Stansbie - Leeds Beckett University
Professor Paul Stephenson - Sheffield Hallam University
Professor Ian Strange - Leeds Beckett University
Dr Christian Stuck - University of Applied Sciences
Professor Andrew Sumner - CBRE Cost Management
Dr Keith Sunderland - Dublin Institute of Technology
Dr Andrew Swan - Leeds Beckett University
Professor Will Swan - University of Salford
Dr Kevin Thomas - Leeds Beckett University
Dr Craig Thomson - Glasgow Caledonian University
Professor David Thorpe - University of Southern Queensland
Associate Professor Apollo Tutesigensi - University of Leeds
Ms Maria Unuigbe - Leeds Beckett University
Professor Andre Viljoen - University of Brighton
Mr David Walton - University of Suffolk
Dr Phil Webber - University of Leeds
Mr Michael White - Leeds Beckett University
Dr Stephen Wilkinson - Leeds Beckett University
Dr Hannah Wood - University of Brighton
Professor John Woodward - Northumbria University
Dr Hong Xiao - Birmingham City University
Professor Peter Young - Colorado State University
Professor Arkady Zaslavsky - CSIRO
Dr Sam Zulu - Leeds Beckett University

SEEDS Technical Review Committee 2018

Professor Lloyd Scott - Dublin Institute of Technology
Dr John Spillane – University of Limerick
Mr Cormac Flood – Dublin Institute of Technology
Dr Keith Sutherland - Dublin Institute of Technology
Dr Conor Norton - Dublin Institute of Technology
Professor Brian Norton - Dublin Institute of Technology
Professor Christopher Gorse - Leeds Beckett University
Dr Mark Mulville - Dublin Institute of Technology

SEEDS Local Organising Committee 2018

Professor Lloyd Scott - Dublin Institute of Technology
Mr Cormac Flood – Dublin Institute of Technology
Dr Keith Sunderland - Dublin Institute of Technology
Dr Conor Norton - Dublin Institute of Technology
Professor Brian Norton - Dublin Institute of Technology
Professor Christopher Gorse - Leeds Beckett University
Ms. Ellen Glover - Leeds Beckett University
Dr Mark Mulville - Dublin Institute of Technology
Ms Lorna Colley- Dublin Institute of Technology
Ms Emmanuella Twumasi - Dublin Institute of Technology
Mr Williams Gadimoh - Dublin Institute of Technology
Mr Andy Maguire - Dublin Institute of Technology

TABLE OF CONTENTS

Sustainability

SUSTAINABLE CITIES AND ITS OPPORTUNITIES IN THE NIGER DELTA REGION OF NIGERIA

Lilian Smart[1] and Babatunde Animashaun[2]

School of Arts, Design and Architecture/Global Disaster and Resilient Centre (GDRC), University of Huddersfield, United Kingdom, Queensgate, Huddersfield HD1 3DH

Keywords: Migration, urbanization, sustainable cities, opportunities of sustainable cities.

Abstract

Presently, more than half the world's population lives in cities, and it is projected that 6 in 10 people will be urban dwellers by 2030; thus, making urbanization a defining feature of the 21st century. It becomes important to make these rapidly urbanizing cities like the ones in the Niger Delta region of Nigeria sustainable for human settlement and find out the opportunities that sustainable cities present. The Niger Delta region is an oil producing region in Nigeria. Following the oil exploratory activities in this region, migration-induced urbanization has been rapid and without development, resulting to diverse challenges. Considerable literature has explored these challenges and its impacts on sustainable cities. However, limited literature explores what characterises a sustainable city and the opportunities it presents. This is important because substantial studies have shown that the wealth and economic success of Nigeria comes from the region, yet it has continued to suffer marginalization and neglect from the government and multi-national oil corporations, hence, rapid urbanisation without development. Unfortunately, there has been little or no steps to ensure the sustainability of its rapidly growing cities. This is because to harness the opportunities of cities, the sustainability of such cities is of paramount importance and should be a priority. Therefore, the aim of this study is to find out what is a sustainable city and what makes a city sustainable? To address this question, this study will critically review and analysis relevant academic literature as well as papers and reports produced by the United Nations on World cities.

[1]lilian.smart@hud.ac.uk
[2]u1670826@hud.ac.uk

Smart, L. and Animashaun, B. (2018) Sustainable Cities and its Opportunities in the Niger Delta Region of Nigeria *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 20-35.

SUSTAINABLE FACILITIES MANAGEMENT IN NIGERIA AND UNITED KINGDOM

Babatunde Animashaun[1] and Adrian Pitts[2]

School of Art, Design and Architecture, University of Huddersfield, Queensgate, Huddersfield HD1 3DH, UK.

Keywords: Sustainability, Facilities management, Built Environment.

Abstract

The built environment is essential in attaining the sustainability agenda, as a result of the impact of facilities management on day to day activities in an environment where people work, live and play. Sustainable environment is one of the most challenging issues facing the facilities management industry in the developed and developing countries. This study sets out to compare and contrast the common best practices of sustainable facilities management amongst practitioners in Nigeria and United Kingdom. To achieve this aim, there is a need to identify the best practices from both regions in order to learn and implement for sustainable growth in the industry. The study adopts the mixed methods with an extensive literature review which informed the use of structured and designed questionnaire survey to focus groups (facilities managers in different organizations) in Nigeria and United Kingdom. The findings show the differences between both regions in energy management and reduction, waste management and recycling, preserving the natural environment. The level of awareness of sustainable facilities management in United Kingdom is high compared to Nigeria. There is a high level of support from government and regulatory agencies for the industry in the United Kingdom. In Nigeria, the support from the government, regulatory agencies, top management levels are inadequate. The study concludes that facilities management practitioners in Nigeria must practically engage with top management, government and regulatory agencies in order to influence policies and decision making in promoting sustainable facilities management and recommend more collaborations with professionals (Builders, Engineers and planners) to efficiently and effectively improve the environment and industry.

[1]u1670826@hud.ac.uk
[2]a.pitts@hud.ac.uk

Animashaun, B. and Adrian Pitts, A. (2018) Sustainable Facilities Management in Nigeria and United Kingdom *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 36-47.

NOMINATION DREAMS: ELUSIVE DIFFERENTIATION AND NEW ENTRANT CHALLENGES. EXAMINING STRATEGIC OPTIONS FOR UK CONSTRUCTION.

John Heathcote

Leeds Beckett University, School of the Built Environment and Engineering, Leeds, LS1 3HE, United Kingdom

Key Words: Sustainable strategies; Strategic Analysis; Construction differentiation.

Abstract

Strategic options for construction firms operating in Irish and U.K. markets might be limited to the cost leadership strategy outlined by Porter (1985), with attempts at differentiation becoming not much more than Public Relations exercises with little impact on client buying behaviour. The constraints that exist to maintain 'price leadership' erects a significant barrier to sustainable construction because clients and contractors have an emphasis on minimising capital expenditure at the expense of other considerations; notably sustainable building for medium to long term returns. This paper discusses factors that conspire to maintain a focus on capital cost reduction and the consequential negative impact on sustainable building. The paper compares the construction market with other Asset Management examples in three selected illustrations from the authors' own primary research or literature, to explore how entrenched is the industry is in constraining suppliers from developing differentiation strategies that would allow for a focus on sustainability and possibly make them a first choice for clients, in the way retail markets see customers prefer brands. Identifying core conditions and barriers that influence 'price leadership' strategies for construction, and long term partnerships in other industries, this paper proposes a study to test its hypothesis "Contemporary attempts by construction firms to differentiate are merely further methods to improve price leadership competitiveness" by proposing a study that will 'test' existing differentiation strategies evident in the market. Some possible ways construction firms might move towards successful market differentiation strategies, and lift existing commercial barriers to more sustainable construction are suggested.

J.Heathcote@leedsbeckett.ac.uk

Heathcote, J. (2018) Nomination dreams: Elusive differentiation and New entrant challenges. Examining Strategic options for UK construction *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 48-56.

A FUTURE-PROOF CULTURAL HERITAGE: A HOLISTIC MIXED METHODS APPROACH

Michela Menconi[1], Noel Painting[2], Poorang Piroozfar[3]

School of Environment and Technology, University of Brighton, Brighton, BN2 4GJ, East Sussex, UK

Keywords: Energy retrofit, Cultural Heritage, Energy simulation, Calibration.

Abstract

Mitigating environmental impacts has been a centre of attention for international commissions, legislative bodies and policy makers. The UK has signed up to an 80% reduction in carbon emissions by the year 2050 compared to 1990 baseline to meet this target at a national level. Energy used (primarily for heating) in the housing sector contributes 27% of all carbon emissions in the UK. Energy performance improvements of existing homes play a substantial role in the achievement of this national target, due to the low demolition rates and construction rates. The UK is facing a major challenge to address retrofit measures in this sector as it inherits the oldest and one of the most culturally rich yet most poorly performing housing stocks in Europe. The aim of this ongoing research is to propose a framework to intervene in traditional listed buildings to improve their environmental impact and shape a more future-proof heritage. A mixed methodology has been adopted using C19th case studies listed dwellings to investigate their current energy performance and the possible improvements in different scenarios of responsive and effective energy retrofits. A literature search, secondary data collection and analysis, visual and measured surveys, questionnaires, interviews, energy bills, meter readings, data logging, thermal-imaging and energy simulation are used to fulfil the research objectives. Providing a brief overview of this research methodology, the paper presents the detailed development of the methods utilised in this study up to date. It explains the measures, strategies and techniques, which were adopted to achieve simulation results of the status-quo energy performance of the selected case studies. This includes calibration of the models – used to ensure that the datasets collected or generated from different sources corroborate each other – and a brief report on the initial results of the current stage of research.

[1]m.menconi3@brighton.ac.uk
[2]N.J.Painting@brighton.ac.uk
[3]A.E.Piroozfar@brighton.ac.uk

Menconi, M., Painting, N. and Piroozfar, P. (2018) A future-proof cultural heritage: a holistic mixed methods approach *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 57-68.

Energy

HVAC DUCTWORK DESIGN AND ITS IMPACTS ON LIFE CYCLE ANALYSIS OF A BUILDING

Andrew Palcan[1], Dr. Blake Wentz[2] and Dr. Lantz Holtzhower[3]

[1]Mechanical Inc., 2279 E Yellow Creek Road, Freeport, IL 61032 USA
[2]Milwaukee School of Engineering, Civil, [2]Architectural Engineering and Construction Management Department, 1025 N Broadway, Milwaukee, WI 53202 USA
[3]Oklahoma State University, College of Engineering, Architecture and Technology, 511 Engineering North, Stillwater, OK 74078 USA

Keywords: Ductwork, Design, Life Cycle Analysis and Sustainability

Abstract

HVAC systems consume a large amount of energy within any building making it important for all HVAC engineers to understand the consequences of their designs. This paper assists in quantifying the effects of pressure drop in ductwork in terms of the life cycle assessment (LCA). Sizing ductwork is often done using a friction loss value that was historic for the design firm. As ductwork increases in size, noise and pressure drop are reduced while smaller ducts have an inverse effect, which can require the use of a larger fan and therefore more energy. This study shows that the production of ductwork has minimal effects when compared to the effects of fan operation. However, how ductwork is sized determines how much energy a fan will consume. The calculations used in this research show that utilizing low pressure or medium pressure ductwork is the most efficient use of materials as well as optimizing energy use when the system is in operation.

[2] wentz@msoe.edu
[3]lantz.holtzhower@okstate.edu

Palcan, A., Wentz, B. and Holtzhower, L. (2018) HVAC Ductwork Design and its Impacts on Life Cycle Analysis of a Building *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 70-77.

A COMPARISON BETWEEN THERMOSTAT AND THERMOSTATIC RADIATOR VALVE SETPOINT TEMPERATURES IN UK SOCIAL HOUSING

Adorkor Bruce-Konuah[1], Rory V. Jones, Alba Fuertes

Department of Architecture and Built Environment, University of Plymouth, Drake Circus, Plymouth, Devon, PL4 8AA, UK

Keywords: Space heating behaviour, thermostat, thermostatic radiator valves, heating setpoint temperatures

Abstract

In the UK, in centrally heated dwellings, space heating is commonly controlled by a whole house thermostat as well as thermostatic radiator valves (TRVs) fitted on individual radiators. TRV settings define a setpoint temperature at which the radiator is switched off, in order to regulate zonal temperatures. This paper presents an analysis of the TRV setpoint temperatures which occupants' select in living rooms and main bedrooms and provides a comparison between these and the whole house thermostat setting. The work capitalises on primary data from a socio-technical household survey undertaken in a sample of social housing in Plymouth, UK during 2015. The mean reported TRV setpoint temperature in the living rooms (n = 144) and bedrooms (n = 120) were 23.4°C and 22.1°C respectively. This result confirms that occupants prefer cooler conditions in their bedrooms and also suggests that occupants are actively using their TRVs to zonally control their heating at home to maintain comfortable thermal conditions and reduce their heating energy demand. The results also indicate that occupants' thermostat and TRV setpoint temperatures vary according to their household and motivation, behaviour and perception characteristics. The mean reported thermostat setpoint temperature was 20.7°C for those who reported a living room TRV setting and 20.9°C for those who reported a bedroom TRV setting. This result suggests that there may be a misunderstanding of the purposes of the whole house thermostat and the individual TRVs within a central heating system. Variations in occupant heating control behaviour have an impact on occupant comfort and household energy use. The results of this study have significant implications for the planning and implementation of energy efficiency measures, behaviour change interventions as well as the design of heating controls.

[1]adorkor.bruce@plymouth.ac.uk

Bruce-Konuah, A., Jones, R. V. and Fuertes, A. (2018) A comparison between thermostat and thermostatic radiator valve setpoint temperatures in UK social housing *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 78-95.

RE-WIND: ARCHITECTURAL DESIGN STUDIO AND THE RE-PURPOSING OF WIND TURBINE BLADES

Ruth Morrow [1], Russell Gentry [2], Tristan Al Haddad [2]

[1]School of Natural and Built Environment, Queen's University Belfast.
[2]School of Architecture, Georgia Institute of Technology, School of Architecture, Atlanta, Georgia, USA.

Keywords: design studio, wind turbines, reuse, circular economy.

Abstract

This paper discusses the opening moves of an international multidisciplinary research project involving researchers from Ireland, Northern Ireland and the US, aiming to address the global problem of end-of-life disposal of wind turbine blades. The problem is one of enormous scale on several levels: a typical 2.0 MW turbine has three 50m long blades containing around 20 tonnes of fibre reinforced plastic (FRP). It is estimated that by 2050, 39.8 million tonnes of material from the global wind industry will await disposal. Whilst land-fill is the current means of disposal, the nature of the materials used in the composite construction of wind blades (glass and carbon fibres, resins, foams) means it unsustainable. Hence, the project sets out to deploy innovative design and logistical concepts for reusing and recycling these blades. The project begins within an innovative joint design studio, staged between Queen's University Belfast and the Georgia Institute of Technology, where architecture students will, within the highly-constrained contexts of the blade properties and the potential reuse sites, systematically generate, filter, and prototype a selection of proposals, reusing the decommissioned wind turbine blades in buildings, infrastructure, landscape, and public art. The paper analyzes the potential and challenges of considering this highly constrained and yet multidisciplinary problem within the context of a Masters level Architecture studio. The paper concludes with an analysis of how outcome-driven design problems challenge traditional design studio cultures, acknowledging the need to make processes and ideas more explicit in order to categorise, analyse, rank and refine proposed architectural solutions.

[1]ruth.morrow@qub.ac.uk

Morrow, R., Gentry, R. and Al Haddad, T. (2018) Re-Wind: Architectural Design Studio and the Re-Purposing of Wind Turbine Blades *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 96-108.

TRANSITION ENGINEERING URBAN CANYONS - ROGER STEVENS COOLING POND CASE STUDY LEEDS, UK

Eric Peterson[1, 2], Ornella Iuorio[1], Christian Berretta[1], Christopher Hassall[2], Thomas Cooper[3]

[1] School of Civil Engineering, Faculty of Engineering, University of Leeds, Leeds, LS2 9JT,
[2] School of Biology, Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT,
[3] Sustainability Service, University of Leeds, Leeds, LS2 9JT United Kingdom

Keywords: Transition Engineering; Urban Heat Island Mitigation; Blue-green infrastructure; Nature-based solutions

Abstract

Our research project focuses on assessing microclimates associated with water features and green infrastructure set among the "Brutalist" concrete canyons developed in late 20th century, and Transition Engineering (identifying pathways) to exploit storm water to mitigate the combined impact of urban heat islands and global warming as far as the end of the 21st century. As a case study we are monitoring the environs circa the Roger Stevens Building (1970) which Heritage England listed at Grade II as a fitting centrepiece to the group of additional buildings on the south of older Red Brick University of Leeds which inspired the "plate glass university" building boom throughout the UK during the 1970. The precinct includes a "Cooling Pond" identified by the Ordinance Survey, which since 1983 reflects upon a flying bronze figure removed from the Midland Bank in London, "keeping a watchful eye out for impromptu swimmers". There is no evidence that the Cooling Pond was ever connected to any mechanical building services by pumps or pipework. We are investigating how the role of this water feature have been evolving over almost time and what role could potentially play today in line with a more contemporary idea of blue/green infrastructure. The pond is currently undergoing redevelopment to allow the previously chlorinated sterile water feature to become a thriving bluegreen ecosystem, as a collaborative living lab involving Estates Services, Sustainability Service, Water@Leeds, School of Geography, School of Biological Sciences and School of Civil Engineering. Within this project we aim at assessing ambient air temperature surrounding the Roger Stevens Building before and after the redevelopment of the Cooling Pond.*

[1, 2]e.peterson@leeds.ac.uk
[1]O.Iuorio@leeds.ac.uk
[3]T.C.S.Cooper@leeds.ac.uk

Peterson, E., Iuorio, O., Berretta, C., Hassall, C. and Cooper, T. (2018) Transition Engineering urban canyons - Roger Stevens Cooling Pond case study Leeds, UK *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 109-120.

Sustainability Education

CHANGING MEDICAL EDUCATION CURRICULUM: CHALLENGES, PREPARATION AND IMPLEMENTATION OF CHANGE

Sabina Cerimagic[1] and M. Rabiul Hasan[2]

[1] Sydney Medical School, University of Sydney, NSW, 2006, Australia
[2] School of Information Technologies, University of Sydney, NSW, 2006, Australia

Keywords: Change management, communication, organisational culture, stakeholder empowerment and involvement

Abstract

Universities are well known for their professional bureaucratic nature, in particular resistance to change. This can be described as behavioural apathy, which is the tendency to preserve the existing organisational structure, even when it is clearly inefficient and unsuited to official goals. This is widespread within universities worldwide, in the shape of a combination of organising practices which are historically located and capriciously resistant and resilient. Behavioral apathy can affect the ability of universities to successfully change curriculum, creating resistance to any alteration of existing practices. Even if a proposed curriculum change is supported by the majority of stakeholders, there are factors that play a role in how well the change is received, implemented and maintained. Those factors are resistance against change, internal communication on change, empowerment and involvement and organisational culture. Bringing change to education curriculum requires adequate preparation and ground settings in which change can be implemented and accepted. There are a number of issues for change leaders to address and prepare before deciding to implement a curriculum change in medical education. This case study will take a closer look at the potential challenges faced by the MD 2020 curriculum at the University of Sydney may face.

[1]sabina.cerimagic@sydney.edu.au

Cerimagic, S. and Hasan, M. R. (2018) Changing Medical Education Curriculum: Challenges, Preparation and Implementation of Change *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 122-132.

REFLECTIONS FROM STAKEHOLDER ENGAGEMENT IN DEVELOPING A CURRICULUM FOR SUSTAINABLE RENOVATION

Kate Simpson[1] and Alice Owen[2]

Sustainability Research Institute, University of Leeds, Leeds LS2 9JT, United Kingdom

Keywords: Stakeholders, sustainable, renovation, skills, installer training

Abstract

Installers with sustainable renovation skills are essential to deliver low carbon buildings. A performance gap often exists between the modelled expectation of reductions in domestic CO_2 emissions, and what newly renovated buildings achieve (Zero Carbon Hub, 2014). One reason for this can be poor detailing and workmanship by installers. In addition, householders have reported dissatisfaction with the levels of sustainable building expertise and advice offered by installers. Many installers work within the Repair, Maintenance and Improvement (RMI) industry as Small and Medium Size Enterprises (SMEs). Installers have been found to favour on-the-job training, however, without formal training the average builder can struggle to consider the 'whole-house approach' necessary for sustainable renovation, good air quality and minimising moisture risks. The findings discussed in this paper stem from a Leeds based workshop and following meetings, held to gather key stakeholders from local Government, developers, construction firms, charities, colleges and research. The aim was to develop course content themes for a pilot curriculum on sustainable building skills, which can be applied to the renovation sector. Existing training approaches were discussed, which could be further developed for SME installers to access on a wider scale. These included formal methods of training, which apprenticeship can now sit alongside, hosted at a college and on the job training. This paper discusses the key course themes arising which could address the sustainable renovation skills shortage within the RMI industry, reflecting on the different approaches.

[1]k.simpson2@leeds.ac.uk
[2]a.m.owen@leeds.ac.uk

Simpson, K. and Owen, A. (2018) Reflections from stakeholder engagement in developing a curriculum for sustainable renovation *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 133-138.

REFOCUSING SUSTAINABILITY EDUCATION: USING STUDENTS' REFLECTIONS ON THEIR CARBON FOOTPRINT TO REINFORCE THE IMPORTANCE OF CONSIDERING CO_2 PRODUCTION IN THE CONSTRUCTION INDUSTRY

John Weirs[1] and Allan Osborne

Faculty of Engineering and Environment, Department of Mechanical and Construction Engineering, Northumbria University, Ellison Building, Newcastle upon Tyne, NE1 8ST

Keywords: Carbon Footprint, CO_2 Production, Reflection

Abstract

The construction industry is the most significant contributor to the UK's CO2 emissions: responsible for an annual output of approximately 45% of the total. This figure highlights the critical role the industry must play in achieving the Government's CO2 reduction target. It is, therefore, incumbent on construction-related educators to emphasise this issue and explore ways in which it can be reinforced. Unintentional desensitisation has resulted in the term 'sustainability' becoming diluted within education; as a result, many students now see sustainability, particular ly CO2 production, as just another concept studied from a theoretical perspective. Consequently, many students fail to grasp fully its broader implications and how it should affect strategic environmental decisions about construction processes, technologies, and products. This paper presents the findings of a unique pedagogy and assessment strategy used with final year construction undergraduate degree students during a sustainable construction technology module. The approach involved students calculating their carbon footprint and reflecting upon and extrapolating their results to the UK construction industry. A random sample of commentaries acquired from student portfolios over four academic years was analysed using computer-assisted qualitative data analysis software. The content analysis showed how the students' reflections on their carbon footprints proved to be an enlightening experience. Terms such as "shocked by my footprint", "surprised at the findings", and "change in attitude" were frequent reflective comments. When students linked their findings to the construction industry, phrases such as "waste generation", "technologies", and "materials" were some of the critical concepts considered. By using their personal experiences as a benchmark, students were able to gain an increased level of understanding of the causes of CO2 production; they also found it more straightforward to relate these issues to the UK construction industry.

[1]john.weirs@northumbria.ac.uk

Weirs, J. and Osborne, A. (2018) Refocusing sustainability education: Using students' reflections on their carbon footprint to reinforce the importance of considering co2 production in the construction industry *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 139-154.

Sustainability theme

CREATING BEHAVIOURAL ENGAGEMENT PROGRAMMES THAT WORK: A CASE STUDY FROM THE U.S. WEATHERIZATION ASSISTANCE PROGRAM

Perla K. Sandoval[1] and Patricia A. Aloise-Young[2]

Department of Psychology, Colorado State University, Fort Collins, Colorado, USA

Keywords: energy conservation; behavioural engagement; Community-Based Social Marketing

Abstract

Community-Based Social Marketing was used to design a programme to engage the clients of a Weatherization Assistance Program offered by the Energy Resource Center (ERC) in Denver, Colorado, U.S.A. The goal of the study was to identify promising behaviours for inclusion in the programme and strategies for changing these behaviours. The study included: 1) literature review; 2) interviews with ERC staff, 3) surveys mailed to ERC clients and 4) in-home interviews conducted with ERC clients. Previous research and data collected with ERC clients were used to evaluate the penetration, probability and impact of possible energy-saving behaviours. The results revealed that drying full loads of laundry, hang drying laundry, washing laundry in cold water, and using window coverings to control solar gain were high priority behaviours. Mid-priority behaviours that were also included in the engagement programme included: employing temperature 'setbacks,' reducing temperature setpoints through the use of clothing and blankets to control comfort, and keeping windows closed. Strategies for targeting these behaviours were developed based on the barriers and benefits for each behavioural target. This case study illustrates how Community-Based Social Marketing (CBSM) can provide a systematic approach to developing and implementing resident engagement programmes.

[1]pksandov@rams.colostate.edu
[2]aloiseyo@rams.colostate.edu

Sandoval, P. K. and Aloise-Young, P. A. (2018) Creating behavioural engagement programmes that work: A case study from the U.S. weatherization assistance program *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 156-166.

EXPLORING MONTE CARLO SIMULATION TECHNIQUE FOR CONSTRUCTION PROJECT RISK MANAGEMENT

Dubem Ikediashi[1] and Amaka Ogwueleka[2]

[1]Department of Building, Faculty of Environmental Studies, University of Uyo, Nigeria
[2]Department of Quantity Surveying, Faculty of Environmental Studies, University of Uyo, Nigeria

Key Words: Risk identification, Risk analysis, Simulation, Project management

Abstract

This paper aims to examine basic theories and principles of Monte Carlo Simulation (MCS) for analysing construction project risk management. The specific objectives are to review the origin of MSC, examine the basic principles and procedures of the technique for construction project risk management, and presents a case study to highlight its application in the construction management domain. Using literature review, findings indicate that although the origin of MCS in construction project management is unclear, its successive use in the analysis of risks has been widely acknowledged. Besides, MCS is discovered through this research to allow for sensitivity analysis and optimisation of real life situations without having to operate the real life system. However, findings reveal that the technique has obvious limitations which include among others high use of computer energy which makes it very expensive and time consuming to build simulation. It is recommended among others that project managers should avail themselves of the opportunity to acquire skill and technical experience to handle complex simulation problems in order to overcome the reluctance in using MCS.

[1]dubemikediashi@uniuyo.edu.ng

Ikediashi, D. and Ogwueleka, A. (2018) Exploring Monte Carlo Simulation Technique for Construction Project Risk Management *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 167-177.

REVIEW OF STUDIES ON RELATIONSHIP MANAGEMENT IN CONSTRUCTION PROJECTS

Jirong Li[1] and Xianhai Meng

School of Natural and Built Environment, Queen's University Belfast, David Keir Building, Stranmillis Road, Belfast, BT9 5AG, UK

Keywords: Relationship management, construction projects, project management, critical review

Abstract

Relationship management, as a "soft" management approach, has a crucial meaning for the success of construction projects. Researchers have gradually realised the significance of relationship management in construction projects since the second half of the 1990s. There appears to be lack of a systematic literature review on relationship management in construction projects. To bridge the gap, this paper analyses the previous research efforts of relationship management in construction projects by critically reviewing the retrieved papers published from 1994 to 2017. Four research topics relating to this field are determined, including (1) different perspectives of exploring relationship management; (2) key influencing factors of relationship management; (3) impacts of relationship management on construction project performance; and (4) characteristics of relationship management, especially in large construction projects. The paper provides insights into relationship management in construction projects with complex and dynamic nature. It is found that the researchers have begun to utilise social network analysis (SNA) to deal with the complexity of relationship management. Besides the dynamics of relationship management deserves efforts in the future research.

[1]jli22@qub.ac.uk

Li, J. and Meng, X. (2018) Review of studies on relationship management in construction projects *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 178-193.

A ROADMAP FOR C-SI SOLAR PANEL END-OF-LIFE TREATMENT

Sydney Edwards

University of Maryland, United States

Keywords: Solar Panels, Recycling, Silicon, Photovoltaic, End-of-Life Treatment

Abstract

As the installation of PV systems grows to promote a path for sustainable energy generation, solar panel recycling and end-of-life procedures have become areas of increasing concern. Given the post-2000s boom in PV installation, and the 25-30 year lifetime of a PV plant, the new industry created by this anticipated 20,000 tons of solar panel waste will be worth upwards of 112 million dollars by 2025 [7]. Building upon research that explores the limitations of Solar Panel Recycling (SPR) methodologies and economics, this paper will identify new factors for assessing the potential of this upcoming industry. These factors will support that SPR technology will be increasingly favorable than past research suggests. To begin forming a roadmap that outlines all necessary considerations for SPR infrastructure, a system dynamics approach has been utilized. A closed loop model was created to demonstrate industry potential based on technological limitations and economics for the U.S. and a small case study for the state of Maryland.

sedward4@terpmail.umd.edu

Li, J. and Meng, X. (2018 A Roadmap for c-Si Solar Panel End-of-Life Treatment *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 194-202.

People

A CONCEPTUAL FRAMEWORK FOR THE ASSESSMENT OF HOUSING-RESIDENT FIT VIA THE CONCEPT OF ENVIRONMENTAL IMAGE

Javad Asad Poor[1], David Thorpe[2]

[1]Department of Architecture, Mashhad Branch – Islamic Azad University, Mashhad, Iran
[2]School of Civil Engineering and Surveying, University of Southern Queensland, Springfield Central, QLD 4300, Australia

Keywords: Housing-Resident Fit; Sustainability; Pro-Environmental Behaviour; Environmental Image.

Abstract

The long-term sustainability in residential environments depends strongly on a wide range of non-technological barriers mostly affected by people's perceptions. A human-based bottom up flexible decision-making approach has the potential for the successful implementation of environmental action plans via providing people's positive environmental perceptions and attitudes, enhancing their pro-environmental behaviours. Pro-environmental behaviour is a key concept not only in promoting the green selection of buildings' physical characteristics and the implementation of engineering, technological, and industrial sustainability achievements but also in improving residents' domestic activities. The bottom-up action plan, therefore, has substantial responsibility in the enhancement of Housing-Resident Fit, which improves the sustainability of the residential sector via occupants' spontaneous self-selection of green products and activities, providing a balanced interplay between occupants and their environment. This research refers to the concept of environmental image, which is the collective conceptual picture of end-users' environmental perceptions, to provide a suitable theoretical basis for developing a bottom-up action plan in housing. The environmental image makes it possible to quantify the abstract data; and hence provides a practical platform for dealing with the complexity of people's perceptions. This study has developed a conceptual framework, which explains a practical methodology for Housing Resident Fit via visually establishing occupants' housing image. According to the framework, studying occupants' housing perceptions would result in the identification of a set of attribute-based housing related factors and the reasons that make the factors critical to the occupants. The results assist in developing suitable intervention strategies, i.e., information strategies and structural strategies, which aim at eliminating the internal barriers (e.g. perception, motivation, attitudes, and social support) and external barriers (e.g. availability, product quality, costs and benefits, regulations, and measures) and promoting rewards. The developed strategies provide occupants' positive attitudes, which are tailored to their proenvironmental behaviours, ensuring long-term sustainable development.

[2]david.thorpe@usq.edu.au

Asad Poor, J. and Thorpe, D. (2018) A conceptual framework for the assessment of housing-resident fit via the concept of environmental image *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 204-213.

TENANTS' WILLINGNESS TO PAY FOR GREEN FEATURES IN OFFICE PROPERTIES

Matthew Oluwole Oyewole[1] and Markson Opeyemi Komolafe[2]

[1]Department of Estate Management, Obafemi Awolowo University, Ile-Ife, Nigera
[2]Department of Estate Management, University of Benin, Benin City, Nigeria

Keywords: Environment, Green features, Office properties, Willingness-To-Pay.

Abstract

The purpose of this study is to investigate tenants' willingness to pay for green features in office properties in Lagos, Nigeria; this is with a view to determining the inclinations of users for green buildings. Data for the study were collected through the use of structured questionnaire administered using purposive sampling. Tenants' Willingness To Pay Index (TWTPI) was used to measure the level of willingness to pay for features of green building by the tenants. The features considered are 'Water, Rain Water and Sewage', Site Selection, Site Design and Land Scape Ecology', 'Building Ecology, 'Waste and Recycling', 'Indoor Air Climate', Material use and Conservation', and Owner and Occupant Education'. A survey of office property tenants finds that majority (94.6%) were willing to pay between 1-5% more for green features. The willingness of tenants to pay for features such as 'Energy Conservation', 'Water, Rain Water and Sewage' and 'Site Selection, Site Design and Land Scape Ecology' ranked first, second and third with TWTPI of 3.12, 2.72 and 2.71 respectively. The paper advocates for relevant agencies to embark on aggressive awareness campaign which emphasizes the direct benefits of green building.

[1]wolesike@yahoo.com

Oyewole, M. O. and Komolafe, M. O. (2018) Tenants' willingness to pay for green features in office properties *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 214-226.

AFFORDABLE HIGH PERFORMANCE HABITAT FOR HUMANITY HOMES

Jeremy Farner

Weber State University, United States

Keywords: High Performance, Passive, Green, Energy Efficient

Abstract

Currently, there is no universal definition of a "high-performance home" in the residential industry. However, there is some consensus in the way that it is measured or performs. Various institutes or certifications have helped establish what constitutes a "high performance home" including but not limited to Passive Haus, Energy Star, HERS, and Net Zero Ready Homes. These certifications have provided a basis from which we can measure how high performing a home really is. According to the New Home Stakeholders Group (Colorado), high performance means setting a higher bar for "comfort, durability, indoor air quality, and lower energy use." Meanwhile, the Appraisal Institute (a global association of real estate appraisers) says the term suggests energy efficiency, sustainability, and the use of environmentally friendly products. The missing element in the equation of whether "high-performance home" is just another form of "green washing" or "marketing strategy" is how affordable design and construction techniques can be. A case study of how a Habitat for Humanity affiliate in Ogden, Utah designed and built a "high-performance affordable home" will be discussed. The home is "super insulated" and employs affordable passive solar design features along with state of the art air sealing techniques to earn the title of affordable true cost of home ownership.

jfarner@weber.edu

Farner, J. (2018) Affordable high performance habitat for humanity homes *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 227-235.

THE VALUE OF FEEDBACK COLLECTION PROCEDURES, TENANT ENGAGEMENT AND COMMUNICATION METHODS AND THEIR ROLE IN REFURBISHMENT AND NEW CONSTRUCTION IN THE SOCIAL HOUSING SECTOR

Petros Tsitnidis

Leeds Beckett University, United Kingdom

Keywords: Feedback collection, communication methods, construction, social housing

Abstract

Since the 1960s, research on building performance has proved the value of continuous evaluation of the buildings that we use. Recently, the significance of the use of Post Occupancy Evaluation and Building Performance Evaluation methods has been highlighted by the reintroduction of Stage 7 at the Royal Institute of British Architects Plan of Work 2013 and the use of GSL Government Soft Landings by the UK Government for all public contracts. Additionally, research on the value of user feedback has resulted to the commercial use of BUS occupant survey methodology and DQM Design Quality Method. Even though these methods have proven their benefit to the built environment, research has been focused on the performance of office buildings. The housing sector has been largely ignored due to its fragmentation and complexity of the factors that affect it. The social housing sector, though, takes up to 17% of the total built environment of the UK. It has, therefore, a significant impact on CO2 emissions and living conditions in the country. The paper describes the findings of research on the procedures social housing providers use to communicate with their tenants and request feedback for their buildings. It also investigates the role of this information in the decision making process for refurbishment and/or new social housing projects. The research aims to create an understanding on the specific feedback needs of the social housing sector. Its ultimate purpose is to contribute to the design of an evaluation survey focused specifically in this sector.

[2]katharina.crafford@mandela.ac.za

Grewar, J., Crafford, K. and Dent, S. (2018) The adoption of water conservation measures by middle- and upper-income households in Nelson Mandela bay municipality in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 248-260.

THE ADOPTION OF WATER CONSERVATION MEASURES BY MIDDLE- AND UPPER-INCOME HOUSEHOLDS IN NELSON MANDELA BAY MUNICIPALITY IN SOUTH AFRICA

John Grewar[1], Katharina Crafford[2], Sharon Dent[1]

[1]Department of Quantity Surveying, School of the Built Environment, Nelson Mandela University, Port Elizabeth, South Africa
[2]Department of Construction Management, School of the Built Environment, Nelson Mandela University, Port Elizabeth, South Africa

Keywords: water conservation, drought, South Africa, green building.

Abstract

South Africa experienced prolonged droughts in recent years, and the growth in water usage outpaces the water supply in some major municipalities. Cape Town made recently international headlines as the first major city which could run out of water, but Cape Town is not the only municipality to run out of water. The Nelson Mandela Bay Municipality (NMBM) located on the south-eastern coast of South Africa also operates in a water-scares environment and has imposed water restrictions on their residents since August 2016. And as of January 2018, the NMBM is in a water emergency situation. This research examines the level of awareness of the NMBM households towards the drought crisis in the bay as well as their knowledge and implementation of water conservation measures in their homes and willingness to invest in water-saving installations. The research adopted the use of a selfadministered questionnaire which was distributed via four schools. Using descriptive statistics, a total of 202 datasets were analysed. This research report is based on a pilot study and is of exploratory nature. Considering that the residents of the Nelson Mandela Bay Municipality (NMBM) had one year to grasp the concept of water restrictions, more than one third (39.1%) of the respondents are "unsure" of their monthly water consumption. "Cost" and "unsure where to start" was named by 36.4% as barriers to installing water-efficient measures (WEM), but the "real" issue is the ignorance about their water usage. This research is the first of its kind in South Africa; therefore, the findings are very valuable as a starting point to address changing South Africans' attitude towards fresh water and by extension changing people's perception towards water worldwide. People must recognise that drinking water is turning into a commodity, a commodity that will soon split the world into countries that have and countries that have not enough fresh water.

[2]katharina.crafford@mandela.ac.za

Grewar, J., Crafford, K. and Dent, S. (2018) The adoption of water conservation measures by middle- and upper-income households in Nelson Mandela bay municipality in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 248-260.

Smart Cities

SMART CONNECTED HOMES: INTEGRATING SENSOR, OCCUPANT AND BIM DATA FOR BUILDING PERFORMANCE ANALYSIS

Kay Rogage[1], Tom Lawrence[2] and Adrian K. Clear[3]

[1,3] Department of Computer Information Sciences, Northumbria University, Faculty of Engineering and Environment, Newcastle upon Tyne, NE1 8ST, United Kingdom
[2]BIM Academy Enterprises Ltd, Newcastle upon Tyne, NE1 3NN

Keywords: Smart Buildings, Sensor Data, Building Performance, BIM for Facilities Management.

Abstract

Buildings produce huge volumes of data such as BIM, sensor, occupant and building maintenance data. Data is spread across multiple disconnected systems in numerous formats, making it difficult to identify performance gaps between building design and use. Better methods for gathering and analysing data can be used to support building managers with managing building performance. The knowledge can also be fed back to designers and contractors to help close the performance gaps. We have developed a platform to integrate BIM, sensor and occupant data for providing actionable advice for building managers. A social housing organisation is acting as a use case for the platform. A methodology for developing the information needs to support data capture across disconnected systems is proposed and the challenges of bringing data-sets together to provide meaningful information to building owners and managers are presented.

[1]k.rogage@northumbria.ac.uk

Rogage, K., Lawrence, T. and Clear, A. K. (2018) Smart Connected Homes: Integrating sensor, occupant and BIM data for building performance analysis *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 262-267.

REACHING THE PERFORMANCE "SWEET SPOT" WITH CERTAINTY

Edward Murphy

Ollio, The Building Performance Consultancy, United Kingdom

Keywords: building performance, design quality, management, POE

ABSTRACT

The search for the so-called "performance sweet spot" (1) within buildings has tended to concentrate on the investigation of narrow technical issues, usually citing poor design, construction detailing or even controls complexity as the primary causes. New research (2) suggests the reasons for errant building performance is significantly more complex than designers understanding, involving metaphysical, sociological, even psychological and cultural factors which lie largely ignored. In addition, resistant and highly conservative protocols within the construction industry conspire to create added misalignment (3), further compromising building user's expectations for a successful building product outcome. The quest for better appreciation by designers and constructors of these complex issues is an urgent one if the industry is to meet the needs of its customers for ever more demanding, healthy and sustainable buildings. This paper examines the divergent issues for designers and users, and how using more customer-focused approaches, design and engagement processes might be better initiated and informed. All with a view to improved user aspirations for buildings which provide a home for better user outcomes, higher quality and lower costs. One where building users and designer's efforts are truly aligned to hit the "performance sweet spot" with repeatable certainty.

edward.murphy@ollioconsult.com

Murphy, E. (2018) Reaching the Building Performance "Sweet Spot" with Certainty *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 268-281.

THE CONCEPT OF SUSTAINABILITY IN SMART CITY DEFINITIONS

Angeliki Maria Toli[1] and Niamh Murtagh

The Bartlett School of Construction and Project Management, UCL, 2nd Floor, 1-19 Torrington Place, London, WC1E 6BT, UK

Keywords: Sustainable City, Smart City, Definition

Abstract

Smart cities have emerged as a possible solution to sustainability problems stemming from rapid urbanization. They are considered imperative for a sustainable future. Despite their recent popularity, the literature reveals the lack of conceptual clarity around the term of smart city, due to the plethora of existing definitions. This comprehensive literature review has identified 31 smart city definitions recovered by non-technology focused literature. The definitions are assessed according to the dimensions of sustainability that they consider, environmental, economic or social, and the priority in which they accord the concept of sustainability. The study reveals that not all approaches to smart city incorporate the notion of sustainability in the same way. Additionally, themes emerge according to the dimensions these definitions consider as well as according to whether they derive from the industry or not. Some definitions offer a more balanced holistic view while others appear to be more focused on different smart city goals or variant ways to achieve them. The findings of this study contribute to knowledge and practice by aiding conceptual clarity and, in particular, by drawing attention to underlying assumptions about the role of sustainability in smart city development.

[1]angeliki.toli.15@ucl.ac.uk

Toli, A. M. and Murtagh, N. (2018) The concept of sustainability in smart city definitions *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 282-294.

SUSTAINABILITY IN THE NIGERIAN BUILT ENVIRONMENT – A SCOPING STUDY REVIEW

Maria Unuigbe[1], Sam Zulu[2], David Johnston[3]

[1, 2]Leeds Beckett University, School of the Built Environment & Engineering, Leeds, LS2 8AG. UK
[3]Leeds Beckett University, School of the Built Environment & Engineering, Leeds, LS2 9EN. UK

Keywords: Sustainability, Nigeria, Built Environment, Scoping Study.

Abstract

Sustainability is not new concept; however, it has received increased attention because of the effects of anthropogenic activity in varied sectors of life. The built environment is one of such sectors, which is often criticized for its effects and as evident in literature, sustainability in the built environment is complex in nature. As such, the interpretations associated with it, the significance attributed to it and its adoption, are diverse in every country. Sustainability in the built environment is important, as it promotes energy friendly and efficient systems in buildings, especially in light of global climate change. However, this appears to be lacking in the Nigerian built environment. The paper aims to examine impeding factors to sustainability in the Nigerian built environment through a scoping study review. Nigeria is often described as a paradox in many ways, one of which is having a power deficit and yet abundant renewable energy sources. The paper presents a comprehensive survey of relevant literature on the perceptions of built environment professionals in Nigeria for identification of impeding factors to sustainability adoption. While impeding factors to sustainability in the Nigerian built environment is not new, the identification and understanding of the factors remains restricted and shallow. As such, it lags the required uptake for sustainable buildings reflective in other countries. In addition, a comprehensive survey of impeding factors to sustainability in the Nigerian built environment is lacking in literature, to the best of the researcher's knowledge. The paper aims to fill this gap through a scoping review, underpinned by Daudt et al.'s (2013) adapted version of Arksey and O 'Malley's (2005) five stage framework. The main findings suggest that the Nigerian context have not been holistically embraced in existing studies, highlighting generalised impeding factors such as finance and awareness as top ranking factors. Furthermore, the review addresses concerns associated with the existing research approach and its shortcomings, as well as strategies for improvement. Further research to expand knowledge is also recommended.

[1]m.i.unuigbe@leedsbeckett.ac.uk

Unuigbe, M., Zulu, S. and Johnston, D. (2018) Sustainability in the Nigerian built environment – A scoping study review *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 295-321.

CSR and Management

PERCEPTIONS OF SAFETY OFFICERS AND CONSTRUCTION MANAGERS ON MEASURES FOR EFFECTIVE IMPLEMENTATION OF ENVIRONMENTAL SUSTAINABILITY DURING CONSTRUCTION

Lerato Bertinah Monama[1], Eric K. Simpeh[2] and Ruben Ndihokubwayo[3]

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, PO Box 1906, Bellville 7535, South Africa

Keywords: Construction Manager, Construction industry, Environmental sustainability, Measures, Safety Officer

Abstract

This study aims at investigating the perceptions of safety officers and construction managers on the effectiveness of measures put in place towards achieving environmental sustainability in construction projects. A qualitative research approach was adopted and purposively selected construction managers and safety officers involved in construction projects around the Western Cape Province were interviewed. Specifically, data was collected by means of semi-structured interviews and participants were directly involved in site construction operations. In total, four construction companies participated in the study. The findings revealed that both construction managers and safety officers play different roles in ensuring environmental sustainability on construction sites and they concurred on some of the measures that they put in place in their respective sites to ensure environmental sustainability. The suggested measures for effective implementation of environmental sustainability included environmental plan, waste management plan, environmental control plan, risk management plan, environmental assessment, soil erosion plan, and pollution prevention plan. The research concludes by recommending that a more detailed analysis on measures of ensuring environmental sustainability in construction is required. Moreover, attention should be focused on how the roles of both construction managers and safety officers impact the environmental sustainability in construction projects because, if one of the pillars of sustainability is weak then the system as a whole is unsustainable.

[1]bertinahlerato@gmail.com
[2]simpehe@cput.ac.za
[3]ndihokubwayor@cput.ac.za

Monama, L. B., Simpeh, E. K. and Ndihokubwayo, R. (2018) Perceptions of safety officers and construction managers on measures for effective implementation of environmental sustainability during construction *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 323-331.

A PILOT STUDY TO DETERMINE THE INFLUENCE OF STRATEGIC MANAGEMENT PRACTICES IN INFLUENCING SUSTAINABILITY DECISIONS IN THE CONSTRUCTION INDUSTRY

Colin Simpson

Leeds Beckett University, School of the Built Environment and Engineering, Leeds, LS2 2EN, United Kingdom

Key Words: Construction, Sustainable, Strategic Management, Organisation.

Abstract:

The Construction Industry is a resource based industry which utilises labor and resources which are used to create competitive advantage thereby allowing for the development of sustainability in a construction organisation. The importance of Strategic Management of these resources has gained a significant importance in Construction Organizations as they seek to become sustainable. Strategic Management decisions on the positioning, direction and focus of a company can all have major impacts on the general strategic development of work practices within an organization in developing sustainability, such as the use of new technologies and managing both tangible and intangible resources effectively. This aim of this research project was to investigate the extent to which strategic management practices influence the sustainability directions of construction industry organization. Structured interviews with senior construction professionals were used to collect qualitative data. The key finding from the study participants agreed that maintaining a competitive advantage was the key to creating sustainability in an organization. In addition strategic management in its wider context was seen as key driver or important consideration in attaining sustainability. The scoping study provides a useful platform for further investigations on the strategic management as a driver in influencing sustainable decision making in the construction industry.

C.Simpson4744@student.leedsbeckett.ac.uk

Simpson, C. (2018) A pilot study to determine the influence of strategic management practices in influencing sustainability decisions in the construction industry *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 332-342.

GOOD MANAGEMENT OF CHANGE IS A SINE QUA NON

Sabina Cerimagic[1] and M. Rabiul Hasan[2]

[1] Sydney Medical School, University of Sydney, NSW, 2006, Australia
[2] School of Information Technologies, University of Sydney, NSW, 2006, Australia

Keywords: Change communications, change management, staff empowerment and involvement.

Abstract

In the last 50 years, the number of medical schools in the world has increased, with a growth of 190%. There are currently 22 accredited medical schools in Australia. The University of Sydney is one of the Asia Pacific region's most highly rated education and research institutions, [specific detail], and the university's medical degree (MD) program offers unparalleled opportunities. However, in order remain one the most sought after medical degrees in the country, the MD curriculum needed an update to reflect the current needs of the community. The goal of the redevelopment of the curriculum is that by 2020, the University of Sydney MD Program will deliver a curriculum based on sound educational principles that will recognise and maintain the existing strengths of the program and produce and equip graduates with the qualities to deliver, lead and advocate for culturally competent, research-informed, evidence-based and patientcentred care in Australia and worldwide. In order to make the proposed changes possible, there is a need to have a buy-in from all relevant stakeholders. This paper focuses on the University of Sydney's MD curriculum redevelopment project and examines the approach management bodies took to involve and empower both academic and professional staff in the project. It also explains how the changes were communicated to all stakeholders.

[1]sabina.cerimagic@sydney.edu.au

Cerimagic, S. and Hasan, M. R. (2018) Good management of change is a sine qua non *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 343-353.

PARTICIPANT INFLUENCES ON THE SUCCESS OF CRITICAL PATH METHOD PLANNING IN CONSTRUCTION PROJECT ENVIRONMENTS

Neil Pickavance[1], Andrew Ross and Damian Fearon

Liverpool John Moores University, United Kingdom

Keywords: critical path method, planning, planner, supply chain, lean construction

Abstract

Critical Path Method planning has been considered as a flawed programming technique even though it remains the planning method preferred by the majority of contractors, clients, and dispute resolution practitioners in the construction industry. Newer methods adopting a social based approach, such as Last Planner® System and Collaborative Planning have, however, not yet managed to position themselves as the method of first choice. A reconsideration of Critical Path Method by critically examining extant literature across construction programme management has identified several approaches to Critical Path Method. These are CPM in logic networks, some work critically reviewing the practitioners of CPM planning, and the modern collaborative planning methodologies. There appears to be a paucity of work on the practical application of CPM at construction contracting environments. This paper reports upon ongoing research to assess the overall adoption and application of Critical Path Method in construction contracting organisations within their project environments. To investigate, exploratory qualitative data was collected through a purposive sample of six semi-structured interviews with construction management personnel. This comprised three Project Managers from one main contractor organisation, a Planner from the same main contractor organisation, and two Planners from separate sub-contractor organisations. Preliminary results indicated Critical Path Method operates within inconsistent and poorly structured environments at contracting organisations and there is little evidence of authoritative implementation and a culture of apathy towards Critical Path Method is observed. An agenda for further work is presented which includes a recommendation for further empirical study focusing on the functional roles, behaviours, and attitudes of people at construction contracting organisations in determining the later success of CPMP planning within their construction project environments.

[1]n.m.pickavance@2017.ljmu.ac.uk

Pickavance, N. Ross, A. and Fearon, D. (2018) Participant influences on the success of critical path method planning in construction project environments *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 354-366.

THE TRANSFORMATION OF DISASTER RISK MANAGEMENT IN MALAYSIA, THE IMPLICATIONS AND SOLUTIONS

Gihan Badi[1], Mohd Syukri Bin Madnor[2]

[1]School of the Built Environment and Engineering, Leeds Beckett University, Faculty of Arts, Environment and Technology. Leeds LS2 8AG, United Kingdom
[2]Assistant Director, International Affairs Unit Policy Planning and Coordination Division, Malaysia Civil Defence Force, Jalan Padang Tembak, 50556 Kuala Lumpur, Malaysia

Keywords: Resilience, Disaster, Flood, transformation, transition, Community role.

Abstract

Natural hazards in Malaysia are regularly happening, mainly flooding which occur every year during the monsoon season that are characterised by heavy and regular rainfall from roughly October to March and inadequate drainage in many urban areas. Flood events in Malaysia from 15th December 2014 to 3rd January 2015 affected more than 200,000 people while 21 were killed. This flood has been described as the worst flood in decades. Since the adoption of Sendai Framework for Disaster Risk Reduction SFDRR 2015-2030 (Sendai Framework) in Malaysia, the Disaster Management Committee which formerly held by the National Security Council (NSC) for central level transferred to the National Disaster Management Agency (NADMA)) whilst at the state and district level transferred to Malaysia Civil Defence Force. The transition made to focus on the implementation of the Community Based Disaster Risk Reduction (CBDRR) effort and the Civil Defence has been given the authority to train public during emergency, disaster and hostile attack. However, moving the management of Disaster Risk Reduction (DRR) from central level to national and community level face many challenges because public generally in Malaysia are relying on the government's response during disaster. This paper will focus on the risk associated with promoting the public, private and NGO's to assist in Disaster Risk Management (DRM) by draw an analysis of the Malaysian policy documents and expert interviews to map out current changes in governance. In addition, investigate data collected from local communities and individuals in two regions in Malaysia about the implication of the government call on community leaders to take a major role in the distribution of aid and assets during the disaster as it helps in the coordination process.

[1]g.badi@leedsbeckett.ac.uk

Badi, G. and Bin Madnor, M. S. (2018) The transformation of disaster risk management in Malaysia, the implications and solutions *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 367-385.

Certification and Automation

THE IMPACT OF DANISH GREEN BUILDING CERTIFICATION (DGNB) ON ORGANIZATIONS WORK PROCESSES AND DOCUMENTATION WORK

Aysar Selman[1], Trine Saaby[2] and Birgitte Munch[3]

[1]University College of Northern Denmark, Architectural Technology and Construction Management, Aalborg, Denmark
[2]University College of Northern Denmark, Energy Technology, Aalborg, Denmark
[3]Odense Development, Odense, Denmark

Keywords: Sustainability, DGNB Certification (DK), Process, Documentation and Integrated design process.

Abstract

DGNB (Danish Green Building Certification) is a certification which is adapted to Danish legislation and norms from a German certification for sustainable construction. Today there is an increasing number of partners involved in this certification, and many discussions evolves around the effects of producing a DGNB certification of a building. To achieve the chosen certification level (silver, gold or platinum), extensive documentation of tests, calculations and processes is required. Traditionally, production of documentation is integrated into or sidelines the (physical) construction process, but a DGNB certification will require implementation of new tasks, processes, and procedures. The introduction of new practical tasks, as well as through a development of visibility and responsibility for production and handling of documentation, a DGNB certification will by producing a common database for all DGNB documentation, transform the involved organizations and open for changes in construction practices and building design. Our research is aimed to help qualify and improve a DGNB certification, by making the involved parties, including builders, consultants, and contractors, able to gain an insight into the various challenges. This will help to draw up a plan for work tasks involved, and create efficient modes of work, to achieve the respective grades and criteria of a DGNB certified building. A qualitative method has been used in the form of literacy assessment and semi structured interviews conducted with a DGNB auditor and an architect involved in DGNB certification processes, along with a questionnaire that allows researchers to investigate the challenges of organizations to fulfill the demands for documentation. The interviews are analyzed to detect and unfold challenging issues of the organizations. The discussion presents experiences and issues that were challenged within a DGNB certification process, pointing out some key factors in improving workflows and improving the effectiveness of the documentation, e.g. increasing the interdisciplinary interaction between involved actors early in the design phase.

[1]adse@ucn.dk
[2]TSA@ucn.dk
[3]birmunch@gmail.com

Selman, A., Saaby, T. and Munch, B. (2018) The Impact of Danish Green Building Certification (DGNB) on organizations work processes and documentation work *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 387-402.

DISPLAY ENERGY CERTIFICATE AND ADVISORY REPORT LOCAL GOVERNMENT COMPLIANCE IN NORTHERN ENGLAND

Emeka Efe Osaji[1], David Johnston and David Glew

Leeds Sustainability Institute, Leeds Beckett University, LS2 9EN, United Kingdom

Keywords: Advisory Report (AR); Compliance; Display Energy Certificate (DEC); Local Government Authorities

Abstract

This paper is part of a Doctor of Engineering (D.Eng.) research that is investigating Central and Local Government Compliance with Display Energy Certificates (DECs) and Advisory Reports (ARs) in England and Wales. In this paper, summary statistics are produced on DEC and AR ratings, lodgement, and 'Fabric-First' priority recommendations of Local Governments Authorities (LGAs) in Northern England for 2008 to 2017. Northern England is England's North East, North West and Yorkshire and the Humber. This is the first independent synthesis of data of this kind, which provides evidence on DEC and AR Local Government compliance in Northern England. This paper adopted and adapted research guidance for development of its Protocol for Quantitative Analysis of Local Government DEC and AR Compliance. It involved:

- *Accessing the OpenDataCommunities Platform to retrieve and catalogue DEC and AR bulk data for all LGAs in England and Wales.*
- *Undertaking data cleaning to verify the integrity of the DEC and AR bulk data and to detect unintentional data corruption and duplication.*
- *Undertaking Content, Statistical and Comparative Analyses to determine the extent of DEC and AR poor-ratings, non-lodgement, and 'Fabric-First' priority recommendations for LGAs in Northern England.*

The significant findings from this study include that: 7.2% of the 375 LGAs in England and Wales appear not to have lodged DECs and ARs via the OpenDataCommunities Platform; While none of the 22 LGAs in Wales have DEC and AR non-lodgement, 27 of the 353 LGAs in England have DEC and AR non-lodgement; The majority of DECs for the North East, North West, and Yorkshire and Humber regions of Northern England were rated 'D' with about 36.782%, 38.228%, and 34.856% respectively; The percentage of total DECs for these regions that will likely not meet the Government Property Unit target to attain DEC 'A' to 'D' ratings by 2018 are 32.228%, 36.077%, and 38.105% respectively; and The percentage of total AR Priority Recommendations for these regions that are related to the 'Fabric-First' approach are about 7.704%, 10.212%, and 8.458% respectively. These are significant, as it underlines likely difficulties that may be faced should minimum energy performance standards be introduced at a future date. The implication of such difficulties with compliance at this regional level is that the DEC and AR are not yet being fully complied with (or enforced) as originally intended by the principle underlying the Energy Performance of Buildings Directive (EPBD). Future work will include: synthesis of quantitative evidence on DEC and AR LGA compliance in Wales and other regions of England; and creation of a Protocol for Qualitative Analysis of UK Government DEC and AR Compliance. These will help determine why DEC and AR poor-ratings, non-lodgement, and 'Fabric-First' priority recommendations occur for UK Central Government and LGAs in England and Wales.

[1]e.osaji7866@student.leedsbeckett.ac.uk

Osaji, E. E., Johnston, D. and Glew, D. (2018) Display Energy Certificate and Advisory Report Local Government Compliance in Northern England *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 403-418.

USE OF UAVS FOR RENEWABLE ENERGY PROJECTS

Constantine Moshi[1], Dr. Jeong-Han Woo[2], Dr. Blake Wentz[3]

[1]WG Yates Construction Co., 22 Century Blvd., Suite 140, Nashville, TN 37214 USA
[2]Milwaukee School of Engineering, Civil, Architectural Engineering and Construction Management Department, 1025 N Broadway, Milwaukee, WI 53202 USA
[3]Milwaukee School of Engineering, Civil, Architectural Engineering and Construction Management Department, 1025 N Broadway, Milwaukee, WI 53202 USA

Keywords: Ductwork, Design, Life Cycle Analysis and Sustainability

Abstract

This paper looks into the opportunities for robotic technology uses in the construction of solar projects. Following the current high demand in the solar construction industry, skilled labor shortage due to the recession has imposed significant challenges to the industry. This paper highlights potential uses of robots to alleviate some of these challenges based on the overall cost reductions, quality management, ease of use, and impact on subsidizing or replacing human labor. The main research methods incorporated in this study were a literature review and survey analysis of industry professionals. The quantitative analysis of the survey results as well as literature review clearly indicates that professionals in the solar industry are open to the idea of robotic technology, but are not aware of the current available advanced technologies and potential uses and benefits of different kinds of robots such as Unmanned Aerial Vehicles (UAVs), commonly known as drones.

[2]woo@msoe.edu

Moshi, C., Woo, J. and Wentz, B. (2018) Use of UAVs for Renewable Energy Projects *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 419-426.

Energy

ENERGY - AWARE CLOUD INFRASTRUCTURE FOR IOT BIG DATA PROCESSING

Madhubala Ganesan [1], Ah-Lian Kor[2], Colin Pattinson[3]

[1]Erasmus Mundus Master in Pervasive Computing and Communications for Sustainable Development
[2, 3] School of Computing, Creative Technologies & Engineering, Leeds Beckett University, United Kingdom

Keywords: IoT Big Data Analytics, Cloud Data Centers, VM consolidation, Power Usage Characteristics

Abstract

Internet of Things (IoT) is an outcome of the emanating third wave of development of the Internet. Big Data Analytics in IoT provide valuable insights for Smart and Sustainable systems. Cloud Data Centers deliver on-demand computing resources for processing voluminous data. Servers that are provisioned for this purpose consume enormous amount of energy contributing to 2% of the global Carbon-dioxide (CO2) emissions. IoT energy concerns are addressed by research in low-power sensors and improved Machine-to-Machine communications. However, Cloud Data Centers still face energy crisis. This work attempts to analyze the energy behavior of compute hosts on applying Virtual Machine (VM) Consolidation in a Multi-node Openstack Cloud. Several works on VM consolidation is evaluated for simulated workload but this work aims to study the performance in a real cloud infrastructure with a big data workload. The preliminary results of this research are presented in this paper.

[1]madhubala.ganesan25@gmail.com
[2]A.Kor@leedsbeckett.ac.uk
[3]C.Pattinson@leedsbeckett.ac.uk

Ganesan, M., Kor, A. and Pattinson, C. (2018) Energy – Aware Cloud Infrastructure for IoT Big Data Processing *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 428-439.

SENSITIVITY ANALYSIS OF ENERGY CONSUMPTION OF INTEGRATED FAÇADE SYSTEMS: SYSTEM AND SUB-SYSTEM VARIABLES OF A BASE CASE MODEL FOR BUILDING ENERGY SIMULATION

Yahya Ibraheem[1, 2], Poorang Piroozfar[1], Eric R. P. Farr[3], Neil Ravenscroft[1, 4]

[1]School of Environment and Technology, University of Brighton, Brighton, BN2 4GJ, United Kingdom
[2]Department of Architectural Engineering, University of Technology, Baghdad, P.O.Box: 18310, IRAQ
[3]NONAMES Design Research Foundation, 1249 F Street, San Diego, CA 92101, USA
[4]Brighton Doctoral College, University of Brighton, Brighton, BN2 4GJ, United Kingdom

Keywords: Sensitivity analysis, base case model, benchmarking, Building Energy Simulation (BES).

ABSTRACT

Buildings Energy Simulation (BES) has been used as a substitute for more time and cost intensive physical modelling methods such as test cells, environmental chambers and real building monitoring. Their flexibility, ease of use and broader coverage are also very strong advantages they have over mathematical modelling for energy studies. Development of a benchmark model for BES is the first step in this methodology and bares high importance on methodological reliability and validity of the study. This paper uses a unique methodology to develop a base case model as a benchmark model for BES of highly- to fullyglazed office buildings in hot and arid climates to test the robustness of the results of the model developed. Using the base case and the variables at the system and sub-system level – as set out through the methodology developed for this study – the paper will conduct energy simulation of different scenarios and will carry out the sensitivity analysis to test out the robustness of the results. The results form part of the analysis of the research, which has been designed to provide a full account of how different combinations of a set of variables can and will influence energy generation/use, indoor comfort, and daylighting of highly- to fully-glazed office buildings in hot and arid climates.

[1,2]y.ibraheem@brighton.ac.uk
[1]A.E.Piroozfar@brighton.ac.uk

Ibraheem, Y., Piroozfar, P., Farr, E. R. P. and Ravenscroft, N. (2018) Sensitivity analysis of energy consumption of integrated façade systems: System and sub-system variables of a base case model for building energy simulation *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 440-453.

USING GREEN WALLS TO HELP REDUCE POLLUTION AND ENERGY CONSUMPTION IN CITIES

Cameron Angel[1] and Tahira Hamid[2]

School of Built Environment and Engineering, Leeds Beckett University, LS2 8AG, UK

Keywords: Green walls, Energy, Pollution, Sustainability

Abstract

The concept of green walls dates back to the 1930's, but the first modern system with hydroponics was created in 1998 by Patrick Blanc (Land Archs, 2014). Since then, green walls have become increasingly popular around the world, with 80% being constructed after 2009 (greenroofs.com, 2013). There are over 3.5 billion people living in cities today, which is half of the world's population. In 2016 the Sustainable Development Agenda stated that by 2030, nearly 60 percent of the world will live within urban areas (United Nations, 2016). With the clear majority of energy consumption and carbon emissions coming from cities, it is important to combine all the resources available to tackle climate change within urban areas, to really make a difference. This paper investigates green walls to see how they can reduce air pollution and energy consumption. A review of existing literature was used to gain and understand of the theory behind how green walls were able to reduce outdoor air pollution, indoor air pollution and energy consumption. The research then focused on finding examples of case studies and experiments which could prove that green walls could perform in reality. A case study was found which showed that green walls were able to reduce air pollution in an outdoor location with high concentrations of particulate matter, and indicated the plants which were most effective in doing this. There were several experiments on internal green walls which showed the potential that they had in reducing CO_2 from the air but there were no case studies of green walls in practice which showed this. There were positive experiments on external green walls which demonstrated their ability to reduce the temperature of the external wall behind them by up to $20^{o}c$ which meant energy consumption was reduced significantly. A year-long study in the UK proved that they were also successful in insulating the building which meant they could help the thermal performance throughout the year. To show how green walls could be advanced for the future, a short study was included on a green wall that has the ability to create electricity.

[1]cameronangel@hotmail.co.uk
[2]t.hamid@leedsbeckett.ac.uk

Angel, C. and Hamid, T. (2018) Using green walls to help reduce pollution and energy consumption in cities *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 454-464.

AN INVESTIGATION INTO THE ENERGY PERFORMANCE OF SCHOOL BUILDINGS REFURBISHED THROUGH SALIX FUNDING

Asem Al Bunni[1] and Homeira Shayesteh[2]

School of Science and Technology, Middlesex University, London, NW4 4BT, United Kingdom

Keywords: BIM, refurbishment, energy performance and existing school buildings.

Abstract

Schools in the UK are part of the existing stock of buildings whose operational carbon must be reduced for the government to meet its objective of reducing carbon emissions by up to 80% of their 1990 levels by 2050. State funding for refurbishment is the most feasible option for public schools using two routes: Condition Improvement Fund (CIF) which is restricted to improving the physical aspects (e.g. expansion) of school facilities; and the Salix Energy Efficiency Fund (SEEF) aimed at energy/equipment retrofit measures. Although the use of BIM technology (underpinned by the government softlanding (GSL) framework) as well as the use of energy modelling and simulation tools have become integral to making buildings more energy efficient, they are constrained by lack of adoption. This study used a mixed-method approach to investigate the effectiveness of contemporary BIM and energy simulation technologies in refurbishment of existing school buildings. Secondary quantitative data collected from 10 case studies of schools that benefitted from SEEF was supported by interviews of seven heads of schools that had undergone SEEF refurbishment. Results showed that: CIF and SEEF which administratively are mutually exclusive funding streams ought to operate in synergy due to the interaction of a building's physical envelope with heat transfer and energy used by equipment and systems; some schools are not getting technical advice on how to optimise the funds they receive from SEEF leading to non-optimal investment. Recommendations provided include: extensive training on BIM and GSL to heads of schools and advise to government agencies to reconcile the purpose of CIF and SEEF for a holistic solution to carbon reduction in schools.

[1]arch.albunni@gmail.com
[2]H.Shayesteh@mdx.ac.uk

Al Bunni, A. and Shayesteh, H. (2018) An investigation into the energy performance of school buildings refurbished through Salix funding *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 465-481.

DESIGN PATTERNS AS A COLLABORATIVE ENTITY WITHIN THE SMART ENVIRONMENT

Aitor Arribas Velasco[1], John McGrory[2] and Damon Berry[3]

Dublin Institute of Technology, School of Electrical and Electronic engineering, DIT, Kevin Street, Dublin 8, D08 NF82.

Keywords: Design patterns, Smart Environments, Collaboration, Processes.

Abstract

Modern technology is increasingly being employed to create a "smart" living experience. These "smart" technology entities are producing copious of amounts data, which in turn rely on increased storage, distribution and computation needs to manage the data. Depending on the scenario, the diversity of piecemeal solutions almost mirrors the numbers of problems posed. Some successful solutions touted as being "smart" for example: save energy, or to support in assisted living, have been created, but the true underlying pattern of interactivity has not been identified. In the field of computing, patterns can provide a general, reusable solution to commonly repeatable occurring problems within a given context through software design. Similarly, can a technology-independent design pattern format and an open software framework be developed to capture, share and redeploy existing successful and reusable strategies for commonly encountered smart environment use cases in areas such as assistive technology, energy management and environmental monitoring? The underpinning notion of this paper is to introduce "how, where and why" a rule set based in "design pattern" format could contribute to describe a general "understanding" of given cases in the smart environment domain, as well as allow different processes to collaborate with each other. At this point, our project performs a preliminary research on how different communities use popular logic encoding paradigms to essentially represent the same idea; a set of conditional statements. With a view to determining a framework that could be used to define the interconnection among each process. This paper extends previous research by exploring different uses of patterns in the domain of software architecture and design. Ultimately, our study aims to link the principle of "rule of thumb" to the concept of design patterns, by making this accessible enough to allow successful "smart space" solutions to be shared widely between outstanding solution providers.

[1]d16126348@mydit.ie
[2]John.McGrory@dit.ie
[3]damon.berry@dit.ie

Arribas Velasco, A., McGrory, J. and Berry, D. (2018) Design patterns as a collaborative entity within the smart environment *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 482-491.

THERMOCHEMICAL HEATING/COOLING STORAGE MATERIALS IN ENERGY SYSTEM FOR BUILT ENVIRONMENT

Yanan Zhang[1], Yate Ding, Auwal Dodo, Saffa Riffat

Department of Architecture and Built Environment, University of Nottingham, Nottingham, NG7 2RD, United Kingdom

Keywords: Thermochemical energy storage (TES); energy storage materials; energy storage system; open energy storage system.

Abstract

More than 40% of energy consumption occurred in building system with 36% of greenhouse gas emissions. In the UK, a major of 63% energy end-use for space heating/cooling for a comfort building condition. Thermochemical energy storage can be a promising advanced technology in addressing massive energy use for heating and cooling in building application. The system can be an alternative to the conventional energy system because of the lower heat loss, higher energy density of the materials, more efficient and environmentally friendly. In this paper, we used different high energy density storage salts (e.g. $CaCl_2$, $MgSO_4$, LiCl, $MgCl_2$) with host matrix such as vermiculite and advanced carbon. The aim of this paper is characterize different composite to find better performing materials with higher energy density, lower heat loss, lower regeneration temperature, higher temperature lift in reaction process and higher system efficient. The pore size of each material was identified by using Mercury Intrusion Porosimetry (MIP), and the energy density of each material was tested using SDT-Q600, the SEM images showed the nano-size detail of composite materials.

[1]yanan.zhang@nottingham.ac.uk

Zhang, Y., Ding, Y., Dodo, A. and Riffat, S. (2018) Thermochemical Heating/Cooling Storage Materials in Energy System for Built Environment *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 492-500.

Use and Re-Use

AN INVESTIGATION OF MUNICIPAL SOLID WASTE GENERATION AND CHARACTERISTICS IN GHANA

Patrick Bowan[1], Sam Kayaga, Andrew Cotton and Julie Fisher

Loughborough University, United Kingdom

Keywords: Municipal solid waste, solid waste generation, solid waste characteristics, Ghana

Abstract

Accurate prediction of municipal solid waste (MSW) generation and knowledge of the waste characteristics provide the basic data on which a waste management system is planned, designed, and operated. However, reliable data on MSW generation and characteristics in most developing countries is absent. This paper examines MSW generation and characteristics in Ghana. The data was obtained from secondary data sources, using qualitative and quantitative research methods, through documentary analysis and content analysis of published literature and official documents. The secondary data obtained for the study is deemed valid, reliable, and accurate since the research design and methodology and data analysis of the documents viewed followed research protocols. The investigation found out that the MSW generation rates across Ghana, irrespective of the socioeconomic considerations range between 0.2 and 0.9 kg/person/day. The MSW composition in Ghana is heterogeneous with different chemical properties; the household MSW composition in Ghana is more organic (60%), 25% recyclables, and 15% miscellaneous. The high organic waste component of the MSW stream in Ghana has resulted in high moisture content (above 50% on average) of the MSW. This organic fraction is an important component, not only because it constitutes a significant portion of the MSW stream in Ghana, but also because of its potentially adverse impact on public health and environmental quality if not properly treated and/or disposed of. The impact of organic MSW on environmental quality takes the form of foul odours, unsightliness and leachate from open dumps, especially after rainfall, and emission of harmful gases. Unless an organic waste is appropriately treated and disposed of, its adverse impact will continue until it has fully decomposed or otherwise stabilised. Therefore, the study recommends the adoption of appropriate management technologies to ameliorate the impact of MSW in the country and other developing countries.

[1]P.A.Bowan@lboro.ac.uk

Bowan, P., Kayaga, S., Cotton, A. and Fisher, J. (2018) An investigation of municipal solid waste generation and characteristics in Ghana *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 502-517.

GREEN CONSCIOUSNESS OF HOUSEHOLD OWNERS IN SOUTH AFRICA

Evan Klopper[1], Eric Simpeh[2] and John Smallwood[3]

[1, 3]Nelson Mandela University, South Africa
[2]Cape Peninsula University of Technology, South Africa

Keywords: Energy wastage, Green consciousness, Recycling, Water wastage.

Abstract

The planet earth has been damaged by people because our industrial systems left us with no choice. High-rise buildings, industrial factories, and power plants were built long before the consequences were known; now concerns regarding global warming, climate change and environmental pollution have been on the rise. The primary aim of this study was to determine the green consciousness of household owners within South Africa. The research was to investigate whether individuals are aware of the environmental damage caused by humans; the actions that are available to reduce their carbon footprint at home; and lastly, to determine whether the running costs associated with energy and water wastage from households could be reduced by creating the awareness and implementation of these actions. A closed and open-ended questionnaire was distributed to 40 household owners within Nelson Mandela Bay, and a response rate of 85% was achieved. The reason for this approach was that the results could easily and accurately be analysed. The findings revealed that most people are aware of the impact that humans have on the environment, and the possible saving on household running costs from going green; however, the respondents tend to lack the motivation to participate in actions such as recycling and the reuse of grey water. This is due to a lack of education concerning the benefits of such actions, as well as the lack of facilities available in South Africa to facilitate the processes involved in recycling and the reuse of grey water. Although, recycling and water saving techniques undertaken by households in South Africa proved to be low; the majority of the respondents in this study indicated that they have adopted most of the energy saving techniques in their household.

[2]SimpehE@cput.ac.za
[3]John.Smallwood@mandela.ac.za

Klopper, E., Simpeh, E. and Smallwood, J. (2018) Green consciousness of household owners in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 518-528.

MONITORING AND ANALYTICS TO IMPROVE SERVICE: 'MANTIS'

Andrew Swan[1], Pete Skipworth[2] and Louise Walker[3]

[1]School of Built Environment & Engineering, Leeds Beckett University, United Kingdom
[2,3] Environmental Monitoring Solutions Ltd, Savile Street East, Sheffield, United Kingdom

Keywords: *Water Monitoring Analytics*, *User interface Global South*

Abstract:

Worldwide, 780 million people live without basic and reliable water supplies. Many rely on hand pumps for their water supply but at any one time a third of pumps are not working. The MANTIS monitoring unit is a self-contained, self- powered remote monitoring device for water hand pumps. With a low-tech design but utilising current Artificial Intelligence techniques, MANTIS records daily pump use patterns and detects irregularities indicating potential problems, such as wear and tear or a receding aquifer, and provides alerts when pumps breakdown. Using the increasingly ubiquitous mobile network, MANTIS communicates daily by SMS with a webhosted user interface, enabling subscribers to view the operational status of remote hand pumps. Users such as government water supply departments and NGOs with responsibility for hand pumps are thereby equipped to quality control maintenance and repair and to plan for more sustainable water resource management. MANTIS provides a context specific tool to manage this essential infrastructure whilst helping users to improve the health and wellbeing of those relying on them for daily water supply. It is adaptable for use in monitoring increasingly used solar pumped water supply. Low budget pilot installations in Sierra Leone and the Gambia have proved the efficacy of the technology, with a pump breakdown being correctly diagnosed via the interface and confirmed by site visits by local project team members. Funding is currently being sought to facilitate a larger demonstration project that will trial MANTIS units on 100 hand pumps and some solar installations in the Gambia. The project team comprises an LBU academic with broad experience of water management in the Global South, the SME Environmental Monitoring Solutions Ltd. and The GLOVE Project NGO in the Gambia, with extensive input from the Gambian Ministry for Water.

[1]A.D.Swan@leedsbeckett.ac.uk
[3]louise.walker@em-solutions.co.uk

Swan, A., Skipworth, P. and Walker, L. (2018) Monitoring and Analytics to Improve Service: 'MANTIS' *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 529-534.

USE OF RECYCLED RUBBER TYRES AS AN ALTERNATIVE INGREDIENT IN THE MANUFACTURE OF CEMENTITIOUS BLOCK MATERIALS

Robert Yuill and Christopher Allen[1]

Department of Construction Management, School of the Built Environment, Nelson Mandela University, Port Elizabeth, South Africa

Keywords: Recycled rubber tyre, cementitious block, sustainability, performance.

Abstract

The growing world population and rapid industrialisation have generated vast quantities of solid waste contributing to an energy and environmental degradation crisis. In particular, there are excessive numbers of waste rubber tyre that are a waste management issue. Previous research has shown the introduction of recycled rubber tyre crumb to building material can improve the durability, thermal and acoustic performance in buildings. Large numbers of low-income buildings in South Africa are constructed from cementitious block but perform poorly. The lives of dwellers could thus be greatly improved because of material changes whilst potentially creating a more cost-effective and sustainable building block. The aim of the research was thus to ascertain whether the introduction of recycled rubber tyre crumb can improve the durability, thermal and acoustic performance of cementitious block whilst creating a more sustainable low-cost building material. The objective was to test alternative cementitious building material mixes incorporating recycled rubber tyre crumb to quantify the performance when compared to existing blocks and determine compliance with South African National Standards. The research showed a decrease in compression strength of 75% at 30% rubber replacement. The thermal performance tests showed an opposite result with a 52% lower transfer at 30% rubber replacement. It also found that crumb rubber possesses less bonding ability, which has an effect on the strength of the concrete blocks, negatively impacting on their potential use for low income dwellings. The fire, thermal and acoustic performance tests showed benefits for the occupants. It is recommended that tests on pre-treated crumbed rubber with improved mix control be conducted to determine whether this would enable the use of the blocks for loadbearing structures. A further recommendation is that research be conducted using a standardised block wall to enable a sustainable life cost analysis to be carried out to determine viability for commercial production of blocks.

[1]chris.allen@mandela.ac.za

Yuill, R. and Allen, C. (2018) Use of recycled rubber tyres as an alternative ingredient in the manufacture of cementitious block materials *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 535-547.

DEVELOPING AND TESTING A BPE APPROACH FOR GREEN BUILDINGS IN INDIA

Maaz Dixit[1], Rajat Gupta[2], Matt Gregg[3], Sanyogita Manu[4], and Prasad Vaidya[5]

[1, 4, 5]Centre for Advanced Research in Building Science and Energy, CEPT University, Ahmedabad, India
[2,3] Low Carbon Building Group, Oxford Institute for Sustainable Development, School of Architecture, Oxford Brookes University, Oxford OX3 0BP, UK

Keywords: building performance evaluation, India, green buildings

Abstract

The Indian Green Building Council claims that India is the second country in the world with the largest registered green building footprint; however, independent evaluation of post-occupancy building performance of such buildings is rare in India. This paper seeks to develop, test and refine a building performance evaluation (BPE) approach for the Indian context (I-BPE), to empirically measure and provide suggestions to improve the actual energy and environmental performance of green buildings using low-cost sensors, occupancy surveys, discussions with design teams, review of design documents, and analysis. Firstly, a critical review of BPE-related studies of Indian buildings is conducted to identify the study elements, methods and tools that are commonly used for performance evaluation in India. These methods are then compared with those used in the UK, for assessing and disaggregating energy use, monitoring environmental conditions and understanding of occupant satisfaction, to customise them for the Indian context in terms of data accessibility, relevance, user expertise and costs. Lessons from the UK's experience through Innovate UK's BPE programme are augmented with Indian building industry experience. The resultant customised I-BPE approach is first tested on a pilot, and followed by a whole building performance evaluation of a green building during the inuse stage. This BPE case study is used to refine the appropriateness for the I-BPE approach for the Indian context, and provide insights for improving future building design, engineering and management. The intent of this integrated and customised approach for assessing real building performance in India is expected to assist the building industry in the delivery of better performing buildings. It will also improve pedagogy across schools of engineering and architecture with better understanding of actual performance.

[2]rgupta@brookes.ac.uk

Dixit, M., Gupta, R., Gregg, M., Manu, S. and Vaidya, P. (2018) Developing and testing a BPE approach for green buildings in India *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 548-557.

Sustainability Education

POSTGRADUATE STUDENT INTERESTS IN BUILDINGS ENERGY RESEARCH, RENEWABLE ENERGY RESEARCH AND TRANSPORT RESEARCH, AS REVEALED THROUGH THEIR DEVELOPMENT OF DISSERTATION PROJECT PROPOSALS

Aidan O'Dwyer

School of Electrical and Electronic Engineering, Dublin Institute of Technology, Kevin St., Dublin 8, Ireland

Keywords: buildings energy, renewable energy, transport, taught masters dissertations.

Abstract

This contribution outlines the interests of interdisciplinary minded, Level 9 (masters) students, in buildings energy research, renewable energy research and transport research, as revealed though their development of individual dissertation project proposals. The author was responsible for the delivery and co-ordination of modules in research skills, whose outcomes were the development of the dissertation proposal. The objectives of the research skills modules are outlined.

aidan.odwyer@dit.ie

O'Dwyer, A. (2018) Postgraduate student interests in buildings energy research, renewable energy research and transport research, as revealed through their development of dissertation project proposals *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 559-562.

USING INNOVATIVE APPROACHES TO TEACHING SUSTAINABILITY SKILLS IN ENGINEERING AND CONSTRUCTION

David Thorpe[1], Ian Craig and Sattar Sattary

School of Civil Engineering and Surveying, University of Southern Queensland, Toowoomba, Australia

Keywords: Innovative approaches, Sustainability, Engineering, Teaching

Abstract

While there has been considerable progress in improved sustainable development through initiatives like the Paris Agreement and the consequent national commitments to reducing greenhouse gases, there is much that still needs to be achieved. Engineering and construction professionals have a significant role in this process. This role has been recognised by professional organisations such as Engineers Australia, which incorporates sustainability into its Code of Ethics, and has published both a Sustainability Policy and a guide to implementing sustainability. Teaching sustainable practices is a first step in this process. In this respect, the University of Southern Queensland has for a number of years offered an undergraduate course in Technology, Sustainability and Society, which is studied by all engineering and construction students completing a three or four-year degree qualification in the first two years of enrolment. As well as teaching environmental sustainability, this course also teaches students the wider dimensions of sustainable development, such as its political, economic, and social components. It therefore provides a foundation for the practice of sustainability that can be progressively developed by students over the balance of their study program. Over time, there have been several initiatives implemented to further develop the understanding by students of the role of sustainability in their professional careers. Such initiatives have included the use of industry based lecturers and tutors, assignments that deal with significant real world issues in sustainable development, and the use of real-time tutorials that use the University's Zoom video conferencing system. These tutorials are designed for the large number of students who study this course online. The course is supplemented at postgraduate level by courses in engineering asset and facilities management, advanced project management and risk management, all of which have a technologically based sustainability focus. The future development of this course is expected to include increased experiential learning approaches, further use of industry based lecturers, and increased use of initiatives like data analytics to better tailor the course to student needs.

[1]David.Thorpe@usq.edu.au

Thorpe, D. Craig, I. and Sattary, S. (2018) Using Innovative Approaches to Teaching Sustainability Skills in Engineering and Construction *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 563-575.

RELEASING AN EDUCATIONAL ANDROID APP

Ian Dickinson[1], Chris Gorse and Melanie Smith

Leeds Sustainability Institute, Leeds Beckett University, Leeds, UK.

Keywords: Mobile app development, e-learning, sustainability education, domestic heat loss.

Abstract

This paper explores the process and challenges of creating an educational app for android devices. The Heat Loss Calculator app was initially conceived to allow researchers to quickly calculate building heat loss by entering the U-values of different building element fabrics. Selecting lower U-values equates to the various insulation improvements which can potentially reduce heat loss and improve energy efficiency. During early development it became clear that the app would also be a useful learning tool for students. Therefore, it was designed with this wider audience in mind, with the intention of publishing it in the public domain. Issues encountered during development and some that became apparent after release on the Google Play Store will be discussed. The user experience will be evaluated by means of an online survey of students and by using the app in a group session in the classroom. The feedback will be examined to inform how the app can be improved.

[1]i.dickinson@leedsbeckett.ac.uk

Dickinson, I., Gorse, C. and Smith, M. (2018) Releasing an Educational Android App *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 576-588.

TOWARDS THE DEVELOPMENT OF A FRAMEWORK FOR INCORPORATING SUSTAINABILITY EDUCATION IN THE BUILT ENVIRONMENT CURRICULUM

Damilola Ekundayo[1], Chika Udeaja[2], Kwasi Gyau[3] and Anthony Higham[4]

School of the Built Environment, University of Salford, The Crescent, Salford, M5 4WT, UK

Keywords: Built Environment Curriculum, Framework, Sustainable Development, Sustainability Mapping.

Abstract

Many proponents believe that there is a linkage between the green agenda and built environment (BE) education. It is increasingly recognised that the BE education curriculum should incorporate sustainability and produce graduates that are confident of taking care of the environment without damaging it for future users. Achieving education for sustainable development within the quantity surveying curriculum and more generally in BE curriculum will require an exploration of the general definition of sustainable development and its three spheres; economic, environmental, and social. In addition, one must acquire knowledge of regulatory and technological issues that encompass both the parts and the whole in dynamic interaction. Clearly, universities operating in the BE field have a vital role in shaping the future pattern of practice and policy in relation to the sustainability agenda. So, it is vital to map the curriculum towards sustainability. This research has been developed in response to the growing need of education for sustainable development. Whilst the study identifies the quality and quantity of sustainability related materials within existing BE curriculum, future research is needed to develop a modular framework for further integration of sustainability education in BE programmes. This framework could serve as an evaluation and a benchmarking tool for those who engage in developing the content of BE degree programmes.

[1]D.O.Ekundayo@salford.ac.uk
[2]C.E.Udeaja@salford.ac.uk
[3]K.A.B.Gyau@salford.ac.uk
[4]A.P.Higham@salford.ac.uk

Ekundayo, D. Udeaja, C., Gyau, K. and Higham, A. (2018) Towards the development of a framework for incorporating sustainability education in the built environment curriculum *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 589-600.

CHANGE COMMUNICATIONS: THE KEY TO EMBRACING AND IMPLEMENTING CURRICULUM CHANGE

Sabina Cerimagic[1] and M. Rabiul Hasan[2]

[1] Sydney Medical School, The University of Sydney, NSW, 2006, Australia
[2] School of Information Technologies, The University of Sydney, NSW, 2006, Australia

Keywords: Change management, Education, Communication strategies, Stakeholder empowerment and involvement.

Abstract

This paper investigates organisational change management in a curriculum change project at an Australian higher education institution and, more specifically, analyses the human factors in this process: communication strategies, empowerment and involvement, and overall approach to change management. As communication is the life blood of an organisation and the oxygen of change within any organisation, this paper emphasises communications strategies in order to engage and inform the relevant stakeholders in the change project. The study involves a specific case at the University of Sydney Medical School, where a change sizing survey was implemented. The findings reveal that in order for the change to be effective, stakeholders require involvement, empowerment and clear communications. This papers ultimate goal is to the goal to successfully implement change – an objective of which is stakeholder buy-in.

[1]sabina.cerimagic@sydney.edu.au

Cerimagic, S. and Hasan, M. R. (2018) Change communications: The key to embracing and implementing curriculum change *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 601-612.

Procurement and Building Performance

AN EXAMINATION OF IRISH CONTRACTING FIRMS POLICIES ON SUSTAINABLE CONSTRUCTION PRACTICE

Duga Ewuga[1] and Lloyd Scott

School of Surveying and Construction Management, Dublin Institute of Technology, Dublin, Ireland

Key Words: construction industry, organizational policies, sustainability and sustainable construction

ABSTRACT

Implementing sustainability policies is an indication of firms' disposition to collaborate closely with their supply chain. This study examines the organizational policies of the top 50 Irish construction-contracting firms on how they refer to the matter of sustainability. List of the top 50 contracting firms was obtained from the Construction Industry Federation (CIF) 2016 report, and the companies' websites were used to obtain their policies. Key sustainability issues were identified using the content analysis method. The summary of the results shows that out of the top 50 construction companies 14%(7) had a clearly stated policy on sustainability, 34% (17) had policies that were not clearly stated and 52% (26) did not have any policy stated on sustainability. The research further categorized and analysed the organizational policies of the firms based on the type of work undertaken and their annual turnover. It is indicative that a firm with a high turnover is likely to address sustainability in their company policies. Some of the issues the top firms stated in their policies on sustainability are gaining competitive advantage through responsible sourcing, engaging community and recycling of waste and other construction products. The results further revealed that the nature of work undertaken by a company is a possible motivator in promoting sustainability to enable a firm gain competitive advantage.

[1]duga.ewuga@mydit.ie

Ewuga, D. and Scott, L. (2018) An Examination of Irish Contracting Firms Policies on Sustainable Construction Practice *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 614-625.

IDENTIFYING MEASURES TO INCREASE PROCUREMENT OF NET-ZERO CARBON RESIDENTIAL BUILDINGS IN SOUTH AFRICA

Brett Nethercott and Christopher Allen[1]

Department of Construction Management, School of the Built Environment, Nelson Mandela University, Port Elizabeth, South Africa

Keywords: Net-zero carbon homes, GBFIs, Nudge, Valuation.

Abstract

Climate change poses a massive threat to humankind. It therefore demands attention from both the public as well as governments. Homes are primary contributors to global warming and environmental pollution, meaning a conversion to net-zero carbon homes will drastically help counteract this negative environmental impact whilst offering a sustainable healthy living environment for its residents. The aim of this research is to investigate possible reasons why high income clients are not procuring net-zero carbon homes in South Africa, thereby reducing their reliance on expensive, unreliable government supplied resources. The studies objectives were to identify if a single residential rating system and better education on the importance of reduced energy, water and materials consumption would generate greater awareness and nudge high income clients towards net-zero carbon homes. Furthermore, it sought to investigate whether provision of additional capital to increase the uptake of these net-zero carbon homes, creating opportunities for banks, would provide an opportunity to lower GHG emissions generated in high-income residential homes in South Africa. The study employed a quantitative research approach using the survey research method with a non-probability snowball sample of affluent achievers as defined by the ACORN geodemographic classification. Conclusions drawn are that a large number of clear benefits exist for clients to procure a net zero carbon home in South Africa, however, little incentive from either government or funding institutions means clients remain reluctant to invest in the added expense as no major benefit accrues to them or the value of their property. Recommendations include the use of targeted education to inform high-income clients and funding institutions of the benefits, nudging both to place greater value on net-zero carbon homes. The implementation of a single trusted residential rating system would see a rise in the number of net-zero carbon homes procured in South Africa.

[1]chris.allen@mandela.ac.za

Nethercott, B. and Allen, C. (2018) Identifying measures to increase procurement of net-zero carbon residential buildings in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 626-638.

GREEN PROCUREMENT FOR MUNICIPAL CONSTRUCTION PROJECTS

Luthando S. Mabhoza [1], John J. Smallwood[2], Eric K. Simpeh[3]

[1, 2]Department of Construction Management, Nelson Mandela University PO Box 77000, Port Elizabeth 6031, South Africa
[3]Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, PO Box 1906, Bellville 7535, South Africa

Keywords: Construction, environmental friendly, green procurement, municipal

ABSTRACT

Green procurement is the tool used by governments to source the supply of products and services that are environmentally friendly to counter the global problem of climate change. The study is a qualitative investigation of the implementation of green procurement in the construction sector at local government level. To realise an extended comparative perspective, the Nelson Mandela Bay Municipality and three smaller municipalities were reviewed. The study commences with the exposition of the aspects of green procurement from the basis of the enabling legal framework to the scholarly contribution from which the study can be predicated. It becomes apparent from this review of legislation that there is scope within the existing body of legislation for the use of green procurement as an environmental tool. The review of literature indicates that development has a negative impact on the environment, which includes vegetation loss, illegal dumping, and greenhouse gas emissions. Furthermore, the literature recommends green lifecycle design, and construction projects to reduce the impact of construction on the environment. A systematic investigation of municipalities by means of interviews with relevant municipal officials involved with the procurement of products and services, infrastructure services and environmental affairs officials made it possible to identify factors that impact on the implementation of green procurement. The investigation determined that the major obstacles to green procurement are: socio-economic challenges that confront municipalities; lack of policy, and lack of awareness. Recommendations include the proposal of initiatives that encourage and improve the implementation of green procurement.

[2]john.smallwood@mandela.ac.za
[3]simpehe@cput.ac.za

Mabhoza, L. S., Smallwood, J. J. and Simpeh, E. K. (2018) Green Procurement for Municipal Construction Project *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 639-651.

BIM and Management

ILLUSTRATING HOW A SYSTEMS APPROACH TO MODELLING PROJECT PLANS IMPROVED INNOVATION IN OPERATIONS

John Heathcote[1] and Andrew Coates[2]

Leeds Sustainability Institute, Leeds Beckett University, School of the Built Environment and Engineering, Leeds, LS2 9EN, United Kingdom

Keywords: Project Management; Planning; Plan optimisation; Modelling

Abstract:

Heathcote and Coates (2017) presented a quantitative study that showed how simple plan 'models' of planned operations could form an important precursor to innovation on projects. That study showed a statistically significant gain on modelled projects against the control group. Reporting on the findings of unstructured interviews with the intervention group project managers, from the 2017 study, this paper provides a more detailed explanation (and illustrations) of more precisely how those improvements were made. Some techniques represent the effective use of computer aided planning tools, with an important emphasis on 'modelling for analysis' rather than traditional 'planning'. Other techniques include methods that can be generalised to 'lean management' and/or 'supply chain management' approaches. Such improvements can form transferable learning to other projects. Two hypotheses are proposed, that H1 "systems' analysis can be supported by visualisation through Gantt chart type modelling of the planned operation". And that: H2 "the management of projects, can be supported by the adoption of supply chain/operations management principles".

[1]J.Heathcote@leedsbeckett.ac.uk
[2]Andrew.Coates@kft.firetrainer.com

Heathcote, J. and Coates, A. (2018) Illustrating how a systems approach to modelling project plans improved innovation in operations *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 653-663.

FACTORS MOTIVATING THE ADOPTION OF BIM- BASED SUSTAINABILITY ANALYSIS

Rana Ayman[1], Zaid Alwan[2], Lesley McIntyre[3]

[1] PhD Student, Architecture and Built Environment, Northumbria University.
[2] Senior Lecturer, Architecture and Built Environment, Northumbria University.
[3] Senior Lecturer, Architecture and Built Environment, Northumbria University.

Key words: BIM technologies, BIM based sustainability, Environmental Assessment methods, Sustainability drivers and barriers.

Abstract

The delivery of sustainable and green certified buildings such as BREEAM and LEED is a highly discussed topic with significant interest growth between the Architecture Engineering and Construction (AEC) industry. At the same time, professionals in the AEC have started to recognize the importance of the synergy between Building Information Modelling (BIM) and the assessment of green building strategies to the construction industry. Several studies demonstrated BIM as a platform for collaboration in the AEC sector in general, rather than to deliver green buildings. Thus fewer researchers have tended to investigate the external and internal problems/factors that affects the delivery of green buildings, and role of digital tools and BIM based strategy in solving them. Through thematic coding of existing literature, this paper formulates a critical review of the key drivers for the change needed in AEC industry. It maps knowledge, makes recommendations for improved collaboration, and offers general insight into the delivery of green building design. This review will act as a base to address the critical factors affecting the delivery of green buildings, and investigate how integrating BIM with sustainability aspects could overcome workflow problems towards better collaboration. The investigation concluded that the practice adoption to BIM-based applications is affected by the immature level of integration and lack of consistent framework that is based on the problems in the workflow, process and gap in communication strategies captured from the field work.

[2]zaid.alwan@northumbria.ac.uk
[3]lesley.mcintyre@northumbria.ac.uk

Ayman, R., Alwan, Z. and McIntyre, L. (2018) Factors Motivating the Adoption of BIM- based Sustainability Analysis *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 664-681.

TOWARDS AUTOMATED BUILDING ENERGY PERFORMANCE SIMULATION FOR BIM BASED RENOVATION PROJECTS

Conor Shaw[1] and Lloyd Scott PhD[2]

[1]Shaw Architectural Solutions, Finland
[2]School of Surveying and Construction Management, Dublin Institute of Technology, Dublin, Ireland

Keywords: Renovation, Process Improvement, Scan-to-BIM, Energy Simulation

Abstract

Improving the acquisition, management and utilisation of existing building data is currently of great interest to industry and academia alike. Given the volume of older, and in the majority of cases, less energy efficient structures comprising the building stock, there is great potential to reduce carbon emissions for the sector as a whole. Based on an extensive review of current literature the research summarised herein was a reaction to the determined rationale that a reduction in the manual effort required to conduct Building Energy Performance (BEP) simulations may result in wider adoption of the method within the context of renovation. Capitalising on efficiency gains made possible through the use of available technologies, the research describes a semi-automated workflow aimed at minimising the manual effort involved in simulating BEP for existing buildings. The Building Information Modelling (BIM) based workflow uses open schema gbXML to provide seamless interoperability between a Single Analysis Model (SAM), containing building and energy data, and multiple BEP simulation tools. This SAM method provides an improved workflow to the status quo. The findings of the research are of relevance not limited to the context of renovation, but have implications to the wider Architectural, Engineering and Construction (AEC) industry, which is currently undergoing a digital transformation. Further research and development aimed at improving exchange schemas is recommended to allow for the collaborative functionality demonstrated in this project, as well as adapting aspects of the format to be more attuned to a renovation context given the acute need for thermal improvement across the building stock. This research contributes to the body of knowledge by proposing a novel approach to integrating BIM with BEP simulation. It provides a development model for others wishing to undertake process improvement in similar fields, and can also be read as a practical guide to multidisciplinary collaboration through the BIM platform.

[1]conorbshaw@hotmail.com

Shaw, C. and Scott, L. (2018) Towards automated building energy performance for BIM based renovation projects *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 682-695.

A COMPARATIVE ANALYSIS BETWEEN THE PROVISION OF MONETARY AND NONMONETARY INCENTIVES TO ACHIEVE HEALTH AND SAFETY PREVENTION MEASURES IN CONSTRUCTION PROJECTS

Ruben Ndihokubwayo

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, Bellville Campus, Symphony Way, P.O. Box 1906, Bellville, 7535

Keywords: Construction projects, Health and Safety (H&S), monetary incentives, Non-monetary incentives

Abstract

This study is aimed at making a comparative analysis between the provision of monetary and non-monetary incentives to achieve health and safety prevention measures in construction projects. Design - The study adopted a deductive approach whereby hypothesis was formulated based on motivation theories, specifically monetary and non-monetary rewards and applied them in construction project situations. A web survey was adopted for the empirical data gathering by means of a questionnaire emailed to nationwide selected construction and consultant firms. A seven point Likert scale questionnaire was developed and paired-sample t-test was used to analyse the data using SPSS. The reliability test was done using Cronbach's alpha coefficient of reliability. Findings - In total of 164 respondents who participated in the study, 147 valid cases were analysed. The test of reliability showed results were highly reliable. A paired-sample t-test revealed there was a statistically significant increase in scores from monetary to non-monetary incentive factors including selecting contracting candidate on the basis that they have H&S plan, the integration of H&S plan in design, and the contractor having a programme for counselling and testing of diseases. Although other factors displayed no statistical significance, they also consistently displayed higher mean scores of non-monetary incentives than monetary incentives. Thus the construction industry favours more the provision of non-monetary incentives than monetary incentives to achieve H&S preventive measures. Value – Findings reveal the current standoff of the South African construction industry attaching higher importance on the provision of non-monetary incentives than monetary incentives in achieving H&S prevention measures. Therefore, these findings imply more has to be done to change the mind set of construction participants to move towards a proactive procurement environment enabling the incorporation of both monetary and nonmonetary incentives to achieve H&S prevention measures.

ndihokubwayor@cput.ac.za

Ndihokubwayo, R. (2018) A comparative analysis between the provision of monetary and nonmonetary incentives to achieve health and safety prevention measures in construction projects *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 696-706.

Zero Energy and Retrofitting

CONCEPTUALIZING A SYSTEM FRAME WORK FOR RETROFITTING EXISTING BUILDINGS IN SOUTH AFRICA

Chikezirim Okorafor [1], Fidelis Emuze[2] and Dillip Kumar Das[3]

[1]Doctoral student, Unit for Lean Construction and Sustainability, Central University of Technology, Free State, 20 President Brand Street, Bloemfontein, 9300, South Africa
[2]Professor, Department of Built Environment, Central University of Technology, Free State Private Bag X20539, Bloemfontein, 9300, South Africa
[3]Associate Professor, Department of Civil Engineering, Faculty of Engineering and Information Technology, Central University of Technology, Free State, Private Bag X20539, Bloemfontein, 9300, South Africa

Keywords: complex adaptive system theory, energy efficiency, existing building, retrofitting.

ABSTRACT

Designing energy efficient retrofits for buildings will bring about environmental, economic, social, and health benefits. However, selecting specific retrofit strategies is complex and requires careful planning. The reported study attempts to provide insights into how the retrofit phenomena can be understood and addressed within a social-technical context. A proposed way of understanding the complexities of retrofitting an existing building with the use of the complex adaptive system theory approach is highlighted and discussed in the paper. The proposal screen buildings for potential improvements that support the development of retrofit strategies, which mitigate carbon emission. The model reveals the relationship between different components of building energy retrofit projects. The implications of the proposed conceptual framework for future research are discussed.

[1]kezirim042@yahoo.com

Okorafor, C., Emuze, F. and Das, D. K. (2018) Conceptualizing a system frame work for retrofitting existing buildings in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 708-718.

IMPROVING THE INTEGRATION OF FUNDING PRIORITIES WITHIN THE DECISION-MAKING PROCESSES OF DOMESTIC RETROFITS IN SCOTLAND

Dayna Rodger[1], Nicola Callaghan, Craig Thomson

School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow, G4 0BA, Scotland

Keywords: Ageing population, domestic housing, energy efficiency, sustainable decision-making.

Abstract

There is a requirement to address the needs of the most at risk individuals in society through robust policies designed to improve the energy performance of buildings and safeguard the wellbeing of the elderly from the known vulnerabilities of their immediate and surrounding environment. Due to reduced funding and the misalignment of priorities there is a need to evaluate the quality control within government retrofitting standards and processes to prevent unintended consequences. It is recognised that due to the complexity of the agenda, holistic integration across a range of service providers is required. In response this research examines the relationships between design and implementation within real-world practice to determine and understand the appraisal procedures in housing and any consequences that arise. This research presents the findings of a preliminary study, where research was conducted through a series of in-depth interviews conducted with key stakeholders within government, social care and the retrofit industry, exploring the extent to which the requirements of an older person's health and wellbeing are holistically being addressed during the retrofit of domestic buildings. The study concludes by posing a series of research questions, providing an agenda for future research and presents a synthesis of insights on practical and policy implications originating from the analysis on decision-making and management.

[1]daynarodger@gmail.com

Rodger,D., Callaghan, N. and Thomson, C. (2018) Improving the Integration of Funding Priorities within the Decision-Making Processes of Domestic Retrofits in Scotland *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 719-732.

AN INTRODUCTION TO SYSTEMISED OFFSITE MANUFACTURED AND ENGINEERED TIMBER DWELLING TYPOLOGIES FROM WELSH AND UK FORESTRY SUPPLY CHAINS, ENABLING TRANSITION TO NEARLY ZERO CARBON HOMES IN WALES

Francesco Zaccaro[1], John Littlewood[2], Paul Wilgeroth[3], Anthony Whyman[4], Gary Newman[2], Robin Lancashire[3] and Gareth Davies[4]

[1, 2, 3, 4] The Sustainable and Resilient Built Environment (SuRBe) group, Cardiff School of Art & Design, Cardiff Metropolitan University, Cardiff, CF5 2YB, United Kingdom.
[2] Woodknowledge Wales, Ffarm Moelyci, Tregarth LL57 4BB, United Kingdom.
[3] TExova BM The Timber Research and Development Association, Chiltern House Site, Stocking Ln, Hughenden Valley, High Wycombe HP14 4ND, United Kingdom.
[4] 2 The Old Sawmill, Tregynon, Newtown, Powys, SY16 3PL, United Kingdom.

Keywords: Timber Dwellings; Building Performance Evaluation; Architectural Technology; Offsite Manufacturing

Abstract

This paper discusses a Knowledge Economy Skills Scholarship two (KESS2) doctoral project co-funded in collaboration with Woodknowledge Wales, to be undertaken by the first author under the guidance of the other authors. The KESS2 project supports the larger Home Grown Homes project, which is spearheading the use of Welsh timber in construction, undertaken by the four organisations authoring this paper. In 2018, there is an increased need to drive efficiencies in housing supply and also performance with the current and future skills shortages in construction (as articulated in the Farmer Review – Modernise or Die) and is helping to encourage a shift to offsite construction, known as OffSite Manufacturing (OSM). The Welsh Government's £10 Million Innovative Housing Programme introduced in 2017 is helping to massively incentivise the shift to OSM in Wales. The move to OSM and increased systemisation is requiring a profound re-think of how the UK conceives and delivers housing. This PhD will explore the architectural technology detailing of the building fabric and synergy with manufacturing detailing through the use of timber, particularly home-grown timber, for engineered timber solutions, and erection on site; developing typologies for a range of housing markets in wales. The challenges include creating a better understanding of the key technological features required to deliver high-performance systemised timber solutions, with an aspiration to achieve nearly zero carbon homes from 2020 in Wales, and that also provide a healthy environment for their occupants, with zero energy costs. Building on the SuRBe group's expertise in building performance evaluation, particularly in fire and thermal parameter assessment this project will instigate a monitoring programme during manufacture, construction and post occupancy. This paper will be useful for academics, architects, building contractors, housing developers and financial institutions and government agencies evaluating Welsh timber as a construction material.

[2] jlittlewood@cardiffmet.ac.uk

Zaccaro, F., Littlewood, J., Wilgeroth, P., Whyman, A., Newman, G., Lancashire, R. and Davies, G. (2018) An Introduction to Systemised Offsite Manufactured and Engineered Timber Dwelling Typologies from Welsh and UK Forestry Supply Chains, Enabling Transition to Nearly Zero Carbon Homes in Wales *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 733-741.

THE ADOPTION OF A DESIGN BUILD APPROACH IN RETROFIT PROJECTS – A DESCRIPTIVE CASE STUDY

Lloyd Scott

Professor at School of Surveying and Construction Management, DIT.

Keywords: *Collaboration, design build, restoration, case study*

Abstract

The delivery Design Build projects across the built environment in Ireland has begun to take significant shape. There are many examples of the traditional are moving towards more collaborative practices. There exists support for the integration of a design build project approach in the retrofit realm where designer, client and developer can work collaboratively. As with the regular design build process the intent behind this collaborative approach is to encourage those associated with the built environment to consider how retrofit design and construction can contribute positively to addressing elements of climate change and the design build process. The opportunity to share the rich nature of the design build process in a unique environmentally and heritage focused project excited the authors. Secondly concerns about the way such projects are captured historically, and specifically the disciplinary knowledge and skills employed in the restoration of such a significant landmark building could be lost if not afforded some place in the research annals. This paper presents a Restoration Design-Build (RDB) process employed in the realignment of a state building in the United States adopting this novel initiative. The author, working closely with the design build manager, adopted a descriptive case study method to enhance the capabilities of understanding and generate constructive reflections and analysis. The intention was to empower the reader to explore new horizons by 'clarifying and negotiating' ideas and concerns around the RDB process. The author evaluated the usefulness of the RDB approach based on direct and indirect measures. The framework approach presented is a part of an ongoing initiative between state and project stakeholders that have shown positive results based on the teams' performance in the presented case study as well as affirmative feedback from some stakeholder participants. The positive measures adopted in this project are shared with the view of trying to encourage those associated with restoration project to adopt this approach.

lloyd.scott@dit.ie

Scott, L. (2018) The adoption of a design build approach in retrofit projects – a descriptive case study *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 742-753.

CSR/Policy

IMPLEMENTATION OF CORPORATE SOCIAL RESPONSIBILITY IN SOUTH AFRICAN CONSTRUCTION SMALL AND MEDIUM ENTERPRISES

Darren M. Sabbagh and Gerrit J. Crafford[1]

Department of Quantity Surveying, School of the Built Environment, Nelson Mandela University (North Campus), Gardham Avenue, Summerstrand, Port Elizabeth, 6001, South Africa.

Keywords: Small and Medium Enterprises, Corporate Social Responsibility, South Africa.

Abstract

Theories on Corporate Social Responsibility have traditionally focused on larger companies, due to their global presence and income generating ability. Research concerning CSR in SMEs is scarce, yet SMEs constitute a significant component of national economies and industries worldwide. The misconception that CSR initiatives are expensive to implement, along with the fact that many SMEs are not aware of what CSR entails, serves as the motivation for this study. A total of 37 randomly selected construction contractors, taken after a sampling frame was applied, participated in the study. Quantitative data from 37 South African small to medium sized construction companies were collected using a structured questionnaire. CSR implementation levels were divided into three components, namely, environmental, social and ethical. Each of the three components was further broken down, and implementation scores were aggregated and analysed. The primary objectives of the study were to examine firstly the awareness level of SME's and secondly their concern about the cost of CSR. The results suggested that SMEs operating in the South African construction industry have implemented a handful of CSR initiatives. Most the SME's that completed the questionnaire were found to exercise both the environmental and economic aspect of CSR; yet implementation concerning social initiatives was limited. Non-parametric correlation analyses showed that higher awareness levels of CSR led to higher levels of implementation. It was also found that the concern about the cost of CSR negatively affected implementation levels, yet SME's still incorporated a few CSR initiatives into their business operations. A less than ideal response rate of 11% presented the major limitation of the study. The study comprised of general building works contractors only. Future studies concerning CSR in construction SME's could include other industry participants such as architects or quantity surveyors. The inclusion of these could provide a more holistic representation of the South African construction industry.

[1]gerrit.crafford@mandela.ac.za

Sabbagh, D. M. and Crafford, G. J. (2018) Implementation of corporate social responsibility in South African construction small and medium enterprises *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 755-770.

KEY ENABLERS IN THE CSR/BUSINESS STRATEGY INTEGRATION SPACE

Tony Kealy

School of Electronic and Electrical Engineering, Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland.

Keywords: Corporate Social Responsibility, Sustainability Reporting, Triple-Bottom-Line, CSR Education

Abstract

Despite the potentially positive image and reputation implications of businesses implementing strategies in Corporate Social Responsibility (CSR), there appears to be a dearth of companies willing to play a leading role in advancing CSR activities to upper levels within the consciousness of the organisation. The vast majority of businesses appear to be merely complying with national regulations in their business sustainability efforts. The aim of this study is to investigate the key enablers in assisting businesses integrate their corporate social responsibility with their business strategy. A 17question online survey was administered to a number of national and global businesses in a range of industries. The resulting qualitative and quantitative data from 86 respondents was analysed and is presented in tabular, graphical, and text form. Quantitative responses were presented in the form of descriptive statistics while qualitative data was analysed and presented thematically. The study found that the three main enablers to businesses integrating CSR with their corporate strategy were (i) leadership in the CSR area, particularly at senior management level (ii) informed education/knowledge in all aspects of CSR, (iii) better measuring techniques for measuring CSR outcomes. Both academia and the business world can contribute and assist in confronting the three main issues and guide businesses as they attempt to integrate CSR with the strategy of their organisation. The study should help to guide business and engineering schools in designing academic programmes to include CSR learning outcomes to their programmes.

tony.kealy@dit.ie

Kealy, T. (2018) Key enablers in the CSR/business strategy integration space *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 771-788.

THE CIRCULAR ECONOMY IN UK CONSTRUCTION – WHAT ARE WE WAITING FOR?

Reuben Brambleby[1] and Fred Sherratt

Department of Engineering and the Built Environment, Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ, United Kingdom

Keywords: circular economy, design, sustainability, waste.

Abstract

This paper considers the current setting for sustainability within the construction sector in terms of the legislative, social and technical contexts. It aims to promote a holistic discussion which covers the technical, systemic and logistical barriers to the adoption of Circular Economy (CE) principles by the UK construction industry. The CE concept is that products are re-used multiple times in distinct settings rather than used in a single setting then materially re-cycled or scrapped as waste. Adoption of the CE concept is recognised as being critically important to achieving the goal of a sustainable society, in 2016 the European Union made a legislative shift towards the CE concept by publishing the Circular Economy Package which introduces new EU resource management targets. The construction industry is a significant user of earth's non-renewable resources and therefore the construction sector plays a pivotal role in resource management and achieving sustainability. It is clear that the rate at which the UK construction industry is adopting CE principles is slow. Dramatic and positive strides have been made by both the demolition and construction industries towards reducing their contribution to landfill waste. However, much of this reduction is achieved either via downcycling, whereby the quality of the construction material is degraded, or via the use of significant quantities of energy in the re-cycling process. For example, concrete can be crushed and downcycled as recycled aggregate and steel from construction demolition is routinely melted down and incorporated into the production of new steel products. The construction sector should be making greater and more informed use of CE concepts, we should be designing in and deploying deconstruction techniques rather than demolition techniques, construction components derived from this deconstruction should be re-used rather than the derived materials being reprocessed, recycled or downcycled. How can we speed up adoption of a CE within construction?

[1]reuben.brambleby@anglia.ac.uk

Brambleby, R. and Sherratt, F. (2018) The Circular Economy in UK Construction – What are we waiting for? *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 789-795.

EXPLORATORY STUDY INTO SUSTAINABILITY EXPERTISE IN THE IRISH ARCHITECTURE, ENGINEERING AND CONSTRUCTION (AEC) SECTOR.

Lloyd M. Scott and Emmanuella A. Twumasi

School of Surveying and Construction Management, Dublin Institute of Technology, Dublin, Ireland

Keywords: Sustainability expertise, sustainable practice, Irish construction

ABSTRACT

The Architecture, Engineering and Construction (AEC) sector is a rich environment, involving the use of expertise at various levels with much intensity and in unique situations. In the attainment of sustainable construction, construction sustainability performance is indispensable. The participants implementing sustainable construction practices are key to a sustainable construction sector. This study seeks to understand the level of sustainability expertise in the Irish AEC sector which is part of an ongoing research at the Dublin Institute of Technology, within the School of Surveying and Construction Management. The early explorative phase of this research involves getting a depth of understanding as to the level of sustainability expertise in the Irish AEC sector. The study adopts a bibliometric review as its method to explore how the sector has begun to change its practice around addressing sustainability expertise and performance. The outcome of this review confirms that a number of gaps do exist in the Irish AEC sector with regard to sustainability expertise in skills shortage and the need for skills development.

[1]d17127590@mydit.ie

Scott, L. M. and Twumasi, E. A. (2018) Exploratory study into sustainability expertise in the Irish Architecture, Engineering and Construction (AEC) sector *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 796-804.

$C0_2$ and Embodied Energy

POTENTIAL CARBON EMISSIONS REDUCTION IN GENERAL AUSTRALIAN CONSTRUCTION SYSTEMS THROUGH THE USE OF BIOCLIMATIC DESIGN PRINCIPLES

Sattar Sattary[1] and David Thorpe

School of Engineering, University of Southern Queensland, Springfield, Brisbane 4300, Australia

Keywords: Construction Materials, Carbon Emission, Sustainable Construction, Bioclimatic Design Principles (BDP).

Abstract

This paper outlines the results of applying a developed research model tool based on bioclimatic design principles to building materials, elements and construction processes within general Australian floor, wall and roof construction systems. The aim of the research was to identify potential reductions in construction carbon emission that might be achieved during the construction process in the general Australian (floor, wall and roof) construction systems. It was found that, as compared to standard building practice and application of the Australian Green Star environmental tool, the bioclimatic research model consistently produced potentially higher reductions in construction carbon emissions for all building materials and elements considered – up to 93 percent for roof construction systems. The construction sector produces around 11 percent of Australian greenhouse gas emissions, and the Australian Federal Government has set a target emission reduction of 26 to 28 percent by 2030 to achieve the 2015 Paris agreement. Given this, consideration of bioclimatic design principles in building design and construction should be an important part of the process to reduce Australian construction carbon emissions to achieve the Paris agreement goals.

[1]sattar.sattary@usq.edu.au

Sattary, S. and Thorpe, D. (2018) Potential carbon emissions reduction in general Australian construction systems through the use of bioclimatic design principles *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 806-819.

ESTIMATING EMBODIED CARBON EMISSIONS OF BUILDINGS IN DEVELOPING COUNTRIES: A CASE STUDY FROM SRI LANKA

Amalka Nawarathna [1], Zaid Alwan [2], Nirodha Fernando [3], Barry Gledson[4]

[1, 2, 4]Department of Architecture and Built Environment, Northumbria University, NE1 8ST, UK
[3]School of the Built Environment, University of Salford, M5 4WT, UK [3]

Keywords: Cradle to Gate, Embodied Carbon Estimation, Sri Lanka, Structural Elements.

Abstract

Even with the increasing attention on reduction of Embodied Carbon (EC) emissions in the global built environment sector, yet most of the developing countries focus only on reduction of Operational Carbon (OC) through improved operational energy performance. The significance of EC estimation and reduction in buildings in these countries are yet to be fully realised. Therefore, this paper provides a case study of an office building located in Western province in Sri Lanka, which is used as a drive to identify the potential for estimating EC emissions of buildings in developing countries. Accordingly, the estimation was carried out confining to the cradle to gate system boundary and structural elements of a building. The estimation process revealed that the EC estimation is a challenging process for a developing country like Sri Lanka as it encountered many challenges such as lack of accurate and up to date EC co-efficient for building materials, time consuming and work intensive nature of estimation, difficulty in choosing a system boundary and unavailability of an appropriate estimation tool. The case study findings revealed that the total structural elemental EC emission per gross floor area is 191.11 kgCO2/m2. Similar to many previous studies, it was identified that the top most EC intensive element of this building is also substructure. However, this study was carried out as a pilot study of a further research and can be extended to incorporate all the elements of the building to provide an accurate value for the overall and elemental EC emissions..

[1]amalka.ranathungage@northumbria.ac.uk

Nawarathna, A., Alwan, Z., Fernando, N. and Gledson, B. (2018) Estimating Embodied Carbon Emissions of Buildings in Developing Countries: A Case Study from Sri Lanka *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 820-830.

THE METABOLISM OF BUILT ENVIRONMENT: ENERGY FLOW AND GREENHOUSE GAS EMISSIONS IN NIGERIA

Yusuf Datti

Bayero University, Kano, Nigeria

Keywords: Energy flow, Environmental impact, Greenhouse gas emissions and Sustainability.

Abstract

It is becoming increasingly clear that the consumption of resources now enjoyed in developed nations will be impossible to be sustained worldwide. While developing countries still have the advantage of low consumption and a smaller ecological footprint per person, they cannot simply develop in the same way as other western cities have developed in the past. The severe reality of population and consumption inequalities makes it contentious whether studies done in developed countries can be translated and applied to developing countries. This research set itself apart by examining the flow of energy in Nigeria and the impact that the flow will have on the environment. A simplified version of an intergovernmental panel on climate change (IPCC) method for inventorying GHG emissions is adopted for this research. Nigeria being a developing country with no country specific, technology specific and facility specific emission factor, thus Tier 1 method seems more appropriate for this research. Additionally, the use of national fuel delivery statistics becomes more practicable in a developing country like Nigeria. Thus activity data used in this paper are derived from energy statistics, compiled by the national statistical agencies such as National Bureau of statistics (NBS), National Population Commission (NPC), other data sources include from Department of petroleum Resources (DPR), the Petroleum Products Pricing Regulatory Agency in Nigeria (PPPRA), Nigerian Electricity Regulatory Commission (NERC) and Nigerian National Petroleum Corporation (NNPC). The results reveal low primary energy consumption in Nigeria as compared to its population with consumption standing at 2,462,794TJ. While the corresponding GHG emissions as compared to the consumption of primary energy is high, it currently stand at 289, 154 (Gg CO2), 44 (Gg CH4) and 4 (Gg N2O). The three largest energy sources in Nigeria are biomass, liquid fuels and natural gas contributing about 36%, 31% and 30% share of energy respectively. Moreover, the findings reveal that the single largest contributor of greenhouse gas emissions in Nigeria is the biomass. It contributes about 36% of the carbon emissions, 65% of the methane emissions and 88% of all nitrogen oxide emissions in Nigeria. Followed by the exploration and flaring of natural gas. Thus the combined emissions from biomass and production of crude oil/natural gas are responsible for two-third of the carbon emissions, nine-tenth of the methane emissions and about nine-tenth of Nitrogen oxide emissions. Furthermore, by substituting biomass fuel with a carbon lean fuel such as natural gas, would lead to overall reduction of carbon emissions by 18%, methane emissions by 63% and Nitrogen oxide by 85%. Since, the combustion of biomass and inefficient exploration of oil/gas appears to be the greatest contributor of GHG emissions in Nigeria, the paper suggest some sustainable options that would lead to the reduction of GHG emissions. These options include the use of more efficient technology in the exploration of oil/gas and the transitioning from biomass fuel to more environmentally friendly fuel such as natural gas.

yudatti.qs@buk.edu.ng

Datti, Y. (2018) The metabolism of Built Environment: Energy Flow and Greenhouse Gas Emissions in Nigeria *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 831-845.

USING GESTURES TO INTERACT WITH HOME AUTOMATION SYSTEMS: A SOCIO-TECHNICAL STUDY ON MOTION CAPTURE TECHNOLOGIES FOR SMART HOMES

Marcel Lowell G. Villanueva[1, 2], Prof. Dr. Olaf Droegehorn[1]

[1]Hochschule Harz – University of Applied Sciences, Wernigerode, Germany
[2]Erasmus Mundus Masters in Pervasive Computing and Communications for Sustainable Development

Keywords: Home Automation, Gesture Control, Usability, Pervasive Computing

Abstract

Homes and working spaces are considered significant contributors to the top percentage of energy consumption and carbon emissions worldwide (GeSI Report, 2017). Previous studies in the field of home- and building automation have demonstrated the sustainability gain brought by smart home solutions, in terms of energy-efficiency, economic savings, and enhanced living and working conditions. A major barrier, however, to the adoption of these solutions is the complexity and limited usability of user interfaces. In addition, various modes of interactions for the control and automation of residential environments are an emerging area of study within Human-Computer Interaction. As a response to these challenges, this study investigates the use of gestures as a natural way of controlling and interacting with home automation systems. Using the available motion capture technology, a gesture dictionary will be defined as a set of meaning actions in free-form and in-air movements. A usability test will be conducted to measure the resulting socio-technical aspects. Lastly, the study will present the analysis and effects of gestures control for a higher up-take of smart home solutions towards designing and maintaining buildings of the future that are both user-centric and resource efficient to reduce our overall carbon footprint.

[1, 2]marvil-7@student.ltu.se

Villanueva, M. L. G. and Droegehorn, O. (2018) Using Gestures to Interact with Home Automation Systems *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 846-858.

Sustainability and People

THE LONG-TERM POTENTIAL OF CONSTRUCTING INSULATED CONCRETE FORMWORK DWELLINGS IN COMPARISON TO USING TRADITIONAL MASONRY

Stephen Elsey[1] and Tahira Hamid[2]

School of Built Environment & Engineering, Leeds Beckett University, Leeds, LS2 8AG

Keywords: Insulating, Concrete, Formwork, Dwelling

Abstract

Insulated Concrete Formwork is an uncommon method of construction which is rapidly gaining popularity in other European nations, offering multiple long-term benefits in regards to energy efficiency and speed of erection. The method was developed in the 1970's and patented by 'Isorast' who have progressively improved on the system to satisfy the best worldwide standards. The more common method of constructing a dwelling is to use traditional masonry which has been widely used since the 1700's with a mason laying bricks/blocks bonded with a mortar to construct the external walls. Within the UK there are over 23 million homes (Office for National Statistics, 2017), over half of which will have been constructed using traditional masonry, considering the vast improvements in technology in and around the construction industry over the past decade it is an ideal time to scrutinize the traditional method and conclude whether insulated concrete formwork would be a valid improvement. The primary aim of this study is to research how well dwellings constructed using insulating concrete formwork could perform in practice and the possible hurdles as to why the approach is often avoided on larger scale developments with some UK housing associations neglecting the method entirely. The research shall be conducted via a combination of questionnaires, desktop studies and company enquiries to ensure a sufficient quantity of results that can be thoroughly examined. The methodology of this research paper was developed on the basis of gaining feedback and experiences of industry professionals during their careers. Individuals will be requested to provide information regarding the residential sector, ICF construction and traditional masonry. The questionnaire survey will establish an idea of what the respondents prioritise within construction and their opinions on various methods.

[1]s.elsey@castleowen.com
[2]t.hamid@leedsbeckett.ac.uk

Elsey, S. and Hamid, T. (2018) The long-term potential of constructing Insulated Concrete Formwork Dwellings in comparison to using Traditional Masonry *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 860-871.

DEVISING AND DELIVERING AN URBAN CITY AT COMMUNITY LEVEL

Eleasha Iyawa[1], Harvey Pritchard[2] and Tahira Hamid[3]

Leeds Beckett University, School of Built Environment and Engineering, Leeds, LS2 8AG, United Kingdom.

Keywords: Masterplan, Regeneration, Urban and Community.

Abstract

Masterplanning has attracted renewed interest in recent years, moving beyond the parameter of a conventional land-use plan to an approach that conveys a vision for the future of an area. (Ardron et al., 2008). The implementation of this approach establishes a guideline for the city in question towards urban regeneration. However, the problem with delivering this 'refined city', is the thorough neglect of the communities that will be affected by the change. This study will explore the effectiveness of local community participation as an integral strategy to masterplanning. Primary data was acquired through the administration of structured questionnaires to local communities, private developers and local council authorities. Furthermore, the associated experiences and feedback were compared against the existing related literature to conclude this study. The response pattern summarises that there is no better way to design for the public than collaborating with the public in the design itself. They are defined as the ultimate users of the buildings and spaces created, therefore; at the centre of any successful masterplan. Two cities within the United Kingdom which are progressively expanding towards urban regeneration were briefly highlighted as a case study. This analysis will be based upon each city's community contributions and collaborations towards its vision for urban rejuvenation through a local development plan. The results conclude that the overall blueprint for the future of any city begins at community level.

[1]eleashaiyawa@yahoo.com
[3]t.hamid@leedsbeckett.ac.uk

Iyawa, E., Pritchard, H. and Hamid, T. (2018) Devising and delivering an urban city at community level *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 872-884.

THE IMPORTANCE OF COMMUNITY INVOLVEMENT IN HOUSING DELIVERY IN WESTERN CAPE, A CASE STUDY IN DELFT

Andisiwe Cima[1], Eric K. Simpeh[2] and Ruben Ndihokubwayo[3]

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, P O Box 1906, Bellville 7535, South Africa

Keywords: Community involvement, Housing delivery, South Africa, Quality

Abstract

In Western Cape there is a huge demand for housing in the post-apartheid era. Government funded housing developments are there to meet these needs and keep up with promises made by the state. Whilst the government has attempted to meet the increasing demands for low-cost housing, research reveals that the focus is on quantity of the houses not quality. There is a sheer number of low-cost houses that has failed to conform to quality expectations, and one of the major factors amongst others have been attributed to the lack of community participation in housing delivery in the Western Cape. Therefore, the study is aimed at evaluating the importance of community involvement in housing delivery in the Western Cape. A quantitative approach was adopted, and a random sampling technique was employed to select the survey participants. Response data was subjected to descriptive analysis. The salient findings include the involvement of community in housing delivery contributes to: creation of employment within the community; developing skills in the community, and assisting the community to take ownership of their houses. Based upon the findings it can be concluded that community participation fosters effective project implementation and sustainable development, empowers communities and builds their capacity to be self-reliant and take charge of their own development.

[1]andisiwe.cima@gmail.com
[2]SimpehE@cput.ac.za
[3]ndihokubwayor@cput.ac.za

Cima, A. Simpeh, E. K. and Ndihokubwayo , R. (2018) The importance of community involvement in housing delivery in Western Cape, a case study in Delft *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 885-895.

BUILDING A CAUSAL MODEL OF VARIABLES INFLUENCING CARBON EMISSIONS IN SOUTH AFRICAN DWELLINGS – AN EXPERTS' KNOWLEDGE ELICITATION APPROACH

Michael G. Oladokun[1, 2] and Fidelis A. Emuze[3]

[1]Department of Built Environment, Central University of Technology, Free State, Republic of South Africa
[2]Department of Building, University of Uyo, Nigeria
[3]Department of Built Environment, Central University of Technology, Free State, Republic of South Africa

Keywords: Carbon Emissions, Causal Models, Dwellings, Mental Models, South Africa, System Dynamics.

Abstract

There are many variables influencing energy consumption and carbon emissions in dwellings. These variables interact and interrelate in a complex way as a sociotechnical problem. The lack of empirical data to support the relationships among some of the variables has been reported to pose problems to studies within this research area. As such, this paper reports the development of a causal model of variables influencing carbon emissions in dwellings based on mental models of the experts. The methodology for the research in this paper draws its philosophical foundation from the pragmatist research paradigm based on the system dynamics approach. Data for building the initial causal model were collected from the related literature and subsequent interview of the experts through their knowledge elicitation. The final causal model was developed by subjecting the initial causal model to experts' review based on focus group approach by way of mental knowledge elicitation. The findings indicate a population of causal variables influencing carbon emissions in dwellings and show the complexity involved among the variables. The study concludes that the approach used in building the causal model has the capability of improving the accuracy and credibility of the developed causal model.

[1, 2]moladokun@cut.ac.za

Oladokun, M. G. and Emuze, F. A. (2018) Building a causal model of variables influencing carbon emissions in South African dwellings – an experts' knowledge elicitation approach *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 896-907.

Architecture and Design

INFLUENCE OF DESIGN PARAMETERS ON ENERGY CONSUMPTION OF HIGH – RISE RESIDENTIAL BUILDINGS IN DIFFERENT CLIMATE AREAS IN CHINA BASED ON GREEN BUILDING STUDIO

Hongyang Li[1.2], Boya Su[3], Yingyan Zeng[3], Huiyan Liu[3], Hailing Weng[3] and Yuan Fang[4]

[1]Associate Professor, School of Civil Engineering and Transportation, South China University of Technology, Guangzhou 510641, China
[2] State Key Laboratory of Subtropical Building Science, South China University of Technology, Guangzhou 510641, China
[3]Student, School of Civil Engineering and Transportation, South China University of Technology, Guangzhou 510641, China
[4]Lecturer, Department of Civil and Transportation Engineering, Guangdong University of Technology, Guangdong 510006, China

Keywords: Design Parameters, Energy Consumption Simulation, High-Rise Residential Buildings

Abstract

Reducing building energy consumption is an important task for establishing a conservation-oriented society and therefore realizing sustainable development strategies in China. As energy consumption of residential buildings accounts for a large proportion of total amount in the country, improving the efficiency of energy use of projects of this type becomes increasingly important. To cope with this, the design parameters should be carefully chosen according to the surrounding natural climate during the architectural design stage. In this paper, we established a high-rise residential Revit model and adopted Green Building Studio (GBS) energy consumption simulation software to analyse the influence of four design parameters on the energy consumption of high-rise residential buildings in China. These parameters are the wall material, window material, window-wall ratio and building orientation. The energy consumption includes cooling and heating and overall use. In order to compare different climate areas, we selected five typical cities located respectively in severe cold region (Harbin), cold region (Beijing), hot in summer and cold in winter region (Shanghai), hot in summer and warm in winter region (Guangzhou) and moderate region (Xishuangbanna). Through the horizontal comparisons and in terms of a certain building design parameter, we obtained the difference of its influence on the energy consumption of the high-rise residential buildings in typical cities of different climatic regions. By longitudinal analysis and in terms of a certain typical city of a climatic region, we got the influencing degrees of different architectural design parameters on its energy consumption. This is significant to distinguish the architectural designs in different climate areas. The results show that in severe cold, cold, hot in summer and cold in winter regions, the architectural design should focus on the thermal insulation performance of the exterior wall while in the moderate, hot in summer and warm in winter regions, the architectural design should otherwise emphasize the window-wall ratio size.

[1, 2]li.terryhy@yahoo.com

Li, H., Su, B., Zeng, Y., Liu, H., Weng, H. and Fang, Y. (2018) Influence of Design Parameters on Energy Consumption of High - Rise Residential Buildings in Different Climate Areas in China Based on Green Building Studio *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 909-920.

IDENTIFYING THE RELEVANT COMPLIANCE CONSIDERATIONS RELATED TO THE REFURBISHMENT OF EXISTING BUILDINGS IN SOUTH AFRICA

Nthatisi Khatleli[1] and Sathia Govender[2]

School of Construction Economics and Management, University of the Witwatersrand, 1 Jan Smuts Avenue, Braamfontein 2050, Johannesburg, South Africa

Keywords: sustainability, legislation, old building stock, refurbishment

Abstract

The construction industry is known to consume significant resources and contribute to the transformation of cityscapes, urban and ruralscapes. However when buildings are completed they still contribute to environmental degradation by their high energy consumption, the growing global environmental awareness is putting pressure on new buildings to be designed in such a way as to conserve energy. In South Africa in line with what is happening globally new buildings are required to comply with environment stipulations to enhance energy sustainability and reduce the impact of new stock on energy consumption. The old stock remains the sticking point as the buildings were delivered before the current legislative pronouncements. It has been observed that even the refurbishment of these buildings is not yielding sustainable performance as the upgrades are purely aesthetical cosmetic upgrades. The Promulgation of the South African National Accreditation System (SANAS) seeks to address this challenge through the South African National Standard (SANS) 1544, which is the basis for the issuance of certificates for compliant buildings. The Research utilized four (office blocks) public case studies of refurbished projects in Johannesburg to understand the level of appreciation and understanding of the legislative prescriptions. Contractual documents were perused through and interviews were held with client representatives and thematic analysis revealed two main observations. The private sector clients are mostly environmentally conscious as this is considered to be an image issue whereas with the government officials there was a very reasonable percolation of the ideals of SANAS. It was observed that despite the noble aspirations by the government a structured approach is needed to bring about the necessary buy-in from all sectors and that there should be a proper implementation of the necessary punitive measures.

[1]nthatisi.khatleli@wits.ac.za
[2]nkhatleli@yahoo.co.uk

Khatleli, N. and Govender, S. (2018) Identifying the Relevant Compliance Considerations Related to the Refurbishment of Existing Buildings in South Africa *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 921-933.

EMOTIVE ARCHITECTURE – SENSORY DESIGN EVALUATION OF SCHOOLS

Phil Grant[1], John Littlewood[2] and Rob Pepperell[3]

[1]Stride Treglown Architects Wales, Dowlais Road, Cardiff, CF24 5LQ, UK.
[2]The Sustainable and Resilient Built Environment (SuRBe) group, Cardiff School of Art & Design, Cardiff Metropolitan University, Cardiff, CF5 2YB, UK.
[3]Fovography, Cardiff School of Art & Design, Cardiff Metropolitan University, Cardiff, CF5 2YB, UK.

Keywords: Post Occupancy Evaluation; Architecture; Human senses: sight, smell, touch, hearing, equilibrium, Intuition; Schools.

Abstract

Post Occupancy Evaluation (POE) is an established process for assessing the thermal performance of buildings already constructed and in use. It could be argued that POE tends to focus predominantly on assessing whether a combination of building fabric and the mechanical and passive systems meet design aspirations for minimising occupant or user energy use for heating and cooling, and maximising thermal comfort and indoor air quality. Yet, POE rarely assesses the sensory experiences of the building users and their perceptions of how well a space works for its intended function. It is also rare to find a POE approach that gives equal weight to the technical performance of buildings and the satisfaction of inhabitants and their aesthetic experience of the architecture (Tweed, 2017). POE for Architects needs to be a different approach that incorporates user sensory 'feelings' that are informed by sight, smell, hearing, touch, and taste. The first author of this paper is an Architect with 30+ years' experience, is award winning for his school design in Wales and works for Stride Treglown Architects in Cardiff. He is investigating the sensory experiences of buildings users in some of the schools that he has designed and that are in use. The data generated by this project will be used to enlighten his and their design of future school in Wales. Furthermore, this D.SBE project is timely since there are many new schools which are to be designed and constructed in Wales over the next ten years. Therefore, the Sensory POE approach developed during this work could enhance the services that Stride Treglown offers its clients, with a possible way in which clients can better understand their buildings in order that the users not only are more productive and happy, but also appreciate the architectural delight of a building and its spaces.

[2]jlittlewood@cardiffmet.ac.uk

Grant, P. Littlewood, J. and Pepperell, R. (2018) Emotive Architecture – Sensory Design Evaluation of Schools *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 934-940.

3D PRINTING IN CONSTRUCTION, HOW EFFICIENT CAN WE MAKE THE CONSTRUCTION PROCESS AND WHAT IMPACT DOES THIS HAVE ON ARCHITECTS/TECHNOLOGISTS?

Owen Rees[1] and Tahira Hamid [2]

Leeds Beckett University, School of the Built Environment and Engineering, Leeds, LS2 8AG, United Kingdom

Keywords: 3D Printing, Construction Materials, Sustainability, Efficiency

Abstract

3D printing was developing in 1995-2000 also known as Contour Crafting, which initially began as a ceramic extrusion and shaping method. These techniques could revolutionise the construction industry. Companies since then have been creating components of buildings using this process. This paper aims to address how the use of 3D Printing has been introduced into construction, and provide an insight into how efficient the latest technology can affect the construction process. This paper will also analyse the impact this has on architects at the forefront of design by being able to create complicated and intricate designs of which cannot be done with traditional construction and design methods. This new technology of 3D printing is an exciting prospect for all Architects and Contractors as it has the potential to become one of the leading technologies in the future due to its efficiency in producing innovative buildings and materials. This paper will use case studies from examples of where 3D printing in construction has been successful to cross examine and determine the efficiency and impacts of 3D printing on Architects/Technologists. The case studies will help provide different insights into the research of 3D printing in construction. The process of 3D printing has many potential advantages with faster construction periods, much lower labour costs as 3D printing has the ability to remove many physical human tasks in the construction process which shows the efficiency of 3D printing in construction. Most importantly, it can provide an increased complexity and accuracy to the design process (J.B. Gardiner, 2011), all of which will be examined throughout this paper. 3D printing in construction refers to various technologies that use 3D printing as a core method to fabricate buildings or construction components (J.B. Gardiner, 2011), with this there is a variety of methods used at a construction scale. Through looking into the various projects of 3D Printing, involving concrete geo-polymers and additive welding through the use of case studies, this paper aims to analyse the efficiency of 3D printing and its direct effect on construction methods, including its drawbacks.

[1]owen.rees1@hotmail.co.uk
[2]t.hamid@leedsbeckett.ac.uk

Rees, O. and Hamid, T. (2018) 3D printing in construction, how efficient can we make the construction process and what impact does this have on architects/technologists? *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 941-952.

General Track

TOWARDS A FRAMEWORK TO SUPPORT FLOOD RISK ADAPTATION MEASURES FOR VULNERABLE COMMUNITIES

Timothy Berry[1], Jessica Lamond, Colin Booth

University of the West of England, Coldharbour Lane, BRISTOL, BS16 1QY, United Kingdom

Keywords: Flood Insurance, Community Resilience, Flood Risk Management.

Abstract

The UK Government's strategy Making Space for Water (2005) heralded a change in approach towards flood risk management (FRM). Since then there have been major improvements in aspects of FRM, such as forecasting and the dissemination of information related to flood risk. Similarly, flood insurance, another facet of FRM, has changed. Flood Re, a scheme that laudably provides affordable flood risk insurance for low-income home-owners, excludes provision of insurance to those in the rental sector (private and social). Those in the rental sector have either little or no access to help and assistance if their home is flooded. In 201516, 4.5 million households were renting. A significant proportion of those households are found in vulnerable communities located in areas of high risk of flooding. This paper introduces new research to examine how tenure effects access to FRM and develop a framework that can be used by policy makers at national and local level to determine, and then support delivery of, FRM measures that are most appropriate to a community. The solution driven nature of this research has led to the adoption of pragmatism as the research paradigm and is likely to follow a multi-method/mixed method approach. The outcome of this research could help organisations and agencies responsible for provision of elements of FRM ensure fairer access to insurance and greater opportunity for involvement with FRM at local level. Building greater community resilience and hence greater sustainability.

[1]timothy2.berry@live.uwe.ac.uk

Berry, T., Lamond, J. and Booth, C. (2018) Towards a framework to support flood risk adaptation measures for vulnerable communities *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 954-962.

PERCEPTIONS OF TELETUBBYLAND: PUBLIC OPINIONS OF SUDS DEVICES INSTALLED AT ECO-DESIGNED MOTORWAY SERVICE AREAS

Mark Gazzard and Colin A. Booth[1]

Centre for Architecture and Built Environment Research (CABER), Faculty of Environment and Technology, University of the West of England (UWE), Coldharbour Lane, Bristol BS16 1QY, UK

Keywords: BREEAM, Drainage, Runoff, and Natural landscapes.

Abstract

Sustainable buildings, sustainable businesses and sustainable behaviours are befitting of modern society. Combining these ideals has been realised in the UK's greenest motorway service areas (in Gloucestershire) where public perceptions towards the installation of sustainable drainage devices has been studied. Whilst the planning of sustainable drainage systems has gathered momentum (since the late 1990s), it is readily acknowledged that there is a deficit of community awareness and knowledge of the purpose, function and wider potential benefits derived from devices used to manage and minimise surface water. Until there is a comprehensive shift away from the traditional approach of underground piped drainage, blue-green infrastructure will remain a relatively unknown entity for the populace and a concomitant shortfall in demand will be encountered. Therefore, public opinions of the motorway service area eco-designed amenity buildings (green roofs) and their surrounding landscapes (swales and ponds) were sought through questionnaire surveys (n = 86) completed by visitors to both the southbound and northbound M5 Gloucester motorway service areas. Results reveal the public share unanimous support for the eco-design sustainable buildings (designed to achieve BREEAM Excellent), and an overwhelming enthusiasm for the aesthetic landscaping of the sites. However, it was clearly evident that visitors were not forming a link between the appearance of the motorway service area features and their associated role in contributing to the sustainable surface water management of the sites, despite the architect's design intention for the landscape to be readily understood. It is concluded that a shift from 'grey infrastructure' will require the involvement of all stakeholders and changing public perceptions of 'blue-green infrastructure' will remain an obstacle until awareness of its value is far-reaching and celebrated beyond the confinements of architectural drawings and planning applications.

[1]colin.booth@uwe.ac.uk

Gazzard, M. and Booth, C. A. (2018) Perceptions of Teletubbyland: Public Opinions of SuDS Devices Installed at Eco-designed Motorway Service Areas *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 963-974.

THE DEVELOPMENT AND APPLICATION OF AN INNOVATIVE RAPID ASSESSMENT TOOL FOR FLUVIAL-FLOOD VULNERABILITY ANALYSIS

Chris House and Parneet Paul

[1]School of Architecture, Built and Natural Environments, Faculty of Architecture, Computing & Engineering, University of Wales Trinity Saint David, Mount Pleasant Campus, Swansea SA1 6ED, Wales, United Kingdom
[2]School of Built Environment and Engineering, Leeds Beckett University, Northern Terrace Building, Queens Square Court, Leeds, West Yorkshire LS2 8AJ, United Kingdom

Keywords: Climate change, Socio-economic, Sustainability, Flood risk assessment

Abstract

Demographic transition has resulted in encroachment and change in land use for some areas prone to flooding. Furthermore, climate change and associated flooding have meant an increased demand for improved flood impact assessment and its understanding so that socioeconomic and environmental impacts are mitigated. This paper proposes and evaluates the application of a novel Localised Rapid Flood Vulnerability Index (LRFVI) as applied to a specific locale in Somerset, UK. The final vulnerability assessment for this case study location ranged from 7 to 21 and was banded under 5 categories: very low/low/medium/high or very high. Analysis demonstrated that the flood vulnerability was unique to an individual location, despite the flood risk being considered the same for identical adjacent properties. Interpretation of these findings provided an increased understanding of the interaction between the socioeconomic and natural environmental requirements and overall flood vulnerability at a localised level. This research also demonstrated the need for a rapid and cost effective flood vulnerability assessment tool at the localised scale. Further application of this indexing tool to a broader geographical level is advocated since it has an adaptable structure and is ideally suited to account for GIS modelling outputs.

[1]p.paul@leedsbeckett.ac.uk

House, C. and Parneet, P. (2018) The development and application of an innovative rapid assessment tool for fluvial-flood vulnerability analysis *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 975-993.

DRIVING EFFICIENT INFORMATION MANAGEMENT THROUGHOUT THE WHOLE LIFE CYCLE OF CONSTRUCTION PROJECTS: TIER 1 CONTRACTOR'S CONTRIBUTION TO REAL VALUE CHALLENGE TO SUSTAINABLE DECONSTRUCTION PROCESSES.

Thomas Nhachi[1] and Richard O'connor[2]

[1]Kier Construction, Central House, Sabre Close, Gloucester GL2 4NZ
[2]Tbi Limited, Reaves Green Barn, Coventry CV7 7DD

Keywords: Building information modelling, sustainable deconstruction, asset information model, whole life value

Abstract

Recent developments in information management in the UK construction industry have promoted effective project team collaboration. Whilst the 1192 standards introduced by the UK central government for Building Information Modelling, BIM Level 2 adoption directly address information management during the design, construction and operation phases, no similar standard has been produced to deal with information management at end of life processes. Absence of a standard to regulate information management at demolition and asset disposal phase implies that the whole life value sustainability loop using the above 1192 standards cannot yet be appropriately closed. This paper argues that BIM should not end at the maintenance phase, but should be extended to the demolition stage to promote sustainable deconstruction processes. Using quantitative structured questionnaires and in-depth interviews, findings gathered from key project members of a tier 1 contractor on 3 education projects in the UK, commissioned to BIM Level 2 requirements, this research established how current site processes lack a systematic way of data capture and information management aimed specifically to support sustainable deconstruction. Furthermore, the research concludes that only through standardised and regulated site installation approaches can the retrieval and repurposing of the BIM Construction Operations Building information exchange, COBie data in the Asset Information Models, AIMs, be extended for appraising the value of physical asset components for reuse at feasibility stages of future projects. This preliminary research provides the basis from which to further develop the BIM 1192 standard to guide a sustainable deconstruction process.

[2]rich@transformbusiness.co.uk

Nhachi, T. and O'connor, R. (2018) Driving efficient information management throughout the whole life cycle of construction projects: tier 1 contractor's contribution to real value challenge to sustainable deconstruction processes *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 994-1007.

A WASTEWATER TREATMENT MODELLING STUDY - COMPARING A STANDARD STATIC MBR FOULING MODEL WITH AN INNOVATIVE ROTATIONAL MBR MODEL WITH THE ROTATIONAL FUNCTION SWITCHED OFF

Franck Anderson Jones[1] and Parneet Paul[2]

[1] Department of Mechanical, Aerospace, and Civil Engineering, College of Engineering, Design and Physical Sciences, Brunel University, Uxbridge, Middlesex, UB8 3PH, United Kingdom
[2] School of Built Environment and Engineering, Leeds Beckett University, Northern Terrace, Queen Square Court, Leeds, LS2 8AJ, United Kingdom

Keywords: membrane bioreactor (MBR); wastewater; rotating membranes; Static Membranes

Abstract

Fouling by activated sludge in membrane bioreactor (MBR) processes for wastewater treatment can be limited using several strategies. Some proprietary MBR systems use novel rotating, flat sheet membranes to assist in fouling limitation. In previous work, an attempt was made to model this rotating fouling process by developing a simulation model based on traditional fouling mechanisms. In order to directly compare the potential benefits of rotational MBR systems, a follow-up study was carried out using the Avanti RPU-185 Flexidisks newly developed static (non-rotating) MBR system. This new process uses the same proprietary membrane arrangement as used in the rotational unit. However, it is configured instead as a static square-shaped unit, in-line with the more traditional submerged flat sheet MBR systems. During this study, the results from operating the static pilot unit were simulated and modelled using a standard fouling model coupled with a viscosity to mixed liquor relationship model. These results were then compared with those obtained from running the rotating MBR model however with rotational switching functions turned off and rotational parameters set to a static mode. This was carried out to determine whether the basic premise of the developed rotational model was empirically sound when compared to a standard MBR flux model. Relatively good agreement was reached between the two types of models, thus vindicating the usage of the rotational MBR model.

p.paul@leedsbeckett.ac.uk

Jones, F. A. and Paul, P. (2018) A wastewater treatment modelling study - Comparing a standard static MBR fouling model with an innovative rotational MBR model with the rotational function switched off *In:* Scott, L. and Gorse, C. (Eds.) *Procs 4th Annual SEEDS Conference*, 6-7 September 2018, Dublin, Ireland, 1008-1022.

A big thank you to our sponsors

Thank you for attending the Fourth International Sustainable Ecological Engineering Design for Society (SEEDS) Conference held on the 6th and 7th September 2018 at the Dublin Institute of Technology Grangegorman campus Dublin. Your participation and involvement has been greatly appreciated and we sincerely hope you had a wonderful Conference. We look forward to meeting you in 2019!!

lsi@beckett.ac.uk
01138126513
www.leedsbeckett.ac.uk/lsi

LEEDS BECKETT UNIVERSITY

Leeds Sustainability Institute

To find out more about
Leeds Sustainability Institute

Tel: +44 (0)113 812 6513

Email: lsi@leedsbeckett.ac.uk