



Association of Researchers in Construction Management

THIRTIETH ANNUAL CONFERENCE

2014

September 1-3

Portsmouth

Programme and Abstracts



CIOB

THE CHARTERED INSTITUTE OF BUILDING

ICSC15



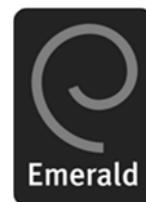
**WILEY-
BLACKWELL**



Taylor & Francis
Taylor & Francis Group



RICS



Emerald

ARCOM 2014 – programme overview

Day 1: Monday 1st Sept

11:00	Registration			
12:00	Lunch			
12:40	Welcome: Graham Galbraith, Vice-Chancellor, Univ of Portsmouth			
13:00	Keynote 1: Tim Broyd			
14:00	Session 1a	Session 1b	Session 1c	Session 1d
15:00	Coffee & Tea Break			
15:30	Session 2a	Session 2b	Session 2c	Session 2d
16:30	Session 3a	Session 3b	Session 3c	Session 3d
17:30	Break: Check in at Hotels			
19:00	Social Reception: Spinnaker Tower			

Day 2: Tuesday 2nd Sept

8:30	Late registration			
9:00	Session 4a	Session 4b	Session 4c	Session 4d
10:15	Coffee & Tea Break			
10:45	Session 5a	Session 5b	Session 5c	Session 5d
12:00	Keynote 2: Libby Schweber			
12:50	Lunch			
13:45	Debate			
15:00	Coffee & Tea Break			
15:30	Session 6a	Session 6b	Session 6c	Session 6d
16:45	ARCOM Annual General Meeting			
17:30	Break			
18:30	Reception and Conference Dinner: Historic Dockyard			

Day 3: Wednesday 3rd Sept

8:30	Late registration			
9:00	Langford Lecture: Martin Löwstedt			
9:45	Coffee & Tea Break			
10:15	Session 7a	Session 7b	Session 7c	Session 7d
11:30	Session 8a	Session 8b	Session 8c	Session 8d
12:45	Closing comments and ARCOM 2015 Conference			
13:00	Lunch			
13:30 to 17:00	ARCOM-CIOB Joint Workshop			

MONDAY 1st SEPTEMBER

From 11.00		REGISTRATION			Richmond Building, Ground Floor Foyer
12:00	12:40	LUNCH			Ground Floor Foyer
12:40	13:00	Welcome	Graham Galbraith, Vice-Chancellor, University of Portsmouth		Lecture Theatre 1, Ground Floor
13:00	14:00	Keynote	Tim Broyd, University College London		Lecture Theatre 1, Ground Floor
<i>Session 1:</i>		1a: Room 2.01, Floor 2	1b: Room 2.02, Floor 2	1c: Room 2.05, Floor 2	1d: Lecture Theatre 2, Gr Fl
14:00	15:00	Sustainability in the built environment	Design	Research method	Human behaviour & culture
		<i>Chair: Chris Gorse</i>	<i>Chair: Poorang Piroozfar</i>	<i>Chair: Chris Harty</i>	<i>Chair: David Boyd</i>
<i>4 papers</i>		<p>Sustainable Construction: Exploring the Capabilities of Nigerian Construction Firms - <i>Afolabi</i></p> <p>Benefits and limitations of social practice theory to evaluate practices in sustainable office buildings: Preliminary findings - <i>King, Colin, Lamond & Williams</i></p> <p>Investigating the level of awareness of building assessment tools in the construction industry of Botswana - <i>Ntshwene, Adu Essah & Dixon</i></p> <p>Identifying project success criteria for uk social housing asset management schemes - <i>Higham & Stephenson</i></p>	<p>Designers' perspectives on the use of immersive virtual reality technology in practice - <i>Maftei & Harty</i></p> <p>The use of evidence based design in NHS construction - <i>Joanne Hardwicke & King</i></p> <p>From pedagogical ideas to a school building: analysis of user involvement in building design - <i>Lallimo</i></p> <p>A decision support framework for HCAI risk assessment and design briefing of healthcare facilities - <i>Al-Bizri & Gray</i></p>	<p>Exploring the field of public construction clients by a graphical network analysis - <i>Eisma & Volker</i></p> <p>Using the Literature Based Discovery Research Method In A Context Of Built Environment Research - <i>Kibwami & Tutesigensi</i></p> <p>Stakeholder Engagement in Research: The case of Retrofit 2050 Research Project - <i>Opoku, Cruickshank, Guthrie & Maria Georgiadou</i></p> <p>Taking off my glasses in order to see: Exploring practice on a building site using self-reflexive ethnography - <i>Löwstedt.</i></p>	<p>A Spanish Subcontractor in a UK Culture - <i>Oswald, Sherratt & Smith</i></p> <p>Malaysian Construction Professionals: Why Are They Leaving? - <i>Ishak, Rashid & Abdul Aziz</i></p> <p>The outcomes of cross-cultural adjustment: a case of british expatriates working on international architectural, engineering and construction assignments - <i>Kononahalli, Lukumon, Spillane & Marinelli</i></p> <p>Determinants of Successful International Expansion of Construction Contracting Firms: A Case Study of Pakistani Firms - <i>Maqsoom & Charoengnam</i></p>

MONDAY 1st SEPTEMBER

15:00	15:30	COFFEE / TEA				Ground Floor Foyer
<i>Session 2:</i>		2a: Room 2.01, Floor 2	2b: Room 2.02, Floor 2	2c: Room 2.05, Floor 2	2d: Lecture Theatre 2, Gr Fl	
15:30	16:30	Sustainability in the built environment <i>Chair: Colin Booth</i>	Health and safety and well-being <i>Chair: Andrew Dainty</i>	Procurement <i>Chair: Andrew King</i>	CIB W113 Law and Dispute Resolution <i>Chair: Tinus Marthinus</i>	
<i>4 papers</i>		<p>Application of sustainability principles in post-disaster reconstruction - <i>MacAskill & Guthrie</i></p> <p>Mathematical Modelling Of Embodied Carbon Emissions Of Building Projects - <i>Kibwami & Tutesigensi</i></p> <p>Towards a life cycle framework for bridge management systems in the UK: Insights from a critical review of international approaches and models - <i>Balogun, Booth, Lamond & Tomor</i></p> <p>The Importance and Implementation Of Sustainability Factors In Malaysian Railway Projects - <i>Amiril, Nawawi, Takim & Latif</i></p>	<p>Safety and Volunteer Construction Workers - <i>Crapper, Foster-Smith, Walsh & Sherratt</i></p> <p>Construction Workers' Views on Workplace Design and 'Healthy' Ageing - <i>Eaves, Gyi & Gibb</i></p> <p>Exploring the internal dimensions of work stress: Evidence from construction cost estimators in China - <i>Xiong, Skitmore & Xia</i></p> <p>Workplace stress in the construction industry: an explanatory model - <i>Bowen, Govender, Edwards & Cattell</i></p>	<p>Assessing qualification systems: the relevance of explicating implicit reasoning - <i>Plantinga, Voordijk & Doree</i></p> <p>The changing role of the public client in construction procurement - <i>Ali, Soetanto & Edum-Fotwe</i></p> <p>Governance structures in collaborative working practices - <i>Kwawu & Laryea</i></p> <p>Stakeholder management in public private partnership projects in Nigeria: towards a research agenda - <i>Amadi, Carrillo & Tuuli</i></p>	<p>Reasons for contractors' delay claims failures in Sri Lanka - <i>Ramachandra, Rotimi & Gunaratne</i></p> <p>Isn't All Loss Consequential? A review of recent case law and its relevance to contractual practices within the Built Environment - <i>Mason & Connell</i></p> <p>Planning law reform and fast-tracking development in Australia - <i>Williams & Williams</i></p> <p>Legal Risk Identification for SMEs in the Construction Industry - <i>Charlson & Oduoza</i></p>	

MONDAY 1st SEPTEMBER

<i>Session 3</i>		3a: Room 2.01, Floor 2	3b: Room 2.02, Floor 2	3c: Room 2.05, Floor 2	3d: Lecture Theatre 2, Gr Fl
16:30	17:30	BIM <i>Chair: Patrick Manu</i>	Cost <i>Chair: Steve Donohoe</i>	Procurement <i>Chair: Andrew King</i>	Project Management <i>Chair: Fred Sherratt</i>
<i>4 papers</i>		Interactive learning in UK construction practice: examining the role of BIM process standards - <i>Maradza, Whyte & Larsen</i>	Exploring escalation of commitment in construction project management: Case study of the Scottish Parliament project - <i>Ahiaga-Dagbui & Smith</i>	A Comparative Analysis of the Desired and Actual Bidding Behaviour of Construction Companies - <i>Arai & Morimoto</i>	Conceptualising Organisational Resilience: An investigation into Project Organising - <i>Oppong Banahene, Anvuur & Dainty</i>
		An Appraisal of the Protocol That Was Published by the Construction Industry Council (CIC) to Facilitate the Use of Building Information Modelling (BIM) on Projects - <i>Al-Shammari</i>	Optimism bias, pathogens and cost overrun: the case of an RTS project in South Africa - <i>Emuze & Ravu</i>	Assessing The Practice of Project Based JVs between Local and International Contractors in The UAE - <i>Oweineh & Skaik</i>	The translation of power: a study of boundary objects in public engagement processes - <i>Chow & Leiringer</i>
		A proposed BIM business value model - <i>Vass</i>	An assessment of critical success factors for the reduction of the cost of poor quality from construction projects in south africa - <i>Aigbavboa & Thwala</i>	International collaboration and partnering in the supply chain as business opportunities for architectural firms - <i>Bos-de Vos, Liefink, Volker & Wamelink</i>	Recasting coordination: a theoretical review in the context of design-build project organisations - <i>Urup & Koch</i>
		Perceptions of the value and viability of implementing lean construction with business information modelling - <i>Marsh, Bryde & Graham</i>	Barriers to life cycle costing usage – <i>Olufolahan, Okoroh & Angela</i>	Experiences of trust in construction project management: the influence of procurement mechanisms - <i>Strahorn, Brewer & Gajendran</i>	Allocating Project Managers to Projects in a Multi-project Environment - <i>Seboni & Tutesigensi</i>
17:30	18.30	<i>Break: Check in Hotels</i>			
18:30	19:00	Social Reception: Spinnaker Tower			

Presentations: 10 minutes; Q&A: 5 minutes

TUESDAY 2nd SEPTEMBER

08:30	09:00	Late registration				Richmond Building, Ground Floor Foyer
Session 4		4a: Room 2.01, Floor 2	4b: Room 2.02, Floor 2	4c: Room 2.05, Floor 2	4d: Lecture Theatre 2, Gr Fl	
9:00	10:15	Sustainability in the built environment <i>Chair: Robby Soetanto</i>	Innovation and information management <i>Chair: Andrew Dainty</i>	Supply chain management <i>Chair: Scott Fernie</i>	CIB W113 Law and Dispute Resolution <i>Chair: Andrew Agapiou</i>	
<i>5 papers</i>		Reverse logistics (RL) implementation among contractors in Australia: Practices and barriers - <i>Chileshe, Rameezdeen, Hosseini & Lehmann</i> Stakeholder-associated risk networks in green buildings: China versus Australia - <i>Yang, Zou & Wang</i> Examining the Barriers to Successful Onsite Construction Environmental Management Operations - <i>Maund, Brewer & Gajendran</i> Material Waste in the Northern Ireland Construction Industry: On-Site Management Causes and Methods of Prevention - <i>Marinelli, Dolan, Spillane & Konanahalli</i> Overcoming the barriers of green innovation in construction projects through its successful management - <i>Coates, Monahan & Clarke-Hagan</i>	Is anybody home? The role of company website for small building contractors in Sweden - <i>Buser & Carlsson</i> Initial use of an idea capture app in a UK construction organisation - <i>Davies & Harty</i> Diffusion of digital innovation in a project-based firm; a case study of a UK engineering firm - <i>Shibeika</i> Overcoming barriers to innovation: Demonstrating an argument in favour of communication arenas - <i>Susanne Engström</i> Delivering school buildings using off- site construction: Stakeholders perceptions - <i>Boothman, Higham & Scott</i>	A conceptual model for improving construction supply chain performance - <i>Dike & Kapogiannis</i> Partnering Practices: An Investigation of Influences on Project Success - <i>Challender, Sherratt & Farrell</i> The Impact of Supplier Development Initiatives on Key Performance Indicators - <i>Gosling, Naim, Towill & Moone</i> An improvement strategy for the defects and rework management process within an SME: An Action Research approach - <i>Taggart, Koskela, & Rooke</i> Identifying and Positioning Construction Supply Chain Planning Problems - <i>Thunberg, Rudberg & Karrbom Gustavsson</i>	Standard form construction contracts; why the need for regular changes? - <i>Maritz & Putlitz</i> A study of the management of time by comparing and evaluating the provisions for the management of time in the JCT standard building contract (JCT SBC), the new engineering and construction contract (NEC3) and the new complex projects contract 2013 (CPC2013) - <i>McLernon</i> Are Australian Standard Forms of Construction Contract Capable of Dealing with the Issue of Extensions of Time Efficiently and Effectively? - <i>Ward & Jefferies</i> Alliance contracting: enforceability of the ConsensusDocs 300 mutual waiver of liability in US courts - <i>Starzyk</i> Motivation agenda for social empowerment and respect for people during the drafting of construction contracts - <i>Crowe</i>	

TUESDAY 2nd SEPTEMBER

10:15	10:45	Tea & Coffee				Ground Floor Foyer
<i>Session 5</i>		5a: Room 2.01, Floor 2	5b: Room 2.02, Floor 2	5c: Room 2.05, Floor 2	5d: Lecture Theatre 2, Gr Fl	
10:45	12:00	Policy research <i>Chair: Paul Chan</i>	Health and safety and well-being <i>Chair: Simon Smith</i>	House building <i>Chair: Shu-Ling Lu</i>	Project management <i>Chair: Apollo Tutesigensi</i>	
<i>5 papers</i>		Construction policy research: beware reason masquerading as truth - <i>Smiley, Fernie & Dainty</i>	We will force you to be well: positive liberty, power and the health and wellbeing of construction workers - <i>Sherratt</i>	Exploring industrialised house-builders' perceptions of local requirement setting - an institutional logics perspective - <i>Viking & Lidelöw</i>	Communication risk and trust in construction projects: a framework for interdisciplinary research – <i>Ceric</i>	
		The Myth of Best Practice Through the Lens of Construction Supply Chain Management - <i>Tennant, Fernie & Murray</i>	Cartoons on Occupational Health and Safety: Semiotic Analysis of Workers - <i>Ulubeyli, Arslan & Kivrak</i>	A synergistic supply chain enhancing offsite manufacturing uptake in australian house building - <i>Mostafa, Chileshe & Zuo</i>	Social Network Analysis on the Inter-Organizational Interactions in Green Building Projects - <i>Venkataraman & Cheng</i>	
		Government influence on the construction industry during the economic recession 2007-2013 - <i>Tansey & Spillane</i>	Health and Safety Practices on Christchurch's Post-earthquake Rebuild Projects: How relevant is Heinrich's Safety Pyramid? - <i>Kestle & Seward</i>	Placing Defects at the Heart of High Quality New Homes: the Learning Perspective - <i>Hopkin, Lu, Sexton & Rogers</i>	Getting to heart of community action against construction projects - <i>Teo & Loosemore</i>	
		Gender equity in construction professions: a new institutionalist perspective - <i>Galea, Loosemore, Powell & Chappell</i>	Validation of Safety Equilibrium Model on High-Rise Building Construction Project in Thailand - <i>Sooksil & Benjaoran</i>	Shall we dance? Encounters for energy renovation of single family houses - <i>Carlsson & Koch</i>	Working together in a knot: the simultaneity and pulsation of collaboration in an early phase of building design - <i>Korpela & Kerosuo</i>	
		A Critical Review of the Literature on Disability Management in the Construction Industry - <i>Quaigrain, Winter & Issa</i>	Understanding the role of local safety groups in managing safety practices between micro construction firms and principal contractors - <i>Aboagye-Nimo, Raiden & King</i>	House Buyers and Builders: The "Ideal" Home in Scotland - <i>Callaghan, Craig & Sommerville</i>	Role conflict in project team dynamics - <i>Kabiri, Hughes & Schweber</i>	
12:00	12:50	Keynote	Libby Schweber, University of Reading		Lecture Theatre 1, Ground Floor	

Presentations: 10 minutes; Q&A: 5 minutes

TUESDAY 2nd SEPTEMBER

12:50	13:45	Lunch				Ground Floor Foyer
13:45	15:00	Debate: 'Do we need to have a method in order for us to be or become a community?'				Lecture Theatre 1, Ground Floor
15:00	15:30	Tea & Coffee				Ground Floor Foyer
<i>Session 6</i>		6a: Room 2.01, Floor 2	6b: Room 2.02, Floor 2	6c: Room 2.05, Floor 2	6d: Lecture Theatre 2, Gr Fl	
15:30	16:45	Sustainability in the built environment <i>Chair: Shu-Ling Lu</i>	Learning and education <i>Chair: Ani Raiden</i>	Information management <i>Chair: Charles Egbu</i>	Project management <i>Chair: Emmanuel Aboagye-Nimo</i>	
<i>5 papers</i>		A Protocol for Evaluating School Buildings' Energy Consumption - <i>Ouf, Issa & Mallory-Hill</i>	Promoting double loop learning in flood risk management within the scottish context - <i>Thomson, Mickovski & Orr</i>	Conceptualising actors' information behaviour: an investigation into project information dynamics - <i>Dzokoto, Edum-Fotwe & Demian</i>	Moving Beyond Project Complexity: Exploring Empirical Dimensions of Complexity in the Construction Industry - <i>Wood, Piroozfar & Farr</i>	
		Renewable Energy Technology means of providing Sustainable Electricity in Nigeria- A Review - <i>Garba & Kishk</i>	Wind Turbine Rescue: Emerging Skill Retention Issues and Challenges - <i>Lawani, Hare & Cameron</i>	Using actor-network theory to understand knowledge sharing in an architecture firm- <i>Adam, Gluch, Julin</i>	A Detailed Analysis of Existing Project Success Factors - <i>Ghaffari</i>	
		Perspectives on the Specification of Building Integrated Photovoltaic (Bipv) Technology in Construction Projects - <i>Boyd, Larsen & Schweber</i>	Motivation of undergraduate Civil Engineering students for higher levels of academic success - <i>Martin, Sorhaindo & Welch</i>	Tacit and Explicit Knowledge in Construction Management - <i>Addis</i>	Servitization in construction: towards a focus on transitional routines - <i>Robinson & Chan</i>	
		Establishing abatement options for construction operations - <i>Ebrahiminejad, Shakeri & Ardeshir</i>	Building economics pre-course student perceptions - <i>Smallwood & Dent</i>	Risk management and uncertainty in hospital construction projects - what role(s) for knowledge and construction management? - <i>Tryggestad, Harty & Themsen</i>	Alternative Project Delivery Systems for Transport Infrastructure in Germany - <i>Habib & Spang</i>	
				An illustration of the development of a strategy for evaluating the design of hospitals within a practice order network- <i>O'Keeffe, Thomson, Dainty</i>	Task characteristics, coordination mode and design coordination performance, an information processing perspective - <i>Zhang</i>	
16:45	17:30	ARCOM AGM				Lecture Theatre 1, Ground Floor
17:30	18:30	Break				
18:30	21:35	Reception and Conference Dinner				Historic Dockyard

WEDNESDAY 3rd SEPTEMBER

08:30	09:00	Late Registration	Richmond Building, Ground Floor Foyer		
09:00	09:45	Langford Lecture	Martin Löwstedt		Lecture Theatre 1, Ground Floor
09:45	10:15	COFFEE / TEA	Ground Floor Foyer		
<i>Session 7</i>		7a: Room 2.01, Floor 2	7b: Room 2.02, Floor 2	7c: Room 2.05, Floor 2	7d: Lecture Theatre 2, Gr Fl
10:15	11:30	BIM <i>Chair: Patrick Manu</i>	Strategic issues for the industry <i>Chair: Simon Smith</i>	Planning, productivity and quality <i>Chair: Chris Gorse</i>	Project management <i>Chair: Charles Egbu</i>
<i>5 papers</i>		<p>The wider implementation issues of BIM within a multifaceted construction company - <i>Dowsett & Harty</i></p> <p>Construction site BIM requirements - <i>Cassano, Trani & Todaro</i></p> <p>The implementation and use of 4d BIM and virtual construction - <i>Gledson & Greenwood</i></p> <p>Perceiving space from multiple perspectives for buildings using BIM - <i>Mayouf, Boyd & Cox</i></p> <p>BIM's impact on the project manager - <i>Xiao & Noble</i></p>	<p>Changing Paradigms in Construction Competitiveness Research - <i>Duman & Giritli</i></p> <p>A conceptual framework for achieving firm competitiveness in construction: A 'creating shared value' (CSV) concept - <i>Awale & Rowlinson</i></p> <p>Boundary making in public private partnership: An historical account in British railway industry - <i>Jintamanaskoon & Chan</i></p> <p>A public commissioning maturity model for construction clients - <i>Hermans, Volker & Eisma</i></p> <p>Exploring the management of multiple business models in one company - <i>Hook & Stehn</i></p>	<p>Re-balancing the construction productivity debate - <i>Loosemore</i></p> <p>Enhancing Labour Productivity Within Construction Industry through Analytical Hierarchy Process, The Case Of Gaza Strip - <i>Hamouda & Abu-Shaaban</i></p> <p>Modelling masonry labour productivity using multiple regression - <i>Thomas & Sudhakumar</i></p> <p>Social perspective of planning in construction: The UK experience - <i>Itodo Daniel, Pasquire & Dickens</i></p> <p>Solid wall insulation retrofit in UK dwellings: Critical factors affecting management and quality - <i>Forman & Tweed</i></p>	<p>Incorporation of different and changing client interests in the course of a project - <i>Kurokawa, Schweber & Hughes</i></p> <p>Integrating External Stakeholder Identification and Project Initiation in Civil Engineering Infrastructure Projects - <i>Elmahroug, Tutesigensi & Brookes</i></p> <p>A study of the current practice of stakeholder management in construction projects - <i>Molwus, Erdogan & Ogunlana</i></p> <p>Refurbishment of higher education premises: stakeholder engagement in the process and product - <i>Painting, Piroozfar & Farr</i></p> <p>Organizational responses to institutional pressures in international infrastructure projects: A transnational pipeline project case study - <i>Wang & Lu</i></p>

Presentations: 10 minutes; Q&A: 5 minutes

WEDNESDAY 3rd SEPTEMBER

Session 8		8a: Room 2.01, Floor 2	8b: Room 2.02, Floor 2	8c: Room 2.05, Floor 2	8d: Lecture Theatre 2, Gr Fl
11:30	12:45	BIM <i>Chair: Poorang Piroozfar</i>	Education <i>Chair: Christine Räisänen</i>	Risk management <i>Chair: Dominic Ahiaga-Dagbui</i>	CIB W113 Law and Dispute Resolution <i>Chair: Paul Chynoweth</i>
5 papers		The role of BIM in preventing design errors - <i>Linderoth, Granath & Johansson</i>	Government institutions and infrastructure skills development - <i>Smith, Regan & Love</i>	Assessing risk dynamics in public private partnership projects - <i>Cheung, Loosemore & Chandra</i>	Is Expert Witness Immunity from Suit a thing of the past in Construction Law? - <i>Mann & Wong</i>
		Leveraging Collaboration through the Use of Building Information Models - <i>Cidik, Boyd & Thurairajah</i>	Construction management curricula in UK and Japan - <i>Mihara, Hughes, Kurokawa & Hojo</i>	Using Appropriate Tools and Techniques for Risk Identification in UK Construction's SMEs - <i>Rostami, Sommerville, Wong & Lee</i>	What does the duty of utmost good faith (uberrimae fidei) in insurance contract mean for the construction industry? - <i>Mann & Wong</i>
		Determinants of Building Information Modelling (BIM) Acceptance for Supplier Integration: A Conceptual Model - <i>Mahamadu, Mahdjoubi & Booth</i>	Changing Institutions of knowing Climate mitigation, craft competences and vocational training in Denmark - <i>Haldor Bertelsen & Koch</i>	Are we adding risk to our projects by mixing objective assessments of compound conjunctive and disjunctive project risks with intuitive approaches? - <i>Arthur & Pryke</i>	Construction Mediation in Scotland: an Investigation into Attitudes and Experiences of Mediation Practitioners - <i>Trushell, Clark & Agapiou</i>
		Challenges to building information modelling implementation in UK: Designers' perspectives - <i>Navendren, Manu, Shelbourn & Mahamadu</i>	The construction SMEs development debate in south africa: contributions from fet colleges - <i>Wentzel, Smallwood & Emuze</i>	Evaluating Risk Management in Independent Water and Power Plants (IWPP) Projects in Saudi Arabia - <i>Alsulaiman, Bowles & Ogunlana</i>	Construction Mediation in Scotland: A comparison of the views and experiences of Lawyers and End-Users - <i>Agapiou & Clark</i>
		Interactive visualisation of heat loss and gain for early-stage energy appraisal of the built environment - <i>Stojanovic, Falconer, Blackwood, Paterson, Fleming & Steff Bell</i>	Lessons learned from Building the Education Revolution (BER) Program by South Australian construction firms - <i>Chileshe & Yorston</i>	A Pilot-study Investigating the Assessment and Allocation of Risks in Public-Private Partnership Transportation Projects in Vietnam - <i>Nguyen, Lewis, Beer & Boussabaine</i>	The application of planning law for environmental protection and improvement in Nigeria - <i>Alloh</i>
12:45	13:00	Closing & ARCOM 2015			Lecture Theatre 1, Ground Floor
13:00	13:30	LUNCH			Ground Floor Foyer
13:30	17:00	CIOB-ARCOM workshop			

Presentations: 10 minutes; Q&A: 5 minutes

Foreword

Welcome to the 30th annual Association of Researchers in Construction Management (ARCOM) conference; an occasion to celebrate construction management research.

ARCOM has developed into a popular and professional research association; our conference is attracting ever increasing number of research students, lecturers, prolific researchers and practitioners internationally. This year our delegates come from 28 countries with diverse range of backgrounds, interests and expertise.

In these proceedings we present the rich variety of contributions to the conference. Project management, building information modelling and sustainability continue to draw a large number of submissions. Health and safety and wellbeing, and construction management education and learning also feature as important themes in the conference together with procurement and information management. Policy research emerges as a new area of interest. In addition to our construction management papers, ARCOM is pleased to host the CIB W113 Law and Dispute Resolution Working Commission as a specialist stream of the conference this year.

We present to you 146 papers that were accepted for publication. This is the result of an intense three-stage review process through which we have been able to maintain high quality standards. Our initial call led to an astonishing 457 abstracts and 235 full papers being submitted. The Scientific Committee have worked very hard to select the final papers for presentation. If your paper is included in these proceedings then you should feel very proud of your achievement!

In addition to the research papers we welcome to the conference Tim Broyd (University College London) and Libby Schweber (University of Reading), our keynote speakers, and Martin Löwstedt (Chalmers University of Technology) who will deliver the Langford Lecture. Tim Broyd and Libby Schweber will join Christine Räisänen (Chalmers University of Technology), Mark Addis (Birmingham City University) and Stuart Green (University of Reading) as panellists on our debate: 'Do we need to have a method in order for us to be or become a community of construction management researchers?' The 30th ARCOM conference is a timely opportunity for an academic debate; time for reflection on the nature of research in construction management and discussion whether a method is central to our development as a community of researchers.

Putting together the academic programme for the conference is a collective effort, and we thank the ARCOM committee and wider Scientific Committee for their voluntary contribution to making the conference such a success year after year. Paul Chan, Andrew Dainty, Chris Harty, Scott Fernie and Simon Smith in particular have been instrumental in supporting us throughout the planning and managing of the conference over the past eight months.

We wish you an enjoyable and inspiring three days in Portsmouth; enjoy the diversity of research presented at the conference and proceedings and make the most of the many networking events. We hope that you will engage in critical reflection and discussions during the conference and afterwards through our web resources and workshops, and thus support our ongoing aim to further the advancement of knowledge in all aspects of management in construction.

*Ani Raiden, ARCOM 2014 Conference Chair, and
Emmanuel Aboagye-Nimo, ARCOM 2014 Conference Secretary
Nottingham Trent University, UK*

ARCOM COMMITTEE 2009/10

Dr Simon Smith, University of Edinburgh, UK (Chair)
Dr Ani Raidén, Nottingham Trent University, UK (Vice-chair)
Professor Charles Egbu, University of Salford, UK (Immediate past chair)
Dr Chris Harty, University of Reading, UK (Treasurer)
Dr Paul Chan, University of Manchester, UK (Secretary)
Dr Shu-Ling Lu, University of Reading, UK (Membership secretary)
Dr Robby Soetanto, Loughborough University, UK (Newsletter editor)
Dr Fred Sherratt, University of Bolton, UK (Workshop convenor)
Dr Stephen Gruneberg, University of Westminster, UK (Director of International Liaison)
Professor Chris Gorse, Leeds Metropolitan University, UK (CIOB Liaison Officer)
Dr Colin Booth, University of the West of England, UK
Professor David Boyd, Birmingham City University, UK
Professor Andrew Dainty, Loughborough University, UK
Dr Steve Donohoe, University of Plymouth, UK
Dr Scott Fernie, Loughborough University, UK
Dr Rod Gameson, University of Salford, UK
Dr Poorang Piroozfar, University of Brighton, UK
Professor David Proverbs, University of the West of England, UK
Dr Victor Samwinga, Northumbria University, UK
Dr Apollo Tutesigensi, University of Leeds, UK
Dr Chika Udejaja, Northumbria University, UK

SCIENTIFIC COMMITTEE

Adebayo Oladapo	University of Central Lancashire
Alex Copping	University of Bath
Andre Doree	Univ Twente
Andrew King	Nottingham Trent University
Andrew Ross	Liverpool John Moores University
Anita Ceric	University of Zagreb
Anthony LAVERS	Keating Chambers, UK
Brian Sloan	Edinburgh Napier University
Christian Koch	Chalmers University of Technology
Christine Räsänen	Chalmers University of Technology
Craig Thomson	Glasgow Caledonian University
David Blackwood	University of Abertay Dundee
David Johnston	Leeds Metropolitan University
David Thorpe	University of Southern Queensland
Derek Thurnell	Unitec Institute of Technology
Dominic Ahiaga-Dagbui	University of Edinburgh
Doug Forbes	Dundee University Incubator
Dylan Tutt	University of Reading
Emmanuel Aboagye-Nimo	Nottingham Trent University
Eric Johansen	Northumbria University
Grant Wilson	Robert Gordon University
James Sommerville	Glasgow Caledonian University
John Connaughton	University of Reading
John Pointing	Kingston University
John Smallwood	Nelson Mandela Metropolitan University
Julian Sidoli del Ceno	Birmingham City University
Julie Adshead	University of Salford
Julie Cross	University of Salford
Kate Carter	University of Edinburgh
Kjell Tryggestad	Copenhagen Business School
Kristian Kreiner	Copenhagen Business School
Leentje Volker	Delft University of Technology
Luke Bennett	Sheffield Hallam University
Marthinus Maritz	University of Pretoria, South Africa
Martin Crapper	University of Edinburgh
Martin Loosemore	University of New South Wales
Martin Sexton	University of Reading
Michael Okoroh	University of Derby
Milan Radosavljevic	University of West Of Scotland
Motiar Rahman	University of Dundee
Nick Blismas	RMIT University
Patrick Manu	University of West of England
Paul Bowen	University of Cape Town

SCIENTIFIC COMMITTEE CONTINUED

Paul Chynoweth	University of Salford
Paul Chinowsky	University of Colorado
Paul Stephenson	Sheffield Hallam University
Peter Demian	Loughborough University
Peter Ward	University of Newcastle, Australia
Philip Davenport	University of New South Wales
Richard Davies	University of Reading
Richard Fellows	Loughborough University
Sam Wamuziri	Glyndwr University
Samuel Laryea	University of the Witwatersrand
Stefan Christoffer Gottlieb	Danish Building Research Institute
Steve Goodhew	University of Plymouth
Subashini Suresh	University of Wolverhampton
Sunny Nwaubani	Anglia Ruskin University
Tim McLernon	University of Ulster, UK
Valerie Caven	Nottingham Trent University
Wei Pan	The University of Hong Kong
Will Hughes	University of Reading

TABLE OF CONTENTS

SUSTAINABILITY IN THE BUILT ENVIRONMENT	1
Sustainable construction - Dania Afolabi, Graeme Larsen and Ian Ewart	2
Benefits and limitations of social practice theory to evaluate practices in sustainable office buildings - L.M. King, C.A. Booth and J.E. Lamond	3
Investigating the level of awareness of building assessment tools in the construction industry of Botswana - Keneilwe Ntshwene, Emmanuel Essah and Timothy Dixon	4
Identifying project success criteria for UK social housing asset management schemes - Anthony Higham and Paul Stephenson	5
Application of sustainability principles in post-disaster reconstruction - Kristen MacAskill and Peter Guthrie	6
Mathematical modelling of embodied carbon emissions of building projects - Nathan Kibwami and Apollo Tutesigensi	7
Towards a life cycle framework for bridge management systems in the UK - Teslim Bamidele Balogun	8
The importance and implementation of sustainability factors in Malaysian railway projects - Assa Amiril, A.H. Nawawi, R.Takim and S.N.F. Ab-Latif	9
Reverse logistics (RL) implementation among contractors in AUSTRALIA - Nicholas Chileshe, Raufdeen Rameezdeen, Steffen Lehmann and Mohammad reza Hosseini	10
Stakeholder-associated risk networks in green buildings - Rebecca J. Yang, Patrick X.W. Zou and Jiayuan Wang	11

Examining the barriers to successful onsite construction environmental management operations - Kim Maund, Thayaparan Gajendran and Graham Brewer	12
Material waste in the Northern Ireland construction industry - Marina Marinelli, Matthew Dolan, John Spillane and Ashwini Konanahalli	13
Overcoming the barriers of green innovation in construction projects through its successful management - J. Monahan, R. Coates and D. Clarke-Hagan	14
A protocol to evaluate school buildings' energy consumption - Ouf M.M., Issa M.H and Mallory-Hill, S.	15
Renewable energy technology means of providing sustainable electricity in Nigerian rural areas - Abdulkhakeem Garba and Mohammed Kishk	16
Perspectives on the specification of Building Integrated Photovoltaic (BIPV) technology in construction projects - Philippa Boyd, Graeme Larsen and Libby Schweber	17
Establishing abatement alternatives in construction - Meysam Ebrahimejad, Eghbal Shakeri and Abdollah Ardeshir	18
DESIGN.....	19
Designers' perspectives on the use of immersive virtual reality technology in practice - Laura Maftei and Chris Harty	21
The use of evidence based design in NHS construction - Joanne Hardwicke and Andrew King	22
From pedagogical ideas to a school building - Jiri Lallimo	23
A decision support framework for HCAI risk assessment and design briefing of healthcare facilities - Al-Bizri, S and Gray,	

C
24

RESEARCH METHOD 25

Exploring the field of public construction clients by a graphical network analysis

- Pieter Eisma and Leentje

Volker

27

Using the literature based discovery research method in a context of built

Environment research - Nathan Kibwami and Apollo

Tutesigensi

28

Stakeholder engagement in research - Alex Opoku, Heather Cruickshank, Peter

Guthrie and Maria Christina

Georgiadou

29

Taking off my glasses in order to see” - Martin

Löwstedt

30

HUMAN BEHAVIOUR AND CULTURE 31

A Spanish subcontractor in a UK culture - David Oswald, Simon Smith and Fred

Sherratt

33

Malaysian construction professionals - Norakmarwati Ishak and Abdul Rashid

Abdul

Aziz

34

The outcomes of cross-cultural adjustment - Konanahalli, A, Oyedele L O,

Spillane, J and Marinelli,

M

35

Determinants of successful international expansion of construction contracting

firms - Ahsen Maqsoom and Chotchai

Charoenngam

36

HEALTH AND SAFETY AND WELL-BEING 37

Safety and volunteer construction workers - Lydia Foster-Smith, Sinead Walsh,

Martin Crapper and Fred

Sherratt

39

Construction workers' views on workplace design and 'healthy' ageing - Eaves,

S.D., Gyi, D. and Gibb,

A.

40

Exploring the internal dimensions of work stress - Bo Xiong, Martin Skitmore and Bo Xia 41	
Workplace stress in the construction industry - Paul Bowen, Rajen Govender, Peter Edwards and Keith Cattell 42	
We will force you to be well - Fred Sherratt 43	
Cartoons on occupational health and safety - Serdar Ulubeyli, Volkan Arslan, and Serkan Kivrak 44	
Health and Safety practices on Christchurch's post-earthquake rebuild projects - Mark Seward and Linda Kestle 45	
Validation of construction safety equilibrium model on high-rise building construction project in Thailand - Nart Sooksil and Vacharapoom Benjaoran 46	
Understanding the role of local safety groups in managing safety practices between micro construction firms and principal contractors - Emmanuel Aboagye-Nimo, Ani Raiden and Andrew King 47	
PROCUREMENT	49
Assessing qualification systems - H.E.C. Plantinga, J.T. Voordijk and A.G. Dorée 51	
The changing role of the public client in construction procurement - Ali Alharthi, Robby Soetanto and Francis Edum- Fotwe 52	
Governance structures in collaborative working practices - Wisdom Kwawu and Samuel Laryea 53	
Stakeholder management in public private partnership projects in Nigeria - Chika Amadi, Patricia Carrillo and Martin Tuuli 54	

A comparative analysis of the desired and actual bidding behaviour of construction companies - Koki Arai and Emi Morimoto	55
Assessing the practice of project-based JV between local and international contractors in the UAE - Samer Skaik and Hussain Oweineh	56
International collaboration and partnering in the supply chain as business opportunities for architectural firms - Marina Bos-de Vos, Bente Liefink, Leentje Volker and Hans Wamelink	57
Experiences of trust in construction project management - Scott Strahorn, Thayaparan Gajendran and Graham Brewer	58
CIB W113 LAW AND DISPUTE RESOLUTION	59
Reasons for contractors' delay claims failures in Sri Lanka - Thanuja Ramachandra, James Olabode Rotimi and Shanika Gunaratne	61
Isn't all loss consequential? - Adam Connell and Jim Mason	62
Planning law reform and fast-tracking development in Australia - Peter Williams and Angelique Williams	63
Legal risk identification for SMEs in the construction industry - Jennifer Charlson and Chike Oduoza	64
Standard form construction contracts - Marthinus Maritz and Uwe Putlitz	65
A study of the management of time by comparing and evaluating the provisions for the management of time in the JCT Standard Building Contract (JCT SBC), the New Engineering and Construction Contract (NEC3) and the new Complex Projects Contract 2013 (CPC2013) - Tim McLernon	66
Are Australian standard forms of construction contract capable of dealing with the issue of extensions of time efficiently and effectively? - Peter Ward and Marcus	

Jefferies	
67	
Alliance contracting - Gregory F.	
Starzyk	
68	
Motivation agenda for social empowerment and respect for people during the	
drafting of construction contracts - Paul	
Crowe	
69	
Is expert witness immunity from suit a thing of the past in construction law? -	
Phebe Mann and David Tze Wan	
Wong	
70	
What does the duty of utmost good faith (uberrimae fidei) in insurance contract	
mean for the construction industry? - Phebe Mann and David Tze Wan	
Wong	
71	
Construction mediation in Scotland - Andrew Agapiou and Bryan	
Clark	
72	
Construction mediation in Scotland - Ian Trushell, Bryan Clark and Andrew	
Agapiou	
73	
The application of planning law for environmental protection and improvement	
in Nigeria - Beauty	
Alloh	
74	
BUILDING INFORMATION MODELLING.....	75
Interactive learning in UK construction practice - Energy Maradza, Jennifer	
Whyte and Graeme D.	
Larsen	
77	
An appraisal of the protocol that was published by the construction industry	
council (CIC) to facilitate the use of building information modelling	
(BIM) on projects - Mustafa Al-	
Shammari	
78	
A proposed BIM business value model - Susanna	
Vass	
79	
Perceptions of the value and viability of implementing lean construction with	
business information modelling - Dianne Marsh, David Bryde and	
Andrew	
Graham	
80	

The wider implementation issues of BIM within a multifaceted property and real estate consultancy - R. M. Dowsett and C. F. Harty	81
Construction site BIM requirements - Marco L. Trani, Manuele Cassano, Massimo Minotti, Davide Todaro	82
The implementation and use of 4d BIM and virtual construction - Barry Gledson and David Greenwood	83
Perceiving space from multiple perspectives for buildings using BIM	84
BIM's impact on the project manager - Hong Xiao and Tim Noble	85
The role of bim in preventing design errors - Peter Johansson, Henrik Linderoth and Kaj Granth	86
Leveraging collaboration through the use of Building Information Models - Mustafa Selcuk Cidik, David Boyd and Niraj Thuraiajah	87
Determinants of Building Information Modelling (BIM) acceptance for supplier integration - Abdul-Majeed Mahamadu, Lamine Mahdjoubi and Colin Booth	88
Challenges to building information modelling implementation in UK - Dharshana Navendren, Patrick Manu, Mark Shelbourn and Abdul-Majeed Mahamadu	89
Interactive visualisation of heat loss and gain for early-stage energy appraisal of the built environment - V Stojanovic, R Falconer, D Blackwood, G Paterson, M Fleming and S Bell	90
COST	91
Exploring escalation of commitment in construction project management - Dominic D Ahiaga-Dagbui and Simon D Smith	93

Optimism bias, pathogens and cost overrun - Fidelis Emuze and Poobalan Ravu 94	
An assessment of critical success factors for the reduction of the cost of poor quality from construction projects in South Africa - Clinton Aigbavboa and Wellington Thwala 95	
Barriers to life cycle costing usage - Olufolahan Oduyemi, Michael Okoroh and Angela Dean 96	
PROJECT MANAGEMENT	97
Conceptualising organisational resilience - Karen Oppong Banahene, Aaron Anvuur and Andrew Dainty 99	
The translation of power - Vivien Chow and Roine Leiringer 100	
Recasting coordination - Lea Urup and Christian Koch 101	
Allocating project managers to projects in a multi-project environment - Lone Seboni and Apollo Tutesigensi 102	
Communication risk and trust in construction projects - Anita Ceric 103	
Social network analysis on the inter-organizational interactions in green building projects - Vignesh Venkataraman and Jack C.P. Cheng 104	
Getting to the heart of community action against construction projects - Melissa Teo and Martin Loosemore 105	
Working together in a knot - Jenni Korpela and Hannele Kerosuo 106	
Role conflict in project team dynamics - Shabnam Kabiri, Will Hughes and Libby Schweber 107	

Moving beyond project complexity - Hannah Wood, Poorang Piroozfar and Eric Farr	108
A detailed analysis of existing project success factors - Mahdi Ghaffari	109
Servitization in construction - William Robinson and Paul Chan	110
Alternative project delivery systems for transport infrastructure in Germany - Mai Habib and Konrad Spang	111
Incorporation of different and changing client interests in the course of a project - Megumi Kurokawa, Libby Schweber and Will Hughes	112
Integrating external stakeholder identification and project initiation in civil engineering infrastructure projects - Mohamed Elmahroug, Apollo Tutesigensi and Naomi Brookes	113
A study of the current practice of stakeholder management in construction projects - Jurbe Molwus, Bilge Erdogan and Stephen Ogunlana	114
Refurbishment of higher education premises - Noel J. Painting, Poorang A. E. Piroozfar and Eric R. P. Farr	115
Organizational responses to institutional pressures in international infrastructure projects - Wenxue Lu and Hua Wang	116
INNOVATION AND INFORMATION MANAGEMENT	117
Is anybody home? The role of company websites - Martine Buser and Veronica Carlsson	119
Initial use of an idea capture app in a UK construction organisation - Richard Davies and Chris Harty	120
Diffusion of digital innovation in a project-based firm: Case study of a UK engineering firm - Amna	

Shibeika	
121	
Overcoming barriers to innovation - Susanne Engström	
122	
Delivering school buildings using off- site construction - Chris Boothman, Anthony Higham and Aaron Scott	
123	
SUPPLY CHAIN MANAGEMENT.....	125
A conceptual model for improving construction supply chain performance - Ikechukwu Dike and Georgios Kapogiannis	
127	
Partnering practices - Jason Challender, Peter Farrell and Fred Sherratt	
128	
The impact of supplier development initiatives on key performance indicators - Jonathan Gosling, Mohamed Naim, Denis Towill and Brian Moone	
129	
An improvement strategy for the defects and rework management process within an SME - Taggart, M., Koskela, L.K. and Rooke, J.A.	
130	
Identifying and positioning construction supply chain planning problems - Micael Thunberg, Martin Rudberg and Tina Karrbom Gustavsson	
131	
POLICY RESEARCH.....	133
Construction policy research - John-Paul Smiley, Andrew Dainty and Scott Fernie	
135	
The myth of best practice through the lens of construction Supply chain management - Stuart Tennant, Scott Fernie and Mike Murray	
136	
Government influence on the construction industry during the economic recession 2007 - 2013 - Paul Tansey and John P. Spillane	
137	
Gender equity in construction professions - Natalie Galea, Martin Loosemore, Abigail Powell, Louise	

Chappell	
138	
A critical review of the literature on disability management in the construction industry - Quagrain R.A., Winter J. and Issa M.H.	
139	
HOUSE BUILDING	141
Exploring industrialised house-builders' perceptions of local requirement setting - Anders Viking and Sofia Lidelöw	
143	
A synergistic supply chain enhancing offsite manufacturing uptake in Australian house building - Sherif Mostafa, Nicholas Chileshe and Jian Zuo	
144	
Placing defects at the heart of high quality new homes - Tony Hopkin, Shu-Ling Lu, Phil Rogers Hopkin, and Martin Sexton	
145	
Shall we dance? Encounters for energy renovation of single family houses - Veronica Carlsson and Christian Koch	
146	
House buyers and builders - Nicola Callaghan	
147	
LEARNING AND EDUCATION	149
Promoting double loop learning in flood risk management in the Scottish context - Craig Thomson, Slobodan Mickovski and Charles Orr	
151	
Wind turbine rescue - Kenneth Lawani, Billy Hare and Iain Cameron	
152	
Motivation of undergraduate civil engineering students for higher levels of academic success - Hector Martin, Christelle Sorhaindo and Ferida Welch	
153	
Building Economics pre-course student perceptions - S. Dent and J.J. Smallwood	
154	
INFORMATION MANAGEMENT	155
Conceptualising actors' information behaviour - Frank Dzokoto, Francis Edum-Fotwe, and Peter	

Demian	
157	
Using actor-network theory to understand knowledge sharing in an architecture firm - Abderisak Adam, Pernilla Gluch and Jonas Julin	
158	
Tacit and explicit knowledge in construction management - Mark Addis	
159	
Risk management and uncertainty in infrastructure projects - Chris Harty, Tim Themsen and Kjell Tryggestad	
160	
An illustration of the development of a strategy for evaluating the design of hospitals within a practice order network - D.J. O’Keeffe, D.S. Thomson and A.R.J. Dainty	
161	
STRATEGIC ISSUES FOR THE INDUSTRY.....	163
Changing paradigms in construction competitiveness research - Dilek Ulutaş Duman and Heyecan Giritli	
165	
A conceptual framework for achieving firm competitiveness in construction - Raman Awale and Steve Rowlinson	
166	
Boundary making in public-private-partnerships - Santi Jintamanaskoon and Paul W Chan	
167	
A public commissioning maturity model for construction clients - Marleen Hermans, Leentje Volker and Pieter Eisma	
168	
Exploring the management of multiple business models in one company - Matilda Höök and Lars Stehn	
169	
PLANNING, PRODUCTIVITY AND QUALITY	171
Rebalancing the construction productivity debate - Martin Loosemore	
173	

Enhancing labour productivity within construction industry through analytical hierarchy process - Hasan Hamouda and Nadine Abu-Shaaban	174
Modelling masonry labour productivity using multiple regression - Anu Thomas and J. Sudhakumar	175
Social perspective of planning in construction - Emmanuel Itodo Daniel, Christine Pasquire and Graham Dickens	176
Solid wall insulation retrofit in UK dwellings - Tim Forman and Christopher Tweed	177
RISK MANAGEMENT.....	179
Assessing risk dynamics in public private partnership projects - Elsa Cheung, Martin Loosemore and Diane Chandra	181
Using appropriate tools and techniques for risk identification in UK construction's SMEs - Ali Rostami, James Sommerville, Ing Liang Wong and Cynthia Lee	182
Are we adding risk to our projects by mixing objective assessments of compound conjunctive and disjunctive project risks with intuitive approaches? - Alex Collins Arthur and Stephen Pryke	183
Evaluating risk management in independent water and power plant projects in Saudi Arabia - Yousef Alsulaiman, Graeme Bowles and Stephen Ogunlana	184
A pilot-study Investigating the assessment and allocation of risks in public-private partnership transportation projects in Vietnam - Nhat, Nguyen, Lewis, John, Beer, Michael and Boussabaine, Abdelhalim	185
EDUCATION	187
Government institutions and infrastructure skills development - Michael Regan, Jim Smith and Peter Love	189

The comparison of Construction Management curricula in universities between the UK and Japan - Hitoshi Mihara, Megumi Kurokawa, Will Hughes and Tetsuo Hojo	190
Changing Institutions of knowing - Christian Koch and Niels Haldor Bertelsen	191
The construction SMEs development debate in South Africa - L. Wentzel, T. Wentzel, J.J. Smallwood, and F.A. Emuze	192
Lessons learned from building the education revolution (BER) program by the South Australia construction firms - Nicholas Yorston and Nicholas Chileshe	193
INDEX OF AUTHORS.....	194
INDEX OF KEYWORDS.....	199

SUSTAINABILITY IN THE BUILT ENVIRONMENT

SUSTAINABLE CONSTRUCTION: EXPLORING THE CAPABILITIES OF NIGERIAN CONSTRUCTION FIRMS

Dania A Afolabi¹, Graeme D Larsen and Ian J Ewart

School of Construction Management and Engineering, University of Reading, Reading, UK

As the built environment accounts for much of the world's emissions, resource consumption and waste, concerns remain as to how sustainable the sector is. Understanding how such concerns can be better managed is complex, with a range of competing agendas and institutional forces at play. This is especially the case in Nigeria where there are often differing priorities, weak regulations and institutions to deal with this challenge. Construction firms are in competition with each other in a market that is growing in size and sophistication yearly. The business case for sustainability has been argued severally in literature. However, the capability of construction firms with respect to sustainability in Nigeria has not been studied. This paper presents the preliminary findings of an exploratory multi-case study carried out to understand the firm's views on sustainability as a source of competitive advantage. A 'mega-international firm' and a 'lower medium-sized indigenous firm' were selected for this purpose. Qualitative interviews were conducted with top-level management of both firms, with key themes from the sustainable construction and dynamic capabilities literature informing the case study protocol. The interviews were transcribed and analysed with the use of NVivo software. The findings suggest that the multinational firm is better grounded in sustainability knowledge. Although the level of awareness and demand for sustainable construction is generally very poor, few international clients are beginning to stimulate interest in sustainable buildings. This has triggered both firms to build their capabilities in that regard, albeit in an unhurried manner. Both firms agree on the potentials of market-driven sustainability in the long term. Nonetheless, more drastic actions are required to accelerate the sustainable construction agenda in Nigeria.

Keywords: competitiveness, developing countries, dynamic capabilities, sustainable construction.

¹ a.dania@pgr.reading.ac.uk

BENEFITS AND LIMITATIONS OF SOCIAL PRACTICE THEORY TO EVALUATE PRACTICES IN SUSTAINABLE OFFICE BUILDINGS: PRELIMINARY FINDINGS

L.M. King¹, C.A. Booth and J.E. Lamond

¹ *Construction and Property Research Centre, University of the West of England (UWE), Bristol, UK*

Despite the acknowledgement that buildings are a major consumer of natural resources, the gap between design and operational building performance continues to present a challenge to both the construction industry and building occupants. Occupant behaviour is recognised as a significant factor in understanding operational performance. Approaches rooted in psychology have typically been adopted to understand behaviour and develop interventions, with the 'individual' as the focus of analysis. Social Practice Theory (SPT) provides an alternative means of appraising the dynamics between elements which converge to form practices impacting on the operational performance of the building, moving the focus of analysis from the individual to the practice. The building features designed to support sustainable behaviour are therefore considered as material elements embedded in wider social systems and not simply as physical features designed to determine behaviour. The benefits and limitations of a social practice approach in this context are appraised through the analysis of research undertaken in BREEAM Excellent certified office buildings considering the practice of moderating comfort. Findings demonstrate that SPT provides an opportunity to contextualise the physical features of sustainable office buildings and permits a more complex analysis of 'why' and 'how' workplace routines and practices are undertaken.

Keywords: behaviour change, green buildings, social practice theory, sustainability.

¹ Louise5.king@uwe.ac.uk

King, L M, Booth, C A and Lamond, J E (2014) Benefits and limitations of social practice theory to evaluate practices in sustainable office buildings: Preliminary findings *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 13-22.

INVESTIGATING THE LEVEL OF AWARENESS OF BUILDING ASSESSMENT TOOLS IN THE CONSTRUCTION INDUSTRY OF BOTSWANA

Keneilwe Ntshwene¹, Emmanuel A. Essah and Timothy J. Dixon

School of Construction Management and Engineering, University of Reading, P O Box 219, Reading, RG6 6AW, UK

Environmental building assessment tools have been developed to measure how well or poorly a building is performing, or likely to perform, against a declared set of criteria, or environmental considerations, in order to achieve sustainability principles. Knowledge of environmental building assessment tools is therefore important for successful design and construction of environmentally friendly buildings for countries. The purpose of the research is to investigate the knowledge and level of awareness of environmental building assessment tools among industry practitioners in Botswana. One hundred and seven paper-based questionnaires were delivered to industry practitioners, including architects, engineers, quantity surveyors, real estate developers and academics. Users were asked what they know about building assessment, whether they have used any building assessment tool in the past, and what they perceive as possible barriers to the implementation of environmental building assessment tools in Botswana. Sixty five were returned and statistical analysis, using IBM SPSS V19 software, was used for analysis. Almost 85 per cent of respondents indicate that they are extremely or moderately aware of environmental design. Furthermore, the results indicate that 32 per cent of respondents have gone through formal training, which suggests 'reasonable knowledge'. This however does not correspond with the use of the tools on the ground as 69 per cent of practitioners report never to have used any environmental building assessment tool in any project. The study highlights the need to develop an assessment tool for Botswana to enhance knowledge and further improve the level of awareness of environmental issues relating to building design and construction.

Keywords: sustainability, building assessment tools, Botswana.

¹ K.Ntshwene@pgr.reading.ac.uk

Ntshwene, K, Essah, E A and Dixon, T J (2014) Investigating the level of awareness of building assessment tools in the construction industry of Botswana *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 23-32.*

IDENTIFYING PROJECT SUCCESS CRITERIA FOR UK SOCIAL HOUSING ASSET MANAGEMENT SCHEMES

Anthony Higham¹ and Paul Stephenson

Department of the Natural and Built Environment, Sheffield Hallam University, Howard Street, Sheffield UK

Embedding the principles of sustainable development and sustainable communities into social housing organisations represents one of the biggest challenges faced by the sector over the last decade. The increasing recognition of the limitations and failings within existing practice has led to calls from both external policy stakeholders and the National Housing Federation for project appraisals to consider an ever increasing number of non-financial benefit enhancing features of UK social housing projects. An important stage in this transformational process will be the identification of the main project centric criteria against which community benefit can be appraised. Relevant literature relating to sustainable communities is reviewed, resulting in the identification of over 400 theoretical features of neighbourhood sustainability. In an attempt to refine these criteria into a more pragmatic list the results of 11 semi-structured interviews held with senior professionals drawn from across one typical social housing organisation, together with the results of 7 validating interviews are reported. Analysis of the collected data established an emergent list of 6 principal success criteria and a further 49 sub-criteria against which project centric benefit can be appraised. The paper concludes by proposing further work relating to the development of a suitable methodology for the appraisal of community benefit in practice.

Keywords: social housing, asset management, sustainable communities, project success.

¹ A.P.Higham@shu.ac.uk

Higham, A and Stephenson, P (2014) Identifying project success criteria for UK social housing asset management schemes *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 33-42.*

APPLICATION OF SUSTAINABILITY PRINCIPLES IN POST-DISASTER RECONSTRUCTION

Kristen MacAskill¹ and Peter Guthrie

¹ *Centre for Sustainable Development, University of Cambridge, UK*

The link between a sustainability agenda and post-disaster reconstruction is gaining increasing attention. However it is not clear how sustainability thinking affects outcomes of reconstruction programmes. This paper identifies key factors that influence how sustainability principles are integrated into decisions for reconstruction. This is based on empirical research conducted in Christchurch, New Zealand, following earthquakes in 2010 and 2011. The discussion focuses on the role of the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) in the city's reconstruction. SCIRT is a collaborative organisation that was established to deliver the rebuild of infrastructure networks (wastewater, water supply, stormwater and roads) through an alliance agreement for design and construction. Information has been gathered through semi-structured interviews with professionals involved in the reconstruction, supported by an investigation of relevant government reports and project documentation. It is clear that constrained finances place a significant limitation on what can be achieved in post-disaster reconstruction. Working within this limitation however, there are several factors that shape how sustainability principles are incorporated into decisions for the design and construction of infrastructure. Some of the key factors identified through the Christchurch case study are: (a) Decision boundaries: organisational arrangements influence how and what decisions are made regarding the nature of infrastructure reconstruction or repair; (b) Conflicting timescales: there is a trade-off between the short-term need to restore services and longer-term considerations of improved system development and maintenance; (c) Best practice: opportunities to adopt sustainable approaches (as defined in the business-as-usual infrastructure construction) can prove to be elusive where adhering to a pre-conceived level of 'best practice' may not be appropriate; (d) Resilience: the concept of resilience is clearly embedded in options analysis for repairing or rebuilding infrastructure, helping to facilitate a longer-term perspective.

Keywords: decision analysis, post-disaster reconstruction, resilience, sustainability.

¹ kam71@cam.ac.uk

MATHEMATICAL MODELLING OF EMBODIED CARBON EMISSIONS OF BUILDING PROJECTS

Nathan Kibwami¹ and Apollo Tutesigensi

Institute for Resilient Infrastructure, School of Civil Engineering, University of Leeds, Leeds, LS2 9JT, UK

It is increasingly recognised that if the emphasis remains on reducing operating carbon emissions (OC) of buildings, embodied carbon emissions (EC) will eventually attain a significant proportion of buildings' lifetime carbon emissions (LC). Emphasis on minimising EC is equally desirable if LC is to be reduced. A first step to minimising EC is quantification, in order to know what quantities to minimise. However, several prevalent approaches of quantifying EC pose challenges in promoting potential alternative actions to reduce EC. In many cases, besides the limitations associated with the boundaries usually adopted, it is difficult (if not impossible), to attribute the respective sources of energy (e.g. diesel, coal, biomass etc.) to the resulting EC. This paper presents a mathematical model for computing EC of building projects and in contrast to previous studies, a concept of disaggregation is adopted in order to identify EC with the respective energy sources. The approach enables the specific sources of energy to bear on the quantification of EC, in a manner that allows differentiation of the contribution of the different sources of energy. The model is presented in a series of mathematical equations. The major benefit associated with the nature of the developed model is that, even without recourse to material substitution (e.g. timber for concrete), it is possible to achieve emission reductions from the same material by optimising the parameters (e.g. energy used in manufacturing and transportation) associated with its EC.

Keywords: building projects, embodied carbon emissions, mathematical model.

¹ cnnk@leeds.ac.uk

TOWARDS A LIFE CYCLE FRAMEWORK FOR BRIDGE MANAGEMENT SYSTEMS IN THE UK: INSIGHTS FROM A CRITICAL REVIEW OF INTERNATIONAL APPROACHES AND MODELS

Teslim Bamidele Balogun¹

Department of Architecture and Built Environment, University of the West of England, UK

Effective Bridge Management Systems (BMS) are of paramount importance to bridge owners and bridge managers. BMS in the UK encompass an inventory of existing bridge stock, schedule of inspections, condition rating of structures, budget planning, deterioration modelling, bid for maintenance funds, and maintenance repair and rehabilitation, but fail to consider sustainability and long-term options. A Life Cycle Assessment (LCA) approach is currently being proposed to address this problem, which can be incorporated into a BMS. In order to achieve this, a critical analysis was performed on international literatures in the area of BMS study. This presents insights of previous approaches and models towards improving existing BMS functionalities, while responding to generic requirements. Findings revealed that the incremental improvement of BMS does not consider sustainability options to enable sustainable decisions to be made regarding bridge management activities. Therefore, systems should start considering sustainability optimization criteria which can be delivered through a life cycle approach.

Keywords: asset management, bridge management system, life cycle assessment, sustainability.

¹ Teslim2.Balogun@live.uwe.ac.uk

Balogun, T B (2014) Towards a life cycle framework for bridge management systems in the UK: Insights from a critical review of international approaches and models *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 63-72.*

THE IMPORTANCE AND IMPLEMENTATION OF SUSTAINABILITY FACTORS IN MALAYSIAN RAILWAY PROJECTS

Assa Amiril¹, A.H. Nawawi, R.Takim and S.N.F. Ab-Latif

Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA (UiTM), Shah Alam, Malaysia

The growth of global railway infrastructure development has encouraged many countries including Malaysia to develop railway as a key strategy to enhance the national transportation infrastructure and strengthen economic competitiveness. Nevertheless, the development of railway infrastructure projects demands massive land use, high cost, huge resources and time. These demands have great impact on the economy, environment and social wellbeing. Implementation of sustainability factors in transportation infrastructure projects particularly in railway projects has been recognized as an important mechanism to minimize these impacts. Albeit, it is not clear as to what extent do sustainability factors are incorporated in Malaysian railway projects. The objectives of this paper are to identify the importance of sustainability factors in railway projects from the stakeholder's perceptions and to investigate level of its implementation in Malaysian railway projects. A questionnaire-based survey was conducted in Malaysia among the railway projects main stakeholders: the client, consultants and contractors. The data were analyzed by means of statistical analysis i.e. ranking of variables based on the mean values. Paired t-test was then used to identify whether there are any significant differences between the factors perceived as important and actual implemented. The findings show that the level of importance and implementation of sustainability factors in Malaysia railway project is still in moderate level. It is anticipated that the findings reported in this paper could be important for future strategies and guidelines for improving the sustainability performance of railway infrastructure projects development.

Keywords: Malaysian railway project, stakeholder, sustainability factors.

¹ assa.amiril@yahoo.com

Amiril, A, Nawawi, A H, Takim, R and Ab-Latif, S N F (2014) The importance and implementation of sustainability factors in Malaysian railway projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 73-82.

REVERSE LOGISTICS (RL) IMPLEMENTATION AMONG CONTRACTORS IN AUSTRALIA: PRACTICES AND BARRIERS

Nicholas Chileshe¹, Raufdeen Rameezdeen¹, Steffen Lehmann² and Mohammad reza Hosseini¹

¹ *School of Natural and Built Environments, Barbara Hardy Institute (BHI), University of South Australia, City East Campus, Adelaide, South Australia 5001, Australia*

² *School of Built Environment, Faculty of Humanities, Curtin University, GPO Box U1987, Perth, Western Australia 6845, Australia*

This paper aims to investigate the perceptions of Australian contractors concerning the prevailing practices and barriers to the implementation of reverse logistics (RL). A review of literature identified 18 practices and 16 barriers to the implementation of RL. Using a triangulated data collection approach, 6 semi-structured interviews and 49 questionnaires were used to collect data. The quantitative survey data was subjected to descriptive and inferential statistics with correlation analysis to examine the strength of relationship among the barriers, whereas content analysis was employed for the interview data. The results indicated the following barriers as most significant: (i) lack of incorporation of salvaged materials by designers; (ii) regulation restrictions to usage of recovered materials and components; (iii) potential legal liabilities; (iv) higher costs; and (v) longer time associated with deconstructing buildings. Relative to the prevailing practices, the top five ranked were as follows: (i) reduction of waste on projects; (ii) clearer understanding of the benefits; (iii) clearer understanding of the challenges; (iv) clearer understanding of the different aspects of reusing building materials; and (v) Enhancing the green image of the organisation. The results of the interviews also confirmed the findings from the survey, and identified the following barriers: (i) lack of support from the government in terms of financial incentives to increase the competitiveness of reused and salvaged items in the market; (ii) The attached stigma and resistance of supervisors, designers, and some authorities towards using salvaged and reused materials; and (iii) Technical barriers associated with usage of salvaged materials. The majority of the interviewees identified economic issues as the major drivers of RL practices. The identified barriers could be used as a 'road map' for the development of appropriate solutions for the successful implementation of RL, and to improve the environmental related decision making processes of the contractors.

Keywords: reverse logistics, barriers, supply chain management.

¹ nicholas.chileshe@unisa.edu.au

Chileshe, N, Rameezdeen, R, Lehmann, S and Hosseini, M R (2014) Reverse logistics (RL) implementation among contractors in Australia: Practices and barriers *In*: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 83-92.

STAKEHOLDER-ASSOCIATED RISK NETWORKS IN GREEN BUILDINGS: CHINA VERSUS AUSTRALIA

Rebecca J. Yang¹, Patrick X.W. Zou² and Jiayuan Wang³

¹ *School of Property, Construction and Project Management, RMIT University, Melbourne, Australia*

² *Building and Construction Management and Institute of Governance and Policy Analysis, University of Canberra, Canberra, Australia*

³ *College of Civil Engineering, Shenzhen University, Shenzhen, China*

The aim of this research is to model stakeholder-associated risk networks and gain understanding of the differences and similarities of green building risks in China and Australia, given the different political, social-cultural and legal systems. This paper builds on the authors' previously published research (Yang and Zou 2014). Case studies of green star accredited recently constructed major office buildings were undertaken in both countries. Data were collected through desktop studies, focused workshops and face-to-face interviews with key project participants, and analysed by using Social Network Analysis (SNA) methods which aims to analyse the characteristics and interdependencies of risks-stakeholders relationships. The research finds that while reputation risks are important for project players in both countries, the ethical risk 'assessment experience and fairness' has been highlighted as crucial in the Chinese green practice due to potential corruption issues. In the Chinese case, relatively higher attention was paid on the quality / technical issues and the government plays more important role to develop rigorous policy systems, as well as improve societies' knowledge and awareness levels on green technology and energy saving. From stakeholder management perspective, communications between internal stakeholders can contribute to a smooth green building design and construction in both countries. The main contribution of this research is the development and application of an integrated method of SNA and stakeholder management in project risk assessment in green buildings in differing political, technical, social and cultural settings. The outcomes of this research have an implication in theoretical development and practical application for both green building risk management and international construction.

Keywords: green building, risk, stakeholder, social network analysis, Australia, China.

¹ rebecca.yang@rmit.edu.au

Yang, R J, Zou, P X W and Wang, J (2014) Stakeholder-associated risk networks in green buildings: China versus Australia *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 93-102.*

EXAMINING THE BARRIERS TO SUCCESSFUL ONSITE CONSTRUCTION ENVIRONMENTAL MANAGEMENT OPERATIONS

Kim Maund¹, Thayaparan Gajendran and Graham Brewer

*School of Architecture and Built Environment, University of Newcastle, Callaghan, New South Wales,
Australia*

With the introduction of ecologically sustainable development (ESD) and subsequent legislative regulations throughout Australia, effective environmental management across the construction sector should occur. In reality, construction operations continue to have detrimental environmental impacts. Within New South Wales the primary legislation governing development control, for the purpose of ESD, has produced a complex legislative system that its ability to achieve the objectives of environmental protection remains questionable. Large scale development projects may evoke need for associated environmental regulatory controls; however, such rules are generally not applicable to small and medium scale developments. Yet, these types of projects make up a significant amount of the development market and collectively a major contribution to detrimental environmental impacts. Given each construction project is unique, the application of complex regulatory controls may result in notably different levels of environmental protection between developments. Inconsistency may be seen with regulatory interpretation, implementation, monitoring and associated processes of enforcement. Using a systemic lens this research linked the efficacy of regulation, monitoring, and information flow to explain variability in the outcomes of onsite environmental management operations. The paper reports preliminary findings of a two stage qualitative study involving semi-structured interviews with key project stakeholders (e.g. government regulatory officers, construction managers) and case study examination of four medium scale development projects. Using a phenomenological coding approach, preliminary analysis identified a number of themes that impact effective onsite environmental management including: environmental interpretation and assessment, compliance and enforcement, external influences, collaboration and engagement.

Keywords: ecologically sustainable development, environmental planning, development planning, government regulation, qualitative analysis.

¹ Kim.Maund@newcastle.edu.au

MATERIAL WASTE IN THE NORTHERN IRELAND CONSTRUCTION INDUSTRY: ON-SITE MANAGEMENT CAUSES AND METHODS OF PREVENTION

Marina Marinelli¹, Matthew Dolan, John Spillane and Ashwini Konanahalli

School of Planning, Architecture and Civil Engineering, David Keir Building, Stranmillis Road, Queen's University Belfast, Belfast, Northern Ireland, BT9 5AG, UK

The construction industry in Northern Ireland is one of the major contributors of construction waste to landfill each year. The aim of this research paper is to identify the core on-site management causes of material waste on construction sites in Northern Ireland and to illustrate various methods of prevention which can be adopted. The research begins with a detailed literature review and is complemented with the conduction of semi-structured interviews with 6 professionals who are experienced and active within the Northern Ireland construction industry. Following on from the literature review and interviews analysis, a questionnaire survey is developed to obtain further information in relation to the subject area. The questionnaire is based on the key findings of the previous stages to direct the research towards the most influential factors. The analysis of the survey responses reveals that the core causes of waste generation include a rushed program, poor handling and on-site damage of materials, while the principal methods of prevention emerge as the adequate storage, the reuse of material on-site and efficient material ordering. Furthermore, the role of the professional background in the shaping of perceptions relevant to waste management is also investigated and significant differences are identified. The findings of this research are beneficial for the industry as they enhance the understanding of construction waste generation causes and highlight the practices required to reduce waste on-site in the context of sustainable development.

Keywords: construction planning, design management, recycling, waste management.

¹ m.marinelli@qub.ac.uk

Marinelli, M, Dolan, M, Spillane, J and Konanahalli, A (2014) Material waste in the Northern Ireland construction industry: On-site management causes and methods of prevention *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 113-122.

OVERCOMING THE BARRIERS OF GREEN INNOVATION IN CONSTRUCTION PROJECTS THROUGH ITS SUCCESSFUL MANAGEMENT

J. Monahan¹, R. Coates² and D. Clarke-Hagan³

¹ *Farrans Construction, Belfast, Northern Ireland, UK.*

^{2,3} *School of Planning, Architecture and Civil Engineering, Queen's University of Belfast, Northern Ireland UK*

The construction industry has a significant opportunity to mitigate the harmful effects construction has on the natural environment. However, green innovations are far from becoming customary in construction as the industry is recognised as slow to adopt innovation. Consequently, to overcome barriers to the adoption of green innovation, it is important to understand how green innovation is defined and what are the obstacles, drivers and influences that affect how it is successfully managed. Through this research, involving a literature review, the collation and analysis of four semi-structured interviews and 60 questionnaire responses, green innovation can be defined as: a process that aims to maximise performance, while minimising environmental degradation, triggered by the need for a new outcome. The research indicates firstly that green innovation barriers consist of organisational, stakeholder and contractual obstacles and that to overcome these barriers and to increase demand, the industry needs more green innovation information available in order to define the ownership and balance cost and quality. Secondly, green innovation management and its adoption are also affected by the attitude, demographic and cognitive characteristics of the manager concerned. The research also shows that successful management of green innovation can be promoted by a culture that involves the whole project team and the evaluation of the project's management in order to document the success factors. Finally, the formation of a new green contract, or the amendment of the design build procurement path to outline the ownership of risk and the alignment of the construction aims and objectives, will promote green innovation adoption.

Keywords: green, innovation, environment, procurement.

² r.coates@qub.ac.uk

Monahan, J, Coates, R and Clarke-Hagan, D (2014) Overcoming the barriers of green innovation in construction projects through its successful management *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 123-132.*

A PROTOCOL TO EVALUATE SCHOOL BUILDINGS' ENERGY CONSUMPTION

Ouf M.M.¹, Issa M.H. and Mallory-Hill, S.

¹ *Construction Engineering and Management Group, Department of Civil Engineering, University of Manitoba, Winnipeg, Manitoba, Canada*

Buildings contribute 20 to 40% of the world's energy consumption, making the need to regulate and minimize their energy use a priority. A standard protocol was developed by the University of Manitoba Construction Engineering and Management Group to evaluate energy consumption across a sample of Manitoba schools in collaboration with the Manitoba Public School Finance Board. The protocol aims to evaluate school buildings' overall historical energy consumption and real-time electricity consumption at the space level. An extensive literature review was carried out to identify relevant parameters, methods and instruments to evaluate buildings' energy use. The protocol identifies school data parameters as well as historical energy data and real-time electricity data parameters to be collected, related methods and recommended values for these parameters. The protocol is currently being validated through its practical application to the sample of Manitoban schools identified. This protocol is expected to be useful to future researchers looking to evaluate other school buildings in other locations and enable buildings operators and managers to track their buildings' energy performance.

Keywords: electricity consumption, energy consumption, evaluation protocol, school.

¹ oufm@myumanitoba.ca

RENEWABLE ENERGY TECHNOLOGY MEANS OF PROVIDING SUSTAINABLE ELECTRICITY IN NIGERIAN RURAL AREAS - A REVIEW

Abdulahakeem Garba¹ and Mohammed Kishk²

¹ *The Scott Sutherland School, The Robert Gordon University, Aberdeen, AB10 7QB, UK.*

² *Aberdeen Business School, The Robert Gordon University, Aberdeen, AB10 7QE, UK.*

Following the failure of the Power Holding Company of Nigeria (PHCN) and fossil fuel source applications for the provision of electricity in Nigeria, the country has been experiencing power energy shortages for over three decades now. More than 65% of the population lack commercial electricity, particularly in the rural areas. This has caused socio-economic problems involving relocation of manufacturing companies to neighbouring countries, unemployment, and endemic rural-urban migration. The research that underpins this paper aims to investigate the potential of Renewable Energy Technologies (RETs) in the provision of sustainable electricity in Nigeria's rural areas. This has been motivated by the strategic value of RETs in identifying when and where electricity is actually required thereby eliminating/reducing the high cost of gridline network and offering a more sustainable alternative to fossil fuels. A systematic review method has been used to examine various RETs regarding their viability and applicability in Nigeria. The sustainability of various RETs is then evaluated using SWOT analysis to screen the technologies to be used in an energy supply mix in Nigeria's rural areas. Biomass, hydro and solar sources are appropriate for use in Nigeria rural areas. The utilisation level of RETs in Nigeria is extremely low except for hydropower source. The major problems of RETs implementation are lack of implementable energy policy, government apathy towards development of RETs and the low purchasing power of majority of citizens. Further work includes the application of whole life costing (WLC) to assess and optimise the economic performance of the identified RETs.

Keywords: Nigeria, renewable energy technology, sustainable electricity, sustainability indicators, SWOT

¹ a.garba@rgu.ac.uk

Garba, A and Kishk, M (2014) Renewable energy technology means of providing sustainable electricity in Nigerian rural areas - A review *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 143-151.*

PERSPECTIVES ON THE SPECIFICATION OF BUILDING INTEGRATED PHOTOVOLTAIC (BIPV) TECHNOLOGY IN CONSTRUCTION PROJECTS

Philippa Boyd¹, Graeme D. Larsen and Libby Schweber

¹ *School of Construction Management and Engineering, University of Reading, UK*

Innovative, low carbon technologies are already available for use in the construction of buildings, but the impact of their specification on construction projects is unclear. This exploratory research identifies issues which arise following the specification of BIPV in non-residential construction projects. Rather than treating the inclusion of a new technology as a technical problem, the research explores the issue from a socio-technical perspective to understand the accommodations which the project team makes and their effect on the building and the technology. The paper is part of a larger research project which uses a Social Construction of Technology Approach (SCOT) to explore the accommodations made to working practices and design when Building Integrated PhotoVoltaic (BIPV) technology is introduced. The approach explores how the requirements of the technology from different groups of actors (Relevant Social Groups or RSG's) give rise to problems and create solutions. As such it rejects the notion of a rational linear view of innovation diffusion; instead it suggests that the variety and composition of the Relevant Social Groups set the agenda for problem solving and solutions as the project progresses. The research explores the experiences of three people who have extensive histories of involvement with BIPV in construction, looks at how SCOT can inform our understanding of the issues involved and identifies themes and issues in the specification of BIPV on construction projects. A key finding concerns the alignment of inflection points at which interviewees have found themselves changing from one RSG to another as new problems and solutions are identified.. The points at which they change RSG often occurred at points which mirror conventional construction categories (in terms of project specification, tender, design and construction).

Keywords: BIPV, innovation, social groups, social construction of technology.

¹ n.j.p.boyd@pgr.reading.ac.uk

Boyd, P, Larsen, G D and Schweber, L (2014) Perspectives on the specification of Building Integrated Photovoltaic (BIPV) technology in construction projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 153-162.*

ESTABLISHING ABATEMENT ALTERNATIVES IN CONSTRUCTION

Meysam Ebrahimejad¹, Eghbal Shakeri and Abdollah Ardeshir

Department of Civil and Environmental Engineering, Amirkabir University of Technology (Tehran Polytechnic), 424 Hafez Ave, Tehran, Iran

Construction operations consume energy and due to the associated emission of greenhouse gases (GHG), leave negative environmental impacts. Many construction contractors look on emission mitigation efforts as being counter to profit and of secondary priority. However, due to increased social pressure, contractors are being obliged to reduce energy consumption and mitigate emissions. This paper focuses on emissions during construction. The aim of this research is to provide construction contractors with an understanding of the effectiveness and cost of available abatement alternatives and aid them in making profitable decisions while minimizing project emissions. Based on data from a road construction project, required material quantities, available suppliers, delivery vehicles and the NONROAD model, the cost and emissions of each possible procurement alternative are compared. The abatement curves are used to present the results. It is shown that by simply considering emissions in decision making, changing material supplier can help mitigate emissions. It demonstrates that for contractors who intend to make environmental friendly decisions, there exist affordable alternatives.

Keywords: construction operations, abatement curves, greenhouse gases, emissions, energy consumption.

¹ ebrahimejad@aut.ac.ir

DESIGN

DESIGNERS' PERSPECTIVES ON THE USE OF IMMERSIVE VIRTUAL REALITY TECHNOLOGY IN PRACTICE

Laura Maftai¹ and Chris Harty

HaCIRIC, School of Construction Management and Engineering, University of Reading, PO Box 129, Reading, RG6 6AW, UK

The role of emerging virtual reality (VR)/ BIM enabled technologies on the construction design process is examined in this paper from an angle of understanding the contextual use of technology in practice. Drawing attention to the dynamics of interrelating the social, perceptual and material/ technical mechanisms involved, the study takes an interest in issues of understanding and reflecting on the effect of immersive technologies on construction design activities as used in concrete 'real – life' settings and as perceived by practitioners. The case study is an on-going construction project for a new hospital in the UK, where an immersive VR environment (IVRE) was used performing design review sessions during the bid preparation stage. It is about understanding practitioners' reflection hence the study augments previous insights based on direct observation and audio-video recordings of multiple design meetings with interviewing the design participants. The focus is on designers' perception of the events, their reflection back on their actions, their conceptual understanding of using IVRE in the process, and their view on the possible connection with broader practices of design. A particular strategy was applied in conducting retrospective discussions with the participants in a data review session format, consisting in both playing back video-clips (thematically selected from the video data set), and revealing the researcher's interpretation around what was happening during the design sessions. This was aimed to allow the participants' reflection on how they experienced particular episodes and to engage them with the research questions, for asking them to describe their understanding and reasoning behind the events. Early analysis suggests that the interview data is particularly informing with regard to participants' perspective on how using IVRE in the design review connects with other VR/ BIM enabled ways of performing the process and exposes their insight on the potential impact on the broader construction context.

Keywords: construction design practice, designers' reflection-on-action, immersive virtual reality environment (IVRE).

¹ l.maftai@pgr.reading.ac.uk

THE USE OF EVIDENCE BASED DESIGN IN NHS CONSTRUCTION

Joanne Hardwicke¹ and Andrew King²

¹ Focus House, Millennium Way West, Phoenix Business Park, Nottingham, NG8 6AS, UK

² Nottingham Trent University, Burton Street, Nottingham, NG1 4BU, UK

Evidence Based Design (EBD) is a process that bases design decisions on credible research and data to produce the best possible environments and outcomes. This process is most effective in hospital design where it can improve patient and staff outcomes and save the organisation money over time. Information regarding the processes and benefits of EBD is readily available, but there is a lack of knowledge on whether it is actually being implemented in the NHS. This paper explores the use of EBD in NHS construction and seeks to determine whether the value adding opportunities it offers are being utilised. An examination of the relevant literature revealed the processes of EBD, the contrasts to traditional hospital design and the barriers to its implementation. These primary themes were further explored through interviews with NHS professionals, researchers and designers, and the use of EBD was investigated via a nationwide survey of architects. The findings show that NHS Trusts have little awareness of the importance of the built environment in hospitals and are sceptical towards the value that EBD offers. This, along with the higher cost of EBD and the current economic climate, contributes to the use of EBD being relatively rare within the NHS, especially on smaller scale construction projects. With a predicted shift away from large hospital projects, the future of EBD in the NHS looks bleak, and therefore this research raises the question of whether the NHS is really striving to get the best value from its construction projects.

Keywords: briefing, design management, evidence based design, procurement.

¹ joanne.hardwicke@focus-consultants.com

FROM PEDAGOGICAL IDEAS TO A SCHOOL BUILDING: ANALYSIS OF USER INVOLVEMENT IN BUILDING DESIGN

Jiri Lallimo¹

¹ Centre for Research on Activity, Development and Learning CRADLE, University of Helsinki, Finland

This study explores a school building design project, which was carried out in collaboration between school staff and students, architects, design engineers and other design experts. This study aims to expand the focus from regarding the users as information briefers in early design phases to cover a long-term user involvement in building design. The research data cover a period of four years. The data include formal documents of the project; interviews of the users, architects and representatives of the client; recordings of twenty design meetings (design team meetings, meetings between users, between users, architects and designers), and design documents produced by the designers and the school users. The results help to interpret the design process as co-design, which expands the users' initially abstract and hidden user needs to visible models and designs. The collaboration requires merging of the users' conceptual tools and the designers' concrete drawings and specifications, the structuring of several co-design forums, coordination by the head-user and specific user groups, and tools for individual working and responsibilities. The results can be used to illuminate and to plan user involvement as a heterogeneous and long-term building design activity.

Keywords: building design, co-design, design tool, user-centred design.

¹ jiri.lallimo@helsinki.fi

Lallimo, J (2014) From pedagogical ideas to a school building: Analysis of user involvement in building design *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 195-204.*

A DECISION SUPPORT FRAMEWORK FOR HCAI RISK ASSESSMENT AND DESIGN BRIEFING OF HEALTHCARE FACILITIES

Al-Bizri, S.¹ and Gray, C.²

¹*The School of Civil Engineering and Surveying, The University of Portsmouth, Portland Building, Portland Street, Portsmouth, PO1 3AH, UK*

²*The School of Construction Management and Engineering, The University of Reading, Whiteknights, Po Box 219, Reading RG 6 6AW, UK*

Healthcare facilities are complex and technologically driven built environments therefore controlling healthcare associated infections (HCAI) is a major challenge not only for the UK's NHS services but also for designers and architects. The problem is the very large number of issues that have to be considered and the difficulty of specifying best practice therefore designing the right facility as many of the values are subjective. Quality Function Deployment (QFD) enables the prioritisation of objectives, an understanding of the links between choices and the potential conflicts between them. HCAI-QFD tool has been developed exploiting the features of QFD, but tailored to the needs of the HCAI control practices. By using a preselected knowledge base of issues and technologies that can be used to provide solutions, a decision framework has been developed to enable the user to access, at any point in the process, additional information from linked knowledge sources and the WWW so enabling them to be informed of the issues. The result is that the user can explore each area in depth. When a decision has been made the user can record the details, which are captured in the tool database that is then used to enhance the final report and so produce a full specification of HCAI control issues and requirements. This can be used for HCAI risk assessment and design briefing of healthcare facilities.

Keywords: briefing, HCAI, healthcare, decision making, QFD, risk.

¹ salam.al-bizri@port.ac.uk

RESEARCH METHOD

EXPLORING THE FIELD OF PUBLIC CONSTRUCTION CLIENTS BY A GRAPHICAL NETWORK ANALYSIS

Pieter Eisma¹ and Leentje Volker

¹ Delft University of Technology, Faculty of Architecture and the Built Environment, Julianalaan 134, 2628 BL Delft, The Netherlands

Because public construction clients form the majority of construction clients and procure over 40% of the construction output in most countries, they are important actors in the construction industry. Yet, the field of research on clients is still underdeveloped. In order to identify the research gaps in this field, a graphical network analysis of existing literature is performed. The analysis is based on a query executed in the scientific database Scopus resulting in around 3,300 publications. By connecting the papers and their references as nodes in a network, an overview is created of the most important topics as previously studied by academic scholars. Collaboration, innovation and sociology are the most studied subjects found. Research methods, public sector and project management are other issues that have attracted scholars to perform research on public clients. Most of the topics are, however, not limited to public clients and based on a relatively low number of specific contribution from the perspective of the public client itself, it can be concluded that especially the public aspect of the construction field is neglected. This opens up interesting opportunities for future research.

Keywords: graphical network analysis, public construction clients, research agenda, research theme identification.

¹ p.r.eisma@tudelft.nl

Eisma, P and Volker, L (2014) Exploring the field of public construction clients by a graphical network analysis *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 217-226.*

USING THE LITERATURE BASED DISCOVERY RESEARCH METHOD IN A CONTEXT OF BUILT ENVIRONMENT RESEARCH

Nathan Kibwami¹ and Apollo Tutesigensi

¹ *Institute for Resilient Infrastructure, School of Civil Engineering, University of Leeds, Leeds, LS2 9JT, UK*

For two disparate research groups, unaware of each other's work, one group can inadvertently solve a problem prevalent in the other. Without considering work from both groups together, such breakthroughs may remain undiscovered. The solution is literature based discovery (LBD), a method which involves investigation or search for novel hypotheses connecting work from two or more disparate contexts. However, LBD has predominantly been used to address medical problems, and its uptake outside medical research remains scanty. In the context of built environment research, there are countable studies that have claimed using LBD and moreover, they presented sparse details. On one hand, studies that have claimed using LBD as a research method seem to confuse it with traditional literature reviews, and on the other hand, even those that could have used LBD seem unaware that they used some kind of LBD-style analysis. Following the original principles of LBD, this paper presents an LBD-inspired research method and a demonstration of its applicability within a built environment research context. The findings indicate promising leads to encouraging LBD and elucidating several misconceptions surrounding its use in built environment research. It is hoped that this paper will encourage future research in built environment, like construction management research, to confidently use LBD appropriately and consciously.

Keywords: built environment, carbon emissions, literature based discovery.

¹ cnk@leeds.ac.uk

STAKEHOLDER ENGAGEMENT IN RESEARCH: THE CASE OF RETROFIT 2050 RESEARCH PROJECT

Alex Opoku¹, Heather Cruickshank², Peter Guthrie² and Maria Christina Georgiadou²

¹ London South Bank University, Department of Built Environment, London SE1 0AA, UK

² University of Cambridge, Centre for sustainable Development, Cambridge, CB2 1PZ, UK

Stakeholder engagement has recently been increasingly identified as key to research projects success. Stakeholder engagement is often seen as communication of the completed research project findings; however engagement with stakeholders that focuses on communicating with and involving them in the knowledge production process is increasingly accepted as the best practice. The study aimed at exploring how the Retrofit 2050 research team engaged fully with relevant stakeholders. The study examines how key stakeholders were recruited, engagement approaches and how the whole process was managed. It illustrates the application of the approaches for stakeholder analysis, engagement and knowledge exchange strategies. This research presents a literature review that considered the power of stakeholder engagement to sustainable urban retrofit research and identified the main process of stakeholder engagement and management. The authors provide participatory and participant observational research perspective of how key stakeholders were engaged throughout the research process. The findings indicate that, engaging with key stakeholders in research can legitimise the result and improves the quality of research output. The study highlights that, personal or one-to-one method of stakeholder engagement is the most commonly used approach to promote stakeholder-researcher relationships. It provides a research case study that can serve as a reference for the systematic consideration of other research teams about the practical approaches for stakeholder engagement in interdisciplinary sustainable urban environment research projects.

Keywords: participatory research, stakeholder engagement, stakeholder analysis, retrofit

¹ opokua@lsbu.ac.uk

Opoku, A, Cruickshank, H, Guthrie, P and Georgiadou, M C (2014) Stakeholder engagement in research: The case of retrofit 2050 research project *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 237-246.*

“TAKING OFF MY GLASSES IN ORDER TO SEE”: EXPLORING PRACTICE ON A BUILDING SITE USING SELF-REFLEXIVE ETHNOGRAPH

Martin Löwstedt¹

¹ *Civil and Environmental Engineering, Chalmers, SE-412 96 Gothenburg, Sweden*

There has recently been a growing interest for ethnographic studies in construction. This interest is predicted upon the belief that ethnographic research to the construction industry can provide a powerful way of illuminating construction practices in new ways. The purpose of this paper is therefore to explicate how ethnography could be used to answer research questions in construction. Drawing on rich empirical data from a field study where the researcher went native, working as a dogsbody on a building site, this paper illustrates how the researcher first battled contrarious roles, only to realize that the transforming perspectives were the true resource. The paper presents the practices on the building site from an observer perspective and a worker perspective respectively and concludes that a self-reflexive ethnographic approach can account for the variations, contradictions, and tensions embedded in the practices of construction.

Keywords: ethnography, self-reflexivity, identity.

¹ martin.lowstedt@chalmers.se

Löwstedt, M (2014) “Taking off my glasses in order to see”: Exploring practice on a building site using self-reflexive ethnograph *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 247-256.*

HUMAN BEHAVIOUR AND CULTURE

A SPANISH SUBCONTRACTOR IN A UK CULTURE

David Oswald¹, Simon Smith¹ and Fred Sherratt²

¹ *University of Edinburgh, King's Buildings, West Mains Road, Edinburgh, EH9 3JN, UK*

² *Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ, UK*

Globalisation of the construction industry has meant that people from different national cultures often work together. This creates many additional challenges for the industry, one of which is forming and maintaining a positive safety culture. This study focuses on a Spanish subcontractor working in the UK on a large construction project (+£500m). Throughout a 9-month period, an ethnographic study was undertaken to explore the safety-related challenges that were created for the principal contractor; the lead researcher was able to spend time on the project as a participant observer to gather data around this phenomenon. Despite some regarding it as suspicious, ethnography has now emerged as another approach for understanding the construction industry. This paper demonstrates that through this qualitative approach, new avenues can be explored to broaden and improve our understanding of the industry. The Spanish subcontractor had a faster but less safe culture than their UK counterparts and found it difficult to change their ways and comply with stricter regulations. During the study period, the Spanish subcontractor was stopped numerous times for safety reasons, and even temporarily removed from site. These failings led to the appointment of a health and safety advisor which did lead to some improvements. The challenges did not only occur when the Spanish subcontractor was not following regulations or revealing a poor safety culture, but also when they appeared to display competence. Under UK legislation, the principle contractor is required to check and monitor the competence of the subcontractor and their systems. However in one scenario the principal contractor did not know anything about the Spanish system the subcontractor were using, so how would it be possible to monitor competence? Findings suggest that whilst the Spanish subcontractor may have been a low-cost option initially, safety risks were increased leading to significant amounts of time, money and resources being required to attempt to control these risks.

Keywords: ethnography, migrant, Spain, UK.

¹ D.Oswald@ed.ac.uk

Oswald, D, Smith, S and Sherratt, F (2014) A Spanish subcontractor in a UK culture
In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 259-268.

MALAYSIAN CONSTRUCTION PROFESSIONALS: WHY ARE THEY LEAVING?

Norakmarwati Ishak¹ and Abdul Rashid Abdul Aziz

¹*Faculty of Architecture, Planning and Surveying, MARA University of Technology, 32610 Perak, Malaysia*

²*School of Housing, Building and Planning, Universiti Sains Malaysia, 11800 Penang, Malaysia*

War on global talents has been going on for decades and the international mobility of talents has been increasing and has caused tremendous downside effects to countries such as Malaysia. According to the World Bank, up until 2010 there were estimated 1 million Malaysians working abroad and thus instigated the establishment of Talent Corporation in 2011. Nevertheless, in order to effectively entice these talents in coming back, finding out who are they and the main reasons they left Malaysia in the first place are mandatory. Although there are many researches in this area, little is known with regards to Malaysia, let alone the talent loss among the Malaysian construction professionals. An empirical study using a quantitative survey and interviews was carried out amongst Malaysian construction professionals working abroad, in an attempt to identify their characteristics and determine the main push and pull factors. By using SPSS and Rasch model of measurement, these factors are then ranked according to their importance. Interestingly the Malay professionals left Malaysia after gaining experience thus they are older as compared to the Chinese professionals. In addition, the most important reason of leaving Malaysia is due to lower income received in Malaysia. However, surprisingly other important motivations are related to personal behaviours such as to get exposure, curiosity, to challenge one's ability and also to live and work in a better environment. Therefore the main reasons are not just about money issue, they also revolve around other aspects of life. These findings hopefully would provide some insights for policy makers and the government in identifying this group of people and understanding the reasons they are leaving and thus could come up with more effective programmes of retaining and attracting these valuable talents in overcoming the talent loss phenomenon.

Keywords: brain drain, construction professionals, push and pull factors, talent loss.

¹ akmarishak@gmail.com

Ishak, N and Abdul Aziz, A R (2014) Malaysian construction professionals: Why are they leaving? *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 269-277.*

THE OUTCOMES OF CROSS-CULTURAL ADJUSTMENT: A CASE OF BRITISH EXPATRIATES WORKING ON INTERNATIONAL ARCHITECTURAL, ENGINEERING AND CONSTRUCTION ASSIGNMENTS

Konanahalli, A¹, Oyedele L O², Spillane, J¹ and Marinelli, M¹

¹*School of Planning, Architecture and Civil Engineering, David Keir Building, Stranmillis Road, Queen's University Belfast, Belfast, Northern Ireland, BT9 5AG, UK*

²*University of West of England, UK*

The main aim of this study is to investigate the consequences of cross-cultural adjustment in an under researched sample of British expatriates working on International Architectural, Engineering and Construction (AEC) assignments. Adjustment is the primary outcome of an expatriate assignment. According to Bhaskar-Srinivas et al., (2005), Harrison et al., (2004) it is viewed to affect other work related outcomes which could eventually predict expatriate success. To address the scarcity of literature on expatriate management in the AEC sector, an exploratory design was adopted. Phase one is characterised by extensive review of extant literature, whereas phase two was qualitative exploration from British expatriates' perspective; here seven unstructured interviews were carried out. Further, cognitive mapping analysis through Banaxia decision explorer software was conducted to develop a theoretical framework and propose various hypotheses. The findings imply that British AEC firms could sustain their already established competitive advantage in the global marketplace by acknowledging the complexity of international assignments, prioritising expatriate management and offering a well-rounded support to facilitate expatriate adjustment and ultimately achieve critical outcomes like performance, assignment completion and job satisfaction.

Keywords: British expatriate, adjustment, performance, job satisfaction, assignment completion, international assignments.

¹ a.konanahalli@qub.ac.uk

Konanahalli, A, Oyedele, L O, Spillane, J and Marinelli, M (2014) The outcomes of cross-cultural adjustment: A case of British expatriates working on international architectural, engineering and construction assignments *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 279-288.*

DETERMINANTS OF SUCCESSFUL INTERNATIONAL EXPANSION OF CONSTRUCTION CONTRACTING FIRMS: A CASE STUDY OF PAKISTANI FIRMS

Ahsen Maqsoom¹ and Chotchai Charoenngam

Asian Institute of Technology, Khlong Luang, Pathumthani 12120, Thailand

International Business (IB) has generally examined international expansion of manufacturing firms, whereas services particularly the construction service sector has received little attention. This study has examined the firm-specific determinants (FSDs) and home country-specific determinants (HSDs) of Pakistani international construction contracting firms (CCFs). This study utilizes the mixed method approach i.e. integrating quantitative and qualitative methods. The data has been collected through the questionnaire survey, one-on-one interviews and company reports. The findings of the study show that an extensive harmony was found between the investigated firms' firm-specific determinants (FSDs) and the past studies. Investigated firms gave high competitive value to FSDs whereas they gave low competitive value to home country-specific determinants (HSDs). The findings of the study failed to support the HSD view of previous models as providing support to Pakistani international CCFs.

Keywords: competitive advantage, contracting, determinants, emerging economies, international expansion.

¹ ahsen.maqsoom@ait.ac.th

Maqsoom, A and Charoenngam, C (2014) Determinants of successful international expansion of construction contracting firms: A case study of Pakistani firms *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 289-298.*

HEALTH AND SAFETY AND WELL-BEING

SAFETY AND VOLUNTEER CONSTRUCTION WORKERS

Lydia Foster-Smith¹, Sinead Walsh, Martin Crapper and Fred Sherratt²

¹ *School of Engineering, The University of Edinburgh, EH9 3JL, UK*

² *Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ, UK*

The construction industry is dangerous – 39 fatalities were recorded in the UK in 2012/13, with comparable and even larger figures reported worldwide. Yet every year, at least several hundred UK-based people take part in construction activities on a voluntary basis, examples being international development projects using ‘gap-year’ students and the substantial UK heritage railway sector that maintains its permanent way and civil engineering infrastructure using volunteers. Most of these volunteers have limited training and no technical qualification, whilst safety regulation frameworks range from being comparable to professional sectors to zero regulation in some international contexts. This research investigates how these volunteer workers construct safety in their volunteering environment. A series of unstructured interviews have been conducted with members of permanent way gangs at several UK heritage railways and with students who have taken part in development projects including the construction of housing and water infrastructure in Eastern Europe and Africa under the auspices of various charities. Taking a social constructionist perspective, the interviews were explored using discourse analysis to illuminate the master discourses of safety within this unique construction ‘industry’. Those with engineering or technical backgrounds developed more tangible constructions of safety, around risks and hazards, within their activities, yet volunteers without this knowledge also acknowledged this wider context of danger. Volunteers on overseas projects developed discourses of ‘difference’ between safety at home and safety outside of the UK; this discourse closely associated with negative practices overseas yet also with an acceptance of the inevitability of this context as part of their voluntary experience. Further work is proposed to determine whether these insights can contribute to appropriate management of safety in these contexts, relative to practice in the professional construction industry.

Keywords: development project, discourse analysis, heritage railway, safety, volunteer.

¹ Martin.Crapper@ed.ac.uk

Foster-Smith, L, Walsh, S, Crapper, M and Sherratt, F (2014) Safety and volunteer construction workers *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 301-310.*

CONSTRUCTION WORKERS' VIEWS ON WORKPLACE DESIGN AND 'HEALTHY' AGEING

Eaves, S.D.,¹ Gyi, D. and Gibb, A.²

¹ Design School, Loughborough University, Loughborough, LE11 3TU, UK

² School of Civil and Building Engineering, Loughborough University, Loughborough, LE11 3TU, UK

With the recent abolishment of a retirement age we are seeing an increase in an ageing workforce. This can often be difficult to manage, particularly in tough working environments such as the construction industry. Construction and building trades are well known for being tough, heavy and manually challenging, which can prove difficult for the older worker to remain healthy in whilst also exacerbating the decline in physical ability seen in the ageing population. Construction workers are often faced with cold, dark, poorly ventilated working environments however, some organisations working in areas such as maintenance provide somewhat less harsh conditions, often with a slower pace of work in comparison to the building trades and industrial work. In this paper, findings from interviews with 74 construction workers will be presented. Workers came from a small maintenance facility, a medium-sized domestic new-build company and a large civil engineering company. In-depth semi structured interviews took place with participants aged from 18 to over 50 in their place of work, incorporating the Stage of Change questionnaire, Nordic Musculoskeletal questionnaire and the Work Ability Index. In this paper comparisons are made between working practices, cultures and attitudes in these three organisations. The aim of this research is to provide direction for better work place design using the experience, knowledge and ideas of construction workers by encouraging healthy ageing in the industry, facilitating healthier working behaviours and enabling positive change.

Keywords: ageing, culture, ergonomics, organisation.

¹ S.Eaves@lboro.ac.uk

Eaves, S, Gyi, D and Gibb, A (2014) Construction workers' views on workplace design and 'healthy' ageing *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 311-320.*

EXPLORING THE INTERNAL DIMENSIONS OF WORK STRESS: EVIDENCE FROM CONSTRUCTION COST ESTIMATORS IN CHINA

Bo Xiong¹, Martin Skitmore and Bo Xia

School of Civil Engineering and Built Environment, Queensland University of Technology, Gardens Point, Brisbane QLD, 4001, Australia

A recurring feature of modern practice is the stress placed on project professionals, with both debilitating effects on the people concerned and indirectly affecting project success. Cost estimation, for example, is an essential task for successful project management involving a high level of uncertainty. It is not surprising, therefore, that young cost estimators especially can become stressful at work due to a lack of experience and the heavy responsibilities involved. However, the concept of work stress and the associated underlying dimensions has not been clearly defined in extant studies in the construction management field. To redress this situation, an updated psychology perceived stress questionnaire (PSQ), first developed by Levenstein *et al* (1993) and revised by Fliege *et al* (2005), is used to explore the dimensions of work stress with empirical evidence from the construction industry in China. With 145 reliable responses from young (less than 5 years' experience) Chinese cost estimators, this study explores the internal dimensions of work stress, identifying four dimensions of *tension, demands, lack of joy* and *worries*. It is suggested that this four-dimensional structure may also be applicable in a more general context.

Keywords: work stress, perceived stress questionnaire, young cost estimators, exploratory factor analysis.

¹ peterxiongbo@gmail.com

Xiong, B, Skitmore, M and Xia, B (2014) Exploring the internal dimensions of work stress: Evidence from construction cost estimators in China *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 321-329.*

WORKPLACE STRESS IN THE CONSTRUCTION INDUSTRY: AN EXPLANATORY MODEL

Paul Bowen¹, Rajen Govender², Peter Edwards³ and Keith Cattell¹

¹*Department of Construction Economics and Management, University of Cape Town, Private Bag, Rondebosch 7701, Cape Town, South Africa*

²*Centre for Social Science Research and Department of Sociology, University of Cape Town, Private Bag, Rondebosch 7701, Cape Town, South Africa.*

³*School of Property, Construction & Project Management, RMIT University, GPO Box 2476, Melbourne 3001, Australia*

The construction industry is noted for high levels of occupational stress, particularly among professional workers. Using data from 676 architects, civil engineers, quantity surveyors, and project and construction managers responding to an on-line survey in South Africa, an integrated conceptual model of occupational stress is proposed. Structural equation modeling is used to test the model iteratively. The results of the final model indicate that: psychological, physiological and sociological strain effects are the terminal consequences of occupational stress; organizational climate is largely determined by gender and job demand, control and support; age, gender, control and organizational climate are predictors of discrimination; psychological distress is predicted by age, job demand and control factors, and organizational climate; sociological stress is determined by age, job demands, discrimination and psychological distress; and age, and sociological and psychological stress effects manifest themselves as predictors of physiological stress effects. Construction employers should regularly review workload allocations, empower employees, foster a supportive work environment, conduct stress appraisals, and hold stress management workshops.

Keywords: construction professionals, predictive modeling, workplace stress.

¹ Paul.Bowen@uct.ac.za

Bowen, P, Govender, R, Edwards, P and Cattell, K (2014) Workplace stress in the construction industry: An explanatory model *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 331-340.*

WE WILL FORCE YOU TO BE WELL: POSITIVE LIBERTY, POWER AND THE HEALTH AND WELLBEING OF CONSTRUCTION WORKERS

Fred Sherratt¹

¹ *Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ, UK*

The UK construction industry has long championed changes and developments in work practices that reduce and avoid negative impacts on worker health and wellbeing. More recently however, approaches have shifted to consider the worker beyond the workplace, and now seek to improve health and wellbeing in worker ‘associated lifestyles’, as crystallised in the UK Department of Health’s Responsibility Deal Construction Pledge. Yet such an approach is a fundamental challenge to construction workers’ liberty, and questions the status of the individual and their autonomy. It can also be seen as an exercise in paternalistic or pastoral power, and consequently a constraint of personal freedoms. Whether this next step in corporate social responsibility is a purely philanthropic quest, seeking to improve individuals own health and wellbeing, or a step towards the creation of a more perfect workforce, one that does not become ill or operate at any less than maximum performance, such an approach brings benefits not only to the workforce but also to those who benefit from what they produce. As companies become more economically powerful than countries, such governmentalisation of corporate powers must be considered. The exercise of this power should be questioned, and the agendas, issues, conflicts and interests behind such approaches fully illuminated and explored. Grounded in a Critical Discourse Analysis (CDA) of the press release of the UK Pledge, a Foucaultian exploration of the power relations in play within this context has been developed. Steven Lukes’ three dimensions of power are considered alongside positive liberty, revealing potential concerns for workers health and wellbeing in terms of their fundamental autonomy, and an increasingly controlled relationship between productive activities and power relations.

Keywords: autonomy, health, positive liberty, power, wellbeing.

¹ fred.sherratt@anglia.ac.uk

CARTOONS ON OCCUPATIONAL HEALTH AND SAFETY: SEMIOTIC ANALYSIS OF WORKERS

Serdar Ulubeyli¹, Volkan Arslan², and Serkan Kivrak³

^{1,2} *Department of Civil Engineering, Bulent Ecevit University, PO Box 67100, Zonguldak, Turkey*

³ *Department of Civil Engineering, Anadolu University, PO Box 26555, Eskisehir, Turkey*

Construction industry is at the top rankings in developed and developing countries in terms of occupational deaths and injuries. This shows that legal regulations themselves could not decrease occupational accidents. In decreasing such incidents, the perception of the society on workers, who are a part of occupational health and safety issue, has an important indicator. Therefore, in this study, it was aimed to present the perception of the society on the responsibility of workers for occupational health and safety through cartoons. For this objective, seven of cartoons exhibited in International Construction Accidents Cartoon Contest held in Turkey were examined through semiotic analysis methodology. As a result, occupational health and safety perspectives of different countries in terms of cultural and geographical background were exposed by means of cartoons from these countries. It was observed that workers in China and in Greece share the same problems such as lack of attention and responsibility, although these countries are quite far from each other geographically and culturally. Similarly, cartoons from Turkey and Russia emphasize the extremely dangerous nature of construction works. In addition, contrary to other countries, workers in Turkey and in Greece wear casual clothes instead of overalls. All of these findings clearly indicate that construction-based occupational health and safety perceptions of countries do not change significantly and that cultural and economic differences between countries do not seem to be an important driver in this regard. Consequently, these results can have a function in guiding workers and worker unions to revise and manage the general perception of the society about them.

Keywords: cartoon, occupational health and safety, semiotic analysis, worker.

¹ ulubeyli@beun.edu.tr

Ulubeyli, S, Arslan, V and Kivrak S (2014) Cartoons on occupational health and safety: semiotic analysis of workers *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 351-360.*

HEALTH AND SAFETY PRACTICES ON CHRISTCHURCH'S POST-EARTHQUAKE REBUILD PROJECTS: HOW RELEVANT IS HEINRICH'S SAFETY PYRAMID

Mark Seward¹ and Linda Kestle

¹ *Unitec Institute of Technology, Auckland, New Zealand*

Health and Safety is at the forefront of the construction sector projects in New Zealand particularly as the post-earthquake rebuild gets underway in Christchurch. Health and Safety best practice on all project sites needs to be constantly reviewed, updated, and implemented to reduce on-site accidents. The research investigated whether Heinrich's (1931) Safety Pyramid was relevant to Christchurch's post-earthquake rebuild projects in the civil construction sector. The selected literature specifically focussed on publications that involved or reviewed the validity of Heinrich's Safety Pyramid. Archival accident data in New Zealand for the year ending June 2103 was reviewed and to complement this data a questionnaire was prepared, and distributed to one hundred construction personnel working on civil construction rebuild projects in Christchurch in the latter part of 2013. In addition, semi-structured interviews were subsequently conducted with five selected personnel including project managers, supervisors and labourers. The reviewed and collected data were analysed with the resultant finding that Heinrich's Safety Pyramid was still considered to have relevance for safety practices on Christchurch's post-earthquake rebuild projects in the civil construction sector.

Keywords: Christchurch, civil construction rebuild, health and safety, Heinrich pyramid, post earthquake.

¹ markseward@hotmail.co.nz

Seward, M and Kestle, L (2014) Health and Safety practices on Christchurch's post-earthquake rebuild projects: How relevant is Heinrich's safety pyramid *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 361-370.

VALIDATION OF CONSTRUCTION SAFETY EQUILIBRIUM MODEL ON HIGH-RISE BUILDING CONSTRUCTION PROJECT IN THAILAND

Nart Sooksil¹ and Vacharapoom Benjaoran

¹ *School of Civil Engineering, Institute of Engineering, Suranaree University of Technology, NakhonRatchasima 30000, Thailand*

Construction work involves a lot of work processes which are subjected to change according to project-specific requirements and context. These changes can cause accident hazards which require workforce management to balance task demand with worker capability. This research proposed the construction safety equilibrium model which was based on the car accident model. This study investigated the factors that influence task demand and capability, and also determined the weight of each factor by the Analytic Hierarchical Process via interviewing construction safety experts. The 15 accident case studies of workers who worked in high-rise building construction projects were applied for validation of the model. The research came up with two results: 1) the highest weight of the main factor of task demand contributed to the work behaviour factor and rule of safety was the most weighted sub-factor; for capability, the dominant main factor was the human factor and frustration was the highest weighted for the sub-factor; and 2) the average task demand level and the average capability level of the sample group was 1.99 and 1.77 of 3.00 point scale. These scores reflect the work that workers were performing when the accidents occurred were too difficult and did not match their capabilities according to the principle of construction safety equilibrium.

Keywords: capability, construction safety, safety equilibrium, task demand.

¹d5640331@g.sut.ac.th

Sooksil, N and Benjaoran, V (2014) Validation of construction safety equilibrium model on high-rise building construction project in Thailand *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 371-379*

UNDERSTANDING THE ROLE OF LOCAL SAFETY GROUPS IN MANAGING SAFETY PRACTICES BETWEEN MICRO CONSTRUCTION FIRMS AND PRINCIPAL CONTRACTORS

Emmanuel Aboagye-Nimo¹, Ani Raiden and Andrew King²

¹ Nottingham Business School, Nottingham Trent University, Nottingham, NG1 4BU, UK

² School of Architecture Design and the Built Environment, Nottingham Trent University, Nottingham, NG1 4BU, UK

Construction projects incorporate the input of a range of tradesmen and different sized firms, ranging from micro to large organisations. Working practices of micro construction firms are carried out in an informal manner while larger organisations tend to adopt more formal on-site management techniques. Many micro firms seek to develop long-term relationships with large principal contractors and a major strain on their relationships stem from the difference in safety management techniques they employ. Faced with a fundamental shift in their style of safety management, workers of micro construction firms must successfully negotiate this challenge. Against this background, records from the Health and Safety Executives show year on year reductions in accident and incident rates in the East Midlands, an indication that the safety practices on projects are being implemented more effectively. Some of this success has been attributed to the efforts of local safety groups, such as Nottinghamshire Occupational Safety and Health Association (NOSHA). As such, it is important that the interdependencies between large principal contractors and micro firms, and the role that safety groups such as NOSHA play in managing this relationship are better understood. This paper presents interviews conducted with some members of NOSHA. This is the first of two phases of empirical work. The roles that the members of the local safety group perform have been found to go beyond simply promoting safety awareness and safety knowledge on site. They have been found to help in conflict resolution among the various construction parties. Such practices help create a harmonious working environment and subsequently lead to long-term working relations.

Keywords: micro firm, informal practice, subcontractors, safety group.

¹ emmanuel.aboagye-nimo@ntu.ac.uk

Aboagye-Nimo, E, Raiden, A and King, A (2014) Understanding the role of local safety groups in managing safety practices between micro construction firms and principal contractors *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 381-390.

PROCUREMENT

ASSESSING QUALIFICATION SYSTEMS: THE RELEVANCE OF EXPLICATING IMPLICIT REASONING

H.E.C. Plantinga¹, J.T. Voordijk² and A.G. Dorée²

¹ *Procurement Department, ProRail, The Netherlands*

² *Department of Construction Management and Engineering, University of Twente, The Netherlands*

In public procurement, most contractors view the qualifying procedures they are obliged to follow as time consuming and wasteful. For one category of public clients, EU rules offer an alternative to qualifying for each project. Public clients operating in the water, energy, transport or telecommunications sectors may establish and operate a so-called ‘qualification system’. This offers contractors the opportunity to qualify for a period of time rather than an individual project. The reasons for applying such a qualification system seem traditionally to be rooted in reducing transaction costs, particularly where the administrative demands are significant relative to the typical value of contracts. As such, it may seem self-evident that a client’s choice between the two approaches should be based on cost efficiency considerations. However, cost efficiency may not be the only motive behind employing a qualification system. A case study is presented here that examines the evolution of such a system and the corresponding reasoning by its operator. While exploring the usability of a conceptual model for managing procurement knowledge, additional reasons for operating the qualification system are reconstructed by exposing the implicit organizational knowledge. Initial results show that formal reasons are combined with implicit ones. These implicit reasons are found to be key in explaining the current utilization of the qualification system. Over time, implicit reasons get included in the reasoning process and come to dominate the original formal reasons. Without proper explication of these reasons, the real value of the qualification system may remain undetected. The contributions of this paper are twofold. First, it reports a case study in which the usability of a model developed for managing procurement knowledge is explored. Second, this paper offers a first insight into the evolution of a qualification system and the corresponding reasoning by its operator.

Keywords: implicit knowledge, public procurement, qualification system.

¹ henrico.plantinga@prorail.nl

Plantinga, H E C, Voordijk, J T and Dorée, A G (2014) Assessing qualification systems: the relevance of explicating implicit reasoning *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 393-402.*

THE CHANGING ROLE OF THE PUBLIC CLIENT IN CONSTRUCTION PROCUREMENT

Ali Alharthi¹, Robby Soetanto and Francis Edum-Fotwe

School of Civil and Building Engineering, Loughborough University, Leicestershire LE11 3TU, UK

The public sector obligation to improve the performance of construction procurement has resulted in several changes to the organisation, roles and systems adopted for development schemes. For example, a less than expected outturn performance of traditional arrangements and the increase demand for public services led to the adoption of integrated procurement systems. These changes have seen a transition of client's role from merely a funder to an active player working collaboratively alongside the private sector (as service providers) at different periods over the last three decades. These changes were expected to improve construction procurement performance dramatically as they allow the clients to enhance their organisational capabilities by assigning major part of their roles to the private sector. However, the literature does not show that the procurement performance has improved as a result of the changes in the client organisation. While research continues to emphasise the importance of the client role in the construction procurement, so far limited attention has been given to the development of the client's internal organisation for better procurement performance. This paper reports a comprehensive review of the role of the client in construction procurement identified by various researchers to establish the role that the client has been performing over the last three decades. This has been achieved by applying a chronological mapping method of materials published on the subject over the last three decades. The analysis indicates that there are critical elements within the client role which have been consistently addressed over the last three decades. In addition, there are elements which have emerged as a consequence of the shift towards integrated systems. An understanding of critical and emerging elements will allow the clients to identify the gap between the required and the existing capabilities within their organisations, and to assess their procurement arrangement.

Keywords: procurement, public client, tendering.

¹ aliharthi@yahoo.com

GOVERNANCE STRUCTURES IN COLLABORATIVE WORKING PRACTICES

Wisdom Kwawu¹ and Samuel Laryea

School of Construction Economics and Management, University of the Witwatersrand, PO Box 20, Wits 2050, Johannesburg, South Africa

Over the past 30 years, there has been growing pressure on construction companies and clients to adopt partnering contracts. This represents an important institutional innovation that potentially acts as a driver for changing rooted managerial approaches towards a sustainable supply chain management and governance. However some of the challenges faced include integrating several relational themes with traditional procurement processes. In addition the factors for creating, managing and fulfilling partnering contracts vary across construction projects. This paper investigates the role of governance structures, processes and actors in the governance of collaboration. Using a case study of a partnering framework agreement between a county council and a road maintenance contractor, some of the factors for creating, managing and fulfilling relational contracts are highlighted. A conceptual framework is adopted to analyse and evaluate the business relationship as it evolves. The results indicate that governance structures, processes and actors involved standardized procedures and use of individual perceptions. In addition, organisational and individual perceptions influenced the choice of appropriate governance mechanisms and strategies used in coordinating, controlling and legitimizing the business relationships. Future studies may look into the moderating and mediating role of relational and formal attributes on performance. Researchers could focus on the interventions that managers undertake to make sure that trust and standardized procedures (control) enhance performance.

Keywords: actors, collaborative working, governance, partnering, structures.

¹ wisdom.kwawu@wits.ac.za

STAKEHOLDER MANAGEMENT IN PUBLIC PRIVATE PARTNERSHIP PROJECTS IN NIGERIA: TOWARDS A RESEARCH AGENDA

Chika Amadi¹, Patricia Carrillo and Martin Tuuli

School of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK.

Over the last couple of decades, Public Private Partnerships (PPPs) have been identified as a viable alternative for procuring public infrastructure. PPPs bring together the best of both worlds; private sector managerial expertise and public sector regulatory and supervisory capacity to procure public infrastructure. While several PPP projects have been delivered successfully, others have experienced challenges such as stakeholders' opposition. PPP projects are by their nature complex involving multiple stakeholders and thus far, there is a lack of adequate and well-structured means of managing these stakeholders and their varied interests which has resulted in neglect of stakeholders. Neglect of interest of stakeholders has been identified as a major factor that undermines the success of PPP projects in Nigeria.

To this end, managing stakeholders in PPP projects in Nigeria has become necessary owing to the fact that support for PPP projects by the general public and transparency in the PPP process are enhanced when end users, local communities and other stakeholders are involved in all phases of the PPP scheme. This paper reviews literature on stakeholder management and concludes that existing frameworks do not provide adequate guidance on how stakeholders in PPP projects should be managed from project conception to operation and maintenance. Some of the main flaws identified with existing frameworks are their lack of attention to multiple parties involved in PPP projects and the inadequacy of stakeholder identification process. This paper thus identifies the gaps in existing stakeholder management frameworks and makes a case for developing a framework for managing stakeholders in PPP projects which would be all inclusive, transparent and that gives end users, local communities and other stakeholders their rightful place as co-owners of the project. This will enhance public support for PPPs and attract private sector investment in infrastructure in Nigeria.

Keywords: frameworks, public private partnership, stakeholder management.

¹ C.J.Amadi@lboro.ac.uk

Amadi, C, Carrillo, P and Tuuli, M (2014) Stakeholder management in public private partnership projects in Nigeria: Towards a research agenda *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 423-432.*

A COMPARATIVE ANALYSIS OF THE DESIRED AND ACTUAL BIDDING BEHAVIOUR OF CONSTRUCTION COMPANIES

Koki Arai¹ and Emi Morimoto²

¹ *Japan Fair Trade Commission, 1-1-1 Kasumigaseki Chiyoda-ku Tokyo, Japan*

² *The University of Tokushima, 2-1 Minami-Josanjima Tokushima, Japan*

In the present paper, we quantify the desired and actual bidding behaviour of Japanese companies by analysing public procurement data from three regional development bureaus. Our study extends the findings of Iwamatsu et al. (2013), who use a survey questionnaire to determine the desired (but not the actual) bidding behaviour of major Japanese construction companies. To compare actual bidding behaviour with desired bidding, we model the probability of participation and the bidding ratio, both of which are regressed on the quantified values of the bidding data and other information. The results are then ranked, compared with those of Iwamatsu et al. (2013), and analysed. We focus on the factors on which firms concentrate when determining (i) whether they will participate in the bidding process and (ii) their pricing during bidding. Although both Iwamatsu et al. (2013) and our study include widely used high-ranking items, in our analysis, 'company circumstances' are highly ranked at the participation stage, while 'competition circumstances' are highly ranked at the pricing stage. This offers a practical justification for including competition circumstances when modelling real-world bidding behaviour.

Keywords: bidding, procurement, statistical analysis, price.

¹ koki.arai@nifty.ne.jp

Arai, K and Morimoto, E (2014) A comparative analysis of the desired and actual bidding behaviour of construction companies *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 433-442.*

ASSESSING THE PRACTICE OF PROJECT-BASED JV BETWEEN LOCAL AND INTERNATIONAL CONTRACTORS IN THE UAE

Samer Skaik¹ and Hussain Oweineh

¹ School of the Built Environment, Heriot Watt University, Dubai Campus, UK

This paper is about assessing the practice of Project-Based Joint Ventures formed between local and international contractors in the UAE construction industry. This common practice nowadays, provides the means for contractors to quickly add resources to enhance project acquisition. Studies indicate that JVs are among the tools that contractors will need to get together in the face of increasing market demands. Specifically, Project-Based JVs are often used in the UAE Construction industry with an exceptional growth in an attempt to diversify from Oil and Gas. The UAE is very business friendly which makes it attractive for such kind of alliance or partnership for local contractors to get the necessary experience and for international contractors to minimize the risks associated with entering new markets. In this context, studies that evaluate this alliance phenomenon in the UAE construction industry are limited. The few industry-related studies have primarily focused on large, international JVs; yet, many JVs are formed on small and medium-sized projects within the UAE. The paper aims to assess the current practices and understand the many factors involved with forming, managing, and controlling JV partnerships. The research methodology adopted a mix of quantitative and qualitative approaches. First, a closed question survey was disseminated to construction professionals in the UAE in light of the literature findings. Second, two case studies were demonstrated and analysed, then triangulated with the literature and survey findings to remove possible bias and improve the confidence in the collected data. The paper concluded that the JV in the UAE construction industry is mostly formed on project-basis rather than continuous collaboration. The management control mostly used in the UAE construction industry is shared management of activities in a venture with the operations shared between parents. The paper addressed major factors that lead to successful JV in the construction projects of the UAE which are namely trust, correct structure, communication, and partner's commitment. Partners' common objectives do not affect the JV success or failure. Willingness to adapt eliminates conflicts and enhances the JV success prospect.

Keywords: joint venture, partnering, procurement, success factors.

¹ s.samer@hw.ac.uk

Skaik, S and Oweineh, H (2014) Assessing the practice of project-based JV between local and international contractors in the UAE *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 443-452.*

INTERNATIONAL COLLABORATION AND PARTNERING IN THE SUPPLY CHAIN AS BUSINESS OPPORTUNITIES FOR ARCHITECTURAL FIRMS

Marina Bos-de Vos¹, Bente Liefink², Leentje Volker³ and Hans Wamelink⁴

^{1,3,4} *Faculty of Architecture and the Built Environment, Delft University of Technology, PO Box 5043, 2600 GA Delft, the Netherlands*

² *Department of Business Administration, Radboud University Nijmegen, PO Box 9108, 6500 HK Nijmegen, the Netherlands*

Due to a shift towards market driven concepts, a risk allocation from the demand side to the supply side and the increasing competition with other skilled actors in the value chain, architectural firms have to adapt quickly to stay competitive. They need to innovate not only their products and services, but also make more fundamental changes in the way they create and appropriate value, thereby replacing or innovating their business models. This research addresses business model design of architectural firms from an activity system perspective. It aims to identify activity systems that are used within the architectural service sector to create and capture value. By analysing the possibilities and restrictions of the activity systems in relation to both firm and supply chain, business opportunities for architectural firms are explored. Archival data and 20 explorative interviews with different architects, clients and contractors, contribute in the identification of two emergent activity systems: international collaboration and partnering in the supply chain. Since the activity systems include new activities, linkages and actors, they require managerial attention in order to 1) enhance value creation and capture by the firm and 2) guarantee optimal collaboration within the supply chain. By applying the concept of activity systems on the field of architecture, the importance of business model design for the value chain of architectural services is showed.

Keywords: architectural services, business model design, collaboration, supply chain integration.

¹ M.Bos-deVos@tudelft.nl

Bos-de Vos, M, Liefink, B, Volker, L and Wamelink, H (2014) International collaboration and partnering in the supply chain as business opportunities for architectural firms *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 453-462.*

EXPERIENCES OF TRUST IN CONSTRUCTION PROJECT MANAGEMENT: THE INFLUENCE OF PROCUREMENT MECHANISMS

Scott Strahorn¹, Thayaparan Gajendran and Graham Brewer

University of Newcastle, Australia

Trust is a key element in the project manager's toolkit, and fostering trust in a project team is often critical to the project's outcome. Literature suggests that relational procurement mechanisms underpinned by "pain-share/gain-share" principles ought to increase levels of trust between project participants as compared to traditionally procured projects, yet little related research exists. Using "trust as a phenomenon" as the philosophical point of departure the intricacies of trust formation and maintenance are explored in these contexts. A framework of trust-related personal attributes, attitudes and behaviours is used to analyse a series of 15 detailed interviews with multiple representatives from construction and client organisations. Preliminary findings identify: participants' desire for trust in projects; widespread absence of strategies for trust building, maintenance and repair; adversarial dispute resolution as the default; poor project team member selection. Widely valued traits in trading partners include open and honest communication; technical competence; fairness; integrity; honesty, and; benevolence. Where disputation has occurred trust repair skills appear to be rare. Positive pre-existing relationships are reported as the antidote for many project ills. Differences in the perception of trust variables associated with procurement context are identified: superficially surprising and counter-intuitive, they reveal pan-procurement principles for trust-based project success.

Keywords: relational procurement, transactional procurement, trust, trust repair.

¹ scott@strahornconstructiongroup.com.au

Strahorn, S, Gajendran, T and Brewer, G (2014) Experiences of trust in construction project management: The influence of procurement mechanisms *In*: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 463-472.

CIB W113 LAW AND DISPUTE RESOLUTION

REASONS FOR CONTRACTORS' DELAY CLAIMS FAILURES IN SRI LANKA

Thanuja Ramachandra¹, James Olabode Rotimi² and Shanika Gunaratne³

^{1,3}*Department of Building Economics, University of Moratuwa, Sri Lanka*

²*School of Engineering, Auckland University of Technology, New Zealand*

Project delays often occur due to the dynamic and complex nature of the construction industry and would lead to claims and disputes between contracting parties. Once a project exceeds the period contractually required to complete a project, there is bound to be an effect on expenditure or income of the contractor as well as the project owner. This study therefore determines the reasons for unsuccessful contractors' delay claims in Sri Lanka. The study administered a questionnaire survey to construction practitioners, contractors and consultants. A total of 55 respondents from both contracting companies (n = 40, with C1-C3 grading) and consultants (n = 15) were selected using stratified random and snowballing sampling methods respectively. The data obtained were analysed using descriptive statistics and Relative Importance Index (RII). The study found that time overrun occurs in 90% of projects in Sri Lanka and was indicative of the delays to settlement of contractors' claims. On average 60% of contractors submitted delay claims with only 40% success rate. The top most frequent reasons for unsuccessful claims include: inadequate documentation to substantiate claims, delayed submission of claim details, failure to establish link between cause and effect of claims and failure to use appropriate delay analysis method. Sri Lankan contractors explained that failure to use appropriate delay analysis method and contractors failing to mitigate the effects of the delays are also contributory factors to failures. In order to mitigate these issues, the study recommends that contractors adopt innovative strategies such as providing a contingency for the amount of claim failures under preliminaries or mark up at bidding stage and includes a measure of over valuation as a negotiating margin when preparing the claim first time. Also contractors would need to maintain up to date records of site transactions, while training of their staff to increase their knowledge of contract procedures are a necessity in Sri Lanka.

Keywords: delay claims, reasons for failures, Sri Lanka.

¹ Thanuja03@hotmail.com

Ramachandra, T, Rotimi, J O and Gunaratne, S (2014) Reasons for contractors' delay claims failures in Sri Lanka *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 475-484.*

ISN'T ALL LOSS CONSEQUENTIAL? A REVIEW OF RECENT CASE LAW AND ITS RELEVANCE TO CONTRACTUAL PRACTICES WITHIN THE BUILT ENVIRONMENT

Adam Connell¹ and Jim Mason

¹ C/O Faculty of Environment and Technology, University of the West of England, Frenchay Campus, Coldharbour Road, Bristol, BS16 1QY, UK

The term “consequential loss” frequently arises during contract negotiations in the context where one party is seeking to limit their liability should they subsequently breach that contract. Parties may have different understandings of the term and typically an exclusion clause will not solely relate to consequential loss, but will also include other heads of losses for which the party will not be liable for, such as loss of profit, loss of revenue and loss of business. The question emerges as to whether the term consequential loss has a definitive legal meaning in its own right. This study seeks to ascertain the definition of the term consequential loss within the construction industry through a review of the legal position regarding liability for breach of contract and consequential loss through the consideration of the case law relating to this topic and the associated secondary sources of information. The study concludes by elucidating a clear interpretation of the term consequential loss when used in contract law.

Keywords: contract law, consequential loss, damages, exclusion clause.

¹ adamconnell@ngbailey.co.uk

Connell, A and Mason, J (2014) Isn't all loss consequential? A review of recent case law and its relevance to contractual practices within the built environment *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 485-494.*

PLANNING LAW REFORM AND FAST-TRACKING DEVELOPMENT IN AUSTRALIA

Peter Williams¹ and Angelique Williams²

¹ Faculty of the Built Environment, University of New South Wales, Sydney, NSW, 2052, Australia,

² Faculty of Law, University of New South Wales, Sydney, NSW, 2052, Australia

Statutory planning and building systems in Australia, like many other countries, have undergone significant reform in recent years. A key focal point of these reforms has been to streamline, simplify and progress the assessment and approval of building and other development projects. Generically referred to as 'fast-tracking', this element of the reform agenda is typically set within a discourse which uses terms, for example, of removing 'red tape' and 'delay', and of promoting 'simplification' and 'appropriate assessment' of planning approvals. While considering the area of planning reform in Australia generally, emphasis in the paper is placed on the state of New South Wales (NSW), Australia's most populous state. From a contextual case study analysis of statutory planning reform in NSW over the past two decades, this paper seeks to demonstrate that there has been a paradigm shift in the nature and purpose of town planning which has been driving this reform process. Increasingly reform of statutory planning and building systems are perceived by governments as essential for the stimulation of economic activity.

Keywords: development assessment, fast-tracking, planning approvals, statutory planning reform.

¹p.williams@unsw.edu.au

Williams, P and Williams, A (2014) Planning law reform and fast-tracking development in Australia *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 495-505.*

LEGAL RISK IDENTIFICATION FOR SMES IN THE CONSTRUCTION INDUSTRY

Jennifer Charlson¹ and Chike Oduoza²

¹ *School of Architecture and the Built Environment, Faculty of Science and Engineering, University of Wolverhampton, Wulfruna Street, Wolverhampton WV1 1LY, UK*

² *School of Engineering, Faculty of Science and Engineering, University of Wolverhampton, Wulfruna Street, Wolverhampton WV1 1LY, UK*

This research contributes to a European Union (EU) funded project "*Risk Management Software System for SMEs in the Construction Industry (RiMaCon)*." The aim was to identify relevant legal risks with a view to manage them. A critical literature review was undertaken and the themes that emerged included procurement, building information modelling, building regulation and construction contract issues including delay, claims and dispute resolution. A case study approach was adopted as the researcher benefitted from a secondment to an SME contractor in Italy where pilot interviews were undertaken. The paper concludes that the literature review seems to have identified legal risks relevant to construction SMEs which will be investigated further.

Keywords: building regulation, contract law, dispute resolution, procurement, risk.

¹ j.charlson@wlv.ac.uk

Charlson, J and Oduoza, C (2014) Legal risk identification for SMEs in the construction industry *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 507-515.*

STANDARD FORM CONSTRUCTION CONTRACTS; WHY THE NEED FOR REGULAR CHANGES?

Marthinus J Maritz¹ and Uwe Putlitz²

¹*Department of Construction Economics, Building 5, South Campus, University of Pretoria, Pretoria, RSA*

²*JBCC, 26 Cedar Avenue, Richmond, Johannesburg, RSA*

Publications of the Joint Building Contracts Committee® (JBCC®) are revised periodically to comply with changing statutory and industry requirements in the interests of standardisation and good practice with an equitable distribution of contractual risk. The latest JBCC® edition was published in March 2014. This paper will highlight the changes that were made in this edition with reasons why such changes were deemed necessary, and, in addition, will look at changes that were recently made to other selected local and international standard forms of construction contracts. The related JBCC® documents have consequently been revised. This include the various JBCC® payment certificate forms, the JBCC® security forms and the JBCC® completion certificate forms. The Association of South African Quantity Surveyors has revised the 'Preliminaries' and has prepared a Model Bill of Quantities Preliminaries trade incorporating the new JBCC® edition 6.1. The Adjudication Rules have also been updated in consultation with the Association of Arbitrators of Southern Africa and the Construction Adjudication Association of South Africa. The content of standard forms of construction contracts and the respective industry model documentation used in South Africa and elsewhere, portray the consensus view of constituent bodies representing building owners and developers, professional consultants, and general and specialist contractors which are aimed at bringing about uniformity in construction procurement documentation. The discussion in this paper is about the question why regular changes are necessary to these standard forms of construction contracts. The discussion will be limited to building contracts with the design provided by the employer and to recent changes incorporated in the JBCC®, the GCC 2014 (RSA), the JCT (UK) and the AS 4000 (Australia). More particular emphasis will be placed on the changes between the JBCC® edition 6.1 (2014) and its predecessor, the JBCC edition 5.0 Reprint 1 (2007).

Keywords: construction contracts, contractual risk, procurement, revisions, standardisation.

¹ tinus.maritz@up.ac.za

Maritz, M and Putlitz, U (2014) Standard form construction contracts; why the need for regular changes? *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 517-526.*

A STUDY OF THE MANAGEMENT OF TIME BY COMPARING AND EVALUATING THE PROVISIONS FOR THE MANAGEMENT OF TIME IN THE JCT STANDARD BUILDING CONTRACT (JCT SBC), THE NEW ENGINEERING AND CONSTRUCTION CONTRACT (NEC3) AND THE NEW COMPLEX PROJECTS CONTRACT 2013 (CPC2013)

Tim McLernon¹

¹ *School of the Built Environment, University of Ulster, Jordanstown Campus, Newtownabbey, Co. Antrim, BT37 0QB, UK*

The aims of this study are to compare the management of time provisions of CPC2013 with those of two analogous construction contracts and to theoretically evaluate and comment on the different contributions made by three construction contracts to the management of time of a construction project. This study used a desk-based approach to analyse the respective provisions of the three contracts to be compared and evaluated. In so doing, the study took account of decided case law that impacts on the legal matters associated with the management of time on construction projects. The findings offer a framework that may be used for the theoretical evaluation and comparison of the provisions for the management of time amongst construction contracts and which may be used for practical evaluation and comparison of the same.

Keywords: construction contract, evaluation, time provision.

¹ t.mclernon@ulster.ac.uk

McLernon, T (2014) A study of the management of time by comparing and evaluating the provisions for the management of time in the JCT Standard Building Contract (JCT SBC), the New Engineering And Construction Contract (NEC3) and the new Complex Projects Contract 2013 (CPC201 In: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 527-536.

ARE AUSTRALIAN STANDARD FORMS OF CONSTRUCTION CONTRACT CAPABLE OF DEALING WITH THE ISSUE OF EXTENSIONS OF TIME EFFICIENTLY AND EFFECTIVELY?

Peter Ward¹ and Marcus Jefferies

¹ *School of Architecture and Built Environment, University of Newcastle, NSW 2308, Australia*

The efficient and effective management of time on complex construction projects (especially when concerned with the development and resolution of extension of time claims) has long been considered a major issue in construction contracts. Recent research has culminated in the production of a new standard form of contract drafted specifically as an attempt to overcome these issues. This research identifies the perceived critical success factors that are recommended to be included in, and addressed by the new standard form of construction contract in an attempt to alleviate these issues, and reviews a selection of Australian standard forms of construction contract for the presence of the perceived critical success factors. A review of current literature was carried out to identify the perceived critical success factors for the effective and efficient management of time with respect to extension of time claims, together with a qualitative analysis of the new standard form of construction contract as verification of the identified critical success factors and their management and application. A comparative analysis was undertaken of the extension of time provisions of a selection of Australian standard forms of construction contract as a means of determining their efficiency and effectiveness for resolving extension of time claims in a modern construction industry. The research identified 69 critical success factors that should be present in the clauses of standard forms of construction contracts to efficiently and effectively enable the resolution of extension of time claims for the benefit of all parties involved. The selected Australian standard forms of construction contract were found to be vague with respect to the content and inclusion of the perceived critical success factors, providing a greater opportunity for an extension of time claim to evolve into a dispute between the contracting parties.

Keywords: claims, conflict, contract law, litigation.

¹ P.ward@newcastle.edu.au

Ward, P and Jefferies, M (2014) Are Australian standard forms of construction contract capable of dealing with the issue of extensions of time efficiently and effectively? *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 537-546.

ALLIANCE CONTRACTING: ENFORCEABILITY OF THE CONSENSUSDOCS 300 MUTUAL WAIVER OF LIABILITY IN US COURTS

Gregory F. Starzyk¹

*Department of Construction Management, College of Architecture and Environmental Design,
California Polytechnic State University, 1 Grand Avenue, San Luis Obispo, California 93407,
USA*

Project alliances are on the leading edge of innovation in alternative project delivery methodologies and the mutual waiver of liability is a central canon thereof. Enforceability of this waiver, however, has yet to be tested in any court of law. If enforcement can be relied upon it has the effect of making claims and dispute resolution processes irrelevant as between the parties to the project alliance whereby the project alliance agreement fulfils one of its principal purposes, elimination of claims. This research examines the mutual waiver of liability that flows from safe-harbour decisions under the ConsensusDocs 300™ Standard Tri-Party Agreement for Integrated Project Delivery in order to determine its potential for enforceability in the courts of the US. It adopts a classic legal research methodology focused upon primary and secondary legal research sources and designed to provide balanced findings in the form of a memorandum of law. Case history findings reveal that courts have increasingly found implied duties of good faith and fair dealing in both design services contracts and construction contracts; that courts have also found fiduciary relationships in cost-plus construction contracts; but that courts have been unwilling to find fiduciary relationships in all design services contracts. Enforceability hinges upon the likelihood of courts finding common law fiduciary relationships and duties of good faith and fair dealing for both design and construction services within the express words of ConsensusDocs 300™. The research concludes with an appeal to the academic community to educate industry participants in the common law meaning of both good faith and fair dealing and the expectations of a fiduciary.

Keywords: contract law, liability, claims, fiduciary duties, good faith and fair dealing.

¹ gstarzyk@calpoly.edu

Starzyk, G F (2014) Alliance contracting: Enforceability of the ConsensusDocs 300 mutual waiver of liability in US courts *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 547-556.*

MOTIVATION AGENDA FOR SOCIAL EMPOWERMENT AND RESPECT FOR PEOPLE DURING THE DRAFTING OF CONSTRUCTION CONTRACTS

Paul Crowe¹

¹ *Capita, The Observatory, Chapel Walks, Manchester M2 1HL, UK*

Collaboration is a key element of the UK Government's current construction strategy. Contracts in the UK are evolving to incorporate an increasing number of collaborative features. In construction literature, there are calls for a more robust approach to the selection of such features relating to overall clients' performance requirements, with clients wishing to improve the overall performance of supply chains. The output of the supply chain is dependent on their workforce, with a key element of performance relating to motivation. There is work in psychology that provides an element of generalisation to human motivation, which establishes enablers of intrinsic motivation that improves workplace vitality, health and wellbeing. The aim of this paper is to provide a framework to assist practitioners make decisions that enable intrinsic motivation. The work establishes the basis of the hierarchy from robust work in psychology (self-determination theory); and relates the hierarchy to suites of contracts operating in the UK including the JCT, NEC, FIDIC and ACA suites. Document and summative content analysis evaluates different contractual mechanisms. The research establishes a critical approach to the incorporation of collaborative features in contracts that links to autonomy, competence and relatedness. Further research should be undertaken to explore construction contracts as enablers for social empowerment and respect for people.

Keywords: motivation, contracts

¹ paul.crowe@capita.co.uk

Crowe, P (2014) Motivation agenda for social empowerment and respect for people during the drafting of construction contracts *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 557-566.*

IS EXPERT WITNESS IMMUNITY FROM SUIT A THING OF THE PAST IN CONSTRUCTION LAW?

Phebe Mann¹ and David Tze Wan Wong²

¹ *School of Architecture, Computing and Engineering, University of East London, London E16 2RD, UK*

² *Information Services Division, University College London, London WC1E 6BT, UK*

Is expert witness immunity from suit a thing of the past in construction law? This article explores whether immunity for expert witness should be abolished or not; whether there is a need to distinguish between immunity from suit from actions in negligence, and immunity from suit from actions in defamation. The analysis from case law shows that it is most likely that in the future, immunity will be largely curtailed. It may be considered just and fair for immunity from suit to remain a significant legal and moral obligation for expert witness in view of human rights and right to a fair trial, although we can see there is evidence of a change in the concept of immunity. It can be argued that parties should ensure they employ competent experts to give them appropriate advice, experts should be accountable for the evidence they provide for the court at trials, and immunity from suit should not be enjoyed by expert witness if Article 6 of the European Convention on Human Rights on the right to a fair trial cannot be upheld. Therefore, it is necessary for the courts to modernise their approach to this particular area of law, and to comply with Article 6 of the European Convention on Human Rights. However, it can be argued that if immunity from suit is removed, very few experts will be prepared to be an expert witness for fear of being liable for negligent evidence. In most circumstances, it would be challenging to please the clients as well as carrying out the overriding duty to the court simultaneously. It makes more sense for the expert witness immunity from suit to be maintained but establishing criteria for departures instead of granting blanket immunity.

Keywords: construction law, expert witness, human rights, immunity.

¹ p.mann@uel.ac.uk

WHAT DOES THE DUTY OF UTMOST GOOD FAITH (UBERRIMAE FIDEI) IN INSURANCE CONTRACT MEAN FOR THE CONSTRUCTION INDUSTRY?

Phebe Mann¹ and David Tze Wan Wong²

¹ *School of Architecture, Computing and Engineering, University of East London, London E16 2RD, UK*

² *Information Services Division, University College London, London WC1E 6BT, UK*

This article aims to understand what does the duty of utmost good faith (uberrimae fidei) in insurance contract mean for the construction industry. In construction insurance contracts, the duty of utmost good faith (uberrimae fidei) plays an important role. The analysis of case law shows that an insurer has the right in law to avoid the contract of insurance in its entirety if the insured was guilty of fraud, non-disclosure or misrepresentation before the contract was entered into. It seems to be unjust because even though the insured may be honest, he could still be in breach of duty. Utmost here means that both the insurer and the insured have the duty beyond the reasonable integrity and honesty. Furthermore, the insurer may also have a claim in the case of a breach of utmost good faith during the contract. It proceeds on the basis that the insurer likewise owes the insured a duty of good faith. While sounding good in theory, it can be argued that it may mean very little in practice. In the last decade, the English courts are turning their eyes towards the mutuality of the duty of good faith owed by the insurers to the insured. There is a new practical focus in the construction industry on inducement to balance the risk on the insured and insurer, where the mutuality of the duty of good faith is shifting towards the obligations on the insurers.

Keywords: construction law, insurance contract, uberrimae fidei.

¹ p.mann@uel.ac.uk

Mann, P and Wong, D (2014) What does the duty of utmost good faith (uberrimae fidei) in insurance contract mean for the construction industry? *In*: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 575-582.

CONSTRUCTION MEDIATION IN SCOTLAND: A COMPARISON OF THE VIEWS AND EXPERIENCES OF LAWYERS AND END-USERS

Andrew Agapiou¹ and Bryan Clark²

¹ *Department of Architecture, University of Strathclyde, UK*

² *Law School, University of Strathclyde, UK*

Recent research in different parts of the UK has pointed to growing acceptance of the mediation process from legal professionals with promises of headline grabbing, potential costs savings for hard pressed construction industry users. Nonetheless in many jurisdictions take up is low despite positive evidence relating to use and there is scant empirical knowledge about construction lawyers' role in the referral of cases to mediation and sophisticated evidence relative to lawyer and client interaction in the expediting use of the process. This paper draws upon recent work (both interview and questionnaire based) that the authors have conducted over the past 24 months with construction lawyers and end-users relative to their experiences of mediation in the Scottish construction field – a multiplicity of viewpoints not found in other comparable studies. The findings reveal a small yet significant measure of generally successful mediation activity and growing support for the process among both lawyers and end users. Nevertheless, the barriers to mediation's acceptance remain well-grounded, both throughout legal and client circles and various solutions to overcoming such obstacles are examined in the paper. Evidence gleaned in Scotland has significance beyond its borders given the commonality of issues pertaining to mediation growth across all developing jurisdictions and the presence of a dominant adjudication regime in Scotland which can be seen as a significant inhibiting factor in the use of mediation in many different countries.

Keywords: Construction Lawyers, end-users, mediation, Scotland.

¹ andrew.agapiou@strath.ac.uk

Agapiou, A and Clark, B (2014) Construction mediation in Scotland: A comparison of the views and experiences of lawyers and end-users *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 583-591.*

CONSTRUCTION MEDIATION IN SCOTLAND: AN INVESTIGATION INTO ATTITUDES AND EXPERIENCES OF MEDIATION PRACTITIONERS

Ian Trushell¹, Bryan Clark² and Andrew Agapiou³

¹ School of Engineering and Built Environment, Glasgow Caledonian University, UK

² School of Law, University of Strathclyde, UK

³ Department of Architecture, University of Strathclyde, UK

Recent research on Construction Mediation in Scotland has focused exclusively on Construction Lawyers' and Contractors' interaction with the process, without reference to the views of Mediators themselves. This paper seeks to address the knowledge gap, by exploring the attitudes and experiences of Mediators relative to the process, based on research with practitioners in Scotland. Based on a modest sample, the survey results indicate a lack of awareness of the process within the construction industry, mediations were generally successful and success depended in large measure to the skills of the mediator and willingness by the parties to compromise. Conversely, the results indicate that mediations failed because of ignorance, intransigence and over-confidence of the parties. Barriers to greater use of mediation in construction disputes were identified as the lack of skilled, experienced mediators, the continued popularity of adjudication, and both lawyer and party resistance. Notwithstanding the English experience, Scottish mediators gave little support for mandating disputants to mediate before proceeding with court action. A surprising number were willing to give an evaluation of the dispute rather than merely facilitating a settlement. The research concludes that, in Scotland, mediation had not yet become the indispensable tool for those seeking to resolve construction disputes due to lack of support from disputing parties, their advisors and the judiciary.

Keywords: construction mediators, mediation, Scotland.

¹ i.trushell@gcu.ac.uk

Trushell, I, Clark, B and Agapiou, A (2014) Construction mediation in Scotland: An investigation into attitudes and experiences of mediation practitioners. *In*: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 593-602.

THE APPLICATION OF PLANNING LAW FOR ENVIRONMENTAL PROTECTION AND IMPROVEMENT IN NIGERIA

Beauty O. Alloh¹

Faculty of Law, Delta State University Abraka, Delta State, Nigeria

The problem of environmental protection in Nigeria when the provisions of planning laws are not complied with in the construction and management of buildings in Nigeria was examined in this research. The papers also examines different state planning laws as well as judicial authorities while advocating the creation of new towns, effective zoning, as well as the provision for enhancing sanitary conditions of the environment. The researchers adopted the doctrinal and non-doctrinal research methods. Materials were gathered from primary and secondary sources. Thus published text (both local and foreign), Journals, law reports (foreign and indigenous) and laws dealing with the subject matter where rely upon. Materials from the town planning offices in Nigeria were used. Officials of the town planning offices, construction engineers as well as lawyers were personally contacted and interviewed when carrying out this research. The objective of this paper is to examine the provisions of planning laws that relates to the construction and management of buildings and to make planning laws an issue of concern to bring about its application in the construction and management of buildings for environmental protection and improvement in Nigerian. The paper explains that the protection and improvement of the environment is important to the present as well as the future generations. Thus, while constructing houses within the environment for development purposes, the provisions of planning laws must be strictly complied with, in order to maintain a balance between the development and protection of the environment. The paper explains further that the need for development has led to the construction of structures without clearly defined patterns. This has led to the development of slums which are the reflection of lack of master plan for such an area or the ineffectiveness of relevant authority in enforcing the existing planning laws. Thus this paper concludes that a proper and effective enforcement of planning laws remains the key to environmental protection and improvement in Nigeria.

Keywords: enforcement, improvement, planning, protection.

¹ boalloh@yahoo.com

Alloh, B O (2014) The application of planning law for environmental protection and improvement in Nigeria *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 603-609.*

BUILDING INFORMATION MODELLING

INTERACTIVE LEARNING IN UK CONSTRUCTION PRACTICE: EXAMINING THE ROLE OF BIM PROCESS STANDARDS

Energy Maradza¹, Jennifer Whyte and Graeme D. Larsen

School of Construction Management and Engineering, University of Reading, UK

From a construction innovation systems perspective, firms acquire knowledge from suppliers, clients, universities and institutional environment. Building information modelling (BIM) involves these firms using new process standards. To understand the implications on interactive learning using BIM process standards, a case study is conducted with the UK operations of a multinational construction firm. Data is drawn from: a) two workshops involving the firm and a wider industry group, b) observations of practice in the BIM core team and in three ongoing projects, c) 12 semi-structured interviews; and d) secondary publications. The firm uses a set of BIM process standards (IFC, PAS 1192, Uniclass, COBie) in its construction activities. It is also involved in a pilot to implement the COBie standard, supported by technical and management standards for BIM, such as Uniclass and PAS1192. Analyses suggest that such BIM process standards unconsciously shapes the firm's internal and external interactive learning processes. Internally standards allow engineers to learn from each through visualising 3D information and talking around designs with operatives to address problems during construction. Externally, the firm participates in trial and pilot projects involving other construction firms, government agencies, universities and suppliers to learn about the standard and access knowledge to solve its specific design problems. Through its BIM manager, the firm provides feedback to standards developers and information technology suppliers. The research contributes by articulating how BIM process standards unconsciously change interactive learning processes in construction practice. Further research could investigate these findings in the wider UK construction innovation system.

Keywords: Building Information Modelling, innovation systems, interactive learning, management of innovation, standards.

¹ e.maradza@pgr.reading.ac.uk

AN APPRAISAL OF THE PROTOCOL THAT WAS PUBLISHED BY THE CONSTRUCTION INDUSTRY COUNCIL (CIC) TO FACILITATE THE USE OF BUILDING INFORMATION MODELLING (BIM) ON PROJECTS

Mustafa A. Al-Shammari¹

School of Civil Engineering and Surveying, University of Portsmouth, UK

The UK Government has mandated using Building Information Modelling (BIM) Level 2 by 2016; however a deficiency in standard frameworks to manage BIM implementation and overcome its associated legal risks could make this planned scheme struggle. Therefore, in February 2013, the Construction Industry Council (CIC) released the first edition of its BIM protocol which provides a legal framework intended to promote the use of BIM level 2 on construction projects. This paper carries out a critical appraisal of the CIC protocol to find out whether it will facilitate BIM use, and therefore, accelerate the uptake of BIM adoption across the industry. An overview of the CIC protocol content is provided, along with a review of its benefits and difficulties of use. Additionally, this paper undertakes an evaluation of the protocol performance regarding its ability to overcome the legal issues facing BIM implementation. The assessment was carried out through conducting interviews and circulating questionnaires among construction professionals. It has been found that the CIC protocol is somewhat successful in managing BIM contracts, and the protocol seems to provide an average performance in overcoming the legal issues associated with BIM implementation. This suggests that the CIC protocol will be fairly useful for accelerating BIM uptake.

Keywords: building information modelling (BIM), BIM level 2, BIM protocol, contracts, intellectual property (IP).

¹ mustafa.al-shammari@myport.ac.uk

Al-Shammari, M A (2014) An appraisal of the protocol that was published by the construction industry council (CIC) to facilitate the use of building information modelling (BIM) on projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 623-632.*

A PROPOSED BIM BUSINESS VALUE MODEL

Susanna Vass¹

Dept. of Real Estate and Construction Management, Royal Institute of Technology, 100 44 Stockholm, Sweden

The business value of IT investments has long engaged researchers in fields of information systems (IS) and information technology (IT). Only in recent years has the business value of IT investments received attention in a construction industry context. Particularly, research on the business value of Building Information Modeling (BIM) has emerged in research during the last decade. However, much of the studies do not account for how organizational and business factors influence the value creation process. The research also tends to emphasize what the economic effects of BIM are rather than exploring how these values are created and under what organizational conditions. Hence, the aim is to explore how business value of BIM can be developed in an organizational and business process context. Building on models of IT business value creation from the IT/IS research field, together with findings from interviews on the perceived economic outcomes of BIM, a tentative BIM Business Value Model is proposed that accounts for organizational and business process factors. The model is then used to analyse and suggest what organizational and business related activities that need further attention from research in order to enable BIM business value creation. The findings indicate that among these activities are managing stakeholder requirements, incentives for BIM use, joint inter-organizational activities with partners and delivery of key information to operations and maintenance. A prerequisite for value creation with BIM is however to be able to manage organizational change if BIM is to have a potential impact on performance.

Keywords: business strategy, information technology, information systems, value management.

¹ susanna.vass@abe.kth.se

PERCEPTIONS OF THE VALUE AND VIABILITY OF IMPLEMENTING LEAN CONSTRUCTION WITH BUSINESS INFORMATION MODELLING

Dianne Marsh¹, David Bryde and Andrew Graham

¹ School of the Built Environment, Liverpool John Moores University, Byrom Street, Liverpool, L3 3AF, UK

Whilst research has been conducted on the theoretical links between lean construction and building information modelling, very little has focused on the areas of perceived value and on the perceived viability from utilising the methods together. Furthermore there has been little research to date on whether building information modelling implementation is regarded as potentially leading to an increase in the use of lean construction. To address these gaps in the literature data were collected from semi-structured interviews with site-based and office-based practitioners with knowledge and experience of lean construction and building information modelling. Analysis of the data identified three broad themes: 1) the drivers of lean construction and building information modelling; 2) the connections between lean construction and building information modelling; 3) barriers to implementation. In terms of the specific connections between the two methods the issues highlighted were a) the importance of educating the team b) the importance of early involvement of project participants and, finally c) the importance of managing change. Overall a strong potentially symbiotic relationship between building information modelling and lean construction was identified, as both share the same philosophy in terms of collaborative working and enhanced communication. The use of the two methods then was perceived as having the potential to add value in both financial and non-financial terms. However, not all interviewees believed that the increased use of building information modelling, if it materialises, would necessarily drive greater implementation levels of lean construction. Though there were some marked differences between the opinions of site-base versus office-based professionals, with the site-based practitioners being much more sceptical as to the value and viability of using lean construction and building information modelling together than their office-based colleagues.

Keywords: information management, information technology, information systems, modelling.

¹ D.Marsh@ljmu.ac.uk

Marsh, D, Bryde, D and Graham, A (2014) Perceptions of the value and viability of implementing lean construction with business information modelling *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 643-652.*

THE WIDER IMPLEMENTATION ISSUES OF BIM WITHIN A MULTIFACETED PROPERTY AND REAL ESTATE CONSULTANCY

R. M. Dowsett¹ and C. F. Harty²

¹ *TSBE Centre, University of Reading, Whiteknights, PO Box 219, Reading RG6 6AY, UK*

² *School of Construction Management and Engineering, University of Reading, Whiteknights, PO Box 219, Reading RG6 6AY, UK*

The purported benefits of Building Information Modelling (BIM) have resulted in its widespread advocacy across the industry. However, the realities of its implementation are often misunderstood and overlooked. BIM is a complex and unbounded technology, therefore trying to apply it to a project without consideration of the associated organisational changes is likely to end in failure or lower than predicted returns. Factors such as professional development and technical support, the technology learning curve, positive and negative feelings towards the technology, and strategy effectiveness can all help and hinder implementation. This paper draws on a set of interviews with members of a BIM implementation board within a large multifaceted construction company. The purpose of the interviews was to establish the 'as-is' position of the organisation in terms of BIM use, focussing on current practices and cases studies of previous and on-going projects and their utilisation of both BIM processes and sustainable design activities. However, thematic analysis highlighted significant barriers to the successful implementation of BIM within the organisation: lack of top-level support, misunderstanding across the organisation over BIM capabilities, regional differences in implementation support, and a predominant focus on the bottom-line preventing effective resource allocation. It is therefore argued that the organisational context and conditions of technology, process, and actor interaction are a necessary precursor to successful BIM implementation and should be taken into account when assessing performance on a BIM-enabled project, in order to comprehensively inform and support change management initiatives.

Keywords: BIM, implementation barriers, performance measurement.

¹ r.dowsett@pgr.reading.ac.uk

CONSTRUCTION SITE BIM REQUIREMENTS

Marco L. Trani¹, Manuele Cassano, Massimo Minotti and Davide Todaro

*Department of Architecture, Built Environment and Construction Engineering, Politecnico di Milano
Via Ponzio 31, 20133, Milan, Italy*

Construction are characterized by some overall requirements (e.g. quality, expected time and cost compliance, productivity, profitability, workers' health and safety) to be satisfied. The necessary process to fulfil these requirements should start from the construction site design phase. The aim of the research is the implementation of construction site information in BIM models in order to support the execution phase design since the early stages of the project. These information concern, among the others, the choice optimization of site plants and equipment (i.e. construction site facilities), during the design phase. For this purpose, the creation of a BIM database of construction site facilities is needed. Each record of the database has thus to discharge a panel of BIM construction site requirements, each of them characterized by a set of physical and operational parameters whose relationships with project information lead the choices of the site designer. The methodology for the identification of these kind of BIM requirements has followed these steps: (i) definition of a set of information characterizing building elements/materials from a construction site point of view; (ii) construction site facilities identification and classification; (iii) first investigation in order to assess which is the adequate detail level of site plants and equipment graphic representation in order to create the above mentioned database. A case history is presented in order to show how BIM is useful for construction site designers to optimize their work, sharing information with the other figures involved in the construction process.

Keywords: BIM, information management, design optimization.

¹ marco.trani@polimi.it

THE IMPLEMENTATION AND USE OF 4D BIM AND VIRTUAL CONSTRUCTION

Barry J. Gledson¹ and David Greenwood

¹ Faculty of Engineering and Environment, Northumbria University, Newcastle Upon Tyne, NE1 8ST, UK

The 2013 UK Government construction strategy, presented at its 'Construction Summit' set targets for 50% faster project delivery and reductions in the overall delivery time for new build and refurbished assets. Despite the best efforts of constructors, who have considerable in house experience, skills and knowledge in project delivery, more than half of all UK construction projects exceed their agreed time schedules; with current data revealing the worst performance for 12 years. The concurrent drive for all centrally procured public construction projects to be working at BIM Level 2 by 2016 is seen as an important step in improving the quality of project information, which, in turn, should result in improvements in project predictability, including predictability of both time and cost. The current research investigates how contracting organisations have adapted their existing practices to utilize BIM and improve project delivery. As part of the work a quantitative survey was undertaken that focused upon the current use of virtual construction. Results show a high level of BIM awareness and a more limited degree of experience of using virtual construction practices to improve construction planning. There was, however, a generally high level of recognition of the potential value of 4D planning. With additional data, the study will investigate whether potential benefits of 4D planning are being actualised, as well as exploring associations between the extent and nature of its use and characteristics of the user organisations.

Keywords: 4D planning, building information modelling (BIM), construction planning, construction scheduling, virtual construction.

¹ barry.gledson@northumbria.ac.uk

Gledson, B and Greenwood, D (2014) The implementation and use of 4d BIM and virtual construction *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 673-682.*

PERCEIVING SPACE FROM MULTIPLE PERSPECTIVES FOR BUILDINGS USING BIM

Mohammad Mayouf¹, David Boyd and Sharon Cox²

¹ Birmingham School of the Built Environment, Birmingham City University, Birmingham B4 7XG, UK

² School of Computing, Telecommunications and Networks, Birmingham City University, Birmingham B4 7XG, UK

The way that space is being perceived during the building design stage affects the way it is delivered. This becomes more complex when considering not only the geometric view of space, but also the building as a whole with all its uses. It is recognised that different users have different needs particularly as regards their use of space. It is proposed that building information modelling (BIM) can accommodate different perspectives on space held by the building design team, facility management team and building occupants. This paper investigates various views on the way that space is perceived from different perspectives. Data have been attained from a university building under construction in the United Kingdom using interviews with the building design team, and questionnaires with the facility management team and building occupants. The collected data demonstrate the complexity of space including the effect of 2D and 3D views on perceptions. The paper concludes with highlighting these different perspectives emphasizing the need for collaboration. Further work is needed to explore different space algorithms, which can accommodate these different perspectives in the BIM model. The paper provides an initial basis towards understanding the problematic nature of space from a holistic approach and its implications of the way it is being perceived.

Keywords: building information modelling (BIM), multiple perspectives, space visualisation.

¹ Mohammad.Mayouf@bcu.ac.uk

Mayouf, M, Boyd, D and Cox, S (2014) Perceiving space from multiple perspectives for buildings using BIM *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 683-692.*

BIM'S IMPACT ON THE PROJECT MANAGER

Hong Xiao¹ and Tim Noble

1 Birmingham School of the Built Environment, Birmingham City University, Millennium Point, Birmingham, B4 7XG, UK

Building Information Modelling (BIM) has been drawing increasing attention since the announcement by the UK government in 2010 that BIM will become compulsory for all major centrally procured government construction projects by 2016. Not only is BIM an innovative design tool, it may fundamentally change the way how a construction project will be procured, constructed, managed and maintained. This paper examines the new challenges faced by project managers who play a central role in a construction project and the inevitable adaptations needed to work in a BIM environment. Based on an extensive literature review, semi-structured interviews were conducted with project managers who have had BIM project experience. This research found that although it has indeed started to impact on the construction industry as a whole and on the projects themselves, BIM's impact on the project manager and the project performance is actually far less substantial than expected. BIM is still at a relatively early stage of development in the UK and even though it represents a new way of undertaking a project, it is not necessarily changing the way a project is currently managed. In addition, BIM is advancing very fast and yet few companies have directly and fully supported the project managers and none was found to have updated the governance and/or project management process. Furthermore, many of the project managers simply are underprepared and not exploiting BIM to anywhere near its full potential, which is leading to missed opportunities. It is recommended that the industry needs to learn to embrace the full potential of BIM across all project team members. The resistance to change should be identified and managed more effectively to achieve a successful BIM implementation.

Keywords: BIM, project manager, adaptation, change.

¹ Hong.xiao@bcu.ac.uk

THE ROLE OF BIM IN PREVENTING DESIGN ERRORS

Peter Johansson¹, Henrik CJ Linderoth and Kaj Granth

University of Jönköping, School of Engineering, P.O Box 1026, SE-551 11 Jönköping, Sweden

Design errors are claimed to account for 26% of the cost of defects, these in turn are stated to encompass 2-9% of production cost for building and constructions. Lack of knowledge and information has been identified as a major reasons for design errors. Recently Building Information Modelling (BIM) has been considered as a mean for reducing design errors. However, limited research has been conducted on the role of BIM as a means for transfer and sharing knowledge in order to reduce design errors. The aim of the paper is to analyse BIM's role of facilitating knowledge and expertise sharing in order to prevent design errors. The aim is achieved by analysing a case study of design errors in a construction project. By drawing on the concept of boundary object it is confirmed that BIM can serve a mean for preventing design errors by facilitating knowledge and expertise sharing, across discipline, time and space, and professional boundaries. Depending the kind of boundary knowledge and expertise should be shared across, different challenges emerge in organizing the knowledge and expertise sharing

Keywords: design error, BIM, boundary objects, knowledge sharing.

¹ henrik.linderoth@jth.hj.se

Johansson, P, Linderoth, H C J and Granth, K (2014) The role of bim in preventing design errors *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 703-712.

LEVERAGING COLLABORATION THROUGH THE USE OF BUILDING INFORMATION MODELS

Mustafa Selcuk Cidik¹, David Boyd and Niraj Thurairajah

¹ Birmingham School of the Built Environment, Birmingham City University, Birmingham B4 7XG, UK

Building information models are a major new means of design information communication and therefore they are of primary importance for successful design collaboration. However, in addition to communicating the design information, models are used in many different situations for different purposes by different stakeholders at different stages in construction projects. The developing model is a result of the different situations encountered in its production through the interaction of stakeholders. Consequently, it is important to evaluate different uses of models by different stakeholders collectively in order to understand the implications of these differences on models and therefore on design collaboration. The paper investigates this through two educational building projects and establishes the origins of these differences to identify how particular situations affect the developing model. Findings suggest that a successful collective use of models requires structure and planning but these plans need to be adapted to the situations in order to enable collaboration.

Keywords: BIM, collaboration, design management, modelling.

¹ Mustafa.cidik@mail.bcu.ac.uk

Cidik, M S, Boyd, D and Thurairajah, N (2014) Leveraging collaboration through the use of Building Information Models *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 713-722.*

DETERMINANTS OF BUILDING INFORMATION MODELLING (BIM) ACCEPTANCE FOR SUPPLIER INTEGRATION: A CONCEPTUAL MODEL

Abdul-Majeed Mahamadu¹, Lamine Mahdjoubi and Colin A. Booth

Construction and Property Research Centre, Faculty of Environment and Technology, University of the West of England, UK.

Building Information Modelling (BIM) is expected to promote efficiency in project delivery through collaboration and integration within a highly diverse and fragmented construction industry. Yet, uncertainty concerns relating to the technical, human and inter-organisational contexts of the usage of technology for Supply Chain (SC) integration remain. This affects willingness and preparedness of SC to participate in such electronic data exchanges due to perceptions of greater risk compared to traditional paper-centric communications across the SC. It remains unclear, what model best explains acceptability of BIM within the SC. A conceptual model to aid investigation of influencing factors affecting acceptance and use of BIM in the SC context is presented. The model is proposed to aid examination of the inter-relationship between the determinants of acceptance and the readiness of the SC as well as its impact on achieving the highest maturity of BIM adoption i.e. a fully integrated SC. The key constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT) model are extended through consideration of the relational and transactional context of integration in the development of a SC specific BIM acceptance model. Through this proposed model, it is argued that the SC firms' disposition towards BIM is a key determinant of technology usage and implementation success hence the need for the study of determinants of acceptance. Directions for empirical validation of the model are presented with a review of potential benefits of understanding the determinants of acceptance on the readiness of the SC.

Keywords: BIM, supply chain, integration, implementation, technology acceptance.

¹ abdul.mahamadu@uwe.ac.uk

CHALLENGES TO BUILDING INFORMATION MODELLING IMPLEMENTATION IN UK: DESIGNERS' PERSPECTIVES

Dharshana Navendren¹, Patrick Manu², Mark Shelbourn² and Abdul-Majeed Mahamadu²

¹ *School of Engineering and Mathematical Sciences, City University, London, UK*

² *Department of Architecture and the Built Environment, University of the West of England, Bristol, UK*

Building information modelling (BIM) has been proposed as a technology enabled process for the realisation of the performance ambitions of the construction industry through integrated management of information in virtual 3-D formats. Significant challenges however exist which undermine its implementation within the construction industry. The identification of these challenges is an imperative precondition for successful implementation of BIM given the associated risk. The design phase has particularly been cited as a significant beneficiary of process improvement and efficiency gains expected from the deployment of BIM. Despite the critical role of the design phase to project delivery and consequently BIM usage, few studies have sought to interrogate the challenges faced by designers. A qualitative approach was adopted through semi-structured interviews to solicit perspectives of UK design firms on the implementation challenges being faced. Findings reveal a categorisation of challenges as design-specific, team-orientated, project-related, technology related (BIM specific), industry-wide challenges and cost. This categorisation is used as a basis for identifying critical challenges which include: design process lag and loss of time; lack of understanding by clients regarding requirements for the BIM model; lack of learning feedback from projects on which BIM has been used; and lack of supply chain integration. Variation in the challenges across different maturity levels of firms is also confirmed in this study, particularly in relation to cost of implementation. Awareness of these challenges provides opportunities for identifying effective solutions for their mitigation.

Keywords: BIM, designers, qualitative research.

¹ dharshana.navendren@googlemail.com

Navendren, D, Manu, P, Shelbourn, M and Mahamadu, A (2014) Challenges to building information modelling implementation in UK: designers' perspectives *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 733-742.*

INTERACTIVE VISUALISATION OF HEAT LOSS AND GAIN FOR EARLY-STAGE ENERGY APPRAISAL OF THE BUILT ENVIRONMENT

V Stojanovic¹, R Falconer¹, D Blackwood¹, G Paterson², M Fleming³ and S Bell⁴

¹*SIMBIOS, School of Contemporary Science, Abertay University, DD1 1HG, UK*

²*Urbahnstudio Ltd/Grenfell Baines School of Architecture, Construction and Environment, University of Central Lancashire, PR1 2HE, UK*

³*Fife College, Stenton Campus, Stenton Road, Glenrothes, KY6 2RA, UK*

⁴*Futurekomfort, 24 Fairykirk Rd, Rosyth, Dunfermline KY11 2QQ, UK*

Integration of Building Information Modelling (BIM) within the scope of commercial operations of Small to Medium Enterprises (SMEs) is becoming more important as the deadline for the 2016 UK government guidelines for collaborative information sharing approaches. Until recently, open source and more affordable BIM software tools were almost non-existent. Instead potential users of BIM tools invested time and money in expensive and complex BIM software solutions. Energy appraisal modelling and visualisation is now becoming possible to implement using BIM methodology. However, even top end BIM software tools do not necessarily meet the requirements of SMEs as they are either too complex, too expensive or lack the necessary features for energy appraisal and visualisation. A custom 3D software tool was developed for an SME specialising in low carbon housing, with the aim of influencing early design choices maximising energy efficiency. The software tool is designed to be a quick calculation tool that uses BIM principals for visualisation and limited data exchange. The software tool, based on computation models from the Passive House Planning Package (PHPP), appropriate for early energy appraisal, is able to compute both numerically and visually the estimated energy usage and solar gain for early stage building designs (corresponding to the Level of Detail (LOD) 100 BIM maturity levels specification). We will describe the design and development process of the software tool, software validation and testing results. We conclude that the software tool can offer a beneficial alternative or used in addition with more complex and expensive 3D BIM tools and features a less steep learning curve.

Keywords: BIM, games technology, stakeholder engagement, energy appraisal.

¹ v.stojanovic@abertay.ac.uk

Stojanovic, V, Falconer, R, Blackwood, D, Paterson, G, Fleming, M and Bell, S (2014) Interactive visualisation of heat loss and gain for early-stage energy appraisal of the built environment *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 743-752.*

COST

EXPLORING ESCALATION OF COMMITMENT IN CONSTRUCTION PROJECT MANAGEMENT: CASE STUDY OF THE SCOTTISH PARLIAMENT PROJECT

Dominic D Ahiaga-Dagbui¹ and Simon D Smith

School of Engineering, University of Edinburgh, EH9 3JL, Scotland, UK

Successfully managing large construction projects within defined budget and time constraints has always been a major challenge largely because crucial decisions about the project's ultimate fate have to be made within an environment of significant uncertainty at the beginning of the project. It is not surprising that cost and time overruns are commonplace on construction projects. Existing literature often suggests economical, technical, political or managerial roots to this phenomenon. A less explored possible cause within construction management framework is the escalation of commitment to a course of action. This theory, grounded in social psychology and organisation behaviour, suggests the tendency of people and organisations to become 'locked-in' and 'entrapped' in a particular course of action and thereby 'throw good money after bad' to make the venture succeed. This defies conventional rationality behind subjective expected utility theory. Through a critical analysis of the literature, we identify different frequently cited enablers of escalation of commitment. Using a hindsight constructivist approach, we then demonstrate references to some of these enablers on the Scottish Parliament project. We found strong evidence in support of possible strategic misrepresentation, confirmation bias, self-justification and optimism bias. We highlight the importance of setting realistic time and budget constraints to circumvent escalation and make several recommendations to attenuate unwarranted escalation of commitment, including the use of an objective outsider to evaluate responses to disconfirming information and the structuring of incentive systems that do not punish for inconsistency in order to curb the effects of self-justification and reputation management.

Keywords: cost overruns, confirmation bias, escalation of commitment, self-justification, strategic misrepresentation.

¹ D.Ahiaga-Dagbui@ed.ac.uk or domdagbui@yahoo.com

Ahiaga-Dagbui, D D and Smith S D (2014) Exploring escalation of commitment in construction project management: Case study of the scottish parliament project *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 755-764.

OPTIMISM BIAS, PATHOGENS AND COST OVERRUN: THE CASE OF AN RTS PROJECT IN SOUTH AFRICA

Fidelis Emuze¹ and Poobalan Ravu

¹ *Department of Built Environment, Central University of Technology, Free State, Bloemfontein, South Africa*

The demand for electricity in South Africa is on the upward trend. To meet the demand, a state own enterprise embarked upon major infrastructure projects, which have been plagued with cost and schedule overrun. The overrun is particularly severe with return-to-service power projects. The aim of the study was to find ways of understanding latent factors that promoted overrun in such projects. Thus, with the use of a case study, the paper presents the contributing factors to cost overruns, which were overlooked at project inception. Major stakeholders with planning and implementation responsibilities were interviewed on the case project. A clear trend that was observable by all the interviewees was the inability to address cost and time overrun that was encountered on the project due to the presence of 'optimism bias and pathogens' in the project environment. Rather, the urgent electricity demand provided a platform for the implantation of optimism bias and planning fallacy, which stimulated pathogens. The practice, industry, task and circumstance related pathogens thus influenced the scale of the cost overrun that has been reported on the case project. The notable insight provided by the exploratory study is that resident pathogens in a complex project environment can work in unison with optimism bias and planning fallacy to engender cost overrun.

Keywords: cost overrun, major projects, South Africa

¹ femuze@cut.ac.za

AN ASSESSMENT OF CRITICAL SUCCESS FACTORS FOR THE REDUCTION OF THE COST OF POOR QUALITY FROM CONSTRUCTION PROJECTS IN SOUTH AFRICA

Clinton Aigbavboa¹ and Wellington Thwala

¹ *Department of Construction Management and Quantity Surveying, University of Johannesburg, Doornfontein Campus, Johannesburg, 2028, South Africa*

The cost of poor quality (COPQ) in the construction industry are cost associated with the prevention, discovery, and resolving of defects. These are caused due to failure in preventing defects and wastages during construction work. They arise whether the product is at design stages, manufacturing plants, or in the customer's hand. The main purpose of this research is to identify the critical success factors (CSF) which have the potentials to reduce the COPQ during planning and execution stages of construction projects in South Africa. This study is descriptively designed to obtain the views of construction professionals in regard to the CSF for the reduction of the COPQ in construction projects. A structured questionnaire survey was conducted amongst 60 construction professional to identify the CSF for the reduction of the COPQ in construction projects. This study identified 10 CSF for the reduction of COPQ in construction projects from a list of 41 different CSF classified under five themes. The ten most important CSF were: defining quality objectives (standards and specifications); providing effective leadership; defining quality control mechanism; team development and deploying skilled work force; team work; providing effective leadership; fulfilling health and safety requirements; measuring performance of activities on critical path; improving the productivity of resources and initiating accountability process. The study contributes to the body of knowledge on the subject of the CSF for the reduction of COPQ in construction project in South Africa.

Keywords: cost of poor quality, critical success factors, South Africa.

¹ caigbavboa@uj.ac.za

Aigbavboa, C and Thwala, W (2014) An assessment of critical success factors for the reduction of the cost of poor quality from construction projects in South Africa *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 775-784.

BARRIERS TO LIFE CYCLE COSTING USAGE

Olufolahan Oduyemi¹, Michael Okoroh and Angela Dean

*Faculty of Art, Design and Technology, School of Engineering & Technology, University of Derby,
DE22 1GB, UK*

Life Cycle Costing (LCC) is widely recognized amongst practitioners and academics as a valuable tool in assessing the economic efficiency of constructed facilities. Clients now want buildings that demonstrate value for money over a long term, and are not interested simply in the design solution which is the least expensive. This change have led to and highlighted the importance of LCC approaches to the design, construction and operation of buildings. However, the majority of building designs are still currently produced unsullied by thoughts of maintenance implications, life expectancy or energy consumption. In a forward looking approach, the paper attempts to provide some recommendations that should facilitate and enhance the implementation of LCC in the UK. A questionnaire was distributed to two group samples of 80 practitioners; the quantity surveyors and builders with a total of 70 practitioners (35 aside) completing the survey. The key findings of the statistical analysis indicated that builders ranked the lack of data as the most prevalent problem while quantity surveyors felt it was the lack of a universal framework. The results suggest that there are different opinions and perplexity on issues relating to LCC application. This research will be of interest to industry practitioners and academic researchers with an interest in life cycle costing

Keywords: barriers, life cycle costing, techniques.

¹ o.oduyemi@derby.ac.uk

Oduyemi, O, Okoroh, M and Dean, A (2014) Barriers to life cycle costing usage *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 785-793.*

PROJECT MANAGEMENT

CONCEPTUALISING ORGANISATIONAL RESILIENCE: AN INVESTIGATION INTO PROJECT ORGANISING

Karen Oppong Banahene¹, Aaron Anvuur and Andrew Dainty

School of Civil and Building Engineering, Loughborough University, Leicestershire, UK

Organisational resilience is a capability which enables organisations to adjust to perturbation, moderate the effects of risk and uncertainty and take advantage of emergent opportunities. The concept of organisational resilience has in the main been developed and operationalized in relation to permanent and stable organisations. The concept is, however, far less applied to project-based forms of organisation, where the temporary, cross-functional and dispersed nature of delivery teams renders some of these concepts problematic. This paper identifies the challenges in applying the concept of organisational resilience to project organisations by systematically reviewing and relating the lines of literature on organisational resilience and project organising. For example, the temporary nature of project organisations hinders learning and knowledge sharing necessary to ensure a dynamic response to evolving threats and perturbations. Other inherent factors, such as the distributed locations of project personnel, also impede this development. This paper goes on to refine the research necessary to develop the concepts so as they respond to the challenges of project-based working.

Keywords: adaptive capacity, organisational resilience, project organising, risk.

¹ k.oppong-banahene@lboro.ac.uk

Oppong Banahene K, Anvuur, A and Dainty, A (2014) Conceptualising organisational resilience: An investigation into project I In: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 797-806.

THE TRANSLATION OF POWER: A STUDY OF BOUNDARY OBJECTS IN PUBLIC ENGAGEMENT PROCESSES

Vivien W. Chow¹ and Roine Leiringer

¹ *Department of Real Estate and Construction, University of Hong Kong, Pokfulam, Hong Kong*

Public consultation and engagement processes have become an integral feature of infrastructure development projects in many parts of the world. Regardless of the drivers behind this trend, legislative or otherwise, a key objective of the process is to facilitate information exchange between affected parties. Somewhat simplified, the process is used by the project team to garner support, collect feedback and address grievances for the project, and by a multitude of stakeholders to voice complaints, lobby for change and secure benefits for themselves. It follows that the process, despite intentions otherwise, is commonly characterised by opposing interests and unequal power relationships that lead to antagonistic standoffs between participants. This paper focuses on what takes place within the engagement process and the format through which information is exchanged. In particular, focus is on the material artefacts that are used to facilitate the information exchange. When used effectively, these artefacts act as boundary objects between participants by allowing them to work together across a diverse range of issues. The paper draws on ongoing research that explores how boundary objects are used in the public engagement process in Hong Kong. The study utilises the Latour-Callon model of 'interessement' to trace how information is translated through boundary objects across a series of engagement events. An argument is put forward highlighting how boundary objects both affect and are affected by power struggles between social groups, and how this in turn affects decision making and goal alignment. In so doing, the notion of the boundary objects possessing inherent properties making them effective communication tools across events is rejected, and replaced by a view that puts more emphasis on how and why they are used by the participants.

Keywords: public engagement, power dynamics, materiality, boundary object, communication.

¹ vivien.chow@gmail.com

RECASTING COORDINATION: A THEORETICAL REVIEW IN THE CONTEXT OF DESIGN-BUILD PROJECT ORGANISATIONS

Lea Urup¹ and Christian Koch

¹ *Department of Civil and Environmental Engineering, Construction Management, Chalmers University of Technology, Sven Hultinsgata 8, 412 96 Göteborg, Sweden*

Coordination, and the lack of it, is frequently ascribed as a key role in successful and less successful building processes. Over the last four decades, the understanding of coordination has shifted from emphasizing formal structures to emphasizing informal mechanisms. A review of four articles shows this development as well as how the formal and informal structures and mechanisms relate. The review is done from a perspective of a large design-build project in Denmark. The review indicates, that formal and informal coordination mechanisms alone are not sufficient to explain coordination in practice. The main coordination mechanisms discussed are mutual adjustment, direct supervision, standardization, relational coordination, adaptive capacity, and IT as a tool to accomplish task and impose a chronological rhythm and schedule on the work processes. From this point of departure a new set of coordination mechanisms for practice is developed rooted in current institutional theory. The mechanisms are internal building of an institution and external building of relationships between a number of institutions. The conclusion is that existing literature on coordination does not fully describe the complexity of coordination in an institutionalised design-build organisation and that a new set of coordination mechanisms rooted in institutional theory contributes to our understanding of complex coordination.

Keywords: coordination, Mintzberg, relational coordination, institutional logic, institutional work.

¹ lu@mth.dk

Urup, L and Koch, C (2014) Recasting coordination: a theoretical review in the context of design-build project organisations *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 817-826.*

ALLOCATING PROJECT MANAGERS TO PROJECTS IN A MULTI-PROJECT ENVIRONMENT

Lone Seboni¹ and Apollo Tutesigensi

Institute for Resilient Infrastructure, School of Civil Engineering, University of Leeds, Woodhouse Lane, Leeds, LS2 9JT, UK

A recent empirical study demonstrated that the process of allocating project managers to projects (PM2P) in multi-project environments of Botswana was not effective. This inspired the authors to seek to understand the structure of the PM2P process with a view of proposing improvements to increase effectiveness. A conceptual model was developed and used in this study, which focusses on using the developed model as a theoretical lens to study the process in a large company, using the case study method. Via an enumeration, qualitative and quantitative data were collected from four project directors and eleven senior level executives through in-depth semi-structured interviews. The analysis of the quantitative data (using univariate descriptive analysis) and qualitative data (using content and thematic analysis) revealed weaknesses in the existing PM2P process demonstrated in five ways namely: (1) absence of documented and specific competencies required of project managers in various roles, (2) lack of management tools and techniques to match project managers to projects, (3) prevalence of ad-hoc projects, (4) lack of consideration of a comprehensive list of inputs and (5) lack of accountability for outputs. The strengths in existing PM2P process were demonstrated in two ways namely: (1) use of management tools and techniques at strategic level to forecast project implementation costs for projects in the pipeline, and (2) managers' recognition of some important criteria to be considered in the PM2P process. The findings provide a strong basis upon which a decision support system can be developed to facilitate a more effective approach to allocating project managers to projects in the multi-project environment of the case study in question. Other companies that undertake business in a multi-project context may benefit from this work.

Keywords: allocation, decision making, project manager, multi-project environment.

¹ mnls@leeds.ac.uk

Seboni, L and Tutesigensi, A (2014) Allocating project managers to projects in a multi-project environment *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 827-836.*

COMMUNICATION RISK AND TRUST IN CONSTRUCTION PROJECTS: A FRAMEWORK FOR INTERDISCIPLINARY RESEARCH

Anita Ceric¹

¹ *Department of Construction Management and Economics, Faculty of Civil Engineering, University of Zagreb, Kaciceva 26, 10000 Zagreb, Croatia*

Communication risk is one of the most important types of risk that occur in construction projects, and trust is one of the most effective ways to minimise it. Interest in communication risk and trust spans economics, sociology and psychology. These social sciences are most relevant for the understanding of different dimensions of trust investigated in the framework of the principal-agent theory. In construction projects, this applies to inter-firm, intra-firm and interpersonal relationships between the project parties. The project owner, contractor, and their respective project managers are among the key parties involved in every construction project. This conceptual paper is based both on empirical research that has evolved in four stages, and on extensive literature review that has developed through three stages. Using the principal-agent theory, this paper offers a framework for interdisciplinary research into communication risk and trust spanning economics, sociology, and psychology. This framework rests on firm theoretical foundations concerning inter-firm, intra-firm, and interpersonal relationships characteristic of construction projects, all of which depend on trust between project parties.

Keywords: principal-agent theory, trust, risk, communication.

¹ anita@grad.hr

Ceric, A (2014) Communication risk and trust in construction projects: A framework for interdisciplinary research *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 837-846.*

SOCIAL NETWORK ANALYSIS ON THE INTER-ORGANIZATIONAL INTERACTIONS IN GREEN BUILDING PROJECTS

Vignesh Venkataraman¹ and Jack C.P. Cheng

Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong

Green building projects are collaboration intensive in nature, and construction of a green building involves execution of complex tasks that are different from those in conventional construction projects. Therefore, collaboration among stakeholders is critical to the success of a green building project. This paper aims to study the inter-organizational interactions among key project stakeholders in green building projects and to investigate the relationship between the interactions and the project performance. To achieve these aims, social network analysis techniques were used to analyse the organizational relationships in green building projects. Considering the nature of green building projects, network measurements were classified into four different aspects – (1) Design, (2) Sustainability, (3) Construction, and (4) Finance. Social network analysis metrics like density, centrality and degree were defined and used respectively to measure the organizational relationships, key players, and powerful and influential players in each network. The developed social network model was applied to a case study green building project in Hong Kong and the outcome is presented in this paper. First hand data concerning communication frequency and information exchanges were collected from key project participants involved in the green building project through interviews and questionnaire. The results show that over-involvement of the client due to the lack of trust in the design team and the strained relationship between the client and the project manager affected the overall project performance. Key players and potential bottlenecks in organizational relationships for each aspect in this green building project are discussed and suggestions for improving project performance were provided.

Keywords: green building, high-performance teams, organizational relationships, project communications, social network analysis.

¹ vvaa@ust.hk

GETTING TO THE HEART OF COMMUNITY ACTION AGAINST CONSTRUCTION PROJECTS

Melissa Teo¹ and Martin Loosemore²

¹ *Queensland University of Technology, Brisbane, Australia*

² *University of New South Wales, Faculty of the Built Environment, Sydney, NSW 2052, Australia*

Construction projects have a potentially large economic, social, ecological and cultural impact on the communities in which they take place. As these communities become increasingly empowered, educated, connected and organised, there is increasing evidence that they are able and willing to mobilise action when they become concerned about the impact of construction projects on their lives. From a construction project management perspective, there has been virtually no research into the structure of these groups and how best to interact with them for mutually beneficial outcomes. Using a thematic story telling approach which draws on ethnographic method and social contagion theories, an in-depth analysis of community action against a construction project is presented. It is concluded that these groups are largely anarchic but are held together and sustained by a core group of activists which are often invisible to outsiders. This raises numerous challenges for project managers in addressing community concerns and in mitigating potential cost and time escalations associated with such action.

Keywords: community, action, protest, project management.

¹ m.teo@qut.edu.au

Teo, M and Loosemore, M (2014) Getting to the heart of community action against construction projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 857-866.*

WORKING TOGETHER IN A KNOT: THE SIMULTANEITY AND PULSATION OF COLLABORATION IN AN EARLY PHASE OF BUILDING DESIGN

Jenni Korpela¹ and Hannele Kerosuo

¹ *Institute of Behavioural Sciences, CRADLE, University of Helsinki, Finland*

Construction projects are complex, and many open questions arise in the early phases of projects. Turning these questions into realistic requirements is a critical task that demands a good deal of specific information, multiple types of expertise and collaboration between designers. Knotworking is a new way to work as a group for a short period of time to accomplish a critical task in a BIM-based building process. This study focuses on the experimentation with knotworking in an early stage of a building project. A characteristic of knotworking is that continuity is connected to the object of the work at hand, not to the stability of the team. An object of activity is considered as a basic motive and purpose of human activity. The object of the design activity is here a school-community centre in central Finland. According to activity theory, an idea or a concept needs to be experimented with to become a new practice. Over a two-day session, two interdisciplinary teams of participants created alternative design solutions and evaluated them. The teams included an architect, a cost calculator, a structural engineer, a HVAC designer, a coordinator, a visualizer and a developer, and an energy specialist. The data consist of video-recordings and observations of these sessions. During the knotworking session, the participants were able to receive feedback from other design disciplines and stakeholders. Knotworking made the simultaneous exchange of information and sharing of expertise possible. Quick changes between working individually, in pairs, in small groups or in the whole group characterize the pulsating quality of working in a knot. With enabling technology and a new kind of pulsating collaboration, knotworking supports 1) creating concrete design solutions in a short period of time, 2) increasing designers' knowledge of the implications of their decisions on the work of their colleagues and the quality of design, and 3) easing shifts from coordinative talk to collaborative design and back.

Keywords: collaboration, building design, knotworking, pulsation, activity theory.

¹ jenni.korpela@helsinki.fi

Korpela, J and Kerosuo, H (2014) Working together in a knot: The simultaneity and pulsation of collaboration in an early phase of building design *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 867-876.*

ROLE CONFLICT IN PROJECT TEAM DYNAMICS

Shabnam Kabiri¹, Will Hughes and Libby Schweber

School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK

Project team dynamics may be affected by mismatches between formal and informal sources of expectations. Conflicting or unclear expectations have not yet been studied closely in construction projects. Using role theory, the effect of such phenomena on project team dynamics was studied in construction projects. Most research into role theory relies on survey data; however, this study takes a qualitative approach. For a public project, contracts were studied, project meetings were observed, and semi-structured interviews with the major members of the design team were carried out to identify formal and informal sources of role expectations. Analysis focused on the misalignment of these sources. A model was developed to help explain project team dynamics and the interaction of formal and informal sources of role expectations. Findings reveal that underspecified roles and responsibilities within contracts and plans of works effected role interactions and ultimately team dynamics.

Keywords: contracts, informal sources of expectations, role expectations, team dynamics.

¹ s.kabiri@pgr.reading.ac.uk

MOVING BEYOND PROJECT COMPLEXITY: EXPLORING EMPIRICAL DIMENSIONS OF COMPLEXITY IN THE CONSTRUCTION INDUSTRY

Hannah L. Wood¹, Poorang A.E. Piroozfar² and Eric R.P. Farr³

^{1,2} University of Brighton, Cockcroft Building, Lewes Road, Brighton, BN24GJ, UK

³NewSchool of Architecture and Design, 1249 F Street, San Diego, CA 92101, USA

Complexity is not an under-researched concept within the construction industry. However, because of the nature and characteristics of this concept, most of the works have traditionally tended to approach it in a reductionist manner, concentrating on project complexity above all others. Therefore a more comprehensive understanding aimed at being able to make more informed decisions correspondent to the specification of new construction in the age of digital tectonics should be developed. As there is an undeniable need for new vantage points, the data should come directly from the immediate context in which complexity is to be scrutinised. A deductive approach based on in-depth study of live cases is deemed appropriate for this purpose. With reference to our previous theoretical framework, this paper deepens the quest for a more intelligent decision process by investigating construction case studies. This review of cases will be carried out using our alternative way of reading complexity which is nurtured by its meaning in many other disciplines, encompassing all aspects of complexity in a more holistic manner. The findings of the study are to be further developed through additional research in order to substantially contribute to a more up-to-date, fit-for-purpose decision framework to effectively manage complexity comprehensively where and when required in the construction industry.

Keywords: complexity, case study, systems, complexity science.

¹ hw35@Brighton.ac.uk

Wood, H L, Piroozfar, P A E and Farr, E R P (2014) Moving beyond project complexity: Exploring empirical dimensions of complexity in the construction industry *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 887-896.

A DETAILED ANALYSIS OF EXISTING PROJECT SUCCESS FACTORS

Mahdi Ghaffari¹

School of Mechanical, Aerospace and Civil Engineering, University of Manchester, Manchester, M13 9PL, UK

The quest for knowledge about which factors influence project success has long been at the centre of attention of the project management community. This quest has produced an enormous number of success factors claimed to assist project professionals. This study is built on the results of 100² empirical and theoretical papers written on project success factors published since the late 1960s and aims to take them one step farther and establish their implications through categorising and statistically analysing them, in addition to explaining the underlying trends that exist for changes of success factors over time. Papers have been sorted into 4 groups: construction, IT/IS, new product development (NPD) and general. This classification will help this study to answer the following questions: What are the most repeated success factors in each category? What are the relationships between success factors from different types of projects? How has researchers' focus on project success factors changed over time? Through answering these questions, this paper identifies the fundamental differences between types of projects and warns practitioners that missing the most relevant success factors might lead to focusing on misleading areas of projects. It also reveals that general papers, constituting the majority of papers written on success factors, are not impartial and their results are biased in favour of IT/IS and NPD projects (that were identified to have more similar success factors), hence factors obtained from them are less applicable to the construction industry; something that needs to be considered by researchers in the construction management field. Furthermore, this paper highlights the change in researchers' focus on success factors from those related to the project team and management level to higher levels of the organisation and external environment. The main contribution of this paper is to identify the above hidden implications of papers written on project success factors.

Keywords: project success, statistical analysis, success factors.

¹ mahdi.ghaffari@manchester.ac.uk

² Please contact the author for a full list of 100 papers used to conduct this study.

Ghaffari, M (2014) A detailed analysis of existing project success factors *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 897-906.

SERVITIZATION IN CONSTRUCTION: TOWARDS A FOCUS ON TRANSITIONAL ROUTINES

William Robinson¹ and Paul Chan

¹ *School of Mechanical, Aerospace and Civil Engineering, The University of Manchester, Sackville Street, Manchester, M13 9PL, UK.*

Construction firms are increasingly compelled to take into account the through-life performance of the buildings they create. In this article, we examine these trends in relation to the Product-Service literature (commonly referred to as ‘servitization’) to explore the implications of new business models within the construction industry. It was found that while the range of promising opportunities and problems of greater servitization in the construction industry have been widely explored, there remains a limited understanding of the conditions and consequences of transitional practices involved in greater servitization. Therefore, through the review of the servitization literature, we identify the need to refocus research attention on organizational routines and practices as the unit of analysis to better understand how organisations can make the transition towards more servitized offerings. Rather than taking servitization as the starting point for overhauling existing routines, we argue for the need to study routines as they evolve, to see how a servitization culture is gradually incorporated in everyday management in construction. Thus, the contribution of this article is to propose a shift away from viewing servitization simply as the imposition of a new business model, but rather by mash-ups of existing, complementary and contradictory routines that organisations realise as they make sense of servitization in practice rather than in theory.

Keywords: organisational practices, product-service models, routine, transition.

¹ william.robinson-5@postgrad.manchester.ac.uk

ALTERNATIVE PROJECT DELIVERY SYSTEMS FOR TRANSPORT INFRASTRUCTURE IN GERMANY

Mai Habib¹ and Konrad Spang

¹ *University of Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany*

Transport infrastructure projects are important for the development of the economy, industry and mobility. Such projects are long-lasting and have huge budgets. In addition, they are affected by the needs of the public owner, and usually involve many stakeholders. The current project delivery system in Germany is characterised by its traditional nature, in which the processes of design and construction are sequential. The owner contracts separately with the designer and the contractor. This separation hinders the collaboration and communication between the designer and constructor. Furthermore, the traditional procurement method based on the lowest price aligns with diverse challenges which often results in cost or time overruns, as well as in adversarial relationships amongst the involved parties. This fragmented structure of the construction industry is dissatisfying for the project participants. This paper examines the actual situation of project delivery and its shortcomings and it therefore investigates the reasons behind the problems of project delivery such as poor planning, scope changes or inappropriate risk allocation. In the 80s and 90s, the Anglo-American construction industry suffered from similar problems. This situation has been analysed by many reports, where suggestions for changes were made and solutions to overcome the adversarial situation of the industry were offered. Consequently, new delivery systems were developed. This paper provides an overview of the problems and obstacles associated with implementing alternative systems regarding the procurement law of public projects in Germany.

Keywords: alternative delivery systems, procurement law, transport infrastructure.

¹ mai.habib@uni-kassel.de

INCORPORATION OF DIFFERENT AND CHANGING CLIENT INTERESTS IN THE COURSE OF A PROJECT

Megumi Kurokawa¹, Libby Schweber and Will Hughes

¹ *School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK*

There is a widespread assumption that clients' expectations should be accommodated during a building project. However, there may be conflicting expectations within a client organization and these may change over time in the course of a project. Actor-Network Theory (ANT) is used to study the incorporation of client expectations into the on-going development of a building project. To illustrate this, negotiations over a particular decision, namely the location of a building on one university campus was analysed. Negotiations went through a number of stages, involving a master plan architect, members of the public, campus maps and the Vice Chancellor. An ANT analysis helped to trace diverse actors' interests in a series of discussions and how these interests conflict with each other as one option was chosen over another. The analysis revealed new client interests in each negotiation process. Also, the prioritisation of client interests changed over time. The documentation of diverse and dynamic client interests especially contributes to the understanding of how some client interests fail to be incorporated in decision-making processes.

Keywords: actor-network theory, client organization, decision-making process, stakeholders, material objects.

¹ m.kurokawa@pgr.reading.ac.uk

INTEGRATING EXTERNAL STAKEHOLDER IDENTIFICATION AND PROJECT INITIATION IN CIVIL ENGINEERING INFRASTRUCTURE PROJECTS

Mohamed H. Elmahroug^{*1,2}, Apollo Tutesigensi¹ and Naomi J. Brookes¹

¹*Institute for Resilient Infrastructure, School of Civil Engineering, University of Leeds, Woodhouse Lane, Leeds, LS2 9JT, UK*

²*Department of Civil Engineering, Faculty of Engineering, University of Eljabel Elgharbi, Gherian, Libya*

Current evidence suggests that there is a delay between the start of project initiation and the beginning of external stakeholder identification during the initiation phase of civil engineering infrastructure projects. A major consequence of this delay is limited project success. The aim of the research reported in this paper is, therefore, to explore the timing between project initiation and external stakeholder identification in order to understand its impact upon project success. A desk study involving three railway projects in three European countries was undertaken. It was found that external stakeholders are often asked to support proposals that may constitute opportunities to the project initiator but neither solve the external stakeholders' problems nor meet their expectations. It has also been identified that the time lag between project initiation and external stakeholder identification leads to external stakeholders having limited (if any) input into key aspects of the project defined before they get on the scene. This often results in misalignment of the project purpose and stakeholder expectations, thereby leading to lack of buy-in from external stakeholders which in turn can limit project success. Chances of project success can be improved by minimising the time lag, and the time lag can be minimised by integrating the project initiation and stakeholder identification processes. Such integration (which is the subject of on-going work) will lead to stakeholders agreeing the problem to be addressed by the project, defining options, and assessing the options for a consensus or near-consensus project that can be implemented with minimal disruption and/or challenge - and this will, in turn, boost chances of project success.

Keywords: civil engineering infrastructure, project initiation, project success, stakeholder identification.

* cnmhe@leeds.ac.uk

Elmahroug, M H, Tutesigensi, A and Brookes, N J (2014) Integrating external stakeholder identification and project initiation in civil engineering infrastructure projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 937-946.

A STUDY OF THE CURRENT PRACTICE OF STAKEHOLDER MANAGEMENT IN CONSTRUCTION PROJECTS

Jurbe J. Molwus¹, Bilge Erdogan and Stephen O. Ogunlana

School of the Built Environment, Heriot Watt University, Edinburgh, EH14 4AS, UK,

Over the past years, stakeholder management has been advocated as a means of increasing the propensity for successful delivery of construction projects. Previous research has focused on addressing the need for a practical guide to carry out stakeholder management in construction projects. However, full benefits expected from stakeholder management cannot be achieved without adequately addressing the following issues: stakeholder management decisions and responsibilities through the project life cycle; internal stakeholder collaboration in carrying out stakeholder management; stakeholder dynamics; and use of available techniques for stakeholder engagement. These issues were investigated using a questionnaire survey which aimed to explore the current practice of stakeholder management within the United Kingdom. The questionnaire comprised of closed and open-ended questions, the data from which were analysed using appropriate statistical techniques and thematic (content) analysis. The main finding was that stakeholder management is mostly not carried out deliberately and that there is need for internal stakeholders to collaborate in carrying out stakeholder management. Furthermore, dynamics in stakeholders' interests is perceived as important and gaining new information about the project is explanatory for that. Finally, the paper surmises that construction organisations need to make stakeholder management a part of their organisational policy and agenda.

Keywords: leadership, responsibility, stakeholder collaboration, stakeholder management.

¹ jjm23@hw.ac.uk

REFURBISHMENT OF HIGHER EDUCATION PREMISES: STAKEHOLDER ENGAGEMENT IN THE PROCESS AND PRODUCT

Noel J. Painting¹, Poorang A. E. Piroozfar² and Eric R. P. Farr³

^{1,2}*School of Environment and Technology, University of Brighton, Cockcroft Building, Brighton, East Sussex, BN2 4GJ, UK*

³*New School of Architecture and Design, 1249 F Street, San Diego, CA 92101, USA*

In spite of various initiatives, much of the UK university building stock is ageing and in need of modernisation both in terms of environmental performance and to respond to the changing landscape of pedagogy and andragogy. Higher educational establishments like to portray themselves as pioneers of a green campaign however decision processes may not always be as easy and straightforward as they seem. Contributing factors will include the complexity of the client brief, the difficulties of timetabling, the desire to operate democratic processes in decision-making and the inevitable compromises resulting from these often conflicting demands. Most universities will have restrictions on the budget, time and working schedules compounded by the need to carry out the construction work on sites where the normal academic activities are to continue. Many university clients will involve the end users in the process of decision-making causing an information overflow whilst some others choose not to get their employees (as the end users) involved at all. This research uses a surgery approach to an ongoing major refurbishment project to map the perceived success of the processes and construction product. The results are aimed to enable similar future projects to run with a greater perceived success, which will in turn benefit all the stakeholders.

Keywords: university sector, refurbishment, stakeholder engagement, process engagement, sustainable refurbishment.

¹ n.j.painting@brighton.ac.uk

Painting N J, Piroozfar, P A E and Farr, E R P (2014) Refurbishment of higher education premises: Stakeholder engagement in the process and product *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 957-966.

ORGANIZATIONAL RESPONSES TO INSTITUTIONAL PRESSURES IN INTERNATIONAL INFRASTRUCTURE PROJECTS: A TRANSNATIONAL PIPELINE PROJECT CASE STUDY

Wenxue Lu¹ and Hua Wang

Department of Construction Management, Tianjin University, Tianjin 300072, P.R. China

International infrastructure projects that are implemented in highly complex environments and involve collaboration among participants from multiple countries often face a variety of institutional pressures. Organizations involved in the execution of international infrastructure projects enact different strategic responses to institutional pressures and respond in a patterned way. The research explores how organizations respond strategically to institutional pressures in international infrastructure projects and how the interconnectedness between the organization under pressure and other organizations in the project influences the response strategy. A case study centred on a pipeline project in Central Asia that organizations are from China, Turkmenistan and Uzbekistan has been conducted to analyse organizations' practical strategic responses, and 4 vignettes were developed, each describing an event in this pipeline project how an organization responded to institutional pressures. Each vignette was carefully analysed by making event list with two dimensions, the organizations involved and the time line. Different vignettes were compared to find the generic narrative model or typical story. The results indicate that the high degree of interdependence and convergence of interest among the organizations lead other organizations in the project to collaborate with the organization under institutional pressures, and take an active response strategy. Besides, local stakeholder relationships can be utilized in response to institutional pressures and it is important to create relationally embedded relationships with local stakeholders. This research contributes to the knowledge of international project management by drawing upon institutional theory and using a strategic perspective to institutional pressures.

Keywords: institutional pressure, international infrastructure project, response strategy.

¹ luwenxue63@126.com

Lu, W and Wang, H (2014) Organizational responses to institutional pressures in international infrastructure projects: A transnational pipeline project case study *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 967-975.

TASK CHARACTERISTICS, COORDINATION MODES AND DESIGN COORDINATION PERFORMANCE, AN INFORMATION PROCESSING PERSPECTIVE

Rong Zhang¹

1 Department of Real Estate and Construction, Faculty of Architecture, the University of Hong Kong, Rm. 533, Knowles Building, Pokfulam Road, HONG KONG

Building design is an information intensive activity, in which information exchange between multi-disciplinary professionals is the key to success. Applying the information processing perspective, a project coalition can be interpreted as an information processing system that facilitates information gathering, processing and distribution. Dynamic in nature, building design projects involve a great deal of uncertainty and equivocality and thus have high information processing requirement. Information processing capacity, in terms of coordination mode, is the key to meeting the information processing requirement. A model is proposed in which information processing theory is used to explaining design coordination. Uncertainty and equivocality originated from design coordination task characteristics in terms of task variety and task analysability requires participants in design coalition to frequently process information to reduce uncertainty and equivocality. Coordination modes enable information process to reduce uncertainty and equivocality by certain information amount and information richness. The model serves three aims: the fit between task characteristics and coordination modes, whether the fit is a predictor for coordination performance, and to which extent a better coordination performance lead to better project performance will be tested under the model. In practice aspect, research results will be helpful in guiding the establishing coordination mechanism in building design project coalition.

Keywords: coordination mode, coordination performance, task analysability, information processing.

¹ srzhang@hku.hk

INNOVATION AND INFORMATION MANAGEMENT

IS ANYBODY HOME? THE ROLE OF COMPANY WEBSITES FOR SMALL BUILDING CONTRACTORS IN SWEDEN

Martine Buser¹ and Veronica Carlsson

¹ *Construction Management, Chalmers University of Technology, Gothenburg, Sweden*

During the last decades, being visible on the Internet has been advertised as the solution to develop businesses. Among other benefits, it should increase profitability by enlarging the number of customers and accelerating processes and communication. Indeed by 2012, 92% of the Swedish micro, small and medium sized enterprises (SMEs) had a website presenting their companies; the construction sector for once is no exception. Looking at SME building contractors we inquire into whether the announced potential of being online has been realized and, in particular if their relations to customers have improved. Referring to customer relationship management and e-business studies, we focus on 4 aspects of websites to assess their qualities: content, convenience, control and interaction. The material consists of a sample of 90 building contractors of the region of Gothenburg in Sweden. We have examined the companies' websites, checked their profile, contacted them by phone and carried out in-depth interviews with 21 of them. The results show quite diversified strategies and benefits of their use of websites. Updating the sites regularly or gaining customers seem to be the exception, and the uses of the web sites are so far rather rudimentary. If there is no surprise in the SMEs building their customers relationship on direct contact and local network, the passivity and lack of visibility towards new customers and business opportunity are nevertheless intriguing. Even more as the sector is facing a rather bad reputation in the public. Finally a close contact with clients is said to be one of the most important factors contributing to innovation which these SMEs acutely need to face the new energy regulations.

Keywords: SME, websites, customers' relations, renovation.

¹ buser@chalmers.se

INITIAL USE OF AN IDEA CAPTURE APP IN A UK CONSTRUCTION ORGANISATION

Richard Davies¹ and Chris Harty

School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK

We report some results from an ongoing action research project to improve creativity, innovation diffusion and knowledge transfer in a large UK construction organisation and its supply-chain. Our focus is on the use of an interactive mobile and desktop app that enabled employees to submit, share, discuss and develop innovative ideas. We use longitudinal system data to determine: how many users register on the system, how many ideas are submitted, how many users actively contribute ideas, and where in the organisation ideators are based. The paper describes the background and organisational context of a company-wide initiative to promote an 'innovation culture' and to implement innovation management systems and processes. We describe the development and specifications of the app, associated innovation portfolio management processes, and the communication and change management activities that accompanied its launch and rollout. We discuss this analysis in terms of existing models of employee creativity and voice and previous research on suggestion schemes, ideas capture and innovation competitions in construction and other industries.

Keywords: innovation, ideas, suggestions, app.

¹ richard.davies@reading.ac.uk

DIFFUSION OF DIGITAL INNOVATION IN A PROJECT-BASED FIRM: CASE STUDY OF A UK ENGINEERING FIRM

Amna Shibeika¹

¹ *School of Construction Management and Engineering, University of Reading,*

Digital innovations are rapidly diffusing within the construction sector. With the UK government policy mandating building information modelling (BIM) by 2016, engineering firms are faced with challenges related to embedding new technologies and associated working practices for the digital delivery of major infrastructure projects. Drawing from diffusion of innovations theory, this research attempts to answer the question of: how digital innovation diffuses in the firm? It adopts a contextualist approach through in-depth case study of a large and international engineering project-based firm. The analysis of the empirical data, which was collected over four years of close interaction with the firm, provides a narrative for the diffusion of the digital innovation across the firm where both the innovation and the firm were in flux. The diffusion process has evolved through three main mechanisms: centralisation of technology management, standardisation of digital working practices, and globalisation of digital resources. This case has both theoretical and practical implications; it describes the diffusion of a digital innovation in a complex social system. This extends diffusion of innovations studies in construction, and guide engineering firms in their efforts to adopt and implement new innovations.

Keywords: digital technology, diffusion of innovation, case study, project-based firm.

¹ A.shibeika@reading.ac.uk

Shibeika, A (2014) Diffusion of digital innovation in a project-based firm: Case study of a UK engineering firm *In: Raizen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 999-1007.*

OVERCOMING BARRIERS TO INNOVATION: DEMONSTRATING AN ARGUMENT IN FAVOUR OF COMMUNICATION ARENAS

Susanne Engström¹

¹ *Luleå University of Technology, Division of Structural and Construction Engineering, SE-971 87
Luleå, Sweden*

Continuous development efforts including steady-state innovations are necessary for such purposes as of improving short-term performance. However, there is also the need to enable more radical renewal, where development efforts typically stretch beyond the single-project milieu. Supplier-led innovation towards e.g. affordable, sustainable building constitutes such an example. To open up for more radical renewal, one implication of an earlier proposed innovation-barrier/enabler model is the need for sustainable client-contractor arenas for communication, enabling the continuous re-thinking of current experience and understanding by allowing for clients' and contractors' different/conflicting meanings to surface and interact. In Swedish building such arenas seem to be lacking. Underpinning the argumentation is previous research addressing barriers for supplier-led innovation from theoretical perspectives of organizational information-processing and descriptive behavioural decision-making. To better understand the significance of suggested arenas, data were collected in three steps. First, representatives of a building company were interviewed about their personal views regarding barriers/enablers for supplier-led innovation and what primarily determine clients' accept/reject of the builder's standardized system solution. Second, the building-company representatives met with representatives from three client organizations for a round-table discussion concerning barriers to innovation and sector renewal, and means to overcome. Finally, follow-up interviews with building-company representatives sought to capture personal reflections following from foregoing discussion. Collected data were analysed in relation to the previously proposed model, thus simultaneously developing the model and making it more accessible to building practitioners. Cross-analyses of interviews and client-contractor discussion revealed multiple gaps of understanding. Furthermore, to open up for innovation challenging steady-state it is suggested that both client organizations and contractor organizations need to pay close attention to how meanings and understandings are formed and shared within as well as between organizations. A subsequent implication is the need for a more systematically employed communication arena, stretching beyond the short-term project milieu.

Keywords: client, communication, contractor, innovation

¹ susanne@ltu.se

DELIVERING SCHOOL BUILDINGS USING OFF- SITE CONSTRUCTION: STAKEHOLDERS PERCEPTIONS

Chris Boothman¹, Anthony Higham² and Aaron Scott¹

¹*Engineering Sports and Sciences Group, University of Bolton, Deane Road, Bolton UK*

²*Department of the Natural and Built Environment, Sheffield Hallam University, Howard Street, Sheffield UK*

Following the calls from the OECD and the James review for the increase in the use of standardisation and modern methods of construction in the delivery of new school buildings. The paper sought to appraise the views of both construction and educational professionals on the use of standardised schools delivered predominantly by the use of off-site techniques and modern methods of construction. 120 questionnaire surveys were issued, to both construction and education professionals located with the north of England eliciting their views on the use of modern methods of construction. Fifty completed questionnaires were returned, representing a response rate of 42%. Analysis of the completed questionnaires revealed that the majority of the respondents support the use of both standardised schools and modern construction techniques. Whilst bespoke school design and stakeholder engagement remains important, the respondents suggested improved pedagogical outcomes, enhanced comfort, value for money and a reduction in the number of defects would be critical to the eventual success of the project. To conclude the research revealed that both the construction and education professionals surveyed are not adverse to the adoption of modern methods of construction or the use of standardised school designs proposed in the James Review.

Keywords: modern methods of construction, off-site construction, education.

¹ JCB1@Bolton.ac.uk

Boothman, C, Higham, A and Scott, A (2014) Delivering school buildings using off-site construction: Stakeholders perceptions *In*: Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1019-1028.

SUPPLY CHAIN MANAGEMENT

A CONCEPTUAL MODEL FOR IMPROVING CONSTRUCTION SUPPLY CHAIN PERFORMANCE

Ikechukwu U. Dike¹ and Georgios Kapogiannis

¹ Faculty of Engineering and Computing, Coventry University, Coventry CV1 5FB, UK

Over the years, the UK construction industry through several reports and enquires has been admonished to change its business approaches. Research points to the industry's adversarial culture and disjointed relationships as the major hindrance in achieving collaboration and improved performance within construction supply chains. Common factors include the traditional construction procurement strategies driven by a win-lose mentality, competitive buyer-supplier relationships - pitting one supplier against another in order to achieve the optimum buy, and most significantly, loosely disseminated nature of information applications and exchange among project participants. Within this adversarial context, engagement with Building Information Modelling (BIM) and its philosophy is showing potential positive outcomes with regards to information exchange and collaborative working practices. This paper is based on a larger ongoing research project which aims to design a BIM-driven conceptual model for advancing collaboration and improved supply chain performance in UK construction projects. The research suggests that full deployment of the BIM concept possibly will greatly diminish the adversarial culture in the industry through promotion of collaborative working ideals. In turn, this will result in enhanced project supply chain performance thus, aligning with the objectives of the UK Government's construction strategy for 2016. Following this proposition, this paper based on a critical review of literature presents the essential elements required for the design of the proposed conceptual model, and its contributions to the construction management discipline.

Keywords: adversarial culture, building information modelling, collaboration, supply chain management.

¹ ikechukwu.dike@coventry.ac.uk

PARTNERING PRACTICES: AN INVESTIGATION OF INFLUENCES ON PROJECT SUCCESS

Jason Challender¹, Peter Farrell² and Fred Sherratt²

¹ Leeds City College, College House, Park Lane, Leeds, West Yorkshire LS3 1AA, UK

² Anglia Ruskin University, Bishop Hall Lane, Chelmsford, CM1 1SQ, UK

Historically, traditional procurement systems have resulted in low levels of client satisfaction, owing mostly to poor cost and time predictability. Alternative approaches, including partnering and collaborative working have consequently been developed. This paper examines whether such collaborative approaches can deliver improvements in project procurement and management, and considers the extent to which partnering practices influence the success of building projects. Project success in this regard is measured in terms of cost predictability, programme implications, quality control, health and safety, risk management, teamwork and communications. A focus is made on the importance and influence of contractor selection processes within collaborative procurement, and what constitutes best practice in this regard. Exploratory interviews were conducted with a group of construction project managers who have had extensive experience with both collaboratively and traditionally procured construction projects. Coding and analysis of the resultant data indicated that collaborative procurement routes do have many advantages over traditional adversarial routes in most cases, but not all. Practitioners regarded the individuals deployed on projects having more influence on success than choice of procurement method. Projects were categorised as suitable or unsuitable for modern innovative procurement methods, dependent on a number of determining factors. There is support for the premise that partnering practices can potentially yield more benefits where projects are highly complex. Early supply chain involvement in design is required, and robust contractor selection processes are vital for collaborative procurement to be successful. Further research is proposed to expand the knowledge base around the range of suitable projects which may benefit from partnering approaches to procurement, in order to facilitate decisions in practice.

Keywords: collaboration, contractor selection, partnering, procurement.

¹ JC8AME@Bolton.ac.uk

THE IMPACT OF SUPPLIER DEVELOPMENT INITIATIVES ON KEY PERFORMANCE INDICATORS

Jonathan Gosling¹ Mohamed Naim² Denis Towill³ and Brian Moone⁴

^{1, 2 and 3} *Logistics Systems Dynamics Group, Cardiff Business School, Cardiff University
Aberconway Building, Colum Drive, Cardiff, CF10 3EU, UK*

⁴ *Mace Group, 155 Moorgate, London, EC2M 6XB, UK*

It is frequently posited that supplier development and long term partnerships are an effective way of gaining a competitive edge. However, due to the lack of regularity in demand patterns in project based industries, some researchers have questioned the effectiveness of such initiatives. Exploiting a unique and interesting longitudinal dataset gathered from a global construction company's archival records, the aim of this paper is to analyse the impact of supplier development initiatives on Key Performance Indicators (KPIs). Supplier KPIs, recorded on a database, are analysed for a range of suppliers from the 1990s to 2013. Suppliers are organised into relational categories for the analysis, including 'long term strategic partners', 'some partnerships arrangements' and 'little partnership arrangements'. The highest performing group was the long term strategic partners, in both average performance scores and the consistency of those scores. We also conclude that suppliers with limited partnering arrangements perform less well on the project 'close out' KPI.

Keywords: supplier development, performance measure, relationship, supply chain management.

¹ goslingj@cardiff.ac.uk

Gosling, J, Naim, M, Towill, D and Moone, B (2014) The impact of supplier development initiatives on key performance indicators *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1051-1060.*

AN IMPROVEMENT STRATEGY FOR THE DEFECTS AND REWORK MANAGEMENT PROCESS WITHIN AN SME: AN ACTION RESEARCH APPROACH

Taggart, M.¹, Koskela, L.K. and Rooke, J.A.

¹ *University of Salford, School of the Built Environment, Salford, M5 4WT, UK*

Irish construction reported strong growth towards the end of 2013, after years of industry recession. Following a property led economic collapse which started in 2007 construction output fell by circa eighty percent. Many construction companies went out of business; those remaining are strongly focused on their bottom line and increasing efficiency to ensure survival. Defects and rework, common in construction, are both wasteful and a cost that can be avoided, thus presenting an obvious target for improvement. A regional SME main contractor collaborated on a project to improve the efficiency of their current processes for the identification, management and elimination of defects and rework in their supply chain. An action research strategy was employed on several field projects, to investigate the problems faced by the company in this area and to develop an improvement plan. Action research involves a five stage problem solving cycle (1) problem diagnosing; (2) action planning; (3) action taking; (4) evaluation of results; (5) specification of learning. Action planning elements emerging from the cycle (at stage 2) are presented here. They are very wide ranging and include; process standardisation; sign off procedures; use of ICT as a collaborative platform; freeware information repository; cost modelling; benchmarks for improvement; planning workshops; root cause analysis of defects and subsequent development of learning materials. Preliminary results indicate a sophisticated understanding of the defects and rework process across the supply-chain, but a general lack of forum and opportunity to contribute to improvement. The results indicate a wide diversity of abilities and resources in SMEs, including human, capital and technological, meaning one size fits all solutions to efficiency improvements are difficult to attain. Prescriptions thus need to be both simple to implement and flexible. The results here offer detailed reflective insight into best practice in designing improvement plans of this nature.

Keywords: action research, defects, rework, supply chain management.

¹ martin.taggart@gmit.ie

Taggart, M, Koskela, L K and Rooke, J A (2014) An improvement strategy for the defects and rework management process within an SME: An action research approach *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1061-1070.*

IDENTIFYING AND POSITIONING CONSTRUCTION SUPPLY CHAIN PLANNING PROBLEMS

Micael Thunberg¹, Martin Rudberg¹ and Tina Karrbom Gustavsson²

¹ *Department of Science and Technology, Linköping University, 601 74, Norrköping, Sweden*

² *Department of Real Estate and Construction Management, Royal Institute of Technology, 100 44, Stockholm, Sweden*

The construction industry struggles with an ineffective supply chain. A literature review, in combination with an empirical study aims at identifying and positioning perceived supply chain planning problems. The empirical part is a series of semi-structured interviews with construction site managers, purchase coordinators, and a project leader. Most site managers are responsible for mid-sized turnkey contracts, which enable comparison. Findings show that most of the supply chain planning problems relate to lack of coordination between actors, and that many of the problems discovered on-site originate from the supply process or the design process. Through proactive coordination of the actors in the supply chain planning process and the actors in the construction process, the problems on-site causing “fire-fighting”-activities could be reduced.

Keywords: coordination, planning problems, productivity, supply chain management, supply chain planning.

¹ micael.thunberg@liu.se

Thunberg, M, Rudberg, M and Gustavsson, T K (2014) Identifying and positioning construction supply chain planning problems *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1071-1080.

POLICY RESEARCH

CONSTRUCTION POLICY RESEARCH: BEWARE REASON MASQUERADING AS TRUTH

John-Paul Smiley¹, Andrew Dainty and Scott Fernie

¹ *School of Civil and Building Engineering, Loughborough University, Leicestershire, LE11 3TU, UK*

One of the defining characteristics of the modern era has been the ascendancy and privileging of an instrumental version of reason at the expense of other, competing forms of rationality. Now deeply established and an integral component of Neoliberal discourse, it forms the dominant form of reasoning for many planners, policy-makers, academics and laypersons alike. Drawing on the works of Max Horkheimer and Max Weber, this paper considers the ways in which instrumental reason diminishes policy formulations and undermines democratic culture. It achieves this through a consideration of the exclusion of 'deep' green activists from policy formulation and an examination of the Capital approach to sustainability popularised by David Pearce. Recognising instrumental reason as a culturally specific value-laden ideal, this paper teases out the assumptions behind such thought and highlights the potential for alternatives. Such a realisation has important consequences, as the ability for built environment policy-makers to reimagine theory and practice becomes possible only when the veil of instrumental reason, cloaked and presented as a value-neutral ideal, is lifted. It is hoped that such a perspective will contribute to the growing theoretical and philosophical debate in Construction Management research.

Keywords: culture, democracy, instrumental reason, policy, sustainability.

¹ J.Smiley@lboro.ac.uk

Smiley, J, Dainty, A and Fernie, S (2014) Construction policy research: Beware reason masquerading as truth *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1083-1092.*

THE MYTH OF BEST PRACTICE THROUGH THE LENS OF CONSTRUCTION SUPPLY CHAIN MANAGEMENT

Stuart Tennant¹, Scott Fernie² and Mike Murray³

¹ *Department of Civil Engineering, University of the West of Scotland, Paisley, PA1 2BE, UK*

² *Department of Civil Engineering and Building, Loughborough University, Loughborough, LE11 3TU, UK*

³ *Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, G4 0NG, UK*

Much is made of the concept best practice. It is repeatedly drawn upon by policy makers, academics and industry practitioners as a quasi-solution to construction industry ills. As an expression, it is often difficult to contest. Indeed, best practice implies identifying policy, process and procedure that offer the most optimum and efficient outcome. In short, best practice is all about improving performance. However, for the majority of commercial organizations, best strategy is also about improving performance. Despite the apparently congruent ambitions, best practice is not equal to best strategy. This misapprehension only serves to propagate the myth of best practice. This is a polemic paper, exploring the utility of best practice through the lens of construction supply chain management. Drawing inspiration from economic theory, construction management literature and previous supply chain management studies, the myth of best practice in construction supply chain management is exposed. Regardless of Government sponsorship and considerable academic investment, adoption of best practice in UK construction supply chain management remains slow and routinely symbolic. Yet, supply chain members do not behave irrationally. If best practice was truly in their best strategic interests it is highly probable that supply chain members would adjust their rules of economic engagement accordingly. It may be strongly argued that in contrast to the prevailing hype and repeated suggestion of supply chain win-win scenarios, UK Government endorsed best practice does not adequately serve the commercial interests of the majority. The very limited achievements of demonstration projects serve as a case in point. Disappointingly, few lessons appear to have been learned. The myth of construction supply chain management and by extension best practice in UK construction continues unabated albeit under a shiny new banner, Construction 2025.

Keywords: best practice, supply chain management, myth.

¹ stuart.tennant@uws.ac.uk

Tennant, S, Fernie, S and Murray M (2014) The myth of best practice through the lens of construction Supply chain management *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1093-1102.*

GOVERNMENT INFLUENCE ON THE CONSTRUCTION INDUSTRY DURING THE ECONOMIC RECESSION 2007 - 2013

Paul Tansey¹ and John P. Spillane²

¹*Department of Civil Engineering and Construction, Institute of Technology Sligo, Ballinode, Sligo, Ireland.*

²*School of Planning, Architecture and Civil Engineering, David Keir Building, Queens University Belfast, Belfast BT9 5AG, Northern Ireland, UK.*

Due to the high degree of international and economic integration across the globe, the 2007 global financial crisis quickly spread, causing recessions and widespread credit restrictions in advanced nations. During recessions, economic fluctuations cause dramatic changes to the market structure of industries, in particular, that of the construction sector. These structural changes can be further influenced by government strategies and policies; which if used incorrectly, can serve to fuel and exacerbate downturns. In contrasting form, during an economic recession, government strategies and policies can also be used to aid in exiting such economic turbulence. From an extensive review of literature it became apparent that very little research offered a comprehensive and systematic overview of Irish and UK construction related government policies and strategies adopted during recessions; hence the emergence of this topic. As part of an ongoing research PhD, the purpose of this paper is to collate and group Irish and UK Government strategies and policies adopted for the construction sector during the recession period 2007-2013; resulting in the establishment of a construction industry development framework and a taxonomic framework. The results reveal serious problems with the national strategic plan for the Irish construction industry, given that there is no overseeing body or target dates for implementation of the proposed actions. Furthermore, both countries failed to prioritize the proposed key actions within their strategic plans. The findings of this paper can be applied in the context of the construction sector to address shortcomings in the respective subsectors, while also aiding policy makers and company executives in mapping out future strategic milestones.

Keywords: economic development, government policies, recession, taxonomy.

¹ ptansey@itsligo.ie

Tansey, P and Spillane, J P (2014) Government influence on the construction industry during the economic recession 2007 - 2013 *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1103-1112.

GENDER EQUITY IN CONSTRUCTION PROFESSIONS: A NEW INSTITUTIONALIST PERSPECTIVE

Natalie Galea¹, Martin Loosemore, Abigail Powell and Louise Chappell

University of New South Wales, Sydney, Australia

The construction industry remains the most male dominated sector in Australia. Despite three decades of formal gender equity initiatives by government and business, there is little understanding of why there has been little change to the hierarchical and numerical underrepresentation of women. Using a New Institutional perspective, more specifically Lowndes and Wilson's (2003) concepts of robustness and revisability, the nature and intent of formal gender equity initiatives, policies and practices are analysed through a single case study of a multinational construction firm. Through in-depth interviews with senior management and a documentary analysis of formal equity and diversity policies it is concluded that the robustness and revisability of policies, initiatives and practices are critical to achieving lasting change in gender equity in the construction industry, as is a focus on men as well as women and gendered practices in policy design.

Keywords: gender, policy, equity, diversity, new institutionalism.

¹ natalie.galea@unsw.edu.au

Galea, N, Loosemore, M, Powell, A and Campbell L (2014) Gender equity in construction professions: A new institutionalist perspective *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1113-1121.*

A CRITICAL REVIEW OF THE LITERATURE ON DISABILITY MANAGEMENT IN THE CONSTRUCTION INDUSTRY

Quaigrain R.A.¹, Winter J. and Issa M.H.

Construction Engineering and Management Group, Department of Civil Engineering, University of Manitoba, Winnipeg, Manitoba, Canada

This paper reports on a review of the literature on disability management in the construction industry. The review explores the concept of disability management and existing guidance in the field in Canada before exploring the pillars of effective disability management programs. The review extends to investigating the literature on the topic as it pertains to the construction industry, focusing on the extent to which disability management practices are implemented in the industry and barriers to their successful implementation. The review is being conducted in preparation for an initiative undertaken by the Construction Engineering and Management at the University of Manitoba and funded by the Workers' Compensation Board of Manitoba. This initiative aims to evaluate the maturity of disability management practices in the Manitoban construction industry. The review shows how disability management as a concept developed in the mid-1980s. Its founding pillars include organizational policies and procedures; recruitment practices; employment retention practices; rehabilitation practices; modified or alternate work opportunities; awareness, training and promotion practices; involvement and collaboration; and monitoring and evaluation. While the concept appears to be constantly evolving, its application in construction remains limited. Only six research papers pertaining to disability management in construction were found, highlighting the need for more work on the topic. The review of these papers shows how the industry's disability management practices remain inadequate. Disability management continues to be seen as a burden to construction employers for the most part, making it difficult to challenge traditional perceptions. Using maturity modelling to evaluate the effectiveness of these practices with the ultimate aim of improving them appears to be an important research opportunity that needs further investigation.

Keywords: disability management, maturity modelling, return-to-work.

¹ quaigra@myumanitoba.ca

Quaigrain, R A, Winter, J and Issa, M H (2014) A critical review of the literature on disability management in the construction industry *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1123-1132.*

HOUSE BUILDING

EXPLORING INDUSTRIALISED HOUSE-BUILDERS' PERCEPTIONS OF LOCAL REQUIREMENT SETTING - AN INSTITUTIONAL LOGICS PERSPECTIVE

Anders Viking¹ and Sofia Lidelöw

¹*Division of Structural and Construction Engineering, Department of Civil, Environmental and Natural resource Engineering, Luleå University of Technology, Sweden*

Industrialised house-builders (IHBs) are housing contractors who use standardised processes and building systems as a means to time and cost efficiently address the current housing shortage in Sweden. Recent governmental investigations argue that the mandate for local planning authorities (LPAs) to intentionally set stricter requirements than those prescribed in the national building code can stifle the potential for increased industrialisation. The aim of this paper is to explore IHBs' perceptions of local requirement setting (LRS). It seeks to use the concept of institutional logic to advance the understanding of how LRS affects IHBs. Data was collected through in-depth interviews with representatives of five IHBs encompassing a mix of building systems spanning the Swedish multi-family housing market. From the data we identify three distinct categories of LRS: intentional, interpretive and public procurement-related. The respondents' perceived issues with LRS are found to relate more closely to the process of setting requirements than to the requirements themselves. The political debate about LRS has entirely neglected interpretive LRS, LRS in public procurement as well as the entire process perspective. Institutional logics is shown to offer new and interesting perspectives on the agency/structure dominated cognitive and intra-organisational processes that shape the emergence of local requirements in interpretative LRS and LRS in public procurement respectively. Since LRS is affected both by individual planning officers (agency) and the LPA organisation (structure) further studies will explore their perceptions of LRS.

Keywords: housing, industrialised house-building, institutional logic, local planning.

¹anders.viking@ltu.se

Viking, A and Lidelöw, S (2014) Exploring industrialised house-builders' perceptions of local requirement setting - An institutional logics perspective *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1135-1144.*

A SYNERGISTIC SUPPLY CHAIN ENHANCING OFFSITE MANUFACTURING UPTAKE IN AUSTRALIAN HOUSE BUILDING

Sherif Mostafa¹, Nicholas Chileshe and Jian Zuo

School of Natural and Built Environment, Barbara Hardy Institute, University of South Australia, City East Campus, G.P.O. Box 2471 Adelaide, South Australia 5001, Australia

Offsite manufacturing could become a key innovation for the future of Australian house building due to its capacity in meeting the growing housing demand, green construction and fewer requirements for labour force. It is a modern construction method where house building involves offsite factories and onsite construction. Three major challenges for managing the two working sites are broken junction, jumbled on-site process and vague demands from unclear customers. The two sites have several forms of non-value added activities. On the other hand, the house customisation adds more complexities to the design specification that leads to slow response to achieve house customer demand in short time. This is a proposition paper which aims to explore the opportunity of offsite manufacturing in Australia. This research conducts the offsite manufacturing exploration by reviewing the related literature. The research discovers that incorporating lean and agile concepts could overcome the existing barriers of offsite manufacturing uptake in Australia. Therefore, four house building strategies: built to stock, assemble to order, design to order, and self-building house are introduced for different house building alternatives in Australia.

Keywords: Australian housing, offsite manufacturing, synergistic supply chain.

¹ Sherif.mostafa@mymail.unisa.edu.au

Mostafa, S, Chileshe, N and Zuo, J (2014) A synergistic supply chain enhancing offsite manufacturing uptake in Australian house building *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1145-1154.*

PLACING DEFECTS AT THE HEART OF HIGH QUALITY NEW HOMES: THE LEARNING PERSPECTIVE

Tony Hopkin¹, Shu-Ling Lu², Phil Rogers Hopkin³, and Martin G. Sexton²

¹ *TSBE Centre, University of Reading, Reading, RG6 6AF, UK*

² *School of Construction Management and Engineering, University of Reading, Reading, RG6 6AW, UK*

³ *House Building Standards, National House Building Council, NHBC House, Davy Avenue, Knowlhill, Milton Keynes, MK5 8FP, UK*

The UK new-build housing sector is facing dual pressures to expand supply, whilst delivering against tougher planning and Building Regulation requirements; predominantly in the areas of sustainability. The sector is currently responding by significantly scaling up production and incorporating new technical solutions into new homes. This trajectory of up-scaling and technical innovation has been of research interest; but this research has primarily focus on the ‘upstream’ implications for house builders’ business models and standardised design templates. There has been little attention, though, to the potential ‘downstream’ implications of the ramping up of supply and the introduction of new technologies for build quality and defects. This paper contributes to our understanding of the ‘downstream’ implications through a synthesis of the current UK defect literature with respect to new-build housing. It is found that the prevailing emphasis in the literature is limited to the responsibility, pathology and statistical analysis of defects (and failures). The literature does not extend to how house builders individually and collectively, in practice, collect and learn from defects information. The paper concludes by describing an ongoing collaborative research programme with the National House Building Council (NHBC) to: (a) understand house builders’ localised defects analysis procedures, and their current knowledge feedback loops to inform risk management strategies; and, (b) building on this understanding, design and test action research interventions to develop new data capture, learning processes and systems to reduce targeted defects.

Keywords: action research, defects, house builders, new homes, risk management.

¹ t.j.hopkin@pgr.reading.ac.uk

Hopkin, T, Lu, S, Hopkin, P and Sexton, M (2014) Placing defects at the heart of high quality new homes: the learning perspective *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1155-1164.*

SHALL WE DANCE? ENCOUNTERS FOR ENERGY RENOVATION OF SINGLE FAMILY HOUSES

Veronica Carlsson¹ and Christian Koch

¹ *Construction Management, Chalmers University of Technology, Sweden*

In the strive for climate change mitigation and transition the building stock is a major issue to acknowledge as its energy consumption and production of carbon dioxide is significant, around 30% of the total in Sweden. Government policies, subsidies and more have therefore been applied to deal with this issue. However the bulk of efforts have focused on dwellings, office buildings, public buildings and other major installations, whereas the single family house areas have received less attention and presently even enjoy a public regulation regime which leaves up to ten years of room for manoeuvre before private house owners are obliged to react. This leaves the arena for more voluntary types of renovation. Studies shows that house owners doing such renovations are prone to contact and use their local SME craftsman. The encounters between house owners and craftsmen come to impede the degree and quality of the energy renovation referring to costs, unstable and/or ineffective technologies, lack of understanding of subsidies and financial options and even general insecurity. This paper reports a local study of three craftsmen contractors and their interaction with house owners as potential customers which is part of a project with a group of participating SMEs. Through interviewing, participant observations and shadowing, the sales processes and negotiations were followed on site inside the customers house. Theoretically the study draws on Goffman's concepts of presentation of self in everyday life, performance, staging and "front". The results show a complex interactive pattern, like a dance, where limited local knowledge play a role as does subtle assumptions about cost and economic capacity. Thus rather than placing the responsibility for conservative renovation actions on either the craftsmen or the house owners, it is claimed here that the two parties are acting in a routinized play they cannot easily escape.

Keywords: energy renovations, detached houses, Goffman, SME.

¹ veronica.carlsson@chalmers.se

Carlsson, V and Koch, C (2014) Shall we dance? Encounters for energy renovation of single family houses *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1165-1173.*

HOUSE BUYERS AND BUILDERS: THE “IDEAL” HOME IN SCOTLAND

Nicola Callaghan¹

University of Greenwich, UK

The UK Government has outlined a variety of targets for new build housing to be zero carbon (Zc) from 2016. In realising this ambitious target, house builders will be required to deliver high energy efficient housing adding to the existing rules and regulations bedevilling the construction industry. This, combined with the selection and purchase of a new home being the single, largest capital investment that a person is likely to make in their lifetime has resulted in the success of Zc housing depending, to some extent, on consumer acceptance, which must align with the attitudes, values and wants of potential home buyers, particularly when faced with a variety of factors influencing consumer decisions. Consequently, this research presents the findings from a comprehensive quantitative study of 202 questionnaires undertaken by house buyers relating to energy efficient, private housing which highlights a misalignment between perceptions and reality with regards to what buyers consider to be the “ideal” home. The results obtained are particularly important as they go some way in narrowing the gap between the views and opinions of house buyers and builders relating to energy efficient homes and the home buying process.

Keywords: consumer, energy efficiency, housing.

¹ cn59@gre.ac.uk

Callaghan, N (2014) House buyers and builders: The “ideal” home in Scotland *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1175-1184.*

LEARNING AND EDUCATION

PROMOTING DOUBLE LOOP LEARNING IN FLOOD RISK MANAGEMENT IN THE SCOTTISH CONTEXT

Craig Thomson¹, Slobodan Mickovski and Charles Orr

¹ School of Engineering and Built Environment, Glasgow Caledonian University, G4 0BA, UK

In Scotland, flood risk is predicted to double by 2100 due to climate change and land use changes within river basins. Flood Risk Management (FRM) has emerged as a strategic framework to encourage resilience through collaboration, risk assessment and flood plans designed to target investment for prevention and defence schemes. Learning in this context has often been criticised for being single loop, reactive, narrow, and fragmented and ignoring wider socio-technical issues. The Scottish Flood Risk Management Act (2009) has shifted focus from flood defence to a holistic prevention based approach which encourages the double loop learning (DLL) necessary to promote sustainability and greater resiliency within the social system. This research explores the extent FRM in Scotland has promoted DLL at both a strategic and project levels following the application of the 2009 Act. A literature review identifies that to promote DLL requires FRM to be proactive, seek new knowledge, be creative, question, and be holistic when making future based decisions. These characteristics were considered in two research phases, 1) a survey of Scottish local authorities (response from 22 of 32) in 2011, supplemented by stakeholder interviews focused on the strategic level and 2) follow up stakeholder interviews in 2014, and case study exploring operational implications at a project level. The research found that changes in FRM since 2009 have provided a framework where DLL can potentially flourish but this is a transitional phase with social-technical barriers restricting its delivery in practice at both strategic and project levels. Findings stress the importance of fostering a proactive and learning culture surrounding FRM which supports the management of explicit and tacit knowledge between strategic and project levels maximising opportunity for DLL during and post flood events, but also in identifying and managing individual projects.

Keywords: flood risk management, double loop learning, knowledge management, case study.

¹ craig.thomson@gcu.ac.uk

WIND TURBINE RESCUE: EMERGING SKILL RETENTION ISSUES AND CHALLENGES

Kenneth Lawani¹, Billy Hare and Iain Cameron

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

The wind energy sector is becoming an increasingly important one for those involved in construction and with the increasing number of technicians employed in the industry, issues of occupational health and safety becomes of paramount interest. This paper explores the occupational health and safety challenges in the wind energy industry in relation to wind technicians' safe and competent use of a rescue and evacuation device in emergency situations whilst working at height. The study reported here evaluated the magnitude of procedural skill and knowledge retention over a three-month period after acquisition; the significant factors influencing procedural skill retention during safe rescue and evacuation; and the impact of cued recognition/recall methods on skill retention. Thirty trainees fully participated in the retention study at intervals of 28 and 90 days. The results suggest that refresher participants should undertake rescue and evacuation practice drills between three and six months after acquisition while fresher participants should undergo practice drills within the first three months. The contributing factors influencing the technicians' procedural rate of retention are the length of time after acquisition and practice, experience, feedback and it is advisable that cues be embedded within the training because with fundamental cues, there is increased retention of procedural tasks. This has implications for the wider construction industry where work at height in harness are carried out in isolated places.

Keywords: competency, rescue and evacuation, skill decay/retention, refresher and fresher, cued recognition/recall.

¹ Kenneth.Lawani@gcu.ac.uk

MOTIVATION OF UNDERGRADUATE CIVIL ENGINEERING STUDENTS FOR HIGHER LEVELS OF ACADEMIC SUCCESS

Hector Martin¹, Christelle Sorhaindo² and Ferida Welch³

^{1,2} *University of the West Indies, St Augustine, Trinidad*

³ *Tunapuna RC Girls, Tunapuna, Trinidad*

It is surmised that more than half of the civil engineering students at the University of the West Indies, St. Augustine campus, fail to complete their degree in the three years prescribed for the completion of the program, suggesting there is need for an intervention strategy. Motivation though often overlooked as a measure of influencing academic success, is being revisited as the strategy to enable success, as it is the thrust behind the desire which drives an individual to achieve a goal. Before the strategy is determined a distinction between the source of motivation and the degree of its contribution must be understood. Determining the effect of intrinsic and extrinsic motivational factors and how they are linked to the academic success of engineering students can provide the basis for the choice of an intervention strategy. Intrinsic motivation was determined as the most important motivational construct towards learning. Principal component analysis determined that the main motivational factors, towards learning present in students currently pursuing an engineering undergraduate degree for all years of study were Personal, Perfectionist, Parental/Family, Job/Career and Social Acceptance. Determining what drives students to their peak performance would assist with the facilitation and design of teaching methods to capture students' interests, promoting learning and understanding as best as possible and consequently, optimizing academic performance.

Keywords: motivation, academic performance, civil engineering, undergraduate.

¹ hector.martin@sta.uwi.edu

Martin, H, Sorhaindo, C and Welch, F (2014) Motivation of undergraduate civil engineering students for higher levels of academic success *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1207-1216.*

BUILDING ECONOMICS PRE-COURSE STUDENT PERCEPTIONS

S. Dent¹ and J.J. Smallwood²

¹*Department of Quantity Surveying, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, South Africa*

²*Department of Construction Management, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, South Africa*

Tertiary Students' pre-course perceptions of a subject provide insight relative to their understanding and appreciation of a subject and challenges that the lecturer may encounter. Furthermore, post-course perceptions can be compared with pre-course perceptions to determine the impact of the presentation of the subject, if any. The purpose of the study reported on is to determine the pre-course Building Economics perceptions of construction management and quantity surveying students, based upon a self-administered questionnaire survey conducted in a South African university. The students were surveyed at the inception of the presentation of the subjects. Findings include: material costs, labour rates, and profit margins predominate in terms of the importance of Building Economics knowledge areas to CMs, and cost control, measuring (quantities), and estimating relative to QS; accurate estimating, design and specification changes, material availability, labour productivity, material availability, and inflation predominate in terms of the extent various aspects contribute to project cost control, and the knowledge gained from the subject will assist students in other modules, and the subject teaches students skills which they can apply in everyday life. Based upon the findings it can be concluded that students have a degree of understanding and appreciation of the subject Building Economics prior to exposure thereto, and they understand and appreciate the importance and role of the subject Building Economics to their programmes and disciplines. It is recommended that such research be conducted on an annual basis, and a preparatory lecture module 'The role and importance of Building Economics' should be evolved for first time Building Economics students.

Keywords: Building Economics, perceptions, students, South Africa.

¹ john.smallwood@nmmu.ac.za

Dent, S and Smallwood, J J (2014) Building Economics pre-course student perceptions *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1217-1224.*

INFORMATION MANAGEMENT

CONCEPTUALISING ACTORS' INFORMATION BEHAVIOUR: AN INVESTIGATION INTO PROJECT INFORMATION DYNAMICS

Frank K. Dzokoto¹, Francis Edum-Fotwe, and Peter Demian

¹ *Construction Management, School of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK*

Research into information technology in construction has received considerable attention in recent years. However, information behaviour (IB) of actors' in the project environment can be undefined, unstructured and suboptimal. The way information is obtained and shared to support project design development, organisational management and site operational activities continue to change rapidly. Major problems that continue to affect actors' performance are their exposure to different information sources and channels, unstructured Information Seeking Behaviour (ISB), and the large amount of time they spend sifting through these sources and channels to obtain context specific information just-in-time for use. Hence, this research uses comprehensive review of IB literature and interviews to investigate the information seeking activities of industry professionals in the project environment. It was found that project actors exhibited five distinct ISBs during the project delivery process which are presented and discussed with a conceptual framework to establish an agenda for future study into effective IB culture. The significance of this research is to investigate the current practices of actors' ISBs in order to define strategies to help improve performance in information seeking, project design and delivery process.

Keywords: actors, information seeking behaviour, performance, project life cycle.

¹ f.k.dzokoto@lboro.ac.uk

Dzokoto, F K, Edum-Fotwe, F and Demian, P (2014) Conceptualising actors' information behaviour: An investigation into project information dynamics *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1227-1236.

USING ACTOR-NETWORK THEORY TO UNDERSTAND KNOWLEDGE SHARING IN AN ARCHITECTURE FIRM

Abderisak Adam¹, Pernilla Gluch and Jonas Julin

Construction Management, Dep of Civil and Environmental Engineering, Chalmers University of Technology, Sven Hultins gata 8, Göteborg, Sweden.

This study investigates knowledge sharing in a large Scandinavian architectural firm, ArchFirm. In particular, a knowledge management initiative called the Knowledge Building (KB) is examined. The study is based on a case study consisting of a document review and 12 interviews. Drawing on Actor-Network Theory (ANT) as analytical lense, KB is conceptualized as a heterogenous network consisting of several actants, human and non-human. Key aspects of ANT used when analyzing data is; translation, semiotic rationality, punctualization and black-boxing, focal actants and obligatory passage point (OPP). ANT as theoretical approach created an opportunity to view the intricate nature of knowledge sharing in an architecture firm from a different perspective compared to previous research. This work also opens a window for further research in the area of knowledge sharing as it relates to architectural practice.

Keywords: actor network theory (ANT), knowledge sharing, professional networks, architecture firm, case study.

¹ abderisak.adam@chalmers.se

Adam, A, Gluch, P and Julin, J (2014) Using actor-network theory to understand knowledge sharing in an architecture firm *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1237-1246.*

TACIT AND EXPLICIT KNOWLEDGE IN CONSTRUCTION MANAGEMENT

Mark Addis¹

Faculty of Performance, Media and English, Birmingham City University, Perry Barr, Birmingham, B42 2SU, UK

In construction better practice has been sought through the employment of knowledge management. Interest in tacit knowledge has grown due to its importance for raising performance at all organisational levels. Aspects of the limits which tacit knowledge places on knowledge management approaches in construction are considered with the focus being upon broad knowledge management categories rather than the details of particular methods. The distinction between knowing how and knowing that coupled with examination of whether the main mode of knowing is tacit or explicit is used to analyse the relationship between tacit and explicit knowledge in construction. There are significant general theoretical difficulties with incorporating tacit knowledge into the objectivist knowledge management approaches which predominate in construction particularly since methods for converting tacit to explicit knowledge are problematic. Improving performance requires appreciating the limitations of objectivist and practice based knowledge management within the context of construction projects as consideration of performance management measures illustrates.

Keywords: information management, measurement, tacit knowledge.

¹ mark.addis@bcu.ac.uk

Addis, M (2014) Tacit and explicit knowledge in construction management *In:* Raiden, A B and Aboagye-Nimo, E (Eds) *Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1247-1254.

RISK MANAGEMENT AND UNCERTAINTY IN INFRASTRUCTURE PROJECTS – WHAT ROLE(S) FOR KNOWLEDGE AND CONSTRUCTION MANAGEMENT?

Chris Harty¹, Tim Neerup Thomsen² and Kjell Tryggestad³

¹ *School of Construction Management and Engineering, University of Reading, UK and Copenhagen Business School, Denmark*

^{2,3} *Copenhagen Business School, Denmark*

The assumption that large complex projects should be managed in order to reduce uncertainty and increase predictability is not new. What is relatively new, however, is that uncertainty reduction can and should be obtained through formal risk management approaches. We question both assumptions by addressing a more fundamental question about the role of knowledge in current risk management practices. Inquiries into the predominant approaches to risk management in large infrastructure and construction projects reveal their assumptions about knowledge and we discuss the ramifications these have for project and construction management. Our argument and claim is that predominant risk management approaches tends to reinforce conventional ideas of project control whilst undermining other notions of value and relevance of built assets and project management process. These approaches fail to consider the role and potential value of knowledge production during the project process, instead seeing knowledge as an input into upfront planning and specification. We examine ways in which actual project practices approach the question of risk management for the case of large public hospital building and infrastructure projects in Denmark. These projects are characterized by long durations involving substantial materiality, high uncertainty, ambiguity, and complexity. Yet, they are also subjected to risk management that operates according to a standardized ‘best practice’ control approach – as if these hospital and infrastructure projects are quite simple, predictive and similar in nature. The cases reveal the emerging uncertainties that challenge the project plan and the risk management approach as new knowledge about the conditions are produced during the project processes. The paper concludes by proposing a more dynamic understanding of the role of knowledge, considering the practical implications of uncertain knowledge conditions as a prevailing condition for construction management rather than something to be known in advanced and reduced by risk management.

Keywords: risk, uncertainty, knowledge, infrastructure.

¹ c.f.harty@reading.ac.uk

Harty, C, Thomsen, T and Tryggestad, K (2014) Risk management and uncertainty in infrastructure projects – What role(s) for knowledge and construction management? *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1255-1264.*

AN ILLUSTRATION OF THE DEVELOPMENT OF A STRATEGY FOR EVALUATING THE DESIGN OF HOSPITALS WITHIN A PRACTICE ORDER NETWORK

D.J. O’Keeffe¹, D.S. Thomson and A.R.J. Dainty

School of Civil and Building Engineering, Loughborough University, LE11 3TU, UK

This paper is part of on-going research that is investigating the potential of a practice theory perspective to understanding stakeholder evaluation of hospital design. Practice theory offers numerous affordances, especially to researchers and practitioners who seek alternatives to the problematic assumed universality of other 'traditional' theoretical perspectives. However there are several disagreements left unresolved in the literature about practice theory methodology that risk compromising its full potential. Drawing on Schatzki's notion of site ontology and illustrated by an on-going ethnographic study of the practice of evaluating the design of a major UK National Health Service (NHS) hospital, this paper seeks to contribute to resolving such disagreements by developing a strategy that generates a methodology for use with practice theory. The strategy is based on the premise of ontological salience and phenomenological congruence. Arguments for the mobilisation of a pluralistic portfolio of methodologies, methods and the synthesis of a pair of analytical devices ('design evaluation as practice' and 'design evaluation in practice') that emerged from the application of the strategy are explored. Dialogical reflexivity is foregrounded as a further and essential part of the strategy. The paper elucidates and enhances both the praxis and practices stimulated by current approaches to design evaluation. It raises important implications for the future development of UK Government policy to substantively improve the design quality of NHS healthcare building sand, in turn, improve patient healthcare outcomes.

Keywords: methodology, practice theory, design evaluation, pluralism, dialogical reflexivity.

¹ dennis.ocaohm@googlemail.com

O’Keeffe, D J, Thomson, D S and Dainty, A R J (2014) An illustration of the development of a strategy for evaluating the design of hospitals within a practice order network *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1265-1274.

STRATEGIC ISSUES FOR THE INDUSTRY

CHANGING PARADIGMS IN CONSTRUCTION COMPETITIVENESS RESEARCH

Dilek Ulutaş Duman¹ and Heyecan Giritli²

¹ *Izmir Institute of Technology, Faculty of Architecture, Izmir, Turkey*

² *Istanbul Technical University, Faculty of Architecture, Istanbul, Turkey*

In the construction industry, every company has to apply some kind of strategic solutions in order to maintain their competitiveness. Although there are variety of discussions of what is the meaning of 'competitiveness' and 'strategy' keywords, in generic terms while the competitiveness means gaining advantage against rivals, strategy refers the actions that provide competitiveness. Construction management literature is abundant in researches, which evaluate the competitiveness strategies of construction industry organizations, however, they approach the "competitiveness" concept from variety of theoretical backgrounds and methodological perspectives. There is a requirement for a systematic summary of the literature in order to demonstrate the changing paradigms in competitiveness research. Therefore, the aim of this paper is to analyse and identify the changing paradigms in construction competitiveness research by utilizing meta-analysis methodology to six leading construction management journals from 2000 to 2014. Findings of the research will clarify how the research focus, level of analysis, sources of information, contribution of papers, author orientation and utilization of different schools of thoughts have changed in time and how future directions could be designed in construction competitiveness research.

Keywords: competitiveness, corporate strategy, meta-analysis.

¹ dilekulutas@iyte.edu.tr

Ulutaş Duman, D and Giritli, H (2014) Changing paradigms in construction competitiveness research *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1277-1286.*

A CONCEPTUAL FRAMEWORK FOR ACHIEVING FIRM COMPETITIVENESS IN CONSTRUCTION: A 'CREATING SHARED VALUE' (CSV) CONCEPT

Raman Awale¹ and Steve Rowlinson

¹ *Department of Real Estate and Construction, The University of Hong Kong, Pokfulam, Hong Kong*

Experience in recent years has emphasized that social sustainability is a key to achieve long-term competitiveness and sustainable growth for firms. However, current studies on competitiveness in the construction management literature are mainly focused on achieving business values i.e. it focuses on an economic perspective of competitiveness but it often neglects social integration. Social dimensions are given relatively lower priority, analysed separately and treated outside the scope of business strategy. An alternative concept, Creating Shared Value (CSV) concept is considered. It aims to enhance a firm's competitiveness by advancing their business and social conditions simultaneously. It can help firms to better respond to societal, environmental, and market needs as well as business activities. However, the relationship between CSV and competitiveness is still unclear, especially in the construction management research. This study attempts to develop a CSV-competitiveness conceptual framework for construction firms based on the analysis of current CSV implementation strategies in other disciplines from a strategic management perspective. The framework categorises firm competitiveness into two dimensions- 1) business success and 2) facilitation of future growth and development. It also argues that through the CSV concept, firms can convert social issue into business opportunity - which is jointly measured in terms of social and business values. This ultimately leads to firm competitiveness. This study addresses how construction firms can achieve competitiveness by implementing the CSV concept.

Keywords: business strategy, business value, competitiveness, shared value.

¹ raman@hku.hk

Awale, R and Rowlinson, S (2014) A conceptual framework for achieving firm competitiveness in construction: A 'creating shared value' (CSV) concept *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1287-1296.*

BOUNDARY MAKING IN PUBLIC-PRIVATE-PARTNERSHIPS (PPP): A HISTORICAL ACCOUNT OF THE BRITISH RAILWAY INDUSTRY

Santi Jintamanaskoon¹ and Paul W Chan

¹ *School of Mechanical, Aerospace & Civil Engineering, The University of Manchester, Sackville Street, Manchester, M13 9PL, UK.*

Since its emergence in 1980s, public private partnerships (PPP) have become a predominant approach for delivering social and economic infrastructure in the UK. This has inspired many scholarships into how such arrangements can bring about better performance for all. In much of the extant work, the focus has been on finding more effective ways of configuring the relationships between the public and private parties, often taking assumption that each of these sectors are homogenous entities. In this paper, we raise the question as to whether boundaries between the public sector and private sector are ever so clear cut. We do so by drawing upon an on-going archival study in to British railway industry in the 1960s. We found that the roles played by stakeholders were often messy, and that the labels of what constituted "public" and what constituted "private" were not always clearly defined. Indeed, relationships were often blended between the two spheres. Rather than to focus on finding better ways of bringing the public and private together in delivering PPPs, it is argued that these arrangements between public and private sectors are better studied as fertile context for boundary making and identity formation.

Keywords: archival research, boundary-making, public-private-partnership, railways.

¹ santi.jintamanaskoon@postgrad.manchester.ac.uk

Jintamanaskoon, S and Chan, P W (2014) Boundary making in public-private-partnerships (PPP): A historical account of the British railway industry *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1297-1306.

A PUBLIC COMMISSIONING MATURITY MODEL FOR CONSTRUCTION CLIENTS

Marleen Hermans¹, Leentje Volker² and Pieter Eisma³

Delft University of Technology, Faculty of Architecture and the Built Environment, Real Estate and Housing, Julianalaan 134, 2628 BL DELFT, Netherlands

Being a public organization with construction needs, whether they are housing, building or infrastructure related, implies close co-operation and interaction with the supply chain. Substantial research exists that focuses on project related aspects of commissioning and on the role of the construction client in general. Only limited research has been done, however, into the impact of organizational characteristics on the level of professionalism and competences of commissioning entities. This research is particularly relevant, when public organizations are re-evaluating their sourcing strategy. As part of the establishment of a new chair of public commissioning, the development of a 'Public Commissioning Maturity Model' (PCCM) is presented in this paper. The model aims to identify the key characteristics of being a competent construction client. The overall aim of this research is to establish an overview of and insight into the nature and impact of characteristics of public organisations as determinants of their professionalism as public commissioning entities. In the PCMM, for each aspect of the commissioning role, maturation stages are defined. Research methods used include a literature survey and expert sessions. The model and methodology build on maturity models developed in asset and project management, supply chain management and purchasing. The research resulted in a framework containing a set of coherent aspects jointly framing the concept of 'professional public commissioning'. This framework can be applied by public commissioning entities to explore their current status and define their desired further development.

Keywords: client, maturity model, performance indicators, procurement, supply chain management.

¹ M.H.Hermans@tudelft.nl

Hermans, M, Volker, H and Eisma, P (2014) A public commissioning maturity model for construction clients *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1307-1316.*

EXPLORING THE MANAGEMENT OF MULTIPLE BUSINESS MODELS IN ONE COMPANY

Matilda Höök¹ and Lars Stehn

Department of Civil, Environmental and Natural resources engineering, Division of Structural and Construction Engineering-Timber Structures, Luleå University of Technology, Sweden

Increased demands for responsiveness and efficiency have led specialized Swedish manufacturing firms and contractors to adopt new production and product strategies. Some firms have adopted multiple business models (BMs) concurrently in order to be competitive in the modern market. A BM can be seen as a conceptual blueprint of a company's money earning logic, and can act as a guiding instrument towards competitiveness. It is known that companies trying to compete with both low-cost and differentiation BMs face challenges such as conflicting value chains and straddling costs. However, further understanding of various aspects of BMs, their implementation and effects (particularly in the construction industry) is required. Thus, the aim of this paper is to explore BM management in a manufacturing firm in the Swedish construction industry, which has adopted evolving BMs (some concurrently) in recent years. The results, based on analysis of long-term (15 years) process data, indicate that strategic events and decisions influence the management of parallel BMs, and that strategic events are important for competitiveness. They also show that successful balancing of concurrent BMs can yield synergistic benefits, such as resource flexibility and lower vulnerability in the construction market. Due to its exploratory nature, this work serves as a first step towards a wider and more general understanding of the management of multiple BMs in construction firms.

Keywords: business model, corporate strategy, longitudinal study.

¹ Matilda.Hook@ltu.se

PLANNING, PRODUCTIVITY AND QUALITY

REBALANCING THE CONSTRUCTION PRODUCTIVITY DEBATE

Martin Loosemore¹

¹ *University of New South Wales, Faculty of the Built Environment, Sydney, NSW 2052, Australia*

Subcontracting is a common aspect of all construction markets but is a particular feature of countries like the UK, Italy and Australia, where similar statutory, political and regulatory changes have reduced the number of vertically integrated firms and driven increased fragmentation and self-employment in the industry. While subcontracting has produced many advantages, particularly around flexibility, it has also led to many challenges around coordination and productivity. It is therefore surprising that subcontractors have been missing from the productivity debate. To rebalance the debate, eight focus groups were conducted with seventy one of Australia's leading tier-one subcontractors. The results indicate that from a subcontractor's perspective productivity could be improved significantly by fairer and more inclusive workplace practices which provide more opportunities for subcontractor's to innovate and to share risk and reward.

Keywords: productivity, subcontractor, fairness, trust, risk, innovation.

¹ m.loosemore@unsw.edu.au

Loosemore, M (2014) Rebalancing the construction productivity debate *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1329-1336.

ENHANCING LABOUR PRODUCTIVITY WITHIN CONSTRUCTION INDUSTRY THROUGH ANALYTICAL HIERARCHY PROCESS, THE CASE OF GAZA STRIP

Hasan Hamouda¹ and Nadine Abu-Shaaban

Construction Management Group, Faculty of Applied Engineering and Urban Planning, University of Palestine, PO Box 1075, Gaza, Palestine

Construction sector plays a leading role in economic growth for countries all around the world. Since construction is a labour intensive industry, productivity is considered a primary driving force for economic development. In the Gaza Strip, the economy is severely challenged by the combined effects of rapid population growth and the closure policy imposed on the area since 2007. Owing to this situation, construction projects are characterized by low profit margin, time and cost overrun making labour productivity a key component of company's success and competitiveness. Although, labour productivity has been subject of study by many researchers, a deeper understanding is still required to improve labour productivity. The main aim of this study is to identify key factors affecting labour productivity in the Gaza Strip. It also aims at formulating a labour productivity baseline model using the Analytical Hierarchy Process (AHP). By reviewing the literature and conducting depth interviews with experienced engineers, thirty critical factors related to labour productivity were identified and categorized into six groups: psychological, experience, supervision and leadership, physical, time and workload, and external factors. Based on the Analytical Hierarchy Process approach, a questionnaire was designed and delivered to sixty contractors to elicit the view on how labour productivity might be affected. A total of 56 feedbacks were analyzed through the AHP. The results indicated that Job satisfaction & security, lack of incentive scheme, skill & experience, drug use, overtime and weather changes have a significant impact on labour productivity in GS. In addition, the developed AHP model provides a framework that can assist managers in evaluating multiple factors and hence effectively improve labour productivity.

Keywords: analytical hierarchy process, Gaza Strip, labour, productivity.

¹ h.hamouda@up.edu.ps

Hamouda, H and Abu-Shaaban, N (2014) Enhancing labour productivity within construction industry through analytical hierarchy process, the case of Gaza Strip *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1337-1346.

MODELLING MASONRY LABOUR PRODUCTIVITY USING MULTIPLE REGRESSION

Anu V. Thomas¹ and J. Sudhakumar

Department of Civil Engineering, National Institute of Technology, Calicut, NITC P. O., Calicut, Kerala, India

Construction labour productivity is influenced by a multitude of factors. Productivity models analyze and estimate the impact of the various factors on productivity. In the present research, multiple regression analysis was used to develop a model to quantify the impact of the influential factors on masonry labour productivity, in the context of a developing country. Previous studies to develop productivity models relied on data collected through questionnaires, wherein the influence of various factors was measured on a qualitative scale. The present study, however, utilized quantitative data directly collected from two case study projects, to develop the model. The regression model identified excessive overtime and material delays as the major factors impacting productivity. The mode of employment of labour was also found to have a significant impact on productivity. Sensitivity analysis was also performed to identify trends of the factors. The significant variables identified by the regression model emphasize the importance of efficient resource planning in achieving high labour productivity.

Keywords: labour productivity, modelling, regression.

¹ anuthomastkmce@gmail.com

SOCIAL PERSPECTIVE OF PLANNING IN CONSTRUCTION: THE UK EXPERIENCE

Emmanuel Itodo Daniel,¹ Christine Pasquire² and Graham Dickens³

^{1,2} *Centre for Lean Projects, School of Architecture Design and the Built environment, Nottingham Trent University, NG1 4BU, Nottingham, UK*

³ *School of Architecture Design and the Built environment, Nottingham Trent University, NG1 4BU, Nottingham, UK*

The demand for improvement in the UK construction industry and the dissatisfaction from end users has been a subject of debate over many years. These challenges have been attributed to the industry's fragmentation and the use of rational approach in the planning and execution of construction projects. However, in recent times, the need to replace the rational approach in planning of construction projects with a more social approach has been emphasised. The aim of this study is to establish the basis of the current rational or technical approach to planning in construction and to evaluate how it can be improved through social conversations such as the Last Planner System (LPS) of production control and collaborative planning (CP). Based on extensive critical literature review, in addition to demonstration project review, the findings indicate that the current rational approach to planning in the construction industry is based on the Rational Comprehensive Model (RCM); which is responsible for the unimpressive performance of the industry. The study went further to evaluate the potentials of the five elements of the LPS in improving the current approach to planning. This was further supported with the UK experience from the Construction Lean Improvement Programme (CLIP) demonstration project reports. The study reveals varied practices with regard to the use of LPS and collaborative planning in the UK. In view of this, the study recommended that further empirical study should be conducted in order to expose the current practice to enable improvement, such as developing a framework for implementing the LPS and CP in the UK construction industry. The study concludes that the practical application of these social conversations will assist construction organisations in delivering more predictable and reliable projects with improved value for the client.

Keywords: collaborative planning, Last Planner®, lean construction.

¹ emmanuel.daniel2013@my.ntu.ac.uk

Daniel, E I, Pasquire, C and Dickens, G (2014) Social perspective of planning in construction: The UK experience *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1357-1367.*

SOLID WALL INSULATION RETROFIT IN UK DWELLINGS: CRITICAL FACTORS AFFECTING MANAGEMENT AND QUALITY

Tim Forman¹ and Christopher Tweed

Welsh School of Architecture, Cardiff University, Bute Building, King Edward VII Avenue, Cardiff CF10 3NB, UK

Driven largely by government policy instruments, the UK solid wall insulation (SWI) industry today is experiencing explosive growth rates. This research explores critical factors in the industry's efforts to overcome a legacy of poor design and build quality in retrofit work. The research employs qualitative and ethnographic methods across a range of UK area-based retrofit projects and installer training programmes. It includes participant observation made while working in the role of SWI installer, and an extended study of a leading SWI installation company and its construction management processes. Findings identify patterns of 'short-termism', financial pressure, limited technical understanding, and point to immature management practices as recurrent impediments to installation quality. The research argues that in the context of a social-technical-political environment which hinders attainment of quality, new approaches to management are needed in the SWI industry.

Keywords: retrofit, quality, policy, training, organisational culture

¹ formantv@cardiff.ac.uk

Forman, T and Tweed, C (2014) Solid wall insulation retrofit in UK dwellings: Critical factors affecting management and quality *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1369-1378.*

RISK MANAGEMENT

ASSESSING RISK DYNAMICS IN PUBLIC PRIVATE PARTNERSHIP PROJECTS

Elsa Cheung¹, Martin Loosemore and Diane Christina Chandra

¹ *University of New South Wales, Faculty of the Built Environment, Sydney, Australia*

There have been many instances of unsuccessful public private partnership (PPP) projects. Traditional reductionist approaches to risk assessment appear inadequate to manage the complex and dynamic interdependencies which exist on such complex projects. Systems dynamics methods have been used extensively outside construction to assess risk in other complex systems and theoretically show great promise in PPP projects. However, interviews with sixteen senior construction professionals with experience of PPPs, while indicating openness to new approaches, revealed significant short-comings in adopting such an approach in this context. It is concluded that if systems dynamics is to be used as a new way of assessing risk on Public Private Partnership projects, existing dependence on linear methods needs to be broken through more education about the merits of system thinking.

Keywords: risk, systems, public private partnerships.

¹ m.loosemore@unsw.edu.au

Cheung, E, Loosemore, M and Chandra, D (2014) Assessing risk dynamics in public private partnership projects *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1381-1389.*

USING APPROPRIATE TOOLS AND TECHNIQUES FOR RISK IDENTIFICATION IN UK CONSTRUCTION'S SMES

Ali Rostami¹, James Sommerville, Ing Liang Wong and Cynthia Lee

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

Risk Management (RM) techniques are important for any organisation. Those firms that have implemented a RM process have recognised that there would be a higher probability of failure if appropriate techniques are not carefully employed during the risk identification stage. This requires proportionate selection of techniques that are compatible with the organisations' needs and limited resources. A literature review on RM indicates the inadequacy in a number of empirical studies done on how techniques influence the RM process. This work investigates the efficacy of the techniques of risk identification within Small and Medium Enterprises (SMEs) in the UK construction industry. Results from a questionnaire survey shows the challenges faced by SMEs in undertaking risk identification and highlights the most common techniques adopted among 153 organisations. Documentation review, expert judgment and checklist analysis are seen as the most important techniques within risk identification; which are practiced for their valuable results, uncomplicated processes and easy to understand structure. Conversely, the group-based techniques like brainstorming and Delphi techniques because of SMEs' inadequate level of knowledge and resources are less practised.

Keywords: risk identification, risk management, small and medium enterprises.

¹ ali.rostami@gcu.ac.uk

Rostami, A, Sommerville, J, Wong, I and Lee, C (2014) Using appropriate tools and techniques for risk identification in UK construction's SMEs *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1391-1400.*

ARE WE ADDING RISK TO OUR PROJECTS BY MIXING OBJECTIVE ASSESSMENTS OF COMPOUND CONJUNCTIVE AND DISJUNCTIVE PROJECT RISKS WITH INTUITIVE APPROACHES?

Alex Collins Arthur¹ and Stephen D. Pryke

¹ Bartlett School of Construction and Project Management, University College London, UK

Various forms of quantitative analytical tools and techniques have emerged through the evolution of construction risk management systems but their full benefit on project performance are yet to be realised. Construction risk analysts continue to rely on statistical and probability tools in their risk data presentation whilst risk management decision-making process tends to reflect the use of intuition rather than rationality. Drawing theories and concepts from systems thinking, and behavioural sciences, the implications of applying quantitative analytical tools and techniques within an instinctive construction risk decision-making context is evaluated. The analysis of construction risk management decision making systems, and discussions relating to the instinctive processing of statistics and probability data, reveals evidence associated with the incompatibilities of mixing objective and subjective approaches to project risk assessment and response. The inference being that, effective instinctive construction risk management practices may require data formats that are compatible with instinctive decision processing. In conclusion, the research provides conceptual analytical evidences for stimulating further investigations into the appropriate format for construction risk management data analysis and presentation.

Keywords: instinctive decision making, probability prediction, risk, statistical data, systems thinking.

¹ Alex.Arthur.10@ucl.ac.uk

Arthur, A and Pryke, S (2014) Are we adding risk to our projects by mixing objective assessments of compound conjunctive and disjunctive project risks with intuitive approaches? *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1401-1410.*

EVALUATING RISK MANAGEMENT IN INDEPENDENT WATER AND POWER PLANT PROJECTS IN SAUDI ARABIA

Yousef Alsulaiman¹, Graeme Bowles and Stephen Ogunlana

School of the Built Environment, Heriot-Watt University, Edinburgh, EH14 4AS, UK

Worldwide countries are striving to meet demands for water and power, which have been estimated as likely to increase at a rate of 7 percent per annum over the coming decade. Water and power plant projects following the Independent Water and Power Plant (IWPP) approach have typically involved a plethora of risks, as they have been reliant on long-term arrangements to transfer project risks, traditionally borne by the government, to the private sector. Since about 75% of IWPP projects in Saudi Arabia (SA) have failed to meet specified objectives, effective risk management (RM) implementation is key to the success of any public and private project. Practitioners, who are key informants in this subject area, have related their experience about RM in IWPP projects in SA through semi-structured interviews, and analysed these through the grounded theory approach. This study gathers and collates data to present findings in a propositional diagram that is fully grounded, based on practitioners' experiences that extend to the ineffectiveness of implementing RM in water and power projects, specifically in IWPP projects in SA. Findings indicate that IWPP parties have implemented RM in an informal way. In addition, there is a general lack of RM knowledge in the SA water and power industry. The paper concludes with an emergent diagram illustrating major phenomena, categories, and subcategories affecting the implementation of RM in IWPP projects in SA.

Keywords: IWPP, risk, Saudi Arabia, water and power.

¹ ya48@hw.ac.uk

Alsulaiman, Y, Bowles, G and Ogunlana, S (2014) Evaluating risk management in independent water and power plant projects in Saudi Arabia *In: Raideen, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1411-1419.*

A PILOT-STUDY INVESTIGATING THE ASSESSMENT AND ALLOCATION OF RISKS IN PUBLIC-PRIVATE PARTNERSHIP TRANSPORTATION PROJECTS IN VIETNAM

Nhat, M. Nguyen¹, Lewis, John¹, Beer, Michael² and Boussabaine, Abdelhalim²

¹ *School of Architecture, University of Liverpool, Merseyside L69 3BX, UK*

² *School of Engineering, University of Liverpool, Merseyside L69 3BX, UK*

Many PPP projects have failed because of risks occurring during operation and earlier studies have demonstrated a need risk assessment and allocation methods for PPPs. Although researchers have been working in this area for years, the amount of empirical work is limited, especially when applied to developing countries. This paper will review previous studies and then describe a pilot study which was carried out in Vietnam. Forty one questionnaires were sent to practitioners working on PPP transportation projects and to officials from government departments. The study attempted to identify key risks in PPPs in Vietnam, and risk allocation perceptions of practitioners in these projects. Also, the pilot study also aimed to test the methods of collecting data, the quality of the questionnaires, and the ability to assess running projects. The purpose of this testing was to carry out a larger study in the fieldwork stage of a PhD program. The findings of the study suggest that ineffective decision-making processes by the public sector, difficulty in obtaining approvals, high inflation, and corruption are the most critical risks in Vietnamese PPPs. For risk allocation, the findings suggest that the government is willing to manage risks relating to political and legal issues. Whereas, private partners are willing to manage risks relating to constructing and operating issues. This may indicate that one of the prime objectives of PPP, the transferring risks to the private sector, has not been achieved. Importantly, the findings have suggested improvement for fieldwork plan. The paper will conclude by proposing a methodology for continuing the study.

Key words: public-private partnership (PPP); risk allocation perception, risk assessment, risk management, Vietnam.

¹ nnguyen@liverpool.ac.uk

Nhat, M, Lewis, J, Beer, M and Boussabaine, A (2014) A pilot-study investigating the assessment and allocation of risks in public-private partnership transportation projects in Vietnam *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1421-1430.

EDUCATION

GOVERNMENT INSTITUTIONS AND INFRASTRUCTURE SKILLS DEVELOPMENT

Michael Regan¹, Jim Smith² and Peter Love³

¹ Michael Regan; Bond University, Gold Coast, Queensland 4229, Australia

² Jim Smith; Bond University, Gold Coast, Queensland 4229, Australia

³ Peter Love; Curtin University, Perth, Western Australia, 6845, Australia

The capacity of state institutions is central to the efficient delivery and management of infrastructure. The paper examines two models for improving the skills of managers in central and line agencies of government for infrastructure procurement and management in emerging economies. The first examines the role of the Public Private Partnership (PPP) unit, a specialist agency equipped with the technical capabilities, transactional experience and budget to provide training and assistance to line agencies for the effective delivery of infrastructure projects. Integrated into this model, and used by several nations, is the use of trained relationship managers to manage service contracts including government commissioned build operate transfer (BOT), outsourcing and concession arrangements. This approach uses relationship management principles whereby the regulatory framework of the contract in matters such as price, quality, service standards, and performance measurement is exercised within the contract. The second model is the Gateway approach to infrastructure project analysis and development. Gateway was initially implemented in the United Kingdom and has been widely adopted in OECD countries over the past decade as an alternative governance framework for public projects that require the participation of multiple government agencies, private advisers, several levels of approvals and close liaison between the executive and political arms of government. Gateway imposes new disciplines on the project procurement process, requires central and line agencies to undertake professional development training and imposes new governance standards for large and complex infrastructure procurement projects. Evidence suggests that Gateway is playing a significant role raising the capacity of public agencies to manage large and complex procurement projects, and improving procurement performance.

Keywords: public procurement, skills development, public institutions.

¹ mregan@bond.edu.au

THE COMPARISON OF CONSTRUCTION MANAGEMENT CURRICULA IN UNIVERSITIES BETWEEN THE UK AND JAPAN

Hitoshi Mihara¹, Megumi Kurokawa², Will Hughes² and Tetsuo Hojo¹

¹ *Institute of Technologists, 333 Maeya, Gyoda, Saitama 361-0038, Japan*

² *University of Reading, Whiteknights, PO Box 219, Reading RG6 6AW, UK*

The development of CM education in universities is of significant interest both for academia and practitioners. The comparison of CM education between countries may provide insights into development in different places. The purpose of this research is to consider the contextual differences in construction management (CM) taught education between UK and Japan. Curricula in the two countries were compared. Interviews were carried out in UK universities to learn more about UK CM education. UK curricula were found to be heavily influenced by partnerships with British professional institutions. In contrast, the curricula of Japanese higher education institutions are restricted by the Ministry's requirement in relation to professional licenses. This raises interesting questions about how each institutional context influenced the development of different kinds of skill. The self-regulation of the professions in the UK seems to make British higher education for the professions more responsive to contemporary industry needs. In contrast, Japanese government's control over the curricula is aimed at developing wider architectural and engineering skills. The intention of this paper is to promote dialogue between British and Japanese institutions for the wider development of CM education.

Keywords: curriculum, education, employment, institutional force, professional license.

¹ mihara@iot.ac.jp

Mihara, H, Kurokawa, M, Hughes, W and Hojo, T (2014) The comparison of Construction Management curricula in universities between the UK and Japan *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1443-1452.

CHANGING INSTITUTIONS OF KNOWING – CLIMATE MITIGATION, CRAFT COMPETENCES AND VOCATIONAL TRAINING IN DENMARK

Christian Koch¹ and Niels Haldor Bertelsen²

¹ Chalmers University of Technology, Sven Hultins Gatan 8, Göteborg, Sweden

² Danish Building Research Institute, Aalborg University Copenhagen, A. C. Meyers Vaenge 15, DK-2450 Copenhagen SV, Denmark

In order to reach the EU 2020 goals for the climate, Danish vocational training units are currently in a process of institutional change triggered by the need of providing energy, and new process competences for the skilled and semiskilled workforce active in construction. The aim of the present paper is to analyze enablers and barriers for this institutional change. The vocational education system in Denmark is strongly institutionalised with unions, employer's associations and the schools in central roles. Drawing on institutional theory contributions on labour market -, educational - and professional institutions, the paper presents a study of institutional work inside and across schools and craft disciplines working in SMEs involved in new building and renovation with an energy aspect. Collaboration between four education committees for carpenters, masons, electricians and plumbers and interviews with seven companies come to focus on competences of interdisciplinary collaboration and sustainable innovation in SME. The anticipation of future building regulation of 2015 and 2020 creates an institutional pressure in education for change including handling differentiated demands of customers and contractors, not always just following regulation but occasionally ahead of it. At a time this needs to be balanced with customer needs with a comfort orientation and issues of cost and financing. The committees act in a contradictory, sometimes conservative manner in this change of institutions of knowing. In the future specialization will be supplemented by horizontal and vertical interdisciplinary and innovative competences integrating the complex process industrialized construction sector. Schools, teachers and digital teaching materials need be developed to support this change supported by front running companies and results from innovative building projects. The education committees in Denmark can have a leading role in this development and set high and motivational standards for the improvements. The analysis sees however a lot more barriers than enablers.

Keywords: competences, craft, vocational training, energy, climate, industrialization.

¹ kochch@chalmers.se

Koch, C and Bertelsen, N H (2014) Changing Institutions of knowing – Climate mitigation, craft competences and vocational training in Denmark *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1453-1462.*

THE CONSTRUCTION SMES DEVELOPMENT DEBATE IN SOUTH AFRICA: CONTRIBUTIONS FROM FET COLLEGES

L. Wentzel¹, T. Wentzel², J.J. Smallwood¹, and F.A. Emuze³

¹*Department of Construction Management, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, South Africa*

²*Department of Built Environment, Cape Peninsula University of Technology, PO Box 1906, Bellville, South Africa*

³*Department of Built Environment, Central University of Technology, Free State, Bloemfontein, South Africa*

The why, when, and how to engender contractor development in South Africa has been interrogated in recent years. Various authors have proposed one panacea or the other without considering the possible contributions of Further Education and Training (FET) colleges in the country. The research identifies key factors that influence how FET colleges are able to facilitate the development of successful construction small and medium size enterprises (SMEs) in South Africa. A survey of the literature was followed by an empirical study, which generated the primary data. A survey was initially conducted among registered construction SMEs, and then interviews were conducted with academics who are employed at FET colleges. The findings indicate that FET colleges serve a multidimensional purpose by producing qualified artisans, who produce quality workmanship in their specific trades and who are capable of establishing successful businesses. Based upon the findings, it can be concluded that FET college structures can provide the foundation for SME development programmes in South Africa. It is therefore recommended that the syllabi for contractor development programmes (CDP) and construction programmes in FET colleges should align with one another in order to develop a specific programme for construction SME development.

Keywords: contractor development, education and training, South Africa.

¹ lance.wentzel@nmmu.ac.za

Wentzel, L, Wentzel, T, Smallwood, J J and Emuze F A (2014) The construction SMEs development debate in South Africa: Contributions from FET colleges *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1463-1472.*

LESSONS LEARNED FROM BUILDING THE EDUCATION REVOLUTION (BER) PROGRAM BY THE SOUTH AUSTRALIA CONSTRUCTION FIRMS

Nicholas Yorston¹ and Nicholas Chileshe²

¹ *Partek Construction and Interiors, 160-177 South Road, Mile End, Adelaide, South Australia 5031, Australia*

² *School of Natural and Built Environment, Barbara Hardy Institute (BHI), University of South Australia, City East Campus, Adelaide, South Australia 5001, Australia*

In response to the global financial crisis (GFC) in 2009, Australia undertook to mitigate the crises through the development of the National Building and Jobs Plan. Part of this plan for the construction industry was the commencement of Building Education the Revolution (BER) projects which comprised over one per cent of Australia's Gross Domestic Product (GDP), a massive outlay of expenditure to be delivered over a rapid time frame by a number of construction organisations. Despite the crisis, there have been limited studies conducted to document the effects of BER, and how construction organisations responded to the challenges. This paper aims to explore the lessons learnt from the strategies implemented by the construction organisations during that BER period. A mixed method approach was employed for the study. Data was collected from 48 organisations using questionnaires, and two interviews were conducted to validate the findings. The following five lessons learned were identified: (i) the potential for high profits existed which brought about an increased requirement for careful resource management; (ii) the preservation of existing client base is crucial for post stimulus survival; (iii) threats and risks are brought about by stimulus and require consideration and planning; (iv) stimulus in the construction provides an opportunity to build an organisation's reputation; and (v) learning from the changes in competitor behaviour should be undertaken throughout stimulus; and by undertaking further research into strategic management, a sixth lesson was identified: (vi) organisations must re-address their business strategies post stimulus to adjust to their new external environment conditions. Given that there have been few stimulus implementations in the South Australian construction industry; the identified successful strategies based on the lessons learnt from the BER could assist construction organisations in undertaking and maintaining work post stimulus, despite the cyclic nature of the industry. The research was localised to the South Australian construction industry.

Keywords: South Australia, organisational learning, global financial crisis, stimulus package.

² nicholas.chileshe@unisa.edu.au

Yorston, N and Chileshe, N (2014) Lessons learned from building the education revolution (BER) program by the South Australia construction firms *In: Raiden, A B and Aboagye-Nimo, E (Eds) Procs 30th Annual ARCOM Conference*, 1-3 September 2014, Portsmouth, UK, Association of Researchers in Construction Management, 1473-1482.

INDEX OF AUTHORS

A

Abdul Aziz, A R, 34
 Ab-Latif, S N F, 9
 Aboagye-Nimo, E, 47
 Abu-Shaaban, N, 174
 Adam, A, 158
 Addis, M, 159
 Afolabi, D, 2
 Agapiou, 73
 Agapiou, A, 72
 Ahiaga-Dagbui, D, 93
 Aigbavboa, C, 95
 Al-Bizri, S, 24
 Alharthi, A, 52
 Alloh, B, 74
 Al-Shammari, M A, 78
 Alsulaiman, Y, 184
 Amadi, C, 54
 Amiril, A, 9
 Anvuur, A, 99
 Arai, K, 55
 Ardeshir, A, 18
 Arslan, V, 44
 Arthur, A, 183
 Awale, R, 166

B

Balogun, T B, 8
 Beer, M, 185
 Bell, S, 90
 Benjaoran, V, 46
 Bertelsen, N H, 191
 Blackwood, D, 90
 Booth, C A, 3, 88
 Boothman, C, 123
 Bos-de Vos, M, 57
 Boussabaine, A, 185
 Bowen, P, 42
 Bowles, G, 184
 Boyd, D, 84, 87
 Boyd, P, 17
 Brewer, G, 12, 58
 Brookes, N, 113
 Bryde, D, 80
 Buser, M, 119

C

Callaghan, N, 147
 Cameron, I, 152
 Carlsson, V, 119, 146
 Carrillo, P, 54
 Cassano, M, 82
 Cattell, K, 42
 Ceric, A, 103
 Challender, J, 128
 Chan, P, 110

Chan, P W, 167
 Chandra, D, 181
 Chappell, L, 138
 Charlson, J, 64
 Charoenngam, C, 36
 Cheng, J C P, 104
 Cheung, E, 181
 Chileshe, N, 10, 144, 193
 Chow, V C, 100
 Cidik, M S, 87
 Clark, B, 72, 73
 Clarke-Hagan, D, 14
 Coates, R, 14
 Connell, A, 62
 construction planning, 83
 Cox, S, 84
 Crapper, M, 39
 Crowe, P, 69
 Cruickshank, H, 29

D

Dainty, A, 99, 135
 Dainty, A R J, 161
 Daniel, E I, 176
 Davies, R, 120
 Dean, A, 96
 Demian, P, 157
 Dent, S, 154
 Dickens, G, 176
 Dike, I, 127
 Dixon, T J, 4
 Dolan, M, 13
 Dorée, A G, 51
 Dowsett, R M, 81
 Dzokoto, F K, 157

E

Eaves, S D, 40
 Ebrahimejad, M, 18
 Edum-Fotwe, F, 52, 157
 Edwards, P, 42
 Eisma, P, 27
 Elmahroug, M, 113
 Emuze, F, 94
 Emuze, F A, 192
 Engström, S, 122
 Erdogan, B, 114
 Essah, E A, 4
 Ewart, I, 2

F

Falconer, R, 90
 Farr, E, 108
 Farr, E R P, 115
 Farrell, P, 128
 Fernie, S, 135, 136

Fleming, M, 90
Forman, T, 177
Foster-Smith, L, 39

G

Gajendran, T, 12, 58
Galea, N, 138
Garba, A, 16
Georgiadou, M C, 29
Ghaffari, M, 109
Gibb, A, 40
Giritli, H, 165
Gledson, B J, 83
Gluch, P, 158
Gosling, J, 129
Govender, R, 42
Graham, A, 80
Granth, K, 86
Gray, C, 24
Greenwood, D, 83
Gunaratne, S, 61
Gustavsson, T K, 131
Guthrie, P, 6, 29
Gyi, D, 40

H

Habib, M, 111
Hamouda, H, 174
Hardwicke, J, 22
Hare, B, 152
Harty, C, 21, 120, 160
Harty, C F, 81
Hermans, M, 168
Higham, A, 5, 123
Hojo, T, 190
Höök, M, 169
Hopkin, P R, 145
Hopkin, T, 145
Hosseini, M, 10
Hughes, W, 107, 112, 190

I

Ishak, N, 34
Issa, M H, 15, 139

J

Jefferies, M, 67
Jintamanaskoon, S, 167
Johansson, P, 86
Julin, J, 158

K

Kabiri, S, 107
Kapogiannis, G, 127
Kerosuo, H, 106
Kestle, L, 45
Kibwami, N, 7
King, A, 22, 47

King, L M, 3
Kishk, M, 16
Kivrak, S, 44
Koch, C, 101, 146, 191
Konanahalli, A, 13, 35
Korpela, J, 106
Koskela, L K, 130
Kurokawa, M, 112, 190
Kwawu, W, 53

L

Lallimo, J, 23
Lamond, J E, 3
Larsen, G, 2
Larsen, G D, 17, 77
Laryea, S, 53
Lawani, K, 152
Lee, C, 182
Lehmann, S, 10
Leiringer, R, 100
Lewis, J, 185
Lidelöw, S, 143
Liefertink, B, 57
Linderöth, H, 86
Loosemore, M, 105, 138, 173, 181
Love, P, 189
Löwstedt, M, 30
Lu, S, 145
Lu, W, 116

M

MacAskill, K, 6
Maftei, L, 21
Mahamadu, A, 89
Mahamadu, A-M, 88
Mahdjoubi, L, 88
Malory-Hill, S, 15
Mann, P, 70, 71
Manu, P, 89
Maqsoom, A, 36
Maradza, E, 77
Marinelli, M, 13, 35
Maritz, M J, 65
Marsh, D, 80
Martin, H, 153
Mason, J, 62
Maund, K, 12
Mayouf, M, 84
McLernon, T, 66
Mickovski, S, 151
Mihara, H, 190
Minotti, M, 82
Molwus, J J, 114
Monahan, J, 14
Moone, B, 129
Morimoto, E, 55
Mostafa, S, 144
Murray, M, 136

N

Naim, M, 129
Navendren, D, 89
Nawawi, A H, 9
Nhat, N, 185
Noble, T, 85
Ntshwene, K, 4

O

Oduoza, C, 64
Oduyemi, O, 96
Ogunlana, S, 184
Ogunlana, S O, 114
O'Keefe, D J, 161
Okoroh, M, 96
Opoku, A, 29
Oppong Banahene, K, 99
Orr, C, 151
Oswald, D, 33
Ouf, M M, 15
Oweineh, H, 56
Oyedele, L O, 35

P

Painting, N J, 115
Pasquire, C, 176
Paterson, G, 90
Pieter, E, 168
Piroozfar, P, 108
Piroozfar, P A E, 115
Plantinga, H E C, 51
Powell, A, 138
Pryke, S D, 183
Putlitz, U, 65

Q

Quaigrain, R A, 139

R

Raiden, A, 47
Ramachandra, T, 61
Rameezdeen, R, 10
Ravu, P, 94
Regan, M, 189
Robinson, W, 110
Rooke, J A, 130
Rostami, A, 182
Rotimi, J O, 61
Rowlinson, S, 166
Rudberg, M, 131

S

Schwebber, L, 112
Schweber, L, 17, 107
Scott, A, 123
Seboni, L, 102
Seward, M, 45

Sexton, M G, 145
Shakeri, E, 18
Shelbourn, M, 89
Sherratt, F, 33, 39, 43, 128
Shibeika, A, 121
Skaik, S, 56
Skitmore, M, 41
Smallwood, J J, 154, 192
Smiley, J, 135
Smith, J, 189
Smith, S, 33, 93
Soetanto, R, 52
Sommerville, J, 182
Sooksil, N, 46
Sorhaindo, C, 153
Spang, K, 111
Spillane, J, 13, 35
Spillane, J P, 137
Starzyk, G F, 68
Stehn, L, 169
Stephenson, P, 5
Stojanovic, V, 90
Strahorn, S, 58
Sudhakumar, J, 175

T

Taggart, M, 130
Tansey, P, 137
Tennant, S, 136
Teo, M, 105
Themsen, T, 160
Thomas, A V, 175
Thomson, C, 151
Thomson, D S, 161
Thunberg, M, 131
Thurairajah, N, 87
Thwala, W, 95
Todaro, D, 82
Towill, D, 129
Trani, M L, 82
Trushell, I, 73
Tryggestad, K, 160
Tutesigensi, A, 7, 28, 102, 113
Tuuli, M, 54
Tweed, C, 177

U

Ulubeyli, S, 44
Ulutaş Duman, D, 165
Urup, L, 101

V

Vass, S, 79
Venkataraman, V, 104
Viking, A, 143
Volker, L, 27, 57, 168
Voordijk, J T, 51

W

Walsh, S, 39
Wamelink, H, 57
Wang, H, 116
Wang, J, 11
Ward, P, 67
Welch, F, 153
Wentzel, L, 192
Wentzel, T, 192
Whyte, J, 77
Williams, A, 63
Williams, P, 63
Winter, J, 139
Wong, D, 70, 71
Wong, L, 182
Wood, H, 108

X

Xia, B, 41
Xiao, H, 85
Xiong, B, 41

Y

Yang, R J, 11
Yorston, N, 193

Z

Zou, P X W, 11
Zuo, J, 144

INDEX OF KEYWORDS

4

4D planning, 83

A

abatement curves, 18
 academic performance, 153
 action, 105
 action research, 130, 145
 activity theory, 106
 actor network theory, 158
 actor-network theory, 112
 actors, 53, 157
 adaptation, 85
 adaptive capacity, 99
 adjustment, 35
 adversarial culture, 127
 ageing, 40
 allocation, 102
 alternative delivery systems, 111
 analytical hierarchy process, 174
 app, 120
 architectural services, 57
 architecture firm, 158
 archival research, 167
 asset management, 5, 8
 assignment completion, 35
 Australia, 11
 Australian housing, 144
 autonomy, 43

B

barriers, 10, 96
 behaviour change, 3
 best practice, 136
 bidding, 55
BIM, 81, 82, 85, 86, 87, 88, 89, 90
 BIM level 2, 78
 BIM protocol, 78
 BIPV, 17
 Botswana, 4
 boundary object, 100
 boundary objects, 86
 boundary-making, 167
 brain drain, 34
 bridge management system, 8
 briefing, 22, 24
 British expatriate, 35
 building assessment tools, 4
 building design, 23, 106
 Building Economics, 154
 building information modelling, 78, 83, 84, 127
 Building Information Modelling, 77
 building projects, 7
 building regulation, 64
 built environment, 28
 business model, 169

business model design, 57
 business strategy, 79, 166
 business value, 166

C

capability, 46
 carbon emissions, 28
 cartoon, 44
 case study, 108, 121, 151, 158
 change, 85
 China, 11
 Christchurch, 45
 civil construction rebuild, 45
 civil engineering infrastructure, 113
 claims, 67, 68
 client, 122, 168
 client organization, 112
 climate, 191
 co-design, 23
 collaboration, 57, 87, 106, 127, 128
 collaborative planning, 176
 collaborative working, 53
 communication, 100, 103, 122
 community, 105
 competences, 191
 competency, 152
 competitive advantage, 36
 competitiveness, 2, 165, 166
 complexity, 108
 complexity science, 108
 confirmation bias, 93
 conflict, 67
 consequential loss, 62
 construction contract, 66
 construction contracts, 65
 construction design practice, 21
 construction law, 70, 71
 Construction Lawyers, 72
 construction mediators, 73
 construction operations, 18
 construction planning, 13
 construction professionals, 34, 42
 construction safety, 46
 construction scheduling, 83
 consumer, 147
 contract law, 62, 64, 67, 68
 contracting, 36
 contractor, 122
 contractor development, 192
 contractor selection, 128
 contracts, 69, 78, 107
 contractual risk, 65
 coordination, 101, 131
 corporate strategy, 165, 169
 cost of poor quality, 95
 cost overrun, 94
 cost overruns, 93
 craft, 191
 critical success factors, 95

cued recognition/recall, 152
culture, 40, 135
curriculum, 190
customers' relations, 119

D

damages, 62
decision analysis, 6
decision making, 24, 102
decision-making process, 112
defects, 130, 145
delay claims, 61
design error, 86
design evaluation, 161
design management, 13, 22, 87
design optimization, 82
design tool, 23
designers, 89
designers' reflection-on-action, 21
detached houses, 146
determinants, 36
developing countries, 2
development assessment, 63
development planning, 12
development project, 39
dialogical reflexivity, 161
diffusion of innovation, 121
digital technology, 121
disability management, 139
discourse analysis, 39
dispute resolution, 64
diversity, 138
double loop learning, 151
dynamic capabilities, 2

E

ecologically sustainable development, 12
economic development, 137
education, 123, 190
education and training, 192
electricity consumption, 15
embodied carbon emissions, 7
emerging economies, 36
emissions, 18
employment, 190
end-users, 72
energy, 191
energy appraisal, 90
energy consumption, 15, 18
energy efficiency, 147
energy renovations, 146
enforcement, 74
environment, 14
environmental planning, 12
equity, 138
ergonomics, 40
escalation of commitment, 93
ethnography, 30, 33
evaluation, 66
evaluation protocol, 15
evidence based design, 22

exclusion clause, 62
expert witness, 70
exploratory factor analysis, 41

F

fast-tracking, 63
fiduciary duties, 68
flood risk management, 151
frameworks, 54

G

games technology, 90
Gaza Strip, 174
gender, 138
global financial crisis, 193
Goffman, 146
good faith and fair dealing, 68
governance, 53
government policies, 137
government regulation, 12
graphical network analysis, 27
green, 14
green building, 11, 104
green buildings, 3
greenhouse gases, 18

H

HCAI, 24
health, 43
health and safety, 45
healthcare, 24
Heinrich pyramid, 45
heritage railway, 39
high-performance teams, 104
house builders, 145
housing, 143, 147
human rights, 70

I

ideas, 120
identity, 30
immersive virtual reality environment, 21
immunity, 70
implementation, 88
implementation barriers, 81
implicit knowledge, 51
improvement, 74
industrialised house-building, 143
industrialization, 191
informal practice, 47
informal sources of expectations, 107
information management, 80, 82, 159
information seeking behaviour, 157
information systems, 79, 80
information technology, 79, 80
infrastructure, 160
innovation, 14, 17, 120, 122
innovation systems, 77
instinctive decision making, 183

institutional force, 190
institutional logic, 101, 143
institutional pressure, 116
institutional work, 101
instrumental reason, 135
insurance contract, 71
integration, 88
intellectual property, 78
interactive learning, 77
international assignments, 35
international expansion, 36
international infrastructure project, 116
IWPP, 184

J

job satisfaction, 35
joint venture, 56

K

knotworking, 106
knowledge, 160
knowledge management, 151
knowledge sharing, 86, 158

L

labour, 174
labour productivity, 175
Last Planner, 176
leadership, 114
lean construction, 176
liability, 68
life cycle assessment, 8
life cycle costing, 96
literature based discovery, 28
litigation, 67
local planning, 143
longitudinal study, 169

M

major projects, 94
Malaysian railway project, 9
management of innovation, 77
material objects, 112
materiality, 100
mathematical model, 7
maturity model, 168
maturity modelling, 139
measurement, 159
mediation, 72, 73
meta-analysis, 165
methodology, 161
micro firm, 47
migrant, 33
Mintzberg, 101
modelling, 80, 87, 175
modern methods of construction, 123
motivation, 69, 153
multiple perspectives, 84
multi-project environment, 102

myth, 136

N

new homes, 145
new institutionalism, 138
Nigeria, 16

O

occupational health and safety, 44
off-site construction, 123
offsite manufacturing, 144
organisation, 40
organisational culture, 177
organisational learning, 193
organisational practices, 110
organisational resilience, 99
organizational relationships, 104

P

participatory research, 29
partnering, 53, 56, 128
perceived stress questionnaire, 41
perceptions, 154
performance, 35, 157
performance indicators, 168
performance measure, 129
performance measurement, 81
planning, 74
planning approvals, 63
planning problems, 131
pluralism, 161
policy, 135, 138, 177
positive liberty, 43
post earthquake, 45
post-disaster reconstruction, 6
power, 43
power dynamics, 100
practice theory, 161
predictive modeling, 42
price, 55
principal-agent theory, 103
probability prediction, 183
process engagement, 115
procurement, 14, 22, 52, 55, 56, 64, 65, 128, 168
procurement law, 111
productivity, 131, 173, 174
product-service models, 110
professional license, 190
professional networks, 158
project communications, 104
project initiation, 113
project life cycle, 157
project management, 105
project manager, 85, 102
project organising, 99
project success, 5, 109, 113
project-based firm, 121
protection, 74
protest, 105
public client, 52

public construction clients, 27
public engagement, 100
public institutions, 189
public private partnership, 54
public private partnerships, 181
public procurement, 51, 189
public-private partnership, 185
public-private-partnership, 167
pulsation, 106
push and pull factors, 34

Q

QFD, 24
qualification system, 51
qualitative analysis, 12
qualitative research, 89
quality, 177

R

railways, 167
reasons for failures, 61
recession, 137
recycling, 13
refresher and fresher, 152
refurbishment, 115
regression, 175
relational coordination, 101
relational procurement, 58
relationship, 129
renewable energy technology, 16
renovation, 119
rescue and evacuation, 152
research agenda, 27
research theme identification, 27
resilience, 6
response strategy, 116
responsibility, 114
retrofit, 29, 177
return-to-work, 139
reverse logistics, 10
revisions, 65
rework, 130
risk, 11, 24, 64, 99, 103, 160, 181, 183, 184
risk allocation perception, 185
risk assessment, 185
risk identification, 182
risk management, 145, 182, 185
role expectations, 107
routine, 110

S

safety, 39
safety equilibrium, 46
safety group, 47
Saudi Arabia, 184
school, 15
Scotland, 72, 73
self-justification, 93
self-reflexivity, 30
semiotic analysis, 44

shared value, 166
skill decay/retention, 152
skills development, 189
small and medium enterprises, 182
SME, 119, 146
social construction of technology, 17
social groups, 17
social housing, 5
social network analysis, 11, 104
social practice theory, 3
South Africa, 94, 95, 154, 192
South Australia, 193
space visualisation, 84
Spain, 33
Sri Lanka, 61
stakeholder, 9, 11
stakeholder analysis, 29
stakeholder collaboration, 114
stakeholder engagement, 29, 90, 115
stakeholder identification, 113
stakeholder management, 54, 114
stakeholders, 112
standardisation, 65
standards, 77
statistical analysis, 55, 109
statistical data, 183
statutory planning reform, 63
stimulus package, 193
strategic misrepresentation, 93
structures, 53
students, 154
subcontractor, 173
subcontractors, 47
success factors, 56, 109
suggestions, 120
supplier development, 129
supply chain, 88
supply chain integration, 57
supply chain management, 10, 127, 129, 130, 131, 136, 168
supply chain planning, 131
sustainability, 3, 4, 6, 8, 135
sustainability factors, 9
sustainability indicators, 16
sustainable communities, 5
sustainable construction, 2
sustainable electricity, 16
sustainable refurbishment, 115
SWOT, 16
synergistic supply chain, 144
systems, 108, 181
systems thinking, 183

T

tacit knowledge, 159
talent loss, 34
task demand, 46
taxonomy, 137
team dynamics, 107
techniques, 96
technology acceptance, 88
tendering, 52

time provision, 66
training, 177
transactional procurement, 58
transition, 110
transport infrastructure, 111
trust, 58, 103
trust repair, 58

U

uberrimae fidei, 71
UK, 33
uncertainty, 160
undergraduate, 153
university sector, 115
user-centred design, 23

V

value management, 79
Vietnam, 185

virtual construction, 83
vocational training, 191
volunteer, 39

W

waste management, 13
water and power, 184
websites, 119
wellbeing, 43
work stress, 41
worker, 44
workplace stress, 42

Y

young cost estimators, 41