Management and Innovation for a Sustainable Built Environment

Programme and Abstracts
Contents

Preface .............................................................................................................................................v
Committees ..................................................................................................................................vi
General Information ................................................................................................................viii
Location & Directions ...............................................................................................................ix
Beurs van Berlage plan ..............................................................................................................x
Social agenda ...............................................................................................................................xi
Programme at a Glance .........................................................................................................xiii
Programme .................................................................................................................................xiv

ABSTRACTS

Day 1: Monday June 20, 2011

General Sessions
Management for sustainable design and construction ................................................................. 1
Innovation in construction (theories and best practices) .......................................................... 9
Economics of the built environment / Whole life cost-benefit-modelling ............................... 16
Socio technical systems/Innovation in construction ................................................................... 24

Workshops
Supply chain integration & collaboration .................................................................................. 32
Deconstructing organizational paradoxes .................................................................................. 48
Innovations in urban planning ..................................................................................................... 57
Social innovation & participation ............................................................................................... 62

Day 2: Tuesday June 21, 2011

General Sessions
Management for sustainable design and construction ................................................................. 66
Construction bidding and contracting ....................................................................................... 74
Economics of the built environment .......................................................................................... 82
Collaboration and integration in design and construction ....................................................... 90

Workshops
Selecting partners & organizing collaboration ........................................................................... 99
Global construction data ............................................................................................................ 110
Sustainable transformation .......................................................................................................... 115

Day 3: Wednesday June 22, 2011

General Sessions
Management for sustainable design and construction ................................................................. 126
Planning for sustainable urban areas .......................................................................................... 134
Management and economics for sustainable design and construction ................................... 147
Innovation in construction (theories and best practices) .......................................................... 158

Authors Index ............................................................................................................................. 169
Keyword Index ............................................................................................................................. 173
Dear conference participants,

It gives me great pleasure to welcome you to the CIB international conference on "Management and Innovation for a Sustainable Built Environment" in the beautiful city of Amsterdam, the capital of the Netherlands. This conference is organised under the auspices of Working Commissions W55, W65, W89 and W112 of the International Council for Research and Innovation in Building and Construction (CIB), together with the European Network for Housing Research (ENHR) and the Association of European Schools Of Planning (AESOP).

Society faces considerable challenges with respect to the development, management and use of the built environment. Sometimes these challenges are typically related to specific countries or continents, for example the extremely rapid real estate development taking place in many emerging countries, or the over supply of office space and commercial housing in several European cities. There are also shared challenges. Examples are the demand for sustainable solutions and the response to changes in society and real estate market during recent years. Beside these new challenges, problems persist around the productivity, effectiveness and efficiency of processes in the industry. For the last decade the building industry has been developing innovative solutions to overcome these challenges. The coming decade will require even more innovation and creativity to deal with these same persistent challenges and with new, perhaps even more difficult challenges.

These challenges often require a joint effort of industry and science, worldwide. Sharing experiences and ideas in the area of innovation and management and planning remains an ongoing priority. Organisations such as CIB, ENHR and EASOP all contribute to this continuous activity of developing, sharing and disseminating experiences as well as both practical and scientific knowledge.

In order to stimulate interaction between the conference participants, the organising committee has designed a programme which enables different opportunities for networking, learning and discussions. In addition to keynote addresses from invited speakers and parallel paper sessions, eight very promising workshops will be hosted by MISBE2011. The subjects of these workshops are all related to current developments. Some workshops are related to specialised subject areas, such as approaches for sustainable transformation processes or supply chain integration and collaboration. There will also be discussion meetings concerning general subject areas such as the enabling of change in the construction industry.

Looking at the submitted contributions for the general sessions and the enthusiasm shown by the workshop leaders during their preparations, I am convinced that it will be a very inspiring event, leading to new insights and followed by many joint (research) initiatives. Finally I express my gratitude to all those individuals who played an important role in the organisation of MISBE2011.

I wish you all an inspiring conference and a pleasant stay in Amsterdam!

Hans Wamelink
Conference Chair MISBE2011
# Committees

## Local Organising Committee

- **Hans Wamelink**  
  University of Salford, UK
- **Rob Geraedts**  
  Delft University of Technology, The Netherlands
- **Leentje Volker**  
  Delft University of Technology, The Netherlands
- **Tom Daamen**  
  Delft University of Technology, The Netherlands
- **Kristel Aalbers**  
  Delft University of Technology, The Netherlands

## Scientific Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl Abbott</td>
<td>University of Salford, UK</td>
</tr>
<tr>
<td>Wim Bakens</td>
<td>CIB, The Netherlands</td>
</tr>
<tr>
<td>Martin Betts</td>
<td>Queensland University of Technology, Australia</td>
</tr>
<tr>
<td>Gerard van Bortel</td>
<td>OTB, The Netherlands</td>
</tr>
<tr>
<td>Peter Boelhouwer</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Richard Burt</td>
<td>Auburn University, Alabama, USA</td>
</tr>
<tr>
<td>Monika Chao-Duivis</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Paul W. Chan</td>
<td>University of Manchester, UK</td>
</tr>
<tr>
<td>Tom Daamen</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Andrew Dainty</td>
<td>Loughborough University, UK</td>
</tr>
<tr>
<td>Geert Dewulf</td>
<td>University of Twente, The Netherlands</td>
</tr>
<tr>
<td>Scott Fernie</td>
<td>Herriot-Watt University, UK</td>
</tr>
<tr>
<td>Agnes Franzen</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Artūras Kaklauskas</td>
<td>Vilnius Gediminas Technical University, Lithuania</td>
</tr>
<tr>
<td>Reinout Kleinhans</td>
<td>OTB, The Netherlands</td>
</tr>
<tr>
<td>Jelle Koolwijk</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Philip Koppels</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Willem Korthals Altes</td>
<td>OTB-TBM, Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Melvyn Lees</td>
<td>Birmingham City University, UK</td>
</tr>
<tr>
<td>Roine Leiringer</td>
<td>Chalmers University of Technology, Sweden</td>
</tr>
<tr>
<td>Jorge Lopes</td>
<td>Polytechnic Institute of Bragança, Portugal</td>
</tr>
<tr>
<td>Shu-Ling Lu</td>
<td>University of Reading, UK</td>
</tr>
<tr>
<td>Alfons van Marrewijk</td>
<td>VU University, The Netherlands</td>
</tr>
<tr>
<td>Vincent Nadin</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Matthijs Prins</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
<tr>
<td>Christine Räisänen</td>
<td>Chalmers University of Technology, Sweden</td>
</tr>
<tr>
<td>Rob Geraedts</td>
<td>Delft University of Technology, The Netherlands</td>
</tr>
</tbody>
</table>
Committees

Stefan Gottliebb
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General information

Conference Secretariat
The registration desk will be open from 8 AM all days during conference hours. Your hostesses will be Gemma van der Windt (phone: +31(0)6 27227520) and Marion van den Boer (phone: +31(0)6 42897731)

Meals and Refreshments
Coffee and tea breaks and at lunchtime, light meals will be served at the Corn Exchange every day beginning on Monday.

Audio Visual Equipment
All lecture rooms will be equipped with the following:
• 1 slide projector
• Laptop PC computer (upload your presentation in the break before your session. On Wednesday you can upload from 8.30 AM. The use of personal computers is not allowed)
• 1 Podium microphone or 1 Wireless microphone (lapel mic)
• 1 laser pointer
• 1 flip over

Conference Publications
All participants are entitled to the Book of Abstracts and the conference proceedings on USB.

Wireless connection:
There will be free wireless conection in the whole conference venue. At the registration desk you can receive login and password.

Public Transport
There are different public transport cards: the so-called “OV-chipcards”. Visitors can purchase a Disposable OV-chipcard at all the Metro stations in Amsterdam, the Post offices and in tobacco stores & gift shops. The I amsterdam City Card provides unlimited usage of trams, buses and metros in Amsterdam. This card is available at several tourist offices of Amsterdam Tourism & Convention Board (ATCB). The best way to plan your trip with public transport in the Netherlands is visiting: http://journeyplanner.9292.nl/

Weather & Climate
In June the weather in the Netherlands can be warm and sunny (16-21 degrees Celsius is average for the time of year). However, our sea-climate entails variable weather conditions, so be prepared for the occasional drop of rain.

Currency
The local currency is Euro (divided into 100 cents). International credit cards are accepted all over the Netherlands in department stores, museums and most shops.

Health regulations
No vaccinations are required when entering the Netherlands from any other country.

Liability
The organisers cannot be held responsible for injury to conference attendees or for any damage, regardless of the cause. Attendees are advised to make their own insurance arrangements.

Emergency phone numbers
Municipal police of Amsterdam: 09-00-8844
Police and Ambulance: 112

Lost and Found
Lost and found articles may be taken to the conference Registration Desk.
Conference | Beurs Van Berlage
Dutch evening | De Admiraal
Conference dinner | HEAT

Central Station
HEAT
Jollemannhof 37

Beurs van Berlage
Beursplein 1 • Damrak 243

De Admiraal
Herengracht 319
**Beurs Van Berlage**
Main locations of the conference programme

**Ground floor**
Corn exchange Hall and Glass Pavilion | Graanbeurszaal met Glazen Zaal
Assay Hall | Keurzaal
Beurs van Berlage café
Skipperscafé | Schipperscafé

**1st floor**
Court room | Raadszaal
Sunday, June 19, 2011

Before the start of the conference, on Sunday June 19, 2011, we would like to invite you to our welcome reception.

The reception will be held in the Beurs van Berlage Cafe (entrance Damrak 243) next to the Beurs van Berlage. The reception starts at 17.00 h.

During the reception the conference registration is open.

Monday, June 20, 2011

18.30 h.: All guests gather on the square in front of the Beurs van Berlage cafe and when the group is complete you will be guided to De Admiraal.
Address De Admiraal: Herengracht 319, Phone: 020-6254334

19.00 h.: You will be welcomed at Tasting room ‘De Admiraal’, for a typical Dutch evening; Dutch snacks, Dutch drinks and a typical Dutch accordion player for the Dutch entertainment.

20.30 h: End Dutch Evening

Tuesday, June 21, 2011

18.30 h.: All guests gather on the square in front of the Beurs van Berlage cafe. When the group is complete you will be guided to the landing stage, this will be a 5 minutes’ walk.

19.00 h.: Champagne Cruise. Boarding on the Canal Boats docked nearby the ‘Beurs van Berlage’.
Address: Oudekerksplein 23

20.00 h.: The boats will arrive at the landing stage of the dinning location HEAT, where you will go ashore, to enjoy a marvelous 4-course conference dinner.
Address: Jollemanhof 37. Phone: 020-6465158

20.30 h.: Dinner introduced with a personal view by Hans de Jonge

22.30 h.: One luxurious coach is waiting in front of HEAT aan ’t IJ. This coach will bring the first guests back to the hotel. After the first shuttle he will come back for the other guests. The coach will shuttle two transfers.

Wednesday, June 22, 2011

17.00 h.: In front of the Beurs van Berlage a luxurious mini coach is waiting for the guests to bring them to the Heineken Brewery.

17.30 h.: The guests will be welcomed at the Heineken Brewery and start the tour.

18.30 h.: End of the tour. The guests can have a drink at the bar and choose a Heineken gadget with the conference voucher in the Heineken shop.
Social agenda

Thursday, June 23, 2011

Technical Tour North/South Line

10.00 h.: All guests will be welcomed at the Information Centre of the North/South line, Stationsplein 7, by a professional guide, with coffee or tea.

10.15 h.: Start of the tour.

11.45 h.: End of the tour. All guests are invited for a coffee/tea break in Cafe de Jaren.

Cafe de Jaren opened its doors in June 1990 as one of the largest cafes in Amsterdam, sporting an entire new and unique formula. The concept is mirrored in its spacious and light rich architecture and interior decoration, as well as in its pleasant, non-pushing atmosphere. The large building features a spacious cafe on the ground floor with an international reading table, a pleasant restaurant with large-choice salad bar on the first floor, as well as a superb canal view terrace.

Architectural Tour

10.00 h.: Boarding on the Canal Boats docked nearby the ‘Beurs van Berlage’, next the Sint Nicolaaskerk – on the other side of the NH Barbizon Palace Hotel

During the boat tour you will see all the beautiful architecture of Amsterdam guided by an English speaking guide. On board we will serve you coffee/tea with cake.

12.00 h.: End of the architectural tour
# Programme at a glance

<table>
<thead>
<tr>
<th>Sunday June 19</th>
<th>Monday June 20</th>
<th>Tuesday June 21</th>
<th>Wednesday June 22</th>
<th>Thursday June 23</th>
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<td>Registration Check-in</td>
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<td>Parallel Sessions General Themes</td>
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<tr>
<td>Keynote Speakers</td>
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<td>Parallel Sessions General Themes</td>
<td>Keynote Speakers &amp; Closing Debate</td>
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<tr>
<td>Parallel Sessions Workshops</td>
<td>Parallel Sessions Workshops</td>
<td>Parallel Sessions Workshops</td>
<td>Business Meetings</td>
<td></td>
</tr>
<tr>
<td>Welcome Reception &amp; Registration (Optional)</td>
<td>Dutch Evening (Optional)</td>
<td>Champagne Cruise &amp; Conference Dinner (Optional)</td>
<td>Heineken Experience (Optional)</td>
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<tr>
<td>Technical or Architectural Tour (Optional)</td>
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### Programme 2011

**Day 1:** Monday June 20, 2011

#### Morning Session

**08.30** Arrival, Registration, Coffee/Tea

**09.30** Welcome by the Conference Chair **Hans Wamelink**

**09.40** Conference Opening by **Dirk Jan van den Berg** (Chair TU Delft, University Board)

**09.50** CIB welcome by **Wim Bakens** (Chair CIB)

**10.00** Keynote lecture Martin Loosemore (UNSW) - Innovating for sustainability: risks and opportunities

**10.30** Break

#### Parallel Sessions - General themes

<table>
<thead>
<tr>
<th>Management for sustainable design and construction</th>
<th>Innovation in construction (theories and best practices)</th>
<th>Economics of the built environment/Whole life cost-benefit-modelling</th>
<th>Socio technical systems/Innovation in construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chair: Steve Rowlinson</td>
<td>Chair: Hedley Smyth</td>
<td>Chair: Richard Fellows</td>
<td>Chair: Chris Harty</td>
</tr>
</tbody>
</table>

**11.00 Page 1**

**DIVERSITY MANAGEMENT: MANAGING MIGRANT CONSTRUCTION WORKERS ON CONSTRUCTION SITES IN LING, MUI HIA CHUA, YONGLIAN KE**

**11.45 Page 2**

**INTELLECTUAL CAPITAL MODEL DEVELOPMENT TOWARDS ADAPTIVE RE-USE SUCCESS: AN ANALYSIS ON HISTORICAL DEVELOPMENT OF CASE STUDIES**

**11.30 Page 3**

**DEVELOPING AND MARKETING SUSTAINABLE CONSTRUCTION SERVICES**

**11.45 Page 4**

**EDUCATION & EMPLOYMENT: A PRELIMINARY STUDY OF FEMALE BUILT ENVIRONMENT UNDERGRADUATE STUDENTS IN MIKE MURPHY, ANDREW DAINITY, ZHAOMIN REN**

**12.00 Page 5**

**PARADIGM SHIFT OR CHANCE? THE FUTURE OF WESTERN EUROPEAN HOUSING STOCKS**

**12.15 Page 6**

**EMBEDDING ENERGY SAVING POLICIES IN THE DUTCH NON-PROFIT HOUSING SECTOR**

**12.30 Page 7**

**TOWARDS AGILE PROJECT MANAGEMENT AND SOCIAL INNOVATION IN THE CONSTRUCTION INDUSTRY**

**12.30 Lunch**

**12.30 Page 8**

**ACADEMIC/INDUSTRY INNOVATIONS FOR SUSTAINABLE BUILDING DESIGN AND REFURBISHMENT**

**12.30 Page 9**

**DESIGN, PROCESS, AND SERVICE INNOVATIONS TO ACHIEVE SUSTAINABILITY**

**12.30 Page 10**

**IMPLEMENTATION OF INNOVATION: THE INERTIA OF IMPLEMENTING THE OPEN BUILDING CONCEPT IN PRACTICE**

**12.30 Page 11**

**EU FUNDED PROJECTS – BEST TOOLS FOR CONSTRUCTION SPECIALISTS EDUCATION**

**12.30 Page 12**

**LIVING BUILDINGS AND THE ASSOCIATED R&D BASED MANUFACTURERS: THE REVOLUTION TOWARDS EVOLUTIONARY CONSTRUCTION**

**12.30 Page 13**

**DRIVERS OF CIVIL ENGINEERING**

**12.30 Page 14**

**BUILDING RENEWAL ON SOCIAL HOUSING – CASE STUDY ON THE RUBEM BERTA SETTLEMENT, BRASIL**

**12.30 Page 15**

**TO THE ACCURACY OF COST INTELLIGENCE TO PREDICT USE OF ARTIFICIAL INTELLIGENCE TO PREDICT THE ACCURACY OF COST ESTIMATE**

**12.30 Page 16**

**AN EVALUATION OF CONSTRUCTION SPEED PERFORMANCE FOR BUILDING CONSTRUCTION PROJECTS IN UK AND GERMANY**

**12.30 Page 17**

**USE OF ARTIFICIAL INTELLIGENCE TO PREDICT THE ACCURACY OF COST ESTIMATE**

**12.30 Page 18**

**ENDOGENOUS RISK IN UNBALANCED BIDDING**

**12.30 Page 19**

**COST INFORMATION IN ENERGY BILLS FOR HOUSEHOLDS EFFECTING THE ADOPTION OF ENERGY TECHNIQUES**

**12.30 Page 20**

**STRATEGIES FOR THE COST-EFFECTIVE TECHNICAL MANAGEMENT OF HOUSING STOCKS**

**12.30 Page 21**

**A REAL OPTIONS APPROACH TO EVALUATE INVESTMENT IN SOLAR READY BUILDINGS**

**12.30 Page 22**

**BUILDING RENEWAL ON SOCIAL HOUSING – CASE STUDY ON THE RUBEM BERTA SETTLEMENT, BRASIL**

**12.30 Page 23**

**THE POTENTIAL IMPACT ON PROPERTY AND SOCIO-ECONOMIC DEVELOPMENT RESULTING FROM ROAD TRANSPORT CORRIDORS IN A CASE STUDY**

**12.30 Page 24**

**PASSIVE HOUSE NETWORKS: A SOCIAL INNOVATION TARGETING INNOVATION IN SME’S IN TRANSPORTATION SECTOR**

**12.30 Page 25**

**SYSTEM INNOVATION FOR SUSTAINABLE BUILT ENVIRONMENTS: THE CASE OF LIGHT EMITTING DIODES (SHUING LU)**

**12.30 Page 26**

**DIVERSITY INTERVENTIONS FOR A SOCIALLY SUSTAINABLE CONSTRUCTION INDUSTRY**

**12.30 Page 27**

**INTERNATIONAL STRATEGIC ALLIANCES IN CONSTRUCTION: PERFORMANCES OF TURKISH CONTRACTING FIRMS**

**12.30 Page 28**

**SOCIO-TECHNICAL SYSTEMS INTEGRATION: CONDITION FOR SUCCESS**

**12.30 Page 29**

**THE ACCURACY OF COST INTELLIGENCE TO PREDICT USE OF ARTIFICIAL INTELLIGENCE TO PREDICT THE ACCURACY OF COST ESTIMATE**

**12.30 Page 30**

**PICO KENNY: THE FUTURE OF WESTERN EUROPEAN HOUSING STOCKS**

**12.30 Page 31**

**LEADERSHIP IN CONSTRUCTION ORGANIZATIONS AND THE PROMOTION OF SUSTAINABLE PRACTICES**
<table>
<thead>
<tr>
<th>Workshop Deconstructing organizational paradoxes</th>
<th>Workshop Innovation and urban planning</th>
<th>Workshop Social innovation &amp; participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing interactions, disentangling contradictions: examining paradoxes of inter-organisational relations in constructing collaborations</td>
<td>Cultural heritage in urban redevelopment projects: a framework to analyse collaborative strategies</td>
<td>Participation in collectively sold private renovations</td>
</tr>
<tr>
<td>Countereft construction products from low-cost sourcing countries</td>
<td></td>
<td>SUSTAINABLE RENOVATION OF THE LARGE-SCALE HOUSING ESTATES, BUILT IN FRANCE OF THE 1950S AND 1970S</td>
</tr>
<tr>
<td>Edward Minchin Jr., Russell Walters, Jiayi Pan, Dongping Fang</td>
<td></td>
<td>Amar Bensalma</td>
</tr>
<tr>
<td>Negotiating strategic-management contradictions in practice: an activity-based approach</td>
<td>Ideology of the eco-city: a discursive approach</td>
<td>Exploring different community attitudes to sustainable technologies</td>
</tr>
<tr>
<td>Christine Rasianen, Ann-Charlotte Stenberg, Martin Lowstedt</td>
<td>Elizabeth Rapoport, Anne Lorene Vernay</td>
<td>Beck Collins, David Boyd</td>
</tr>
<tr>
<td>A spatiotemporal perspective on empowerment in projects</td>
<td>The area-based planning process of Dutch housing associations Annavan Overmeer</td>
<td></td>
</tr>
<tr>
<td>Enoch Sackey, Martin Tuuli, Andrew Dainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A new professional in neighborhood approach</td>
<td>A method to study the management of urban development projects</td>
<td></td>
</tr>
<tr>
<td>Ton van der Pennen</td>
<td>Erwin Heukkens</td>
<td></td>
</tr>
<tr>
<td>The management of requirements: what causes uncertainty in integrated design approaches?</td>
<td>Research methodologies for studying the informal aspects in construction project organisations</td>
<td>Redevelopment of industrial properties in: from the municipal perspective</td>
</tr>
<tr>
<td>Vedran Zejac, Timo Hartmann, Hans Boes</td>
<td></td>
<td>Helena Palsson, Stefan Olander</td>
</tr>
<tr>
<td>Building information modelling and the culture of construction project teams: a case study</td>
<td>Organizational ambidexterity in the construction industry</td>
<td></td>
</tr>
<tr>
<td>Graham Brewer, Thayapan Gajendran</td>
<td>Pernilla Runeson, Andrew Dainty</td>
<td></td>
</tr>
<tr>
<td>Supply chain integration challenges in project procurement in: IBS contractors’ perspective</td>
<td>Standardizing knowledge: a dialectic view on architectural knowledge and its managers</td>
<td></td>
</tr>
<tr>
<td>Anis Aliuza Abdu Shukor, Mohammad Fadhlil Mohammad, Rohana Maththub</td>
<td>Pernilla Runeson</td>
<td></td>
</tr>
<tr>
<td>Innovation in processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neile Boussensaere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaborative networks support sustainable business settings regarding integration of design and construction</td>
<td>Paradoxes of innovation and architectural design: a model of design knowledge generation in architectural practices.</td>
<td></td>
</tr>
<tr>
<td>Jan Worst</td>
<td>Peter Raisbeck</td>
<td></td>
</tr>
<tr>
<td>Extended construction supply chain management: relationships, rewards and risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stuart Tennant, Scott Fernie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A critique of integrated working and partnering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stephen Gruneberg, Jan Mustooch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The integrated housing supply chain model for innovation: narrative analysis towards developing pathways methodology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelly London, Jessica Siva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain collaboration between a housing corporation and two general contractors, the first steps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jelle Koolwijk</td>
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<td>Supply chain integration and collaboration - a relationship management approach</td>
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<td>Steve Rowlinson, Piona Yan Ki Cheung</td>
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**MISBE2011**

**Day 1: Monday June 20, 2011**

**Afternoon session**

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<th>Glass Pavilion</th>
<th>Assay Hall</th>
<th>Skippers Cafe</th>
<th>Court Room</th>
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<tbody>
<tr>
<td>Workshop Supply chain integration &amp; collaboration</td>
<td>Workshop Deconstructing organizational paradoxes</td>
<td>Workshop Innovation and urban planning</td>
<td>Workshop Social innovation &amp; participation</td>
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<td>Workshop leader: Will Hughes</td>
<td>Workshop leader: Paul Chan</td>
<td>Workshop leader: Tom Daamen</td>
<td>Workshop leader: Kristel Aalbers</td>
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<tr>
<td>Page 32</td>
<td>Page 48</td>
<td>Page 57</td>
<td>Page 62</td>
</tr>
<tr>
<td>Countereft construction products from low-cost sourcing countries</td>
<td>Developing interactions, disentangling contradictions: examining paradoxes of inter-organisational relations in constructing collaborations</td>
<td>Cultural heritage in urban redevelopment projects: a framework to analyse collaborative strategies</td>
<td>Participation in collectively sold private renovations</td>
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<tr>
<td>Edward Minchin Jr., Russell Walters, Jiayi Pan, Dongping Fang</td>
<td>Christine Rasianen, Ann-Charlotte Stenberg, Martin Lowstedt</td>
<td>Elizabeth Rapoport, Anne Lorene Vernay</td>
<td>Sake Zijlstra, Giselle Stowijk</td>
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<tr>
<td>Negotiating strategic-management contradictions in practice: an activity-based approach</td>
<td>The ideology of the eco-city: a discursive approach</td>
<td>The area-based planning process of Dutch housing associations Annavan Overmeer</td>
<td>Exploring different community attitudes to sustainable technologies</td>
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<tr>
<td>Enoch Sackey, Martin Tuuli, Andrew Dainty</td>
<td>Elizabeth Rapoport, Anne Lorene Vernay</td>
<td>Annavan Overmeer</td>
<td>Beck Collins, David Boyd</td>
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<td>A new professional in neighborhood approach</td>
<td>A method to study the management of urban development projects</td>
<td>Erwin Heukkens</td>
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</tbody>
</table>
Day 2: Tuesday June 21, 2011

Morning Session

Keynote Lecture by Karin Laglas (Dean Faculty of Architecture, TU Delft) - Public-private collaboration for sustainable urban area development

Keynote Lecture by Anke van Hal (TU Delft) - A merger of interests in the existing housing stock

Parallel sessions General themes

<table>
<thead>
<tr>
<th>Programme</th>
<th>Day 2</th>
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<tbody>
<tr>
<td><strong>Management for sustainable design and construction</strong></td>
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<td>Glass Pavilion</td>
<td>Assay Hall</td>
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<td>Chair: Jan Bröchner</td>
<td>Chair: Monika Chao-Duivis</td>
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</table>

10.30 Page 66

ADVANCEMENT OF SUSTAINABLE DEVELOPMENT, CONTRACTING, DESIGN, AND SUPPLY BUSINESSES: VIS-A-VIS CONSTRUCTION MARKETS

10.45 Page 67

DEVELOPMENT OF THE SUSTAINABLE BUILDING AND CONSTRUCTION PRODUCTS INDUSTRY IN Timothey Rose, Karen Manley

11.00 Page 68

SUSTAINABLE CONSTRUCTION FOR INDUSTRIALIZED DETACHED HOUSE, SUB-ROLE OF RESOURCE RECYCLE FACILITY

11.15 Page 69

AN OVERVIEW OF GREEN BUILDING PRACTICE IN Deniz Ilter, Tolga Ilter

11.30 Page 70

CAD-CAM AND CNC TECHNOLOGY IMPLEMENTATION FOR A SUSTAINABLE REFURBISHMENT OF HISTORIC DISTRICTS. A CASE STUDY FOR Kepa Iurralde

11.45 Page 71

FACILITIES MANAGEMENT: PROPOSALS FOR PRACTICE IMPROVEMENT AND DEVELOPMENT SUPPORT THROUGH EDUCATIONAL PROGRAMMES IN Dries Hauptfleisch, Basie Verster

12.00 Page 72

INNOVATIONS WITHIN DBFMO PROJECTS FROM A MAINTENANCE AND ENERGY-USE POINT OF VIEW

12.15 Page 73

IMPLEMENTING GREEN DESIGN INITIATIVES IN THE UAE

12.30 Lunch

Break

10.45 Page 82

ORGANISING LARGE SCALE GREEN COVERED ROOFS: Classification of green roof specifications and green roofs implementation; the economics of green roof's Peter Teeuw, Christoph Maria Ravesloot

11.00 Page 84

ANALYSING THE TRANSMISSION PATTERN WITHIN THE FRAMEWORK OF HOUSING SUPPLY AND MONETARY POLICY IN Junxiao Liu, Kerry London

11.15 Page 85

THE CONSTRUCTION INDUSTRY AND THE CHALLENGES OF THE MILLENNIUM DEVELOPMENT GOALS Jorge Lopes, Rui Oliveira, Manu Isabel Almeu

11.30 Page 86

RANKO BON REVISITED: THE VOLUME/SHEA RELATIONSHIP Tuilio Gregori, Roberto Pietroforte

11.45 Page 87

TRUST AND MONEY: 20 YEARS OF (NO) PROGRESS? Richard Fellows

12.00 Page 88

INFORMATION SYSTEM FOR COST ESTIMATION OF COMMUNAL INFRASTRUCTURE

12.15 Page 89

ETHICAL AND SUSTAINABLE EMPLOYMENT IN CONSTRUCTION: THE CASE OF BLACK AND MINORITY ETHNICS’ (BME’S) ENGAGEMENT

12.30 Lunch
## Programme

### MISBE2011

#### Day 2: Tuesday June 21, 2011

**Afternoon session**

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<td><strong>Workshop Selecting partners &amp; organizing collaboration</strong></td>
<td><strong>Workshop Global construction data</strong></td>
<td><strong>Workshop Sustainable transformation</strong></td>
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**Programme**

**Day 3: Wednesday June 22, 2011**

**Morning Session**

### Parallel sessions

**General themes**

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<th>Glass Pavilion</th>
<th>Assay Hall</th>
<th>Skippers Cafe</th>
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<td>Management for sustainable design and construction</td>
<td>Planning for sustainable urban areas</td>
<td>Management for sustainable design and construction</td>
<td>Innovation in construction (theories and best practices)</td>
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<td><strong>Chair:</strong> Andy van den Dobbelsteen</td>
<td><strong>Chair:</strong> Stuart Green</td>
<td><strong>Chair:</strong> Martin Sexton</td>
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#### Day 3 Schedule

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
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<td>09.00</td>
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#### Abstracts

- **SUSTAINABLE PLANNING AND LAND VALUATION. NEW FORMS OF SUBURBAN GROWTH IN AREAS OF THE**
  Gema Ramirez Pacheco, Federico Garcia Erviti

- **EXPLORING THE BUSINESS CASE FOR MORE ADAPTABLE BUILDINGS: LESSONS FROM CASE STUDIES**
  James Pinder, Rob Schmidt, Alistair Gibb, Jim Saker

- **THE INEVITABLE AND CONTINUING GROWTH OF REGULATIONS FOR PLANNING AND BUILDING**
  Fred Hobma

- **THE AMSTERDAM GUIDE TO URBAN PLANNING**
  Andy van den Dobbelsteen, Nico Tillie, Juliane Kurschner, Bart Mantel, Laura Hakfoort

- **REDESIGN – UPGRADING THE BUILDING STOCK TO MEET (NEW) USER DEMANDS**
  Hilde Remoy, Theo van der Voorden

- **CONCEPTUAL FRAMEWORK FOR POTENTIAL IMPLEMENTATION OF MULTI-CRITERIA DECISION MAKING**
  (MCDM) METHODS FOR DESIGN QUALITY ASSESSMENT
  Timurcin Harputlugil, Matthias Prins, Tanju Guitekin, Ilker Topcu

- **DUTCH STRATEGIES FOR THE HISTORIC URBAN CORE, THE HISTORIC INNER CITY, FADED GLORY OR CORE BUSINESS?**
  Wouter Toorn Vrijthoff

- **CLIMATE CHANGE EFFECTS ON LIVING QUALITY: AWARENESS OF HOUSING ASSOCIATIONS**
  Martin Rodgers, Ad Straub, Henk Vascher
### Day 3: Wednesday June 22, 2011

#### Afternoon Session

**Plenary session in the Glass Pavilion**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>11.30</td>
<td>Keynote Lecture George Ofori, Research and Industry Reform</td>
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<td>Closing debate on Construction Industry Reform</td>
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<tr>
<td>13.00</td>
<td>Lunch</td>
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<td>CIB 112 meeting: Culture in Construction</td>
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<td>Chair: Wilco Tijhuis</td>
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**Glass Pavilion**

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DIVERSITY MANAGEMENT: MANAGING MIGRANT CONSTRUCTION WORKERS ON CONSTRUCTION SITES IN SINGAPORE

Florence Ling; bdglyy@nus.edu.sg
Mui Hia Chua; michelle.chuamh@gmail.com
Yongjian Ke; bdgky@nus.edu.sg

Keywords: Diversity management, Leadership styles, Management practices

ABSTRACT

It is not sustainable for construction projects in Singapore to rely merely on a Singaporean workforce due to the low participation rate of indigenous workers. A typical construction site in Singapore thus comprises migrant workers from several countries. This gives rise to the need for diversity management on construction sites to ensure social sustainability. The aim of this research is to examine styles that project managers adopt when managing multicultural migrant workers in construction projects. The specific objectives are to: investigate the socially sustainable managerial practices adopted by project managers when dealing with migrant construction workers from China, India and Thailand; and identify if there are any differences in management practices when dealing with migrant construction workers from different countries. The research method is questionnaire survey, and data were collected from project managers who had managed migrant workers in Singapore. In-depth interviews were also conducted to confirm the statistical results. The research found that project managers tend to use task-oriented more than relation-oriented management style to achieve social sustainability. The management practices that are significantly implemented include requiring workers to be punctual, giving assertive instructions, providing close supervision and enforcing rules so that social sustainability can be maintained on construction sites.
INTELLECTUAL CAPITAL MODEL DEVELOPMENT TOWARDS ADAPTIVE RE-USE SUCCESS: AN ANALYSIS ON HISTORICAL DEVELOPMENT OF CASE STUDIES

Kartina Alauddin; kartina.alauddin@student.rmit.edu.au
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ABSTRACT

Adaptive re-use can be a significant strategy for achieving sustainability as it ensures a continuous building life-cycle and prevents it from destruction. Adaptive re-use projects have their own unique environment and specific challenges to ensure success. There are complex designs and construction problems unique to adaptive re-use projects thus specific skills and expertise are required. As Australia’s building stock ages, more and more attention are being turned to adaptive re-use projects and the critical factors towards its success. The literature review identified and regarded project management as a critical success factor for these projects. Given the extremely complex and conflicting construction challenges we contend that construction management is a critical success factor. The aim of this paper is to identify the unique problems in the adaptive re-use process of historical buildings. It is a highly specialized field with significant learning accumulated and significant levels of intellectual capital created within the project teams. Two case study projects with similar project teams are examined to explore the relevance of the concept of reflexivity. We propose an intellectual capital model for project success to understand how to capture, transform and accumulate intellectual capital within project stakeholder’s communities who are dedicated to adaptive re-use projects. The model is a step towards the development of a practical construction management methodology grounded in theory and empirical observations.
DEVELOPING AND MARKETING SUSTAINABLE CONSTRUCTION SERVICES

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Key words: Sustainability, Services, Marketing, Construction, Economic development

ABSTRACT

Increasing calls for action on addressing the negative impact of human activities on the natural environment have lead to the growth of new markets for sustainable solutions. At a more macro level, the role of construction and marketing in economic development has been well established. In striving towards economic growth, a balance between marketing and construction should be considered to achieve sustainability. Engineering consultancies and other businesses have been developing the provision of ‘sustainability services’ to a diverse range of sectors including construction, energy and transportation, corporate and others. This has also been stimulated by policies enshrined in governmental legislation. Market growth in developed countries such as the UK and Singapore has been fast due to the implementation of more stringent regulations. This paper considers how the principles and practice of marketing may be applied to the promotion of sustainability services offered by engineering and construction consultancies and contractors. It will also consider the constraints and barriers, together with the opportunities for sustainability service markets in developed and developing countries.
EDUCATION & EMPLOYMENT: A PRELIMINARY STUDY OF FEMALE BUILT ENVIRONMENT UNDERGRADUATE STUDENTS IN SOUTH WALES

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Keywords: Women, Discussion, Careers, Education, Preliminary study, Longitudinal study

ABSTRACT

Recently available figures for South Wales’ university’s and college’s intake indicate a ratio of 83 male to 17 female students on undergraduate built environment courses. It could be contended that any increase in the numbers of females attending such courses should reflect more females at the ‘coal face’ but what of the experiences, perceptions and expectations while on those courses? The female respondents were questioned utilising semi-structured, digitally recorded discussions in relation to education, employment and how and why they arrived at their careers determining the influences in choosing that career path. Issues arose including poor careers advice, inappropriate work experience, lack of peer support, a general lack of knowledge of the industry and the perception of outmoded male attitudes. The aim is to ultimately gain a longitudinal view of female experiences over the ‘life’ of their courses and concurrent employment, to ascertain over time if the respondent’s views have changed and original expectations met. It is suggested a better understanding of women’s experiences through a longitudinal study may support the sector to improve the number of successful female built environment technicians.
PARADIGM SHIFT OR CHOKE? THE FUTURE OF WESTERN EUROPEAN HOUSING STOCKS

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Keywords: Housing stock, Stock management, Paradigm shift, Life cycle extension, Renovation, Housing pathology

ABSTRACT

The 20th century saw an enormous worldwide growth of the housing stock. In particular the building boom after WW-II, during which the housing stock in most countries was multifolded, focussed the attention of the housing sector primarily to the planning and realisation of new construction; the consciousness of the enormous maintenance and management task to come was still a far cry.

The begin of the 21st century shows a completely different situation that urges for a paradigm shift.

New construction in most western countries has faded down below an annual production of 1% of the existing stock, and often well below. Parallel to this, the ageing existing stock draws growing attention. The necessary investments in major repairs, renovation, adaptation and redevelopment count at present for a total turnover well beyond that of new construction. Improving the energy efficiency to the required standards of tomorrow will give these investments a strong extra boost.

Though the change from new addition to the adaptation and transformation of the existing stock is well under way, large parts of the construction and real estate practice seems hardly aware and to stick to business as usual: new constriction, if not in greenfields then in brownfields. The knowledge about how and when to successfully maintain, manage, adapt, transform and redesign has still a way to go. At the same time, the awareness grows that housing problems are only partly related to the physical supply side and solving them requires more than bricks and mortar.

The paper illustrates the paradigm shift in Western Europe and explores the consequences for the management of the housing stock.
EMBEDDING ENERGY SAVING POLICIES IN THE DUTCH NON-PROFIT HOUSING SECTOR

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Keywords: Energy saving, Implementation, Social housing, The Netherlands

ABSTRACT

Many Dutch social landlords have formulated energy saving ambitions for their housing stock. On the national level, the Dutch government and several umbrella organizations have agreed that CO2 emissions will be reduced with 30% in 2018 compared to 2008. In the same year, 20% of the energy use in the housing sector should come from renewable energy sources and all newly built houses should be climate neutral. The existing housing stock should be climate neutral in 2050.

Many studies on policy implementation have emphasized the difficulties of putting policies into practice. The paper presents several ways in which Dutch social landlords incorporate their energy saving policies in their ‘regular’ housing management, such as planned preventive maintenance, renovations and other physical improvements.

The research questions are as follows:

- What are the current energy saving policies of Dutch social housing organisations?
- Which objectives are formulated?
- In which way do Dutch social housing organisations materialize their energy saving policies in their physical investments in new building and in the existing stock? What are the main stimuli and barriers for this materialization?
- In which way do the current energy saving policies of Dutch social housing organisations coincide or conflict with their policies in other fields (e.g. rent setting, maintenance strategies)?
- To which extent are the energy saving ambitions of Dutch social housing organisations realized? What are the main factors of success or failure for this?

Several landlords were selected that have formulated an energy saving policy and that have at least some experience in implementing these policies. Interviews were held with managers of asset and maintenance management and with policy staff of social landlords. It is investigated to which extent the policy ambitions, both at the portfolio level and at the project level, are carried out, and in which way these ambitions are embedded in the organisations’ regular working processes. In addition, the main stimuli and barriers for the implementation of the energy saving policies are identified. Special attention has been paid to the feasibility of combinations of energy saving measures with other physical improvements in the housing stock. Results show that the implementation of energy saving policies in annual improvement and maintenance plans is in most cases not problematic, and that the most significant problems arise during the preparation of individual investment projects.
TOWARDS AGILE PROJECT MANAGEMENT AND SOCIAL INNOVATION IN THE CONSTRUCTION INDUSTRY

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Keywords: Projectmanagement, Lean manufacturing, Project management competences

ABSTRACT

Towards agile project management?
Meredith distinguishes a major development in the field of general management that traditional, hierarchical management is increasingly replaced by so called "Consensual management". Such a development also occurs in the field of project management. Agile project management (originated in the world of IT and software development) has many characteristics of lean thinking. In the Manifesto of the Agile Alliance is stated: “We are Uncovering better ways of Developing software by doing it and helping others do it. Through this work we have come to value: Individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, responding to change over following a plan. That is, while there is value in the items on the right, we value the items on the left more”. Agile stands for the individual and interaction, rather than procedures and tools, results over paper security and respond to change over the finishing a tight plan once it’s drawn up. In that sense, agile fits more into the current complex and turbulent era than the traditional project management. Agility and flexibility are important, because projects have to adapt to inevitable changes. This environmental turbulency leaves no room for bureaucratic organisations and unwavering procedures. Important are: self-managed or self-organizing teams, a lot of customer interaction, "even when there isn’t a problem to be solved!", motivated individuals, and the leader is more a coach and facilitator who clears obstacles.

A controversy between agile and traditional project management?
We will discuss the various ways to choose the appropriate project management model for a specific project. If there is a large amount of complexity and many different stakeholders and interests (and potential controversies) in an absolutely unique project, then don’t choose a hierarchical and bureaucratic project management model.

Research
In early 2008 we conducted a study into current and desired project management competences in the construction industry. This was a survey in which the self-image of a representative group of 130 project managers from both clients, builders and consultants was examined. This study gave a clear picture of developments in the industry, the advent of integrated contracts made competences such as cooperation and communication more important while the hard technical skills were decreasingly necessary. This raised the question whether the project leader of the future still needs to be an engineer. The results from this research strongly support the trends as described before.

Finally, concluding
Both our survey and the literature describe a trend towards what we call agile project management. Some conclusions in advance:
• The ICT sector is far ahead on the construction industry in the field of research on project management. The construction industry is relatively invisible in the scientific debate. The good news is that we can learn a lot from this sector.
• The most current ongoing research and consultancy has excessive attention to Taylorist project management. Since there is a break towards agile project management, new theory and research is required (including a research agenda!). Besides structure, more attention to the "soft side" of the profession is imperative.
ACADEMIC/INDUSTRY INNOVATIONS FOR SUSTAINABLE BUILDING DESIGN AND REFURBISHMENT

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Keywords: Construction innovations, Academia, SMEs

ABSTRACT

Development and efficient dissemination of innovations for sustainable building design and refurbishment are crucial for the competitiveness of companies operating in the construction sector which faces the pressure to reduce levels of carbon emissions from existing and new buildings to zero. The sector is also challenged to become more sustainable regarding its other environmental, social and economic impacts.

An overwhelming majority of companies operating in the construction sector in Scotland are small to medium size enterprises (SMEs) who do not have sufficient resources in the current economic downturn to undertake research in building design, products and processes that will make buildings more sustainable. A joint project of seven Scottish universities has been initiated to support collaboration with small to medium size enterprises in developing and disseminating innovation for sustainable building design and refurbishment.

The project concept and methods used for efficient dissemination of the project outputs to SMEs across Scotland are explained. An analysis of the outputs of feasibility studies completed and academic consultancy provided through the project indicates the range of problems tackled and trends in the development and use of innovations for more sustainable built environment in Scotland.
DESIGN, PROCESS, AND SERVICE INNOVATIONS TO ACHIEVE SUSTAINABILITY

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Keywords: Sustainability, Client-driven innovation, Design innovation, Community engagement

ABSTRACT

Climate change has led to the global recognition of the need to reduce the carbon footprint of buildings. In the UK increasingly demanding building regulations require contractors to use innovative products and processes in their construction processes in order to deliver the specified environmental sustainability performance levels. Cost effective innovative solutions for achieving sustainability in construction requires considerable effort and commitment. As a fragmented and project-based industry, much construction innovation is co-developed at the project level. The major objective of this study is to analyse a construction project by exploring the role of design, process, and service innovations in achieving sustainability. In this respect, the eco-friendly accommodation at Lancaster University has been investigated as a case study. The project presents a case of client-driven innovation where building regulations on sustainability were taken into account in developing design and planning the construction process. The paper discusses the leading role of the university client as well as the role of partnering approach and community engagement in the innovation process. Finally, some recommendations are provided based on the lessons learned in this project.
IMPLEMENTATION OF INNOVATION: THE INERTIA OF IMPLEMENTING THE OPEN BUILDING CONCEPT IN PRACTICE

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ABSTRACT

The Open Building concept has been developed half a century ago. Despite the relative potential advantages to society, this concept of Open Building has not been widely implemented in the construction industry. Consequently, it did not lead to a general new approach of designing structures. Why does the construction industry use the Open building concept so rarely among their projects? Using in-depth semi-structured interviews with the ‘founding fathers’ of Open Building in combination with literature, the inertia which obstructs the implementation of Open building in the construction industry are identified. The study shows that inertia on adopting the principles of Open Building are primarily related to the type of collaboration between firms on construction projects. Only few impediments are of technical nature.
THE AGENT-CONSTRUCTION SYSTEM FOR PROCURING MEGA PROJECTS IN CHINA

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Keywords: Procurement innovation, Agent-Construction System, Construction procurement, China

ABSTRACT

Driven by its unprecedented urbanization plan, there is a huge demand of facilities, such as road infrastructure, schools, and hospitals in China. Heated discussions have been directed towards various innovative procurement systems such as Public-Private-Partnership (PPP), Private Finance Initiative (PFI), and Building-Operating-Transfer (BOT) that help materialise the projects and truly deliver value to the society. This research examines an agent-construction system (ACS or in Chinese Dai Jian Zhi) by relating them to China’s particular Political, Economics, Social, Technological, Environmental, and Legal (PESTEL) background. It is found that the ACS is promising in procuring public projects owing to two merits: (a) clearly defined right and responsibilities; and (b) appropriate allocation of resources and risks amongst parties involved. The research is particularly useful when governments worldwide are searching for innovative procurement approaches to help deliver public projects and services. It also sheds light on how to devise an innovative procurement system. A word of caution, nevertheless, is that readers should not follow this “good practice” slavishly. One ought to truly understand the essence of procurement innovation and devise suitable innovative procurement systems in a given PESTEL setting.
EU FUNDED PROJECTS – BEST TOOLS FOR CONSTRUCTION SPECIALISTS EDUCATION

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ABSTRACT


The aim of the TRAIN.COM project is to design and apply a training system in basic machinery maintenance using a new technology called augmented reality. This system will improve the basic skills of machinery operators related with a safe maintenance of their machines and not only with their operation. The Augmented Reality (AR) is the term to define a direct or indirect view of the physical environment in the real world, which elements combine with virtual elements in order to create a mixed reality in real time. So, it consists in a group of devices which add virtual information to real information. This is the main difference with virtual reality, because it doesn’t replace physical reality, but superimposes virtual data on real world. This project is going to be focused in excavation works for two reasons. Firstly, because of intensive work, which emphasizes the necessity of preventive maintenance. Secondly, because of the enormous quantity of self-employers and SMEs, who own machines and are working for others companies. This project is going to be based upon the outcomes obtained in the project “Training system for mechanical digger operators”, in which one of the most important developments was maintenance training. Furthermore, it included a experimental system based on PDA of which function was to support the learning through the use of checklists. The system pretends to enhance the training of operators in the field of maintenance, through the use of Augmented Reality. To reach this aim, the project will provide a system which will allow to select maintenance operations by means of a interface easy to use by the operator.

The NORW project is related to development of studies in English for construction managers in Poland and Norway (English as a language of instruction). The project will cover development of some new courses, modules and curriculum as well as modification of existing ones. New curriculums will come into being in cooperation with sector of small and medium – sized enterprises. The project will create two first courses organised in the blended learning mode of teaching: “Economy and Financial Management in Construction” and “Construction Management”. Need for the courses was confirmed during numerous research works and projects and contacts with Polish, Norwegian and other European construction companies. Operational goals of the project are: increasing the attractiveness of teaching at Universities and increasing the professionalism of construction managers running the European funded projects in construction. Detailed goals are: creation of the didactical internet platform for teaching elements of management in construction together with didactical materials and methodology, both in English and Polish. Project will be then transferred to other EU countries.
LIVING BUILDINGS AND THE ASSOCIATED R&D BASED MANUFACTURERS; THE REVOLUTION TOWARDS EVOLUTIONARY CONSTRUCTION

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ABSTRACT

The construction industry is not sustainable. The statistics give a clear picture. Expressed in percentages of the totals in the Netherlands and when calculated over the total lifecycle, from the early start to the processing of waste after demolition, energy consumption is more than 50%, CO2 emission is more than 50%, waste production is 35%, road transport is 25%, failure costs is more than 15%, average profits of construction companies are less than 2% of the turnover. The contribution of the construction industry to the GNP is 11%. The global figures will probably be worse as cooling requires disproportional more energy than heating. Practitioners and scientists all over the world agree that the construction industry with the associated structure and culture should be changed fundamentally. In this paper a great design of a sustainable construction industry is presented. Using "attribute listing" as method, the contours of a future Construction Industry is described in 50 typical characteristics and attributes each of them in full contrast to the current situation. The result is remarkably close to the “normal” world and can be considered as Evolutionary Construction with Living Buildings. This is darwinism for construction industry. Sustainable buildings can only created by variation, selection and reproduction. Like car producers, building producers will develop new buildings from existing buildings. Each new or adapted building will contain the experience and knowledge accumulated during a long series of already realized buildings. As result, the value of buildings will be at least twice as much, the prices at least 50% lower and the delivery time at least 50% shorter. This seems to be a revolution but it is shown that a few early adopters have implemented already some parts of the defined changes. In this paper the basic principles and thoughts, which have been used for this design work, are presented. In 2012 a book will be published on Evolutionary Construction.
DRIVERS OF CIVIL ENGINEERING

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Keywords: Key indicators, Civil engineering, Market change

Civil engineering uses copious amounts of natural resources and changes nature into a built environment. In the industry, ecologically sustainable development is everyday-life in the business and there are a range of technologies developed with a cradle to cradle philosophy. In the European Union, civil engineering projects have been a part of creating economic competition requirements and raising the so-called new member states to the level of the old ones. To reduce the negative effects of the economical downturn, the old member states have also invested in infrastructure. These examples reveal the role of civil engineering in policymaking.

However, the situation is changing because new, international construction firms specialised in the realisation of demanding projects have emerged in the civil engineering industry. Once a closed market, civil engineering is now turning into a genuinely open market. Previously, forecasting the industry consisted mainly of assessing the public sector’s budget realisation, but now the industry is gradually moving over to a market-based model. This introduces an opportunity to assess the construction market by means of market research. Moreover, the opening and globalisation of the market presents additional information needs.

Since 1993, the research group has gathered barometer-type information from designers and contractors for economic cycle forecasts. In addition, the group has had at its disposal realization information and information regarding changes in the companies operating environment. The goal of the research has been to distinguish from the information flood those pieces of information that best predict future development. Based on a statistical analysis, we have developed a leading indicators system for the operative planning of civil engineering industry companies and for the direction of contractors’ procurements.
AN EVALUATION OF CONSTRUCTION SPEED PERFORMANCE FOR BUILDING CONSTRUCTION PROJECTS IN UK AND GERMANY

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Keywords: Construction speed performance, International benchmark, Simple linear regression, Statistical adequacy of categorization

ABSTRACT

It is aimed to design a study that facilitates a fair comparison of construction speed performance for residential and office developments in UK and Germany. The definitions of the populations are restricted hence there is a necessity to construct a common basis for two different data sets. Subsequent to data base filtering, random sampling was performed via computer algorithm and 200 observations from each location were retained in the samples. Available quantitative variables were utilized to create factors and the response variable. 2 sample t-test was designed to test the group differences between two samples resulted in no substantial variation exists between population means. Limitations applied to 2 sample t-test forms a motivation for further investigation and in this context a factorial study is designed. This enables to observe the effect of not only the location factor but also the hypothesized factors that may influence the mean response. The analysis yielded that project location causes a significant variation in the mean response when factors regarding facility, standard and height are taken into account. Consistent with the complexities involve in construction projects, it is concluded that neglecting the effect of construction speed related factors and only taking project location into account would not be an appropriate approach for a post ex facto research where observations can not be controlled.
USE OF ARTIFICIAL INTELLIGENCE TO PREDICT THE ACCURACY OF PRE-TENDER BUILDING COST ESTIMATE

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Keywords: Accuracy, Artificial Neural Network, Cost, estimating, Modeling, Pre-tender

ABSTRACT

Pre-tender estimates are susceptible to inaccuracies (biases) because they are often prepared within a limited timeframe, and with limited information about project scope. Inaccurate estimation of project uncertainties is the underlying cause of project cost overruns in construction. Typically, cost engineers and quantity surveyors would add contingency reserve to a pretender estimate in order to account for any unforeseen cost that may arise between the date of the estimate and the projected completion date of the project. The traditional 10% rule of thumb for estimating contingency is subjective - based on experience and expert judgment, and are often inadequate. In the research reported in this paper, we propose that learning algorithms trained to use the known characteristic of completed projects could allow quantitative and objective estimation of the inaccuracies in pretender building cost estimates of new projects. The study assumes that the accuracy in the initial estimate (bias) of a completed project is the difference between the actual project completion costs minus the pretender cost forecast expressed as a percentage of the actual project completion costs. A three-layer ANN model of feed-forward type with one output node was constructed and trained to generalise nine characteristics of 100 completed projects and the cost data from those projects. The nine input variables of the model are project size (measured by number of storeys and gross floor area), principal structural material, procurement route, project type, location, sector, estimating method, and estimated sum. Estimate accuracy (bias) was used as the output variable. The prediction power stands at 73% correlation coefficient, 3% of Mean Absolute Error and 0.2% Mean Squared Error. It was found that in more than 73% of the test cases the predicted estimate bias did not differ by more than 8.2% from the expected (Maximum Absolute Error). This means that amount of estimate bias predicted by the ANN are similar to what actually occurred. The trained ANN model can be used as a decision making tool by cost advisors when forecasting building cost at the pretender stage. The model can be queried with the characteristics of a new project in order to quickly predict the error in the estimate of the project. The predicted error represents the additional contingency reserve that must be set aside for the project to cater for cost overruns. The model can also be extended to forecast actual cost of a project when the estimated cost is known.
ENDOGENOUS RISK IN UNBALANCED BIDDING

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Keywords: Unbalanced bidding, Unit price contracting

ABSTRACT

Models of unbalanced bidding can be categorised as two types. The first category assists clients in detecting and contractors in optimising skew bidding. More theoretical oriented models of the second type focus on predicting bidding behaviour in order to study market efficiency. None of the models in the latter category have incorporated risk as an endogenous variable. A model of such is presented in this paper. The model shows that exposure and aversion to risk greatly influences bidding behaviour. Anecdotal evidence then point to the institutional setting of the Swedish construction market as suitable for studying contractor risk perception.
COMPARATIVE STUDY ON THE COMPOSITION OF ENERGY BILLS

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Keywords: Investment appraisal, Energy costs, Consumer, Energy bill

ABSTRACT

Financial appraisal is an important aspect in adopting techniques that reduce the (fossil) energy use of buildings. When financial appraisal of an energy technique takes place, fixed prices for the form and amount of energy are often used and are multiplied by the estimated amount of energy savings. However, after a certain time period an energy bill for the user of a building only partially shows variable prices depending on the form and amount of energy. Many costs mentioned by a common energy bill are time related or are related to the national political regime. Infrastructural costs depend for example on the type of connection you have to the grid. These costs form an annual fee. The VAT or additional energy taxes that need to be paid, depends on the political regime and are often expressed in a surcharge in terms of percentage. This paper focus on the differences between marginal and average energy costs and the differences in variable and fixed energy costs. The impact price differences have for the financial appraisal of energy saving techniques for multiple actors is shown by conducting a comparative study on energy bills. It shows that marginal energy costs are significant lower than average energy costs.
STRATEGIES FOR THE COST-EFFECTIVE TECHNICAL MANAGEMENT OF HOUSING STOCKS

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Keywords: Technical management, Housing stocks, Strategies, Existing buildings

ABSTRACT

By focusing on the existing residential buildings, the technical management of the housing stock has become the most important duty of the technical departments in German housing companies. As a research field, the existing residential buildings are underestimated so far. There are no scientific studies that use the experience of activities (e.g. repair, maintenance, alternations, additions) on existing residential buildings and their influence factors for the rational, cost effective and systematic selection of future activities. That’s why the objective of the study is to provide strategies for the cost-effective technical management of the housing stock.

This research is based on the empirical study of 2939 activities carried out from 2003 to 2007 on a typical housing stock in western Germany. The housing stock includes 2164 dwellings with a total living space of 152,755 m². The apartments are located in 251 multi-family houses of different ages in large cities in western Germany. The housing stock is managed by a strategically attractive housing company, which has adapted her business to changing market conditions through diversification.

Using the methods of descriptive statistics, costs and cost key values of the activities are presented in accordance with the management concepts renting, privatization or condominium. The cost key values are calculated separately for the dwelling areas (units) and common areas of the housing stock. The largest costs and cost key values occur when the management concept privatization is applied. In the common areas, the cost key values of the investigated activities are e.g. 8.7 times higher when applying the management concept privatization then renting. The cost key values of the management concept condominium are 15 times less than the cost key values of the management concept renting.

When comparing the calculated cost key values with appropriate literature values of other German housing companies, the calculated cost key values are well above the benchmark. Overall, the studied housing company is investing twice as much in its housing stock as the comparison companies on average. The high level of investment is mainly due to the management concept privatization.

This raises the question of which activities must be carried out on the existing housing stock and which not?

With the implementation of the activities the duties of the technical management of the housing stock will be met. The duties of the technical management are divided into the maintenance and adaptation requirements. Cost reduction potentials have those activities that go beyond the responsibilities of technical management.
In compliance with the obligations of the technical management, based on the causes of the activities, strategic recommendations are derived to reduce costs. The benefits of the strategic recommendations will be evaluated with the identification of potential cost savings. The cost reduction potentials are different for dwelling and common areas of the studied housing stock. The investigation shows the cost reduction focus on the common areas. 40% of the cost in the common areas of housing stock can be saved from a technical point of view. Looking for management concepts, in the management concepts renting and privatization arise similar costs savings of 40% while in the management concept condominium reveals no cost savings.

The identified potential cost reductions are the final opportunity to derive a concept for the rational selection of activities on the housing stock. The general omission of the not technically necessary activities is deemed critical for the long-term user-oriented operation. It is proposed that the not technically necessary activities are evaluated by using a multi-criteria decision making model (AHP and cost-effectiveness analysis). With the help of the model, the activities with the best cost-benefit ratios are proposed for implementation.
A REAL OPTIONS APPROACH TO EVALUATE INVESTMENT IN SOLAR READY BUILDINGS

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Key Words: Sustainability, Photovoltaic, Energy, Investment Analysis, Real Options

ABSTRACT

Sustainable building technologies such as Photovoltaics (PV) have promising features for energy saving and greenhouse gas (GHG) emissions reduction in the building sector. Nevertheless, adopting these technologies generally requires substantial initial investments. Moreover, the market for these technologies is often very vibrant from the technological and economic standpoints. Therefore, investors typically find it more attractive to delay investment on the PV panels. Nevertheless, they can prepare “Solar Ready Buildings” that can easily adopt PV panels later in future at the optimal time; when their prices are lower, energy price are higher, or stricter environmental regulations are in place. The conventional valuation methods such as Net Present Value (NPV) are unable to identify the optimal timing for investing in the PV panels. Hence, in order to avoid over- and under-investment, the decision makers should be equipped with proper financial valuation models that help them identify the optimal investment timing. We apply Real Options Theory from finance/decision science to create an investment valuation framework for finding the optimal time for investing in PV technologies. Our proposed investment analysis model uses experience curve concept to model the changes in price and efficiency of the PV technologies over time. It also has an energy price modeling component that characterizes the uncertainty about future retail price of energy as a stochastic process. Finally, the model incorporates the information concerning specific policy and regulatory instruments that may affect the investment value. Using our mode, investors’ financial risk profiles of investment (i.e. Cumulative Distribution Function of the Investment Value) in the “fixed” Solar Building and “flexible” Solar Ready Buildings will be developed. This will determine the Financial Value (if any) of investing in the Solar ready building and identify the optimal time for installing the PV panels.
BUILDING RENEWAL ON SOCIAL HOUSING – CASE STUDY ON THE RUBEM BERTA SETTLEMENT, PORTO ALEGRE, BRASIL

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Keywords: Social housing; Design; Building renewal; Sustainable construction; Waste reduction

ABSTRACT

This study proposes a method and presents proposals to re-qualify a social housing complex, with diversification and expansion of units. The construction of large social housing condominiums can be criticized from several points of view. These projects have limited financial resources and there is a gap among the project and user’ requirements, generating a low quality product, which have an accelerated degradation and generate more maintenance waste in life cycle. Building renewal is a form of recycling and has influence in social, economic and environmental issues. The aim of this paper is to propose a design methodology for the renovation, which be sustainable and oriented on value creation. It consider environmental and economic feasibility based on embodied energy in materials and hedonic price models, respectively. We conducted design simulation, focusing on a typical housing complex, located in the Rubem Berta settlement, in Porto Alegre, Brazil, and verify a potential for value adding. This work contributes to the discussion of alternatives to social housing deficit in Brazil.
PASSIVE HOUSE NETWORKS: A SOCIAL INNOVATION TARGETING INNOVATION

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Keywords: Buildings; Energy efficiency; Innovation diffusion; Technology adoption; Business networks

ABSTRACT

This study examines opportunities for the emergence of SME networks regarding highly energy-efficient housing, as well as the barriers they face. A theoretical innovation diffusion model is developed from the point-of-view of social and environmental entrepreneurship and sustainable consumption. The qualitative analysis reflects key elements from the theoretical model and is based on a representative case study of a successful passive house network located in the Belgian Flemish Region. Data were gathered during the emergence of the network, by means of participant observation and action-based (thematic innovation) research. Interviews provided further supplementary information. The study concludes that the successful emergence of an SME network regarding highly energy-efficient housing requires a holistic approach, in which both enterprises and clients are guided in each step of the innovation-decision process. In their role as intermediaries between clients and firms, change agents should be supported by policy that facilitates networks for innovation diffusion.
SYSTEM INNOVATION FOR SUSTAINABLE BUILT ENVIRONMENTS: THE CASE OF LIGHT EMITTING DIODES

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Keywords: High technology, Light emitting diodes (LEDs), System innovation

ABSTRACT

The United Kingdom (UK) government policy is increasingly directed at transforming the built environment to an environmentally sustainable one. The government, for example, has set a target for a reduction in carbon emissions by 80% by 2050 compared to 1990 levels. A large number of new policies and regulations are being introduced to minimise the impact of the built environment and the construction industry on the environment. These pressures are inducing a large amount of product and process innovation across distributed networks: manufacturers, suppliers, installers, clients, users, and so on. To address this challenge, this research suggests that the explicit adoption of a multi-level perspective of sustainable transition management as a way forward. The key point of the multi-level perspective is that transitions or long-term changes come about through interplay between processes at different levels in different phases. This model consists of three levels: socio-technical landscape, regime, and technical niches. This paper reports on an ongoing Construction Knowledge Exchange funded project which is tracking, real time, the start-up and growth of a company which is developing and introducing a range of leading edge light emitting diode (LED) technologies. Interim results will be presented with the focus being on the distributed interaction between the principal actors: a LED module manufacture, a luminaire (light fitting) manufacture and a range of end user.
DIVERSITY INTERVENTIONS FOR A SOCIALLY SUSTAINABLE CONSTRUCTION INDUSTRY

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Keywords: Best practice; Cultural diversity; Management strategies; Construction industry

ABSTRACT

Major construction sites in Australia have an above average presence of ethnic minorities. These groups and the interfaces between them require effective management in order to meet the social imperatives of sustainable design and construction. A survey of 1155 workers and 204 managers on Sydney construction sites respectively, found a significant level of normalisation of negative forms of cross cultural interaction. Yet it was also found that anti-racism programs are not currently a management priority and that they generally lack sophisticated community relations aspects. This paper presents the results of a desk-top study of leading global companies within and outside the construction sector which have won international awards and recognition for their cultural diversity strategies. A key insight is that the companies profiled see diversity as a key resource and as an opportunity rather than a risk which is best harnessed through long-term and on-going commitment of senior management. These leading companies also recognise that cultural diversity strategies operate at three levels - in terms of its relationship with its own workforce; its relationship with its clients and; its relationships with the communities in which it operates - and if properly managed it can be a source of competitive advantage.
INTERNATIONAL STRATEGIC ALLIANCES IN CONSTRUCTION: PERFORMANCES OF TURKISH CONTRACTING FIRMS

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Keywords: Strategic alliance, International construction, Turkish contractors

ABSTRACT

Firms need various resources and capabilities in order to compete with each other effectively. These resources and capabilities can be acquired, developed internally, or obtained via an ongoing cooperative relationship with another firm through the use of a strategic alliance. The use of strategic alliances in construction industry has increased sharply over the last decade and they are particularly effective in helping a firm maintain a superior competitive position in dynamic environments. Alliances reportedly improve the competitiveness of the construction firms by providing access to external resources, by providing synergies and by fostering rapid learning and change. The purpose of this research is to identify the success factors and key components of the development process of strategic alliances, and propose a process model of strategic alliances performances based on alliance conditions in international construction industry. The research involves a questionnaire survey conducted to the Turkish contracting firms operating internationally. Different types of projects constructed by Turkish contractors in Commonwealth of Independent States, Middle East Countries, African Countries, and other regions of the world between 2002 and 2009, were analyzed and used in the developments made in this study. The results indicate that shared risk, trust between parties, and equity are found to be the most important determinants of strategic alliance success. The research findings support the contracting firms enhancing their productive capacities and acquiring competitive advantages that enable them to increase alliance performances. The study also commences on how the identified factors enhance the effectiveness of the participating firms’ competitive strategies by providing for mutual resource exchanges (technologies, skills, or products).
SOCIO-TECHNICAL SYSTEMS INTEGRATION: CONDITION FOR SUCCESS

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Keywords: Systems integration, Sustainable urban development, Network, Case study

ABSTRACT

Today, many new urban areas, such as cities, towns, villages, or districts, are being built worldwide and their completion requires the development of a number of infrastructures. Among others there is a need for energy and drinking water provision, waste management and wastewater treatment, transport facilities and so on. Each of these societal functions can be conceptualized as part of separate socio-technical systems. Traditionally urban planners consider each of these socio-technical systems independently from each other.

In the last decades, increased environmental consciousness has been pushing cities and municipalities to minimize the environmental footprint of, among others, newly developed urban areas. One of the possible strategies to do so is to make a transition towards a circular urban metabolism, as supported by Herbert Girardet. This means that the material and energy cycle should be closed. In other words, the aforementioned socio-technical systems have to be locally integrated to each other (e.g. domestic waste can be used for energy provision or sewage as a source for generating transport fuel, etc.).

This process, here referred to as ‘systems integration’, requires the collaboration of a number of actors whose interest, expectations and working culture may greatly differ from each other. These differences may lead to tensions that need to be resolved before the integrated systems can be realized. Moreover, there is not one single way through which systems integration can be achieved. Outcomes highly depend on who takes responsibility for the realization of the system, which stakeholders are involved in the design process, to which degree and how.

Finally, already existing technological landscape may also strongly influence, or even limit the path that systems integration may take. For instance, actors may push for solutions that build upon rather than compromise the technological solutions they already invested in.

In this paper, we try to understand the tensions that emerge when integrated systems are developed. By analyzing the processes behind urban developments where various socio-technical systems have been (tentatively) integrated, we aim to identify the necessary conditions for systems integration at the urban level. Our empirical material draws upon two case studies: Hammarby Sjöstad in Stockholm, Sweden, and EVA-Lanxmeer in Culemborg, the Netherlands. Moreover, our analysis will be based on insights from both socio-technical system theory and actor-network theory. Hammarby Sjöstad was planned and initiated from the top down by the City of Stockholm, as an integrated system. In collaboration with the infrastructure companies of the city, the Hammarby Model was created in an attempt to close the material and energy flows of the district as much as possible. EVA-Lanxmeer however, was initiated from the bottom up, by individuals and experts interested in sustainable living. It is only later on that the municipality of Culemborg became involved in designing and constructing the district. Integrated solutions were considered throughout the process, however only some of them could be realized.
Our cases show that when realizing integrated systems, it is crucial that all actors are in place. If for one reason or another, a certain actor refuses to participate, strategies (or a consensus) must be found to convince and/or force him (her) to participate or the system has to be changed to function without the actor. Otherwise, the integrated system cannot be realized. Moreover, our analysis also shows the need for a concept keeper that should consistently guard and push forward the integrated vision for the district.
THE IMPACT ON PROPERTY AND SOCIO-ECONOMIC DEVELOPMENT RESULTING FROM ROAD TRANSPORT CORRIDORS IN AFRICA: A CASE STUDY

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Keywords: Cost of corridors, Development corridor, Nodal points, Property development, Socio-economic development, Spatial development initiatives

ABSTRACT

The development of road corridors are important, having extensive impacts, substantially wider than the cost of the actual road construction. The resultant property and broader socio-economic development is visible over a wide spectrum, but problematic to measure.

In order to evaluate these impacts it is necessary to analyse the theoretical basis of corridor development and to measure and evaluate the outcomes. This was undertaken by tracking the possible development of corridors in Africa as a whole, and by specifically evaluating the outcomes of the Maputo Development Corridor (MDC) that stretches over 590km form the economic heartland in South Africa, to Maputo, the capital of Mozambique.

An extensive literature review was undertaken, covering the period from inception in 1996, to the present. Quantified field studies were done and qualitative observations made.

The outcome of the study indicates general consensus that many development objectives have been satisfied, whilst problems are encountered to establish extensive quantative data. It is relatively easy to determine impacts on traffic patterns, tourism, etc. However, it is very difficult to substantiate comprehensive socio-economic impacts, wealth creation and property development resulting directly from a corridor development. The so called “trickle down” effect is very evident, falling in the domain of “visual evidence and opinion” rather than hard quantative data. Whilst the cost to establish a corridor is determinable, the resultant financial rewards in a wider context is difficult to adjudicate.
LEADERSHIP IN CONSTRUCTION ORGANIZATIONS AND THE PROMOTION OF SUSTAINABLE PRACTICES

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Keywords: Construction organization, Leadership, Leadership style, Sustainable practice

ABSTRACT

The construction industry is a very important sector in achieving society’s sustainable development goals; however the change towards sustainability is a process that presents a leadership challenge. Construction organizations need leadership that provide the collective vision, strategy and direction towards the common goal of a sustainable future. The aim of this paper is to critically examine the role, drivers and factors affecting leadership in the effective implementation of sustainable practices in construction organizations. A review of relevant literature and preliminary qualitative results from an in-depth interview with eight (8) leaders in United Kingdom construction consultant organizations, including sustainability directors, managers and consultants is presented. Analysis of the collected qualitative data revealed that, one major driver for construction organizations to pursue sustainability is to gain reputation and to win more contracts. However, one major challenge facing leadership is the lack of client demand for sustainability. Such results underline the need for committed and authentic leadership in the promotion of sustainable practices in construction organizations. This establishes the basis for further investigation in an on-going doctoral level research on the role of leadership in promoting sustainable construction practices.
COUNTERFEIT CONSTRUCTION PRODUCTS FROM LOW-COST SOURCING COUNTRIES

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ABSTRACT

The U.S. Federal Bureau of Investigation estimates that two percent of all US airliner fasteners are counterfeit and that at least half of those are dangerously deficient. Sadly, a failed fastener was recently blamed in the crash of a state-of-the-art B-2 stealth bomber. Economically, the counterfeiting “industry” does twice the business worldwide as the illegal drug trade. But what does the practice of counterfeiting mean for the construction industry? The answer is injury, death, and economic loss. Recent events include a worker killed while welding when a counterfeit “Motorola” battery exploded. Workers have been injured when counterfeit pipes and valves have failed when placed under pressure. Concrete has failed on China’s newest high-speed railway before the $12 billion project is even completed. The culprit? Fake fly-ash that looks exactly like the real thing and can only be detected through laboratory testing. The media has been filled with news stories in recent years about the problem with counterfeiting, copyright infringement, intellectual property violations, the grey market (the trade of something legal through unofficial, unauthorized, unintended distribution channels), the practice of passing fake raw materials off as the real thing (see fly-ash above), and the deliberate manufacture of inferior products and bribing officials to accept them, or selling the products to a local subcontractor who installs them and covers them up before the owner or prime contractor discovers them. This last scenario happened to one of the world’s largest international construction owners. Though China is usually the country identified as the source of these problems, research by the research team has indicated that China is not the only source country of these problem products. While over 85% of the problem is estimated to originate in China and Hong Kong, nations traditionally allied with the US are also identified as source nations. In fact approximately five percent of the problem products reportedly originate in US ally nations Taiwan, Pakistan, and the UK. These figures are based on items seized by U.S. Customs and Border Protection agents and are for all products. An international team of investigators spent two years conducting an investigative study that entailed 192 face-to-face interviews conducted in seven countries. Those interviewed were executives, procurement officers, and quality managers for some of the world’s largest construction owners, contractors, insurance companies, manufacturers, and suppliers. Also interviewed were government and pseudo-government officials. Preventative actions for buyers that should be taken from this research are supply chain management and training. For instance, if China is going to sell to the west, they need to understand how westerners feel about counterfeiting. Conversely, if the west is going to buy from China, westerners need to understand the risk and send corporate representatives to China to oversee production. This can mean third-party verification, resident inspection, extensive use of product material identification (PMI), or many other methods of inspection. As for training, the buyer must train the people that they retain to manufacture for them in low-cost sourcing country to manufacture things to western standards. They must train their own people, both in their Procurement Division and their last line of defense, their field personnel. Finally, the construction industry must train law enforcement personnel, especially customs and border patrol personnel in what to look for. U.S. Customs officials interviewed as part of the research
said that “construction items are not on our radar. We don’t know what to look for. Please train us.” The results of this research are shared in this paper.
THE ROLE OF RESPONSIBLE SOURCING IN CREATING A SUSTAINABLE CONSTRUCTION SUPPLY-CHAIN

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Keywords: Construction materials and products; Procurement; Projects; R&D; Sustainability

ABSTRACT

Responsible sourcing (RS) provides a means to manage and ensure the attainment of sustainability objectives by procuring materials with a certified provenance. It is demonstrated typically through an organisation’s procurement policy, via its purchasing decisions and practices, and addresses a range of environmental, economic and social considerations. Use of RS provides a pragmatic link between the ‘triple bottom line’ aspects of sustainability and greater accountability and traceability in the supply-chain. Many people will already be aware of similar schemes and supplier auditing in other sectors (e.g. FairTrade and Rainforest Alliance), but there is no such prominent position for responsible sourcing in the construction industry, with the exception of FSC/PEFC schemes for timber.

Recent developments suggest this situation will change imminently. In the UK, the government requires that 25% of construction products shall be from schemes recognised for responsible sourcing by 2012 and major contractors are considering raising this target even further for major commodities like aggregates, metals, steel, concrete, bricks and glass.

Construction stakeholders have also raised serious questions about the environmental and ethical credentials of sourcing of materials from some countries. For these reasons, the construction industry is becoming increasingly aware of the role that responsible sourcing can play in creating, measuring and demonstrating a sustainable supply-chain; in addition:

• Certification and assessment standards now exist (e.g. BES6001)
• Credits can be gained in assessment schemes such as BREEAM, Code for Sustainable Homes and CEEQUAL
• A reasonable range of certified products is now available including aggregates, cement, concrete, reinforcement and bricks.
• There is a modest, but increasing market pull from clients and investors.

However, the construction industry lacks general awareness and expertise in RS; few people have the experience of developing such supply-chains and more materials suppliers need to offer certified products. New research is bringing together industry and academics to disseminate knowledge on RS, exchange good practice, create training materials and develop a research agenda. Early results from an industry survey and 12 company case studies show that major materials industries are instrumental to provision of RS goods; clients and major contractors will drive change in the supply-chain; robust supplier auditing can be used to engage sub-contractors; scope for enhanced reputation and market differentiation are encouraging many parties to seek certification; but questions remain over the cost of implementation, involvement of SME businesses and market demand.

This research has important implications; responsible sourcing has the potential to transform the construction supply-chain into a transparent and sustainable enterprise, but market forces rather than the notion of ‘doing the right thing’ are likely to determine its widespread adoption. Our research will map the way forward for RS in the construction sector by considering its context, markets and technologies and identifying critical research directions.
SUPPLY CHAIN PARTNERSHIP WITHIN HOUSING RENOVATION – APPROACHES FROM THE DUTCH HOUSING ASSOCIATION SECTOR

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ABSTRACT

Supply chain partnership within housing refurbishment has to date not been given much specific attention which may be found surprising because refurbishment is outgrowing new developments on the housing market and has specific characteristics that require adapted approaches to supply chain management. In this paper we explore the specific features of supply chain partnership within housing renovation, looking in particular at some innovative approaches in the Dutch housing association sector. From general literature on building process innovation, we derive a taxonomy of supply chain integration. By comparing the specific features of renovation with new development we critically assess the advantages and disadvantages of the distinguished forms. The theoretical assessment is tested against some innovative approaches in the refurbishment practice of Dutch housing associations.
LOCALISING THE SUPPLY CHAIN

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Keywords: Sustainability, Localisation, Supply Chain, Knowledge Management, Information Exchange Networks

ABSTRACT

The UK committed in 2008 to reduce its greenhouse gas emission by 80% by 2050. The construction industry is a key contributor to the greenhouse emissions and future legislative adjustments for the built environment are well underway. The industry will face many challenges and it is expected that its profile will be very different by 2050. The scenario that there will be pressure for the supply of labour, materials and components to be much more localised due to increased energy costs is very likely. In turn, supply chains, which currently are becoming increasingly long as the demands of projects become increasingly complex, will inevitably have to face the localisation challenge.

The long supply chains provide the increasingly high levels of technical input relating to design, manufacture, installation and servicing in the context of an industry anxious to maintain flexibility in the face of uncertain levels of workload and investment. These tall contractual hierarchies contain a massive amount of expertise but the contractual hierarchy constrains the effective management of knowledge and innovation through excessively long network paths, containing multiple, perversely incentivised, network bridges and gate keepers. Contractual relationships, knowledge management and information exchange networks define the localised supply chains and important work need to be done to examine the potential for these networks to establish and be maintained. Social network analysis can be employed to map existing supply chains and to provide predictive models for local supply chains in 2050.

The paper discusses how to best examine what the capabilities of the local supply chains today are and what their capabilities would be if they were specifically enhanced to meet 2050 challenges. These capabilities inform the supply chain management’s targets which mainly focus on continuous improvements of the supply chain increasing value and stimulating knowledge sharing and innovation. Sustainability targets are yet to be fully incorporated in the value equation, which is what the 2050 challenge requires; therefore particular attention is paid to it. It is suggested that exploring the location of intellectual capital in the construction supply chains, demonstrating how the use of BIMs and vertical integration of the supply chain might be exploited to provide interfaces between local supply chain actors and end-users, examining the logistics and embedded energy, comparing the today’s logistical demands with a 2050 localised supply chain scenario, is a starting point in developing the concept of the localised supply chain as a successful approach the sustainability problem.

The aim of the paper is to make a valuable contribution to the emerging research on sustainable/ green supply chains approaching it from a localisation perspective. Its presentation in the MISBE 2011 Conference provides an excellent opportunity for direct discussion and feedback to this approach for further research.
THE MANAGEMENT OF REQUIREMENTS IN SUPPLY CHAINS OF CONSTRUCTION DESIGN: WHAT CAUSES UNCERTAINTY IN INTEGRATED DESIGN APPROACHES?

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Keywords: Construction design, Requirements management, Supply chains, Uncertainty, Integrated design

ABSTRACT

Although a substantial amount of literature advocates the integrated collaborative design processes for construction projects, very little explicit knowledge exists about the impact of the integrated processes on project uncertainty. In contrast with construction site processes, which can in most cases be organized as a sequence of tasks mutually interlinked by technological interconnections, design is a highly interdependent and iterative process that needs different management approaches. To manage the complex interdependencies of design, managers need to make sense of how far-reaching the impact of addressing a particular requirement will be on project outcomes.

By using the theoretical dichotomy of wicked and tame problems, this paper conducts a study on a design and engineering mega-project to induce the shortcomings of traditional project management applied to complex design problems. This study develops a cognitive map of how a requirement propagates through the entire scope of an ill-structured design problem and contends that the traditional design management techniques do not capture the ill-structure of the design sufficiently. The paper finally develops a list of theoretical propositions and an accompanying set of practical recommendations that are based on the notion that design should be managed on the basis of distinguishing between wicked and tame parts of the problem. The study contributes to design management literature with an early normative framework for managing complex construction design.
BUILDING INFORMATION MODELLING AND THE CULTURE OF CONSTRUCTION PROJECT TEAMS: A CASE STUDY

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Keywords: ICT, BIM, TPO, Culture

ABSTRACT

It has often been asserted that the collaborative use of Information and Communication Technology (ICT) in general and Building Information Modelling (BIM) in particular across the temporary project organisation (TPO) represents the future of construction project delivery. Anticipated benefits include greater design coordination, reduced conflict, efficiency savings, and a valuable information stream for use throughout the operational life of a building. However the success of BIM in a TPO is dependent upon the presence of participant firms that share compatible technologies, business processes, and cultures, led by people who hold attitudes and display behaviours conducive to collaboration. Research suggests that these conditions are unlikely to exist throughout a TPO, or even within the entirety of its first tier stakeholders, and that this arises as a consequence of their individual attitudes towards ICT-mediated collaboration, and their subsequent decision-making in this regard. Their collective interaction thereafter defines the culture of the TPO, more often than not resulting in differentiation, or fragmentation: true integration is the exception. This paper presents a case study of a TPO, identifying differentiated cultures within the project, and their causes. It suggests that careful selection of trading partners and thereafter focused attention to the establishment of a TPO may mitigate many of these negative outcomes.
SUPPLY CHAIN INTEGRATION CHALLENGES IN PROJECT PROCUREMENT IN MALAYSIA: IBS CONTRACTORS’ PERSPECTIVE

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Keywords: Industrialised Building System, Integration, Procurement, Supply Chain

ABSTRACT

The Malaysian Construction Industry Master Plan (CIMP 2006-2015) identified the innovative approaches of Industrialised Building Systems (IBS) and its supply chains as having important roles in improving the productivity and quality of construction processes. However, the fragmented scenario in the construction industry leaves the IBS supply chain players with noticeable difficulties in terms of competitiveness and efficiency. Supply chains in IBS involve relationships between many organisations and processes, with the evolution of many specialised roles and embedded relationships. The procurement method is utilised as a mediator tool and as the means of controlling integration between players. Although efforts have been undertaken to enhance the IBS practice in Malaysia, various integration challenges have arisen from amongst the IBS players. There is an urgent need to improve the integration of supply chains and a good approach of supply chains integration should be fully established.

The purpose of the research is to identify the challenges of IBS supply chain integration with regard to existing project procurements. The methodologies involved a thorough review of literature and the qualitative method of using semi-structured interviews which were conducted amongst IBS contractors in Malaysia. The findings reveal role and responsibility, understanding the knowledge, risk liability, financial and contract matters and attitude and relationship are the challenge factors that hinder the successful integration between the contractor and other related parties. Such issues require much attention in pursuance of greater integration within the supply chains in the Malaysian construction project. The findings of the research will provide valuable theoretical support for integration in order to strengthen the value of supply chains in the Malaysian construction industry.
INNOVATION IN COLLABORATION FOR BELGIAN BUILDING PROCESSES

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Keywords: Innovation, Collaboration, Partnering, Comparative, Belgium

ABSTRACT

Today in many of our neighbouring countries ‘working together in integrated project teams’, using groupware and BIM, is the future way of process thinking in the building practice. Everyone is convinced that ‘teams outperform individuals’! Especially when diverse skills, judgement and experiences can enhance the project’s outcome.

This paper contains the first phase of a comparative study of IPD processes, ways of enhanced collaboration and communication between the different stakeholders in the supply chain of projects abroad, to solve the problems occurring in traditional construction processes used in Belgium. Before the search for solutions can start several questions need an answer first. ‘Which types of building processes are being applied in Belgium today? From which problems do stakeholders in construction suffer? Do all stakeholders understand the problems? Why do Belgians keep following these traditional processes? Are they already aware of the progress in innovative processes made in our neighbouring countries? Is there economical, professional, legal or political support for them?’

This paper is written as a part of a PhD research, which starts with an exploratory study to be able to clearly define the problems occurring in the traditional Belgian building processes.

Future challenges comprise an analytical study of integrated project delivery methods used together with adjusted contracts to enhance the building processes in the Netherlands and the UK. There building teams, integrated contracts like design & build and turn-key, public private partnerships, alliances, SPE’s, … are intensively used. The restriction of the monopoly status of the architect in Belgium together with preserving at all times his incompatible relation with the contractor will be considered first. The following questions will guide the PhD research in the future: ‘Which future perspectives can Belgium have? What kind of integrated methods are successful in our neighbouring countries? Are there any possibilities to implement them within the Belgian legislation or is a profound revision inevitable? Will an evolution be enough or is a real revolution to be expected? ...’
COLLABORATIVE NETWORKS SUPPORT SUSTAINABLE BUSINESS SETTINGS REGARDING INTEGRATION OF DESIGN AND CONSTRUCTION

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Keywords: Collaborative networks, Assessment, Integration, CPFR-model, Total-cost-of-ownership

ABSTRACT

Introduction: Collaborative networks (CN’s) represent systems of legally independent partners in industries and services that cooperate on shared economic sense, coordinate and communicate in changed business paradigms using systems supported by Internet technology and web-based services. Actually, collaborative networks represent promising business paradigms to cope with the current turbulence on markets. Considering design and construction of private and public property collaborative networks encompass opportunities like enlargement of capacity, cost effectiveness and avoidance of doubles. Participation in CN’s provide firms not only enlargement of their business capacity, but also an opportunity to start a new economic life cycle. Traditional business settings of the construction process represent organization of craftsmen. Current business settings are based on industrial approach of the construction process.

The adoption of Internet and web-based solutions offer a challenge to change and indicate speed in workflow management and exchange of information, which are topics in managing the construction process. Internet and information technology appear to be enablers of CN’s. For instance participants in the construction process such as: architects, engineers, contractors, suppliers and subcontractors aligned to collaboration have to accept new roles, when they enter systems of CN’s.

Problem: Considering collaborative networks and the traditional business settings of the construction industry the following questions are of importance to find a solution:

1. Are collaborative networks adopted by governments, industries, supportive industries, public services and private services? Are they legally supported by current national and international law?
2. How does the construction market and adjacent markets cope with collaborative networks to regulate competition and transparency?
3. How do we organize collaborative assessment of partners in collaborative networks?

This research paper has two objectives:

1. To identify ontology of collaborative networks focused on integration of design and construction.
2. To initiate an assessment model to test sufficiency of participants to enter collaborative construction industries’ networks focused on integration of design and construction.

Conclusion: Collaborative networks (CN’s) indicate transfer of total spatial solutions. The best back-up of contracts encompassing offers meeting the business standard “cost of ownership” are provided by collaborative networks. These networks show synergy between “economies of scope” and “economies of scale”. Collaboration means enlargement of capacity regarding design, engineering, construction and maintenance. Firm assessment of partners will contribute to sustainable collaborative networks that cover requirements set by
the public and private domain. Considering supply chain management, collaborative networks are able to implement the CPFR - model in the construction industry. The CPFR – model encloses collaboration, planning, forecasting, and replenishment. Strategy and planning of the CN’s containing design, engineering and construction are clearly focused on the investor and user. Supply chain management (SCM) is strictly focused on forecasting “time to market” and “time to volume” setting strict guidelines to all partners involved in the construction process. Logistics and the building process are submitted to fulfillment of the contract. Strict assessment of effectiveness and efficiency of partnership is measured. Necessary to arrive at CN’s realizing contracts with the guarantee of “total cost of ownership” in accordance with the investors’ specifications.
EXTENDED CONSTRUCTION SUPPLY CHAIN MANAGEMENT: RELATIONSHIPS, REWARDS AND RISKS

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Keywords: Supply Chain Management, Strategic Alliances, Competition, Construction Industry

ABSTRACT

Over the past decade, the UK construction industry has sought to exploit the rewards of supply chain management practice. Advocates of supply chain management are now proposing that enlightened stakeholders within the UK construction sector will seek to commercially benefit from improved supply chain understanding. Suggesting that extended supply chains, rather than discrete companies will compete and tender for future building projects. This paper explores construction industry capability to implement an extended construction supply chain culture. Where commercial solidarity prevails and supply chains, including small and mediums sized enterprises (SME’s) vie for construction projects and economic advantage.

To date, much of the innovation in construction supply chain management has focused on two short, bilateral relationships namely; the project centric relationship between the client and first tier main contractor and the organisation centric relationship between the main contractor and the second tier subcontractors and suppliers. Downstream supply chain relations with third and fourth tier suppliers and manufacturers have been limited. Despite recent advancements in construction supply chain management theory and practice many barriers continue to inhibit the realisation of fully integrated construction supply chains. Economic, social and cultural conventions require to be investigated to appreciate the complexity associated with the strategic alignment of extended supply chain stakeholders’ commercial and social interests.

Drawing on a model of supply chain maturity, the practicalities of extended construction supply chain relationships, rewards and risks are reviewed. Given the current structure of the construction industry, it is proposed that the attainment of extended construction supply chain management practice will require key industry stakeholders to develop innovative collaborative policies that will be progressive, organisationally supportive and commercially attractive to SME’s.
A CRITIQUE OF INTEGRATED WORKING AND PARTNERING

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Keywords: Integrated supply chain, Partnering, National Specialist Contractors Council, Key performance indicators, Subcontractors

ABSTRACT

Many authorities have supported the concept of integrated working or partnering. They claim a number of advantages of partnering such as greater co-operation, cost savings, timely completion of projects and improved quality but there remain a number of difficulties both at a theoretical and practical level. These difficulties manifest themselves in the views expressed by some specialist contractors, whose voice is all too often overlooked.

A number of issues can be seen in the responses of specialist contractors to questions put to them in the quarterly survey of the National Specialist Contractors Council. These include measures of interim payment periods, tender prices, suppliers’ prices, profit margins, contractual behaviour, methods of appointing specialist contractors and the time allowed to price a proposal. These measures can be compared to the state of the specialist contractors’ markets to reveal the underlying causes of main contractor behaviour and treatment of their subcontractors. For example, market constraints in times of economic difficulties may indeed directly affect such behaviour. If the gains and benefits of partnering were truly shared between all parties, then it is significant to note the views of specialist contractors and the fact that the difficulties they face in dealing with main contractors have not diminished over time.

Many of the perceived gains have been measured and reported as key performance indicators (KPIs) and these results are compared to the results of the survey of specialist contractors which has been tracked over a number of years.

It is shown that the divergence in opinions about the performance of contractors calls into question the gains to the supply chain in the construction sector claimed by the proponents of integrated working. Further, the practice of partnering has not extended its reach throughout the sector that might have been expected.

The conclusion drawn is that the drive to partnering has been a marketing exercise by contractors and not matched by practice. Instead it has allowed the strongest players in the building team to continue to take advantage of the weakest members and that the time has come to call the concept of partnering as practiced in the UK a failure.
THE INTEGRATED HOUSING SUPPLY CHAIN MODEL FOR INNOVATION: NARRATIVE ANALYSIS TOWARDS DEVELOPING PATHWAYS METHODOLOGY

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ABSTRACT

With anticipated population growth the significance of housing infrastructure provision is expected to increase in the next two decades. The Australian National Housing Supply Council estimates that around 3.2 million additional dwellings will be required in the next 20 years to accommodate a population growth from 2008 to 2028. Moreover, it also forecasts that the current demand-supply gap of 178,400 dwellings will increase to approximately 640,000 by 2028. According to the Australian Bureau of Statistics (ABS, 2010), the country currently needs to be building 17,400 homes every month. Housing supply, however, has oscillated between 10,000 to 16,000 dwellings per month since 1990. Based on the average number of approvals over the first three months of 2010, the current supply is around 14,500 dwellings per month. The shortfall means we are faced with a crisis in our capacity to plan, design and construct to meet our nations needs unless we act immediately to improve our capacity for a more efficient, effective and innovative supply system. The problems of the housing sector include; low profit margins for builders and subcontractors, high risk, fragmented supply, adversarial relationships between firms, wasted resources (time, cost and materials), low innovation, poor communication flows, low productivity and poor project management skills. The industry is highly resistant to change, tend to not have a holistic view of the industry and feel powerless to effect change. There are significant large national companies who are the market leaders in the residential sector who have some capacity to effect change however in reality it is suspected that this group struggles to do so in a whole-scale concerted manner. The underlying structural and behavioural characteristics create an overwhelming inertia that resists change. The sector's level of productivity, performance, competitiveness and innovation is linked to developing more sophisticated and focused integrated supply delivery solutions that improves coordination involving the various actors and stakeholders and which is aimed at reducing risk and costs. The development of integrated supply delivery solutions has not been extensively recognised in the Australian residential sector. The aim of this research project is to undertake a case study analysis of successful implementation of delivering an innovation to the housing sector which required an integrated construction supply chain model. The objectives were to: identify the barriers and enablers to adoption of the innovation; examine the characteristics of the process of integration of the construction supply chain towards adoption of an innovation and develop a methodological process pathway to adoption and diffusion model for an integrated housing construction supply chain. Although this study is one case study it represents a program of research being conducted with a newly formed national Australian Housing Supply alliance. The paper describes the theoretical background to the study and the results of a detailed case study.
CHAIN COLLABORATION BETWEEN A HOUSING CORPORATION AND TWO GENERAL CONTRACTORS, THE FIRST STEPS

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Keywords: Supply chain integration, Lean, strategic alliance, Housing corporation

ABSTRACT

Several housing corporations in the Netherlands have realized they cannot do it alone if they want to renovate their housing stock faster, cheaper and with a higher quality. More and more of these corporations are forming strategic alliances with contractors and other partners to reach these goals. They are applying principles of supply chain integration and lean on the total process of the building lifecycle, under the umbrella concept of Chain Collaboration (Ketensamenwerking in Dutch).

This article draws from active research executed on two projects which started in 2010 and are still under development. It focuses on the definition and design phase and describes the approach applied to implement the chosen strategies.
SUPPLY CHAIN INTEGRATION AND COLLABORATION - A RELATIONSHIP MANAGEMENT APPROACH

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ABSTRACT

In this research we examined, by means of case studies, the mechanisms by which relationships can be managed and by which communication and cooperation can be enhanced in sustainable supply chains. The research was predicated on the contention that the development of a sustainable supply chain depends, in part, on the transfer of knowledge and capabilities from the larger players in the supply chain.

Relationship management is a system that provides a collaborative environment and a framework for all participants to adapt their behaviour to project (and longer term) objectives. It is about open communication, sharing resources and experiences, exposing the ‘hidden’ risks in the project. The case studies suggest that leadership has a strong influence on the relationship management climate which needs to be facilitated and nurtured. Commitment and action by senior management (and, so, parent organisations) can have a strong impact on the team and relationship management culture, indicating relationship management has a high chance of failure when there is inadequate support from top management. Like all relational contracting approaches, trust between relationship management partners is important. The authors conclude that without a positive approach to relationship management a sustainable industry and continuous improvement are not possible. So, the authors postulate that a ‘sustainable supply chain’ is essentially tautological without the existence of a clear relational vision that leads to both soft and hard infrastructure to assist and inform decision making and encourage relationship building.

The research adopted a triangulated approach in which quantitative data were collected by questionnaire, interviews were conducted to explore and enrich the quantitative data and case studies were undertaken in order to illustrate and validate the findings. Handy’s view of organisational culture, Allen & Meyer’s concepts of organisational commitment and Van de Ven & Ferry’s measures of organisational structuring have been combined into a model to test and explain how collaborative mechanisms can affect supply chain sustainability.

It has been shown from the research that the degree of match and mismatch between organisational culture and structure has an impact on staff’s commitment level. A sustainable supply chain depends on convergence – that is the match between organisational structuring, organisation culture and organisation commitment.
DEVELOPING INTERACTIONS, DISENTANGLING CONTRACTION: EXAMINING PARADOXES OF INTER-ORGANISATIONAL RELATIONS IN CONSTRUCTING COLLABORATIONS

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Keywords: Collaboration, Paradox, Observations, Sense making, Time synchronicity

ABSTRACT

The positive nature of partnering to resolve adversarial relationships in the construction industry has been well-rehearsed. However, critics argued that espoused benefits of partnering have not materialised because business-as-usual prevails. Furthermore, scholars have insisted that more needs to be done to analyse emerging practices in inter-organisational collaborations. This study examines an emerging collaboration. Basically, the research sought to investigate effective knowledge sharing during the early stages of a real-life collaborative venture between three infrastructure companies. The case study was informed by participant observations and interviews with key people involved in forming the collaborative venture. Findings reveal a number of paradoxes that are perplexing on the one hand, yet generative in terms of actions on the other. These paradoxes relate to the three areas of sense making, formal methods and time synchronicity.
NEGOTIATING STRATEGIC-MANAGEMENT CONTRADICTIONS IN PRACTICE: AN ACTIVITY-BASED APPROACH

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ABSTRACT

Managing organisational activities challenges actors’ abilities to negotiate contradictions and paradoxes inherent in much human practice. Organisational theorists have suggested ways in which managers may address such contradictions, e.g. embracing them (Beech et al 2004; Smith and Tushman 2005) or separating and transcending them (e.g. Poole and van der Ven 1989). Price and Newson (2003) consider paradoxes from the construction-management literature perspective, and suggest that strategic-management success depends on strategists’ ability to create balance between paradoxical strategies such as rational versus creative strategies and strategy versus organisational effectiveness.

However, much of the literature on organisational paradoxes so far remains theoretical. To test the offered models, there is a need for empirical studies of how paradoxes and contradictions are negotiated in situated practice. There is also a need to explore innovative approaches and frameworks for such empirical studies. One such approach, proposed in this paper, is Strategy-as-Practice.

Over the last decade Strategy-as-Practice has grown as a distinctive field of strategic-management study (e.g. Whittington 2006; Jarzabkowski et al 2007), grounded in the broader social sciences’ “practice turn” (e.g. Schatzki et al 2001). Strategy-as-Practice focuses on strategising as situated, social practice constructed through interactions of multiple actors embedded in institutional contexts. In these situated practices, content, process, intention, emergence, talk and action are intricately intertwined, as are inherent contradictions that are part and parcel of dynamic activity systems (e.g. Engeström et al 1999).

The purpose of this paper is to explore how tensions and contradictions arise and are negotiated in strategy-management meetings in a large construction company. In 2008, the company revised its environmental strategies, focusing on one particular strategy: to be a sustainable builder of society. What did this strategy actually mean? What did management intend it to mean, and how was it made sense of by employees as the meetings unfolded? To answer these questions, we observed, recorded and analysed four strategy revision meetings with several actors across different levels in the organisation. This paper discusses how micro-level strategic activities are linked with broader institutional practices.

The interpretations of “sustainable development” were imbued with tensions, ambiguities and contradictions reflecting, among others, the paradox between rational versus creative strategies and that between strategy versus organisational effectiveness. The actors invoked different meanings that have been (re)negotiated and (re)conceptualised over time and across several institutional and organisational boundaries and levels. These meanings were used as rhetorical resources to pit opposing groups against each other or to align them, using the same “green” label.
REFERENCES


A SPATIOTEMPORAL PERSPECTIVE ON EMPOWERMENT IN PROJECTS

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Keywords: Chaos theory; Complexity theory; Empowerment; Spatiotemporal

ABSTRACT

The complex and dynamic nature of project environments presents both opportunities and challenges for the empowerment of individuals and teams. Yet, empowerment is a complex concept in its own right, taking on multiple forms across people, is contextually embedded and shifts over time. As research on empowerment in projects continues to grow, pertinent questions are emerging aimed at promoting the growth of empowerment theory and its applicability in practice. For example, how do organizations empower employees at different levels and still be able to achieve goal congruence across the organization?; how does empowerment manifest itself across project phases?; and how does empowerment manifest across co-located or geographically/physically spaced individuals on the same or different projects/teams across the same organization? The multiplicity and dynamism of empowerment in projects across three aspects - space, time and levels, and their intersections are examined within the context of the complex, dynamic and uncertain operational realities of projects. It is argued that such a spatiotemporal agenda is better understood through the lens of chaos and complexity theory, a perspective that reveals the way in which empowerment is intertwined with other managerial interventions and business strategies for the successful delivery of projects.
A NEW PROFESSIONAL IN NEIGHBORHOOD APPROACH

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ABSTRACT

In policy and governmental scientific discourses the statement is more and more heard that an effective approach to neighborhood renewal calls for a typical kind of professional, a so called ‘new professional’. This person must be given policy freedom to capitalize on his special capabilities in planning and decision making in neighborhood renewal. These professionals are not mainstream; they ‘make a difference’. They are not detained by the systematic and logic of their organization or by bureaucratic rationality. Characteristics of the new professional were found in the relevant literature. Because of that we typed them ‘the exemplary urban practitioner’. What they have in common is their attention to every day life (in neighborhoods) and a pragmatic problem orientation. They take part in relevant governance processes of policy making. In the actual neighborhood renewal this ‘exemplary urban practitioner’ gets a new, integrated task to solve complex problems bottom up, and finds challenges in the everyday life in urban communities. In their problem orientation they no longer regard housing, living, poverty, health, education, safety, etc. as separate issues. The question we work out in the paper/lecture is how these ‘new professionals’ obtain and create their policy freedom, and fill in this constructed policy context. We illustrate this practice with an empirical case study in the so called ‘krachtwijken’ of The Hague. We presents portraits of a ‘new professional’ operating in these districts. Qualities of the ‘new professionals’ have to do with personal qualities as engagement, guts, creativity, innovativeness, flexibility, and the necessary social skills. But they also have organizational skills such as strategically insight, policy networking skills, and entrepreneurship, to be able to be a ‘good’ governance partner.
RESEARCH METHODOLOGIES FOR STUDYING THE INFORMAL ASPECTS IN CONSTRUCTION PROJECT ORGANIZATIONS

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Keywords: Temporary Project Organization, Contradictions, Ambiguity, Conflicts

ABSTRACT

It has been argued that the informal aspects of construction projects play a significant role in the way the project coalesces and subsequently operates. These informalities (e.g. practices, systems, clans) may be real and visible, or simply perceived and thus invisible; commonly encountered in projects or specific to a particular project’s context; ethical/legal or unethical/illegal. These dimensions suggest a framework within which to describe the emergence of a project’s organizational behaviour. Non-functionalists and subjectivists argue that the informal issues can be best understood by using an emancipatory framework of investigation. This paper presents an approach to the design of research methods appropriate to such tasks. In doing so it accommodates various philosophical points of departure, and the blending of various methods, to construct rigorous analysis to deliver context specific outcomes.
ORGANIZATIONAL AMBIDEXTERITY IN THE CONSTRUCTION INDUSTRY

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Keywords: Ambidexterity, Exploration, Exploitation, Innovation, Procurement

ABSTRACT

Organizational ambidexterity refers to an organization’s ability to both exploit existing knowledge, assets, and positions for short-term profits and also explore new knowledge, technologies, and markets to enhance long-term development. Ambidexterity research has mostly focused on firm or business unit levels. Studies dealing purely with project or alliance levels in project-based industries are non-existent. The purpose of this conceptual paper is to examine if it is a useful concept for discussing sustainability and competitive advantage in the construction industry, to what degree ambidexterity is present, and how it may be affected by procurement procedures and project governance. Short-term project focus and decentralization inhibits learning from one point in time and space to another, making it more difficult to reap the benefits of exploration than of exploitation. Due to strong path dependence there is an apparent risk that construction industry actors may be trapped in suboptimal stable equilibrium by focusing too heavily on exploitation and too little on exploration. This paper discusses how procurement procedures and project governance can affect the possibilities to achieve ambidexterity in construction projects. Joint specification, partner selection, incentive-based payment, and collaborative tools are important means to affect ambidexterity so that a suitable balance between exploitation and exploration can be obtained in construction projects.
STANDARDIZING KNOWLEDGE: A STUDY OF THE CHANGING ROLES OF MANAGERS AND EXPERTS

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Keywords: Social practices, Roles, Knowledge management, Industrialized building, Construction process

ABSTRACT

Many organizations within the construction industry are currently developing standardized practices. Increased standardization involves new ways of organizing construction projects, changing interrelations between professional groups, setting a new culture, i.e. challenging the institutionalized way of being. It, for instance, leads to a concentration of key knowledge into specific knowledge networks and artifacts. This in turn creates new and/or strengthened roles of expertise within the organizations leading to a reallocation of knowledge, as well as power, from the project setting to centrally organized functions, specialist consultancies and knowledge networks. Based on two case studies of one construction company and one architect company, this paper examines the tensions and paradoxes inherent in these ‘new’ roles. In the study, 34 persons were interviewed; actors responsible for changing practices, developing tools and ensuring learning among employees. The study contributes to theory building within a research field that examines the emergence of new roles and practices in construction and the contradictions which arise leading to tensions and possible conflict. Many of the assumptions that underlie these new practices run counter to the established norms and local practices as well as to construction practitioners’ ‘intuitions’.
PARADOXES OF INNOVATION AND ARCHITECTURAL DESIGN: A MODEL OF DESIGN KNOWLEDGE GENERATION IN ARCHITECTURAL PRACTICES.

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Keywords: Organisational Paradoxes, Innovation, Architecture, Design, Teams

ABSTRACT

What are the organisational paradoxes that beset the design process in architectural firms? As innovative knowledge workers and system integrators architects are often called upon to produce innovative and custom designed buildings. Architects can be characterized as knowledge intensive professionals which help to lead innovation. However, most of the research conducted in design innovation and organisational paradoxes has had a product portfolio focus. For example, it has been claimed that product innovation relies on two seemingly contradictory and paradoxical processes in product development organisations: the exploitative and the exploratory. How might these concepts be related to architectural firms and design teams? Using the above concepts an initial model was developed and then tested in order to understand the paradoxical processes that architects employ when designing? How might design processes in service firms differ from either linear or dichotomous models of innovation with its origins in product development? An initial model is proposed which is then tested and refined. These questions are tested in a broader survey of 73 Australian architectural practices. The survey aimed to identify the linkages between exploitative and exploratory design processes in the firms and the organisational paradoxes which surround these A survey framework was developed which defined and highlighted to what degree architects instigate Radical or Incremental design changes in projects. The survey identified the extent to which Australian architects generate new design solutions after a particular design has been mandated. It concludes that these architects deliberately sought to foster highly paradoxical processes within their firms in the early stages of a project in order to create new design knowledge. Highly paradoxical processes, which oppose exploitative and exploratory design activities, tend to diminish as the project proceeds. Further research is needed to clarify if design processes with a high degree of paradox are where project innovation occurs. The paper concludes by outlining a model of exploitative and exploratory innovation and organisational paradox in knowledge intensive design firms.
CULTURAL HERITAGE INCULTURAL HERITAGE IN URBAN REDEVELOPMENT PROJECTS

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Keywords: Cultural heritage, Urban redevelopment, Stakeholder analysis, Strategies, Balancing costs and benefits

ABSTRACT

Due to technological, economic and spatial developments, various inner-city industrial areas have lost their former use and their original economic value. Many of these areas have elements of cultural-historical value. Preserving this cultural heritage means managing it for the benefit of current and future generations, and – in this way - contributing to a sustainable development. Governments, private parties, citizens and interest groups are often convinced of the desirability of preserving the cultural heritage. However, the presence of cultural heritage entails extra complexity. The lack of a transparent instrument for balancing costs and benefits is considered to be one of the major bottlenecks in transforming the cultural heritage for new uses. Hence, public and private parties are searching for new strategies to embed cultural heritage in urban redevelopment projects. In this paper we present a framework to study (process-) strategies and their effect on balancing costs and benefits. To develop this framework, we analyzed five Dutch urban redevelopment projects with cultural heritage and confronted the results with literature. We then argue that value creation and value claiming go hand in hand and that settlements regarding costs and benefits of cultural heritage depend on how stakeholders handle this tension in the process of planning.
THEIDEOLOGY OF THE ECO-CITY: A DISCURSIVE APPROACH

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Keywords: Eco-city, Discourse, Sustainability, Planning, Hammarby Sjöstad

ABSTRACT

Around the world, growing concern about the environmental implications of urban living is putting pressure on municipalities to come up with strategies and measures to keep cities liveable, minimize environmental degradation and reduce carbon emissions. One response to these concerns is the emergence of new sustainable urban developments, sometimes called “eco-cities.” In a recent review, Joss (2010) identified more than 70 such projects worldwide. A brief look at such projects demonstrates that the term “eco-city” is being used to describe a diverse range of urban projects which vary in scale, ambition, and design. In this paper, we use discourse analysis to explore these differences and reveal the underlying ideologies of these projects. In the social sciences, discourse analysis is used to study the way in which issues and understandings are socially constructed. It does so through the analysis of both statements, and the context in which those statements are made. A number of authors have demonstrated the value of discourse analysis to understanding how planning decisions are made (Kumar & Pallathucheril 2004; Portugali & Alfasi 2008). Similarly, in the field of environmental sociology, discourse analysis is used to explore the way that environmental issues are constructed by actors (Dryzek 2005; Hajer 1995).

The particular value of discourse analysis demonstrated by these works is its ability to reveal the impact of intentional and unintentional expressions of bias and ideology. Building on this work, in this paper we analyse how planners communicate about eco-city projects to the world in order to search for the ideologies underpinning their work. Such an understanding could then inform sustainable planning policy and practice. Our analysis focuses on the positions that planners take on two key issues: their views on how to achieve environmental change and sustainability their views on how to undertake planning practice.

The paper consists of two parts. First we present the results of a discourse analysis of documents about a selection of eco-city projects, and of interviews with practitioners working on these types of projects. In the analysis we identify the presence, recurrence and context in which indicative words and phrases, such as technology, participation, and sustainability are used in communicating about the projects. From this analysis, we establish two broad categories that projects fit into, each of which is defined by an underlying ideology about the best way to achieve urban sustainability. From this analysis we identify two categories of eco-cities: the technocentric eco-city, and the process-focused, socially grounded eco-city.

In the second part of the paper, the implications of each ideology are further explored through a closer analysis of one example from each category. Hammarby Sjöstad in Stockholm, Sweden is used to illustrate the technology-focused projects while EVA-Lanxmeer, in Culemborg, the Netherlands is used as an example of the socially grounded eco-city initiative.

Our analysis shows that eco-city projects may emerge from very different ideologies about how to undertake sustainable urban planning. The respective roles of technology and of participation emerge as particular points of difference. We believe this demonstrates the need for further constructivist studies of sustainable urban developments to develop a more critical understanding of how contemporary projects propose to achieve urban sustainability.
THE AREA-BASED PLANNING PROCESS OF DUTCH HOUSING ASSOCIATIONS

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**Keywords:** Housing, Planning, The Netherlands, Asset management

**ABSTRACT**

Housing associations in The Netherlands are important actors in the field of urban planning, since they own and manage nearly one third of the total Dutch housing stock and account for 46% (2008) of all newly developed housing. Housing associations are independent social enterprises, which take their own decisions on this stock. Therefore it is important to find out how these organisations make these decisions.

These decisions can be made in different ways. Many housing associations in The Netherlands work with asset management plans to secure that their portfolio meets company goals and market demand. However, in practice decisions of housing associations are often not a direct result of their strategic plans, but of incidents at the neighbourhood level, or of emerged opportunities. Next to that, housing associations nowadays do not only focus on the quality of their own housing stock, but also on the physical, economical and social quality of the whole neighbourhood, which implies cooperation with a wide variety of local actors. As a result housing associations in the Netherlands are increasingly employing an area-based approach towards asset management, which takes into account the characteristics of areas and the other actors present in the area.

In order to analyse the different ways housing associations implement this area-based approach, the concept of planning is used. Planning is deconstructed into four elements (actors, activities, knowledge and purpose) and five planning types are identified (rational, incremental, collaborative, political and advocacy planning). These planning types and their elements are transformed into propositions that are tested in a survey among housing managers working in priority neighbourhoods. From this survey a diffuse picture arises. Housing associations use different elements from different planning types. However, emphasis is on the elements of the rational and collaborative types.
A METHOD TO STUDY THE MANAGEMENT OF URBAN DEVELOPMENT PROJECTS

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Keywords: Urban Development Project, Management, Organization, Public & Private Actors, Effects

ABSTRACT

The management of urban development projects in the Netherlands has changed significantly in recent years. These projects have become mainly ‘led’ by developers as they manage the entire life cycle of development projects, while public actors mainly facilitate development projects. This changes the way projects are organized and managed and might resolve in different outcomes. Therefore, this research aims at understanding the roles of public and private actors in private sector-led urban development projects and aims at determining the effects of their cooperation by conducting empirical research in different contexts. This paper provides a method for academic scholars to study the management of urban development projects, as management has been underestimated in theory as a way to influence project outcomes. A conceptual steering model is introduced which provides opportunities to describe, analyze and compare complex urban development cases. Furthermore, empirical findings from case studies in the Netherlands and England are presented and compared with each other to indicate how the conceptual model can be used.
REDEVELOPMENT OF INDUSTRIAL PROPERTIES IN HELSINGBORG, SWEDEN: FROM THE MUNICIPAL PERSPECTIVE

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Keywords: Property Development, Urban Planning, Project Management, Relationships

ABSTRACT

The structure and purpose of urban areas varies over time. For 50-100 years ago it was often desired to have closeness between the city centre and adjacent industries and infrastructure, e.g. the harbour and railways. Today these land areas are coveted for housing and commercial interests. In the beginning of the 21st century the municipality of Helsingborg in the southern part of Sweden decided to convert the south industrial harbour area in Helsingborg into housing and offices. The purpose of this paper is to elucidate the factors that can influence future relationships between various stakeholders in urban redevelopment projects, special attention will be given to efforts made in early stages of how to manage and organise the project from an overarching vision into an action plan for project implementation. Interviews with participants in the project management team for the development of the H+ area in Helsingborg and with involved municipal officials lead to mapping the expectations for the future development. Partial results shows that open communication between involved stakeholders and public officials give a good base for participation and engagement. Transparency and goal definition along the project planning characterise a well performed property development process. Thus, creating an interest by developers to invest and establishes a baseline for stakeholder management in forthcoming phases of the project.
PARTICIPATION IN COLLECTIVELY SOLD PRIVATE RENOVATIONS

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Keywords: Wallisblok, Klushuizen, Commissioning, Empowerment, Social diversity

ABSTRACT

Several pilot projects have spawned an increasing number of schemes involving individuals in renovation. A well known and awarded (World Habitat Awards 2008) project is the “Wallisblok” a.k.a. “Dichterlijke Vrijheid”. This project involved the sale (for a symbolic amount) of a run down building block to a collective of future homeowners. The building block was in poor technical conditions and the collective owners had to (re)design and renovate the building block according to requirements set by the municipality. These requirements included both the quality of the renovation as well as the minimal investment. This scheme has been exported, copied and repeated due to its success. However, the schemes are different in several aspects, for example the price has never been as low as it was in the first project.

In the evaluations that have been written on the projects and especially on the Wallisblok, several gains are mentioned. Amongst others, neighborhood improvement, home and street quality improvement, personal control over housing quality, participation amongst owners, strengthening of neighborhood bonds and collective (neighborhood) maintenance are mentioned (Sour 2009). Moreover effects that touch on demographic characteristics of the neighborhood (attracting high income new residents, Van Der Laan 2009), on reaching environmental goals (climate change, Van Hal 2009) and contribute to solve general socio-economic problems in the neighborhood.

In this paper an overview of the stated effects and experiences is given and these are compared with the envisioned effects at the initiation of the project. The paper draws upon other (Dutch) evaluations and on literature that addresses similar effects. Based on explorative interviews some improvements for the schemes are addressed. Based on similar projects and international experiences some adjustments in the schemes will be suggested to make future projects even more successful. For the final conclusion effects are put in perspective of scale and competences of the collective that are necessary to create a successful project. We try to translate lessons and experiences to a more international implementation of the scheme for use in more generalized housing and regeneration situations.
SUSTAINABLE RENOVATION OF THE LARGE-SCALE HOUSING ESTATES, BUILT IN FRANCE OF THE 1950s AND 1970s

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Keywords: Atmosphere, Large-scale housing, Urban renewal, Perception, Tools

ABSTRACT

Built massively in France between 1953 and 1973, large-scale housing named “grands ensembles”¹ was considered at its construction as the future of modern housing. It was one of the solutions to the France housing crisis raised after the Second World War. The first inhabitants of these districts were very happy to live in these spacious, airy and sunny apartments surrounded by green spaces. But over time, the life quality in this social housing has suffered degradations (social, urban and architectural). Now, these large-scale housing estates are associated with segregation, nuisances and danger zones. We can find the same problems in other large-scale housing around the world (Hellemann G, 2004). Consequently, the improvement of the living conditions in this urban housing, through sustainable renovation, is now a priority for urban policy. The main challenge is to ensure a global improvement at different levels: socio-economic, architectural and environmental. Unlike the first renovations (started in 1980), considered as “standard operations” (replacing windows, renovating building fronts…).

This communication introduces the results of three case-studies of large-scale housing estates situated in Nantes (France): Dervallières (1952/1965), Breil Malville (1955/1967) and Malakoff (1967/1971). The first aim of this work is to produce the knowledge of architectural and urban quality in this kind of housing like: sunshine quality, wind speed, sound atmosphere, landscape, etc. The second aim is to propose design and decision help tools dedicated to renovation projects. This research is based on the confrontation of results obtained by multidisciplinary approaches. We carried out a sensitive approach through surveys (questionnaires, interviews), where inhabitants expressed their perceptions of their areas life. Then, a physical approach using simulation tools allowed us to explain micro-climatic phenomena (sun, wind, humidity, air and temperature). The last approach named “expert”, consists in exploring and analysing the architectural aspects of three-districts.

Finally, this work allowed us to identify the atmosphere² typology, which characterizes the studied large-scale housing, taking into account the renewal operations and the atmosphere provided by architect-designer. We also propose evaluation grid with user criteria for evaluating the architectural and urban atmosphere in this large-scale housing, and for environmental diagnostics before a renewal operation.

REFERENCES:
HELLEMAN Gerben. 2004, « The renewal of what was tomorrow’s idealistic city » Amsterdam’s Bijlmermeer high-rise, Great Britain, Elsevier Ltd, p. 3-17
1* The French name
2* Atmosphere can be defined as the interaction between physical phenomenal and spatial environment perceived by the occupant for this space (Augoyard J-F, 1999, the atmosphere: fundamental concepts and interdisciplinary problems, « Atmosphere » courses). Overall, the atmosphere is the perception which we have of our multi-sensory environment: sound, microclimate, visual, olfactory…
INNOVATION IN THE CONTEXT OF A DEVELOPING COUNTRY: A CASE OF GROUP HOUSING PROJECT

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Keywords: Innovation, Group housing project, Organisational motivation, Inter-organisational interaction, Nepal

ABSTRACT

This paper presents a case of group housing project that was new of its kind implemented in the underdeveloped economy of Nepal. The project has been taken as a contextual innovation because of its newness and uniqueness in the context of the country at the time of implementation. This study presents a detail account of the project implementation emphasizing the challenges faced by the involved key parties. It provides important insight into the project which eventually proved to be a significant and successful initiating push in triggering a promising new real estate sector in the national economy. Qualitative approach was used for the research in which the main instrument for collecting primary data was face-to-face semi-structured interviews with the key people involved in the project. The findings have been presented in terms of the categories of challenges as the initial perceived constraints, management level challenges, and project level challenges.
EXPLORING DIFFERENT COMMUNITY ATTITUDES TO SUSTAINABLE TECHNOLOGIES

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Keywords: Communities, Sustainable technologies, Attitudes, Intervention

ABSTRACT

Different communities have different attitudes to sustainable technologies, and this paper will explore those differences, and how they affect the adoption of sustainable technologies.

A number of reports published in recent years (IPCC 2007, Stern 2006) have highlighted concerns of climate change as a result of human activity, and the importance of acting to mitigate those changes. As a result, the Climate Change Act (2008) sets a legally binding target to cut carbon emissions by at least 80% by 2050. This legislation has led to large numbers of initiatives to use sustainable technologies. Some of these initiatives are in the form of top down interventions, imposed by local authorities or other bodies, while others have been community-led, or bottom up.

Communities have different socio-economic backgrounds. Their choices are constrained by the physical, social, cultural and institutional context in which they find themselves (Owens 2008) and this affects their attitudes to sustainable technologies, and the ways in which they might go about adopting them.

For this pilot paper, two socio-economically different communities were looked at – Northfield and Moseley, both in Birmingham. These communities underwent the adoption of sustainable technologies via different governance or community arrangements and interventions. Northfield is an economically challenged community that has seen some houses benefit from ‘Birmingham Energy Savers’, a Birmingham City Council led project that has retrofitted houses to provide them with PV. Moseley is a more affluent community which has received funding from British Gas as part of their Green Street competition to help cut carbon emissions, a project led by the community group Sustainable Moseley (SusMo).

Comparison showed that community governance arrangements or interventions need to relate to the context of the community in question. Northfield, being a more challenged community with financial concerns and less of a community identity, was able to benefit from a top down intervention from a trusted body - Birmingham City Council – who was itself only able to offer this programme to disadvantaged community members living in its own housing stock. Moseley, being an affluent community, is unable to benefit from Birmingham City Council’s project, but is able to self organise. It is however, experiencing difficulties meeting its objectives due to the amount of time volunteers are required to contribute to the project. Just as there are many communities, there are many attitudes to sustainable technologies, therefore many methods of intervention, governance and action will be possible. It is vital that these relate to the context in which they will be applied.
ADVANCEMENT OF SUSTAINABLE DEVELOPMENT, CONTRACTING, DESIGN, AND SUPPLY BUSINESSES VIS-A-VIS CONSTRUCTION MARKETS

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Keywords: Business management, Building products, Construction, Design, Sustainability

ABSTRACT

The aim is to advance sustainability as part of managing the four kinds of businesses in construction markets. Porter’s (1980) five forces framework is preferred for trying to capture complexity of managing businesses through stakeholder transactions across eight competitive arenas within each of hundreds of (inter)national markets. The advancement of sustainable business management is based on the implanting of relevant drivers into each of the eight arenas. In life-cycle contracting and development businesses, novel high-sustainability drivers include the coupling of object development ideas with sustainability advantages along negative impacts. In design-build contracting businesses, such drivers include the re-engineering of value chains with all tiers of designers, subcontractors, and suppliers. In design businesses, such drivers include the transformations of design firms into long viewers, path dependency breakers, stock-specific programmers, object-specific planners as well as impact blockers and their cause tracers. In supply businesses, such drivers include the adoptions of cradle-to-cradle certifications, product formula renewals, and full responsibility takings over the life-cycles of supplied units. Firms can readily adopt the 8-arena framework for implanting high-sustainability into their businesses, targeted arenas, and focal contexts.
DEVELOPMENT OF THE SUSTAINABLE BUILDING AND CONSTRUCTION PRODUCTS INDUSTRY IN AUSTRALIA

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Keywords: Sustainable Products, Innovation, Construction industry, Australia

ABSTRACT

This paper draws on a major study the authors conducted for the Australian Government in 2009. It focuses on the diffusion issues surrounding the uptake of sustainable building and construction products in Australia. Innovative sustainable products can minimise the environmental impact during construction, while maximising asset performance, durability and re-use. However, there are significant challenges faced by designers and clients in the selection of appropriate sustainable products in consideration of the integrated design solution, including overall energy efficiency, water conservation, maintenance and durability, low-impact use and consumption. The paper is a review of the current state of sustainable energy and material product innovations in Australia. It examines the system dynamics surrounding these innovations as well as the drivers and obstacles to their diffusion throughout the Australian construction industry. The case product types reviewed comprise:

* Solar energy technology
* Small wind turbines
* Advanced concrete technology
* Warm-mixed asphalt

The conclusions highlight the important role played by Australian governments in facilitating improved adoption rates. This applies to governments in their various roles, but particularly as clients/owners, regulators, and investors in education, training, research and development. In their role as clients/owners, the paper suggests that government can better facilitate innovation within the construction industry by adjusting specification policies to encourage the uptake of sustainable products. In the role as regulators, findings suggest governments should be encouraging the application of innovative finance options and positive end-user incentives to promote sustainable product uptake. Also, further education for project-based firms and the client/end users about the long-term financial and environmental benefits of innovative sustainable products is required. As more of the economy’s resources are diverted away from business-as-usual and into the use of sustainable products, some project-based firms may face short-term financial pain in re-shaping their businesses. Government policy initiatives can encourage firms make the necessary adjustments to improve innovative sustainable product diffusion throughout the industry.
MAIN: SUSTAINABLE CONSTRUCTION FOR INDUSTRIALIZED DETACHED HOUSE, SUB: ROLE OF RESOURCE RECYCLE FACILITY

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ABSTRACT

Backgrounds
The industrialized house is a house which applied an advanced industrial technology to the production. In Japan, the effectiveness of the applied technology has been demonstrated. However, the difference of productivity among construction projects is pointed out (Wu et al., 2008). Construction sites in the central area of Tokyo are small. There are no stock yards at construction sites. A general contractor is starting to adopt a little collection of industrial wastes from small projects (Hamada et al., 2004). The comprehensive logistics for detached house projects is necessary. Moreover, some industrialized detached house manufacturers have set up resource recycle facilities.

Objectives
The main objective of this research is to analyze the actual function and effect of resource recycle facility in a Japanese industrialized detached house manufacturer, and to propose the comprehensive and efficient resource recycle system from the standpoint of economic and environmental assessment. This research surveys the kinds of waste separation and their quantities at construction sites to make clear the effort at sites for industrial waste disposal. Then this surveys the waste separation and recycle system at resource recycle facility and analyzes the effectiveness of the facility established by house manufacturer itself.

Research Method
The survey institute is a Japanese house manufacturer M. It has built the industrialized houses on the basis of Japanese industrialized system with the wood panel bonding construction method. The structure of house is mainly composed of floor panels, wall panels and roof panels. The panels are manufactured in the factory beforehand, and are joined with glue at construction sites. Nailing and screwing is necessary as a finishing operation. After the shell of the building with the panels is erected, the desired finishes are applied to both inside and outside. On the outside, the plywood is often covered with the siding. On the inside, the fabric is often applied.

This research compares the former industrial waste disposal system and the current industrial waste disposal system with the resource recycle facility of house manufacturer M. First, this surveys 4 construction projects as the former system, and makes clear the kinds of waste separation and their quantities at construction site. How to dispose industrial waste outside construction sites is also surveyed. Secondly, this analyses the operation results of the resource recycle facility built in 2009 as the current system, and makes clear the effectiveness of more kinds of waste separation at the resource recycle facility.

Finally this discusses the role and function of the resource recycle facility established by the house manufacturer itself.
AN OVERVIEW OF GREEN BUILDING PRACTICE IN TURKEY

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Keywords: Green buildings, Building assessment, Sustainable design and construction, Turkey

ABSTRACT

The building industry is responsible for a large part of the world’s environmental degradation as buildings converge in themselves major indexes of energy and water consumption, raw material employment and usage of land. Thus, green buildings, which are defined as resource-efficient and ecosystem-conscious structures designed with a holistic understanding of social and environmental responsibility, have become the flagship of sustainable development. Today, in several countries, there is a well developed green building practice that is used to improve and assess diverse aspects of a building such as site selection, energy, water, material consumption, waste production and pollution. Ongoing development of the sustainability phenomenon, as well as some pioneer green projects in Turkey, has brought on awareness and discussions regarding the green building practice in the Turkish architectural, engineering and construction (AEC) industry recently. In this paper, current green building practice, legislative framework and policies regarding green buildings have been analyzed and deficiencies in policies and statutory regulation in Turkey are determined to bring forward suggestions towards a more institutionalized development of green building practice. On the other hand, Singapore’s Green Building Masterplan and its key aspects have been overviewed as a best practice in terms of a planned and holistic approach in the quest for constituting a model for countries looking for a widespread adoption of green building practice in the near future like Turkey.
CAD-CAM AND CNC TECHNOLOGY IMPLEMENTATION FOR A SUSTAINABLE REFURBISHMENT OF HISTORIC DISTRICTS. A CASE STUDY FOR BILBAO

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Keywords: CAD-CAM technology, Old quarters refurbishment

ABSTRACT

After having researched a construction system based on CAD-CAM and CNC, we come to the conclusion that this system is appropriate for implementing it in refurbishment processes in old buildings. More precisely, refurbishment in buildings erected before industrialization with wooden structure and masonry facades in dense and historic city quarters. The main goals of the construction system are the recyclability of all elements, energy savings, bioclimatic performance, economy, accuracy and safety in the building site and simple procedures to write the project documentation.

The old quarters accessibility is often a handicap for implementing standardized components. In this case, the structural panels can be elevated to the floors with a reasonable physical effort for the worker, using the staircase, instead of an electric elevator.

Moreover, the heterogeneous personal economical resources of the neighbours in the building, is often an added problem for executing overall refurbishment of buildings. This system allows to make partial refurbishments and can work in different phases.

The new program layout planned for the buildings or apartments solved with the common refurbishment technologies and systems, requires an added slab of 20 cm for the drainage piping system. The application of the system can avoid this.

The construction system is adaptable to any geometry. In this way, there is no problem to applying the system on non-orthogonal plots. Using a CAD-CAM coordinated system the structure is easily adaptable to irregular geometries and dimensions.

During the first industrial era, in the historic city centre buildings, the insertion of plumbing system in a wooden structure building was rarely successful. The wooden structure near these plumbing facilities, is almost always rotten or damaged. The proposed construction system offers a solution for this problematic.

Normally such historic buildings do not have a correct insulation. The system allows a bioclimatic performance of the whole building.
FACILITIES MANAGEMENT: PROPOSALS FOR PRACTICE IMPROVEMENT AND DEVELOPMENT SUPPORT THROUGH EDUCATIONAL PROGRAMMES IN SOUTH AFRICA

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Keywords: Educational programmes, Facilities management, Facilities management development, Industry structuring, Research

ABSTRACT

An investigation is made into the structure of international practice and the comparative local situation.

Local structuring is loose, and to diverse for the available resources in a developing country. No integration exists between perceived practice requirements and the limited academic and research support available.

The research is based on an international literature and internet overview, with local conditions cast against it. Some quantified data has been generated in practice.

Practical implications arising out of the above is reflected in a proposed structure for the facilities management industry, supported by integrated education, training and research.

The perceived value of this research nestles in adding value to the industry through a unified approach to development.
INNOVATIONS WITHIN DBFMO PROJECTS FROM A MAINTENANCE AND ENERGY-USE POINT OF VIEW

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Keywords: DBFMO, PFI, PPP, Innovation, Maintenance, Energy-use, Performance specifications

ABSTRACT

In most literature integrated contracting and procurement is assumed to result in more innovative solutions as a result of the intended process integration. This paper explores so-called Design Build Finance Maintain Operate (DBFMO) cases in the Netherlands on resulting innovations focusing on maintenance and energy use. This as it might be assumed that in case of a DBFMO contractor innovations on these aspects are of direct benefit and thus the most easy to detect.

In this study two DBFMO office projects are investigated. The two DBFMO projects are compared with five traditionally build office projects. First, the introduction describes the motives and the goal of the research. The second section provides the theoretical framework. In the third section the research methodology is explained. The case studies are presented in the fourth section. The fifth section presents the findings. The last section contains the conclusions and discussion.
IMPLEMENTING GREEN DESIGN INITIATIVES IN THE UAE

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ABSTRACT

The drive for more sustainable built environment in the United Arab Emirates (UAE) received a significant boost in the period 2006-2008 supported by new legislations from the government and increased interest from major stakeholder especially municipalities. The absence of locally developed frameworks for evaluating sustainable design of buildings has created opportunities for the introduction of foreign ones. LEED has become popular in industry and has even influenced the current attempts to develop a local framework. The paper will report the findings of a research that, first, evaluated the effectiveness of LEED framework in dealing with local issues. Secondly the paper will examine 2 case studies where LEED was used in one of the cases to ensure the development is sustainable. The second case study sustainability was driven by what was considered to be “responsible” design. The need for more integrated design practices is highlighted in the analysis as well as the role of the local
SUBCONTRACTOR SELECTION BASED ON DATA ENVELOPMENT ANALYSIS (DEA)

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Key words: Subcontractor selection; Decision Support system; Performance measurement; Benchmarking; Data envelopment analysis.

ABSTRACT

In today’s construction market, subcontractors execute significant portions of construction work. Subcontractors lessen resource requirements faced by general contractors and provide specialized expertise to construction projects. The reliance of general contractors on subcontractors to execute major portions of construction work makes the success of construction projects highly susceptible to the performance of these subcontracting organizations. As a result, subcontractors' selection decisions are of crucial importance to general contractors bearing in mind that such decisions are exercised by general contractors multiple times in every single project. This paper contributes a Data Envelopment Analysis (DEA) model to guide general contractors in their subcontractor selection decisions.
A CRITICAL ANALYSIS OF RISK MITIGATION MEASURES FOR TARGET COST CONTRACTS IN CONSTRUCTION INDUSTRY

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Keywords: Guaranteed maximum price contracts (GMP), Target cost contracts (TCC), Risk mitigation measures, Construction industry, Hong Kong

ABSTRACT

A scarcity of empirical research has been observed on risk mitigation measures for those construction projects procured by guaranteed maximum price contracts (GMP) and target cost contracts (TCC) worldwide. This paper aims to seek and examine the risk mitigation measures associated with GMP and TCC (GMP/TCC) construction projects through an industry-wide empirical questionnaire survey launched in Hong Kong. Survey respondents were invited to delineate their levels of agreement on 18 individual risk mitigation measures identified from reported literature and in-depth interviews, and the views of client group were compared with those of contractor group. The survey results manifested that both the client group and contractor group are in general consistent in their views towards the risk mitigation measures for GMP/TCC contracts. However, the Mann-Whitney U Test revealed that they held different perceptions on 4 out of the 18 risk mitigation measures, and the findings may stem from different roles involved in the projects. The research findings are useful in providing industrial practitioners with valuable pointers towards effective risk mitigation measures of applying GMP/TCC schemes at an early stage of project delivery.
MULTI-CRITERIA EVALUATION OF THE BIDS IN PUBLIC CONSTRUCTION

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Keywords: Public procurement, Multi-criteria evaluation, Classification of bidding Procedures

ABSTRACT

One of the main tasks of local and national Governments is giving the people the public facilities they need. Carrying out such activity can involve many problems, because of the amount of money required in such projects and the relevant number of involved stakeholders. In particular, a public sponsor needs to find a private firm able to build these infrastructures with the best compromise among the required resources (money, time...) and the quality of the work (in terms of, for instance, service level, technical features...). Consequently, multi-criteria evaluation schemes are often and often used by tendering committees for this kind of public works.

Reaching this goal is made more difficult all over the world by attempts of corruption of the public officers made by some competitors. In most of the States of the world, appropriate laws prescribe transparent procedures in order to avoid such events, which can determine a huge economical detriment to Governments.

The European Union Public Procurement Directive 2004/18/EC imposes the use of the Linear Weighting technique (when it is possible) in public tenders to be awarded according to the Most Economically Advantageous Tender criterion. In this case, the committee has to decide the weights of each criterion in advance at the request of tender. Generally these are drawn on the basis of subjective judgments. This makes the method affected by internal consistency and validity problems. Consequently, there isn’t an absolutely optimal choice of weights. Moreover, when this awarding mechanism is used, public officers can give an advantage to a given bidder simply by assigning a high weight to a criterion that only that competitor is expected to fully meet. Consequently, this method is characterized by some subjective choices which makes corrupted behaviours possible.

In the last years the literature about this issue presented many models for the evaluations of bids in public tenders. Some of these were proposed specifically for public works of construction, while other ones are more generic but can be successfully implemented also for the evaluation of the bids for the building of a facility. Among these methods, some aim at the optimal choice of the weights for the Linear Weighting. Other ones are based on the qualitative comparison among alternatives. Another group of method is based on the estimation of the utility coming from each bid. Finally, another possible approach aims at determining a sort of social cost coming from the completion time and from the quality of the final work to be summed up to the required bid.

The purpose of this paper is to make a classification of different bidding mechanisms for public construction projects proposed by the literature. The strengthens and the weaknesses of each of them are illustrated. Such an analysis aims at giving Government and public firm advice on what tendering mechanism best meet its requirements, needs and expectations in the evaluation of the bids.
TRACING RISK PATHS IN INTERNATIONAL CONSTRUCTION PROJECTS: A CASE STUDY

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Keywords: Vulnerability, Risk assessment, Structural equation modeling

ABSTRACT

International construction projects are mostly known with poor cost performance. Their large sizes, multi-party environments, along with unfamiliarity of foreign firms with host country conditions create high chances of cost overrun and delay which lead to disagreements, claims and failures. In the case of such disagreements, identification of the responsible parties for a sequence of interdependent events that lead to project failure is a tedious task. Factors that result in cost overrun usually occur in the form of a chain of causally dependent events, each of which are either under the responsibility of one party, or shared among different project participants according to the related contract clauses. The diversity of the factors, namely global, country, company and project specific factors, increases the complexity of negotiation process between the project participants when cost overrun and delays occur in international projects.

The major idea in this research is that cost overrun depends on causal relations between various risk sources (namely, risk paths) and sources of vulnerability that interfere with these paths. Using the data of 166 international construction projects and utilizing Structural Equation Modeling (SEM), a Risk-Path Model that represents the interactions among different risk and vulnerability paths is identified. A network of interactive risk paths that can be traced from the initiation stage to its final effect on project cost overrun may help allocation of risk and cost overrun to various parties. Such an approach is believed to ease determination of the responsible parties and the configuration of the final risk and cost sharing scheme in a project. Moreover, SEM can be used to predict potential risk paths and estimate the level of cost overrun.

In this paper, through a comprehensive case study, the complex risk emergence pattern in a real construction project is demonstrated. Employing the SEM-based Risk-Path Model, the most significant risk paths are identified, cost overrun is estimated and how the model can be used for risk and cost allocation between the parties is discussed.
BARRIERS TO IMPLEMENTATION OF ENERGY PERFORMANCE CONTRACTING (EPC) MECHANISM INTO HOTEL BUILDINGS RETROFIT IN CHINA

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Keywords: Energy Performance Contracting, ESCOs, Building energy efficiency

ABSTRACT

Building sector contributes a large part of total energy consumption. Building Energy Efficiency Retrofit (BEER) is an effective approach to save energy & reduce emission and improve sustainability of existing buildings. Energy Performance Contracting (EPC), a market oriented mechanism provided by Energy Service Companies (ESCOs), has been widely used to improve energy efficiency in developed countries. EPC mechanism has been introduced in China since 1990s and implemented in different energy efficiency improvement projects. However, EPC mechanism is still unimplemented in some existing building retrofit projects. This research takes hotel buildings as example aims to identify the barriers to implementation of EPC mechanism into hotel buildings retrofit in China. Quality research methodology is employed in this research. In order to identify these barriers, a set of interviews are conducted. After that, a qualitative analysis of feedback information is discussed. Finally, a series of corresponding measures for remove identified barriers are proposed.
FOURTEEN PROCESSES DEFINING COMPETITIVE ADVANTAGE OF BRAZILIAN TRADE CONTRACTORS

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Keywords: Trade Contractors, Subcontractors, Specialty Contractors, Competitiveness, Brazil

ABSTRACT

Brazilian Trade Contractors, or Subcontractors and Specialty Contractors, are main players in the Brazilian Building Industry competitiveness. They are part of a highly fragmentized and informal chain, with a great diversity in their value propositions, their organizational forms and, as a consequence, in their results. Nonetheless, despite their heterogeneity, most of them are SMEs lacking resources, capabilities, and other assets. This lack of assets and a competition led by the lower bid offering produces the bankruptcy of 50% of them at their fourth year operation, with negative consequences in the competitiveness of the whole Industry.

Hence, understanding the causes of that performance is an important issue to improve Trade Contractors management practices and, consequently, their performance. This paper focuses on internal factors, specifically, on the internal processes that allow Trade Contractors to achieve a good performance in their specific competitions.

For this purpose, data was gathered from a qualitative research in 24 Trade Contractors with good performance and in 7 other agents that hire them, mainly in Sao Paulo - Brazil.

We have two main results: First, we identified fourteen processes conducted by Trade Contractors, namely: Strategic Process, Planning and Management, Commercial, Information Technology, Technical Assistance, Marketing, Financial and Accounting, Procurement, Product Design, Design for Production, Production Planning, Human Resources, Occupational Safety, and Production. Second, those processes are performed in different configurations in accordance with different value propositions and the size of the Trade Contractor.
THE LEVEL OF COMPLIANCE WITH THE PUBLIC PROCUREMENT ACT (ACT 663) IN GHANA

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Keywords: Ghana, Public Entities, Public Procurement, Public Procurement Act, Compliance

ABSTRACT

The Public Procurement Act (Act 663) 2003 was introduced in Ghana to streamline the anomalies in public procurement. The objective of the law is to promote fairness, transparency and ensure that public procurement is non-discriminatory. The implementation of the Public Procurement Act 2003 (PPA) has been quiet challenging coupled with a number of inefficiencies. The aim of this study is to observe and compare the extent to which selected public procurement entities have complied with the processes and requirements of the Law during the year 2008. The entities were chosen from the Ashanti and Brong Ahafo regions of Ghana. Structured questionnaire and face-to-face interviews were used to obtain data for this study. The overall compliance levels in the Ashanti and Brong Ahafo Regions lies at 19.58% and 17.8% respectively. This indicates low compliance levels of public entities. The study confirms that the Public Procurement Act 2003 (Act 663) is observed to proffer solutions but not without challenges. In the pursuit to improve compliance with the Act the study recommends that public entities recruit procurement personnel and organize intensive and regular procurement training for the personnel handling public procurement especially in the area of procurement processes.
PERFORMANCE BASED HOUSING POLICY IMPLEMENTATION: TOWARDS SUSTAINABLE CONSTRUCTION, INNOVATION AND COMPETITIVENESS

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KEYWORDS: Public purchasing power, Innovation, Performance-based procurement, Sustainability, Housing policy

ABSTRACT

The objective of this paper is to study the impact on innovation and sustainability of using performance-based procurement (PBP) in the implementation of the national housing policy. Another objective is to present PBP as a strategic tool for promoting competitiveness, innovation and sustainability in the construction chain through the use of the State purchasing power taking this chain towards a low-carbon economy model. The main conclusion of this research is that the use of a performance-based approach both in the selection of building projects and in the contracting of maintenance companies for these buildings is a good strategy for the Brazilian government to use its purchasing power to promote sustainability and competitiveness in the building sector, having a leading role towards the path to a global low-carbon economy and also successfully fulfilling the national housing policy.
ORGANISING LARGE SCALE GREEN COVERED ROOFS, THE ECONOMICS FOR BUILDING OWNERS AND CITY POLICIES CALLS FOR CHANGE

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Keywords: Green Covered Roofs, Design and Construction Process, Sustainable Water Management, Green Urban Policy, Cost benefit

ABSTRACT

During the last two decades the use of plants on rooftops has grown fast. Cities use different arguments to make policies for large-scale programs possible. One argument is that green covered roofs contribute to reduction of CO2 emissions on the local scale of the building, which is mitigation. CO2 reduction can be realised because there is a contribution to extending the life expectancy of the roof. There is a potential reduction in fossil energy use, especially in cooling. On this scale water can be retained and PM can be captured, which are adaptation approaches. When roofs are covered with plants on a large scale this will also contribute to adaptation, often being part of sustainable water management.

However there is an intriguing difficulty in organising the intertwining of these two approaches to climate, energy and water: It is very hard to organise, since the stakeholders keep their natural roles in their traditional organisational patterns. They are not accustomed to collaboration in this new context. New patterns and new collaborations however have to be established soon to speed up the process.

The paper will show the arguments for mitigation and adaptation approaches on the scale of buildings and on scale of cities. These arguments are elaborated against the background of cost and benefits from the major stakeholders. Calculations of municipalities showed that benefits for private partners, investing in green roofs, are smaller compared to the public benefits on a larger scale. The total private benefit can even be negative. Nevertheless the summation of private and public benefits is nearly always positive. The calculations also show that the total benefits are the largest in the high-density areas surrounding the city centre and lowest in industrial areas. The city centre itself is most beneficial for public benefits.

The paper summarises the arguments of cities, as part of their policy and put them opposite of the arguments of urban designers in order to distinguish gaps between intentions of policy makers and design criteria of urban planners, which led to recommendations for both. Then an analysis shows the potential for successful collaboration as well as possible risks.

The decision makers, more specified the public sector, seems to have the key to the breakthrough. They have the largest financial benefits to get the right roofs on the right places. Acquire knowledge, sharing knowledge (and experiences) and moreover the inevitable change in the way one collaborates with the partners is the first step to make. From the construction contractors perspective it is important that their product will fit the private investors needs as well as the public subsidies interests and still make a profit. They will serve the market, but who will direct the market?

The paper will conclude with recommendations for improvements in collaboration to speed up the realisation of green covered roofs on large scale.
BUILDING RENOVATION – A NEW INDUSTRY?

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**Keywords**: Evolution of construction, Path dependence, New industry

**ABSTRACT**

Based on construction economics, building economics and assessments of building service life, the renovation need of buildings is notably higher than the actual amount of building renovation. As energy saving renovations become more common, the volume of building renovation is forecast to grow even further. Building renovation suffers from both a lack of suppliers and tailored solutions.

This study has searched for a reason for this phenomenon. This is a theoretical study in economics, testing the rationalisation ability of three different economics theories, including the theory of construction economics, evolutionary economic theory and the theory of creating customer value.

Each of these theories explains a part of the phenomenon. In accordance with path dependence theory, companies in the construction industry have locked on new construction, and in the sector of new construction, companies have developed from small to large, following the industry evolution theory. International companies have entered the market looking for business where the volumes suit them. New construction has created buildings that cannot necessarily be renovated with local skills.

In accordance with construction economics theory, renovation construction competes in all owner sectors with other expenditures, and since renovations can be postponed, they often are. Demand is not activated by interesting supply or by supply corresponding to the needs. Renovation projects are implemented with a production-oriented new construction concept. In addition, a user-oriented approach does not produce a good outcome if it does not include catering for the special features of renovation construction.

The competitive factors in renovation construction are specific to such an extent that it is a different industry than new construction.
ANALYSING THE TRANSMISSION PATTERN WITHIN THE FRAMEWORK OF HOUSING SUPPLY AND MONETARY POLICY IN AUSTRALIA

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Keywords: Housing supply, Monetary policy, Transmission pattern

ABSTRACT

Housing supply is one of important components of the housing sector. Compared with an increasingly strong housing demand, the growth rates of total housing stock in Australia have exhibited a downward trend since the end of the 1990s whilst the significant adjustments in Australian monetary policy were being implemented. This research aims to comprehensively estimate the nature of the relationship between housing supply and monetary policy by a vector error correction model. According to the empirical results, a transmission pattern comprised of the indicators associated with housing supply and monetary policy can be identified, which suggests that there is a significant interrelationship between monetary policy and the supply side of the housing sector in Australia.
THE CONSTRUCTION INDUSTRY AND THE CHALLENGES OF THE MILLENNIUM DEVELOPMENT GOALS

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Keywords: Construction industry, Economic development, MDGs, Sub-Saharan Africa

ABSTRACT

It has long been recognised that the role of the construction industry in socio-economic development goes beyond its share in national output. A number of studies have focused on the issue of employment creation others have emphasised its multiplier effect on other sectors of the economy. The construction industry has also historically been linked with the process of industrialisation and urbanisation. Existing paradigms on the structural change of the construction industry as national economy develops over time has been evolving from an approach that stresses the role of construction investment (indeed physical capital accumulation) as an engine of economic growth to one where the pattern of the evolution of the industry should follow that of the general economy.

The role of construction infrastructure in the process of development has gained a new stimulus following the United Nations Millennium Declaration at the Millennium Summit in New York in September, 2000. Eight Millennium Development Goals (MDGs), measured through 21 targets, were devised. According to international development agencies as well as some writers concerned with the development process, the services provided by infrastructure have a pervasive effect on the economic and social targets related to the MDGs. An important question which should be the concern of the construction economics research community is, thus, how a well functioning construction industry could contribute to the attainment of these targets.

Using data obtained from World Bank and United Nations publications, and making use of an analysis developed in previous works, this study presents some prospects of the pattern of development of the construction industry in two groups of countries in Sub-Saharan Africa, according to their level of economic development. Some insights for the growth strategies of the construction industry in the groups of countries are also presented.
RANKO BON REVISITED: THE VOLUME/SHARE RELATIONSHIP

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Keywords: Construction volume, Gross national product, Construction sector, Econometric technique

ABSTRACT

As described by Maddison, economic development has been characterized by “the bell shaped pattern of relative industrialization and de-industrialization”. In the early stages of economic development construction adds the physical capital utilized by the rest of the economy, but as the economy matures growth ceases to be extensive and becomes intensive in terms of physical capital. When manufacturing reaches maturity, so does construction. Hence the contribution to gross national product by both sectors starts declining, while services become the new engine of the economy. In this regard, Bon wrote that, at some point of economic development, the relative decline of construction is accompanied by the absolute decline of its production volume. In this paper we try to assess these relationships using the database provided by the United Nations Statistics Division that covers more than 2000 countries for years 1970-2008. This unbalanced panel is analyzed using standard econometric techniques that should reveal the long term pattern between construction and growth.
TRUST AND MONEY: 20 YEARS OF (NO) PROGRESS?

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Keywords: Behaviour, Finance, Globalisation, Projects, Trust

ABSTRACT

In almost 20 Years since Latham published the interim report ‘Trust and Money’ in which he asserted that there was too little of either in the UK construction industry, has anything changed? This paper addresses issues of what trust is, how it is created and its fragility, and progresses to examine how trust operates in the construction industry. The second major thread, money, is examined in the context of the economics and financing of construction projects and organisations in an era in which globalisation of the finance industry has occurred as well as global and local crises in that industry and many countries economies. Market emphases and process changes have occurred at several levels, continuing existing trends but also spawning new ones. A key question, which is examined as the underpinning, central theme of this paper, is that although structural changes and procedural changes are highly evident, what has changed in behaviour within the industry, why, and with what consequences regarding trust and money?
INFORMATION SYSTEM FOR COST ESTIMATION OF COMMUNAL INFRASTRUCTURE

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Keywords: Urban Infrastructure, Costs Planning, Demography

ABSTRACT

As in many industrialized countries, the population of Germany is constantly getting older and smaller nowadays. These demographic changes cause adaptations of technical and social infrastructure in both quality and quantity, to ensure their aspects of economy and usability at long term. Therefore, urban development planning and municipal infrastructure planning have to work closely together. Decisions like expansion, renovation, re-dimensioning or even closing of municipal infrastructure should be based on long term strategies of urban development, in order to keep the budget of future remaining costs. For this reason, development strategies and important new projects have to be evaluated within their infrastructural running and life cycle costs.

A current research project in cooperation with a German Municipality will enable the involved planning teams to systematically integrate the consequences of demographic changes in their infrastructural projects in terms of supply quality and cost efficiency. As part of the project, this first study prepares the database of cost indicators and their drivers for municipal infrastructural project cost estimation in early project phases.
ETHICAL AND SUSTAINABLE EMPLOYMENT IN CONSTRUCTION: THE CASE OF BLACK AND MINORITY ETHNIC’S (BME’S) ENGAGEMENT

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Keywords: BME, Ethical, Sustainable, Diversity and employment

ABSTRACT

The instability of employment resulting from fluctuations in demand and the widespread use of contracting systems poses major problems of attractiveness to the construction industry. As this practice has a considerably negative impact on training, retention and progression of manpower in the industry, coupled with the fact that the industry is one of the largest employers, positioned as most country’s top employer with over two million employees in the UK, for example; which had been projected to increase into the foreseeable future had it not been negatively impacted upon by the recent downturn, the inevitable situation of anticipated skills shortages in a number of professions would have resulted. Even then, as much needed investment is cut from training in the sector, this issue of skills shortages can be very devastating in the event of an upturn which is indeed certain.

Consequently, it is anticipated that the construction industry should have been looking to expand its recruitment base and therefore would become progressively multicultural to reflect the diversity of the population. Although the objective of equal opportunity policies is to ensure proportional representation to job opportunities by eliminating differential treatment based on an individual’s social group identity, adopting a policy, however, has not guaranteed to enhance opportunities for minority groups. Indeed there is a view that many equality initiatives can be superficial gestures devoid of any real action and substance.

As a result, the paper has the aim of considering the ethical as well as the sustainable aspects of increasing the engagement of the BME sections of the population who, hitherto, have been underrepresented. Is it not the case, that migrants perhaps are confounded by the complexity of the professional accreditation processes, for example? It is worth noting that the white population has been seen to be aging while BMEs have quite a younger age profile making it sustainably intelligent to proportionally engage this section of the population for the future of the industry. Furthermore, it is ethically prudent to involve the sections of the population whose involvement has, until now, been very minimal in the industry. It is probably, for instance, a recipe for bitterness and resentment where religion has been used as a tool of marginalisation in the industry.
THE RISE OF THE ZZP’ER (SELF-EMPLOYED PROFESSIONAL) IN THE CONSTRUCTION INDUSTRY

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Keywords: Zzp’er = independent professional = self-employed person; Labor relations; HRM-policy

ABSTRACT

55% of all carpenters is self-employed (zzp’er), 37% of plasterers or wall-/floor finishers is zzp’er, and 28% of the bricklayers and interpolators is zzp’er. Of all the business in the construction sector, 15% is now done by independent professionals.

The figures are taken from a recent publication of the Economic Institute of Construction (EIB). The Institute confirms a trend in recent years. The EIB predicts that, despite the crisis in the construction industry, the evolution towards more zzp’ers in construction continues and is expected to go on: 30.000 in 1999 to 79.000 in 2009 and possibly 125.000 in 2020.

This development raises questions. Who is the zzp’er? What motivates him? Is it money, the beautiful van, his independent status? Or is there possibly more behind it? Could it be that businesses in the construction industry in general fail as employers? These and other questions gave rise to further literature- and field research into the backgrounds, characteristics, motivations and expectations of the construction- zzp’er, and into the reasons construction companies have to hire them.

Furthermore: what are the implications for collaboration in the future? Is this the beginning of the end of the job in the construction industry?
STUDY OF THE SUBMITTAL PROCESS USING LEAN PRODUCTION PRINCIPLES

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Keywords: Lean construction, Lean office, Submittals

ABSTRACT

In the Architecture, Construction and Engineering (AEC) industry office activities link the information flows from project teams and the production processes on the field. Despite their importance to the overall project, office activities have been overlooked and several authors point out that they are often mismanaged, lack planning, or are buffered to account for the great amount of variability within processes developed at the office level, eventually resulting on site inefficiencies and cost overruns. This paper presents a study of the submittal process through the use of Lean Thinking. Submittals are documents exchanged between the general contractors, subcontractors, the project architect and its team of designers and consultants. Submittals carry information about products and processes used to deliver a project, and are submitted from the parties constructing the project, or supplying materials to it, to the designers so that the submitted information can be checked for conformance to project specifications. The study shows that for the project investigated the submittal process lacked transparency, had low workflow predictability, and showed low levels of reliability. The study concludes that the submittal process can be streamlined by enhancing communication and information sharing amongst stakeholders, through the understanding of the causes of variation in lead times and the understanding of participants’ needs.
TOWARDS THE USE OF PROJECT ALLIANCE: JOINT DEVELOPMENT OF TEAM SELECTION PROCEDURES AS AN EXAMPLE OF STEPS TAKEN

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Keywords: Project alliance, Collaboration, Selection criteria, Shortlisting, Competition

ABSTRACT

Project alliance is a relatively fresh project delivery method where the owner and service providers, the designer and the constructor, share the risks of the project and the payment to the service providers is tied to the overall success of the project. It is based on a multi-party contract between the key actors to a project, who implement it through a joint organisation and observe the principles of information accessibility in pursuing close cooperation.

The project alliance system evolved from the need to improve the implementation of demanding and risky investment projects. Experiences from the model from “down under”, where it has broken through, reached Finland some years ago. Since then, the Finnish Transport Agency, including its predecessors, has intended to introduce the system in its transport infrastructure projects. The first planned projects involve rail renovation and urban road tunnel construction that are about to start in the very near future. The procurement process for service providers has already started with one of the projects and will start later this year with the other. This paper sheds light on the present state of the preparations for applying project alliance in Finland. After reintroducing the key ideas and principles of project alliance and how they reached Finland, the presentation focuses on the initial joint development between the Finnish Transport Agency, the industry and VTT. The development of qualitative team selection process and criteria is singled out for more detailed review as an example of steps taken so far. In that work, the legal praxis concerning competitive tendering in public procurement was found a special challenge which is why it was considered that the implementer selection procedure based on competence (or quality) alone could not be introduced as such. On the other hand, there was the desire to avoid heavy competition involving design and total pricing. Another challenge was to make a clear enough distinction between reducing the number of candidates and tender evaluation as concerns suitability criteria. As a result, a procedure of competitive selection is established for the early involvement of service providers through a collaborative approach. Service providers are selected as a team; in other words, designers and builders are not selected separately and matched. According to the model, selection takes place through elimination of candidates and a subsequent two-phase tendering process: the qualitative tender precedes the workshops that are part of evaluation, followed by submission of tender price data. Then, selected service providers develop the project and its designs in cooperation with the owner before the actual target cost is set and the parties are ready to finally commit to the implementation of the project in question. Later legal consultations have, however, encouraged the owner to depart from the use of the calculated/comprehensive tender price estimate as a selection criterion for the first projects, and the price component is likely to consist only of the fee percentage. Correspondingly, the process also differs from the presented one. Therefore, the proper legal praxis concerning competitive tendering in public procurement, that was said to have been found a special challenge earlier, may still remain so. It is likely that views on the presented solutions will evolve as experiences are gained; as they have until now. Despite all the confusion, the ambience generated by the efforts so far is promising, and it seems that all the parties look forward to taking up the practical work and seizing the benefits a collaborative project delivery is likely to offer.
USING ‘WHOLE LIFE CYCLE VALUE’ TO EVALUATE INFRASTRUCTURE MEGAPROJECTS

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Keywords: Criteria, Evaluation, Stakeholders, Whole life cycle value

ABSTRACT

Project evaluation is an effective tool in project management as it provides stakeholders with a management process through which they can learn from the past and perform better in the future. Although various project monitoring and evaluation methods have been used in the construction industry, most of these traditional evaluation approaches emphasize the three basic success criteria of time, budget and quality. However, recent research emphasizes ‘satisfaction’ of the key stakeholders as also important. It is therefore necessary to develop a more holistic evaluation tool to evaluate projects from perspectives of all key group stakeholders. However, it appears that no systematic project evaluation approach focusing on project stakeholder perspectives, has been developed.

This paper aims to develop systematic evaluation criteria, based on the concept of whole life cycle value (WLCV), which integrates all the key stakeholders’ value objectives and can be used to evaluate an infrastructure megaproject more holistically and comprehensively. Projects aim to deliver value, including cost savings for client, desired functions for all end-users and other stakeholders over the whole life. The exercise of identifying value objectives of key group stakeholders and integrating these value objectives into the client value objectives, and next formulating reasonable WLCV criteria are hypothesized to be key contributors to achieving maximum project WLCV. It is therefore important to be able to identify, analyze and deal with the expectations of each group of stakeholders over the entire project life time, i.e. from client requirements formulation up to demolition / re-use.

In order to maximize WLCV, we must identify its essential components, namely: significant main-criteria for measuring project WLCV, as well as related sub-criteria which will help evaluate specific dimensions of the parent main-criteria. To be holistic as intended, both main and ‘sub’ criteria should relate to all stakeholders including the client.

Based on a comprehensive literature review in evaluation, decision making and value management studies, several semi-structured interviews with experts in academia and industry, and findings from the first stage of a relevant case study, this paper proposes a preliminary WLCV criteria system for infrastructure megaprojects. A preliminary WLCV model will be formulated in the next stage of this research, based on the findings of a planned questionnaire survey.

This would help clients to find which components of the project WLCV are more critical and then pay more attention to those parts, e.g. in collecting and distilling relevant experiences from past projects and deploying knowledge so acquired in future projects, to increase project WLCV. All other stakeholders can also benefit from this, as the client could then consider and assign reasonable weights / scores to their value objectives when identifying target components of the project WLCV.

This paper concludes with a discussion of some of the major difficulties in identifying, balancing and formulating WLCV criteria and some useful directions and opportunities for further research in this field.
BIM-BASED USER PRE-OCCUPANCY EVALUATION METHOD FOR FACILITATING THE DESIGNER-CLIENT COMMUNICATION IN DESIGN STAGE

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Keywords: BIM, User activity simulation, Pre-Occupancy Evaluation

ABSTRACT

This paper introduces a BIM based user pre-occupancy evaluation method (UPOEM), which is applied in architectural design stage for the aim to improve the efficiency and effectiveness of the communication between designers and clients. There are constant interaction between the clients’ requirements and designers’ solutions during the early design stage. However, there are some problems emerged during the designer-client communication process, such as inexperienced clients have difficulty in understanding 2D drawings; there is a lack of an efficient method to remind the design brief and help the clients to review the design; as well as the time constraint on the communication. The building information model (BIM) or BIM tools have provided a better platform to demonstrate both of the graphical and non-graphical information of the design. However the BIM tools paid less attention on facilitating clients to understand how their activities are accommodated in the building model, or helping them to express their requirements and feedback on the design. Therefore, this proposed method simulates the end users’ activities in the future built environment based on building information models, so as to improve the clients’ understanding on the design; a clients requirements and feedback interface is also designed to help clients express requirements and review the design. A framework of applying the UPOEM in conventional designers-users communication meetings is proposed in this paper.
VALUE-BASED BRIEFING, DESIGN AND MANAGEMENT OF HOSPITAL BUILDINGS

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Keywords: Added value; Hospitals; Stakeholders; Strategy; Performance

ABSTRACT

Corporate or Public Real Estate Management is usually defined as the management of the real estate portfolio of a corporation or public authority by aligning the portfolio and services to the needs of the core business, in order to obtain maximum added value for the business and to contribute optimally to the overall performance of the organization. Recent paper explores the concept of adding value by real estate and related performance indicators in connection to organizational goals and objectives, and the way it is or could be applied in value-based briefing, design and management of buildings. The conceptual framework is being illustrated with research findings on hospital buildings.

In the Netherlands, healthcare real estate is increasingly perceived as a strategic resource due to alterations in healthcare legislation and finance system. During the last decade the government transformed the old budgetary system into a so-called regulated market system. In the former system the proposal for a new hospital building or renovation of an existing building had to be approved by the government to fit with the planning regulations (number of beds per 10,000 inhabitants), the maximum number of square meters per bed or per function, the maximum budget for investment costs per square meter, and permit requirements laid down in the national Building Code. After approval all running costs related to the building were guaranteed by the government and paid by the insurance companies during the life-time of the building, independent of healthcare production. In the new system hospital organizations have to reimburse all real estate investments by production of healthcare products and services i.e. treatment-diagnosis combinations.

Decisions on hospital real estate have a strong impact on organizational performance, both with regard to benefits such as creating a healing environment, satisfaction of patients, employees and visitors, labour productivity and image, as with regard to the costs of healthcare delivery and real estate life cycle costs. Political decisions, demographical and economical developments, innovations in medical technology and a continuously changing market of demand and supply are all part of a dynamic and unpredictable context, whereas healthcare real estate decisions have a long term impact. The ever changing context with new opportunities and risks and the involvement of a growing number of stakeholders necessitates to changing traditional hospital real estate management into a more businesslike and integrated approach. Although most healthcare organizations are aware of the necessity to change, many of them lack sufficient knowledge and tools to steer on the added value of corporate real estate in connection to organizational performance.

Based on literature review, interviewing stakeholders, analyzing documents such as strategic accommodation plans, findings from Msc graduation projects and a PhD study into hospital real estate strategies in a changing context, a conceptual model is presented that links organizational objectives and possible added values of real estate. The research findings show how different hospitals prioritize different added values, depending on their overall...
organizational policy, its position in a network of health care providers and local context. A number of added values is elaborated on by opening the black box and showing which real estate interventions may cause a positive effect on patient satisfaction, labour productivity, marketability of the building and competitive advantage.

The conceptual framework and research data may be used to support complex decision making in briefing, design and management of hospitals and other health facilities.
COLLABORATIVE DESIGN OF PARAMETRIC SUSTAINABLE ARCHITECTURE

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Keywords: Sustainable architecture, BIM, Collaborative design, Parametric design, IFC

ABSTRACT

Sustainable architecture is complex. Many aspects, differently important to many stakeholders, are to be optimized. BIM should be used for this. Building Information Modelling is a collaborative process where all stakeholders integrate and optimize their information in a digital 3D model. Sometimes it is called Green BIM. But what exactly is that? Is the International Standard Organization IFC standard useful for this? And is it compatible with new developments in parametric design?

Based on two years of feasibility studies for his design of one of the first sustainable office designs in the Netherlands, six years of directing the Union of Computer Using Architects, ten years of research and education at Delft University of Technology, where his dissertation was about collaborative architectural design in virtual reality, the author gives his vision on BIM from the point of view of architects. Advantages and disadvantages of BIM are listed. Full parametric design is needed because it keeps the design flexible and open for changes until the end of the design process. However it is not compatible with IFC; only object parametric design is. A possible way out of this paradox could be the use of scripts that only create objects if they are not already in the BIM database and otherwise only adapt their properties. An example of parametric sustainable architectural design explains the mentioned issues.
THE INTEGRATED MANAGEMENT SYSTEMS: THE ROLE OF THE MAIN CONTRACTORS

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Keywords: SA 8000, Health & Safety Management System

ABSTRACT

The authors sought to assess the effectiveness of the integration of different Management Systems (Quality Management System, Environmental Management System, Health & Safety Management System) to be installed at a number of Main Contractors and Large Clients in order to improve the Contract Management.

Accordingly to results gathered by the authors, Quality Management Systems are widespread in Italy over the last decade, because of a legal compulsory requirement stemming from the Public Works Acts enforced in 1994 and in 2006. Nevertheless, in spite of such a dramatic rise in the number of Contracting Firms' certifications conforming to the ISO 9001:2008 Standard, the reliability of Quality Control-related procedures failed tremendously, while the corresponding rules have been quite often discarded in the field.

Actually, only a small amount of the Large Private and Public Client Organisations awarded their own tenders to main Contractors available and wishful to comply with Quality Planning’s clauses.

On the other hand, very few Italian Contractors are certified in conformity to ISO 14001:2004 Standard and even less in conformity to the recent BS OHSAS18001:2007 Standard. Consequently, it’s not surprising that neither Clients nor Construction firms have any practical perception of the document PAS99:2006, a BS specification aimed to bring together the shared requirements and to support the integration of Quality, Environmental and Safety requirements; Social Accountability Management requirements (with reference to SA 8000) should find also place in such a perspective, if not for ethical reasons, at least to deal with unfair competition.

Whenever constrained to adhere to possible requests established by the Clients, the best effort that Contractors display is intended to widen the scope of the basic Quality certification, installing inside the original Quality Management System the other ones. Through this action, Contractors set up a pseudo Integrated Management System suitable to engender a sort of added value.

Finally, the paper tries to highlight some findings dealing with such an approach linked to a firm belief of the authors: the efforts made by the Client towards an effectively integrated Management system could be easily made trivial whenever the Main Contractors chose not to reflect the Management System rules in their actual behaviour.

Finally, the paper tries to highlight some findings dealing with such an approach: possible efforts made by the Client could be easily made trivial whenever the Main Contractors are distinguishing the very formal rules from its own current behaviours.
BALANCING BETWEEN FEASIBILITY AND RELATIONSHIP INTERVENTIONS TO PREVENT DYSFUNCTIONAL CONFLICT IN PUBLIC PRIVATE PARTNERSHIP PROJECTS.

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Keywords: Interventions, Dysfunctionality, Conflict, Public private partnership, Area development

ABSTRACT

Research shows that there are many bottle-necks in Public Private Partnership (PPP) Projects in Dutch spatial development. Due to the specific properties of Public Private Partnerships, these bottle-necks can lead to dysfunctional conflicts which are damaging the project. Hence the question is: how to prevent these conflicts? Literature doesn’t answer this question on an operational level in the context of a PPP project in spatial development. So ten cases of PPP in spatial development are selected in which a conflict escalated in a way that the existence of the project was on the edge. The research strategy is to compare cases in a cooperative climate with cases in a competitive climate. Data are collected by interviewing representatives of the public side as well of the private side. Analyzing the data, several interventions are found. Analysis shows that in a cooperative climate a rich variety of interventions is used, while in a competitive climate the interventions are limited. The analysis also shows that in a competitive climate interventions are more focused on the relationship between the partners than on feasibility, while in a cooperative climate both aspects are equally attended. Regardless of a cooperative or a competitive climate, the interventions found are concerning the feasibility of the project or the relation between actors. One moment it proves to be necessary to emphasize feasibility and the other moment the relationship. Therefore it is concluded that in spatial development dysfunctional conflicts in PPP projects can be prevented by balancing between feasibility and relationship.
FORMAL AND INFORMAL CONTRACTING WITH THE COMPETITIVE DIALOGUE PROCEDURE

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Keywords: Procurement, Contracts, Relationship development

ABSTRACT

The combination of increased project complexity (Baccarini, 1996; Laufer et al., 1996; Alderman et al., 2005; Walker, 2007), changed role of the government (Blanken, 2008) and the sector’s poor professional functioning (Latham, 1994; Egan, 1998; National Audit Office, 2001; Dorée, 2004) form the context in which several changes in the construction industry are embedded. These changes are twofold: on the one hand they are aimed at new structures (formal processes and contracts) and on the other at new working relationships (informal processes and understandings).

Formal tasks and roles of the market and of government have changed. Public clients have less influence on the contents of works and confine themselves to monitoring and checking the public’s interest. Conversely, market organizations have, alongside the executive, also more substantive tasks. Stemming from these changing tasks and roles, structures have been amended and are continuously developing. Integrated contract forms, PPP constructions and active discussions on aspects such as prices, risks and contractual terms are becoming more common during the procurement of construction projects. Further, there is also growing attention paid to the ‘soft’ aspects of construction. The call for new cooperative forms, increased mutual trust, improved communication and mutual understanding becomes louder.

In this context, the Competitive Dialogue (CD) was introduced by the European Commission in 2004. This procurement method consists of several discussion rounds between the principal and potential suppliers, during which all aspects of the tender can be discussed. The CD procedure aims to align complex demands of principals with possible solutions that contractors have to offer (Hebly and Lorenzo van Rooij, 2006). It is, however, unclear how formal and informal structures and processes in the CD are interrelated and are determining its effectiveness. In essence, there are two perspectives. In the first perspective, formal and informal structures and processes in the CD are serving as alternatives: what is arranged in a contract does not need to be discussed informally and vice versa. In the second perspective, formal and informal structures and processes are considered as complementary. Formal contracting processes can lead to informal processes such as the development of mutual expectations and social relationships.

Major question in this study is how formal and informal processes are interrelated in interorganizational contracting by the CD procedure. Insights of both formal and informal contracting processes are combined in a theoretical framework. The aim of this theoretical framework is to study how processes of formal and informal contracting affect each other and the effectiveness of the CD procedure. Basis of the framework to be developed in our study is the process model of Ring and Van de Ven (1994). This model gives an overview of how both formal and informal processes are involved in relationship development. However, in order to understand how these processes are interrelated, especially during the contracting process, a
more detailed overview is needed. To make the model of Ring and Van de Ven (1994) useful for our study of (in)formal contracting with the CD procedure, the model is expanded with the models of Ring and Van de Ven (2000) and Vlaar et al. (2006). These three relationship development models are combined to one model for studying formal and informal contracting processes in procurement by the CD procedure.
LEGAL ASPECTS OF BIM

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ABSTRACT

Working with BIM has three different legal aspects.

The contractual relationship between parties will need to be adjusted. The usual general conditions have not taken into account the aspects of working at the same time in one model by different parties. Nor can they. New contractual documents need to be developed for this aspect of the contract.

Than there are aspects concerning procurement law: is it possible to demand that tenderers work with BIM? What does this mean for tenderers who don’t work with BIM? Can they be excluded?

Thirdly: there are many laws regarding non-contractual aspects such as the copyright law, legislation on electronic communication, the electronic signature etc. etc.

In this paper all these legal aspects will be dealt with from primarily a Dutch point of view, but secondly also from a European point of view.
THE INTERPLAY BETWEEN PUBLIC PROCURING AUTHORITY AND PRIVATE COMPETITORS: EXPERIENCES WITH THE COMPETITIVE DIALOGUE

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Keywords: Competitive dialogue, Trust, innovation, Competition, Road infrastructure projects

ABSTRACT

In 2002 the European Commission introduced the competitive dialogue as a procurement procedure to enable an open public-private dialogue leading to more innovation, increased competition and more trust. Over the last years this procedure has been increasingly applied in complex Dutch road infrastructure projects. This article aims to analyze the experiences from practice in order to assess whether the goals of the European Commission are met. Additionally, it aims to provide recommendations on how to improve public-private interaction in general and the competitive dialogue specifically. On the basis of interviews and in-depth case study research, the experiences of involved public and private actors in several road infrastructure projects were investigated. Subsequently, the results were validated during expert meetings with contract managers.

Results indicate that the competitive dialogue can lead to more innovation. However, this innovation mainly consists of process improvements as involved actors get more experienced with the procedure and with the processes involved. Product innovation on the other hand proves to be more difficult to achieve. A reason for this is the reserved attitude and risk avoidance at the public procuring authority’s side. This attitude is reflected in strict planning and tender documents which limit the room for innovative solutions and in a strong focus on maintaining the level playing field, limiting the possibilities for open dialogue (just say nothing, so that there is no risk of saying something wrong). The dialogue has proven to increase competition in Dutch procurement. In fact, the procedure is more influenced by competition than expected beforehand by the European Commission. The private competitors are only willing to be open on perceived risks and threats. The chances and opportunities which could be of added value to the project quality are only limitedly discussed and at a late stage in the dialogue. Although the public-private contact in the procurement procedure leads to increased trust, it is hard to maintain this in an environment driven by competition.

It can be concluded that although the competitive dialogue has proven to be a useful procedure to procure complex projects, the ideal situation of an open public-private dialogue has not yet been realised. Competition and risk avoidance limit the openness of current dialogues, strengthening the judicial character with a focus on maintaining the level-playing field and limited innovation possibilities. It is recommended for public authorities to provide more possibilities for innovation by not specifying the desired end-result in detail beforehand. Furthermore, openness of private competitors in the dialogue should be rewarded and the dialogue should be limited to the complex issues for which public-private interaction can lead to added value. This will lead to less (unwanted) strategic behaviour, decreased transaction cost and an open dialogue with a focus on seizing chances and possibilities.
STIMULATION OF PROJECT COOPERATION BY PROCUREMENT PROCEDURES AND PROCUREMENT CLIMATE

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Keywords: Project cooperation, Procurement procedures, Procurement climate, Project performance

ABSTRACT

In The Netherlands, public works are contracted more and more in integrated ways. In recent literature, it is argued that procurement procedures will influence project performance. Even more, the procurement climate itself is found to influence the project performance by strengthening or altering the relationship between procurement procedure and project performance. In this paper, the relationship between procurement procedures and –climate and project cooperation is defined, project cooperation being an important indicator for project performance. The results of the literature study and the qualitative survey show a clear need for a procurement procedure not merely based on the project itself, but also on collaboration and soft parameters. In-depth case studies are used to analyze abovementioned relationships and find more detailed descriptions. The procurement procedure, procurement climate and project cooperation of three projects were assessed: KOSMOS STAKAN, 2nd Coen Tunnel, Houten-Castellum alliance. The added value of a collaborative procurement climate is emphasized by the in-depth case study results. Based on those results, suggestions for further research are given.
GUIDELINE FOR PARTNERSHIP BETWEEN CLIENT AND CONTRACTOR IN INFRASTRUCTURE PROJECTS IN GERMANY

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Keywords: Partnering, Collaboration, Cooperative contracting, Incentive based project optimization

ABSTRACT

This paper deals with the current situation of large infrastructure projects in Germany. The result of a field study shows many of the main participants are dissatisfied with the current situation and wish for a change. For this reason at the chair of Project Management at the University of Kassel a guideline for partnership between client and contractor in infrastructure projects was developed by different working groups of practitioners and scientists. It contains beside a preamble seven elements referring to clear project specifications, defined processes for project changes, fair risk handling, common data systems, regulations for responsibilities and decisions, contractual alternative dispute solutions and contractual incentive regulations. At present this guideline is in the testing phase to improve it, if necessary, and to collect experiences for a possible binding implementation in complex infrastructure projects in Germany.
PARTNERING AND THE TRADITIONAL: INSTITUTIONAL DETERMINANTS OF GOVERNANCE IN DANISH CONSTRUCTION

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Keywords: Collaboration, Foucault, Partnering, Institutional change, Management

ABSTRACT

Projects have traditionally been constituted by contracts, whose enforcement is held in place by governance mechanisms that involve high degrees of surveillance. In this light, partnering is advocated as a project specific, communicative alternative to this traditional legal coordination process of the construction industry. In a Danish context partnering has, however, so far not been able to offer a well-defined alternative to this traditional regulatory governance frame. However, rather than providing a well-defined alternative, in this paper we argue that partnering can be seen as a nullification of the traditional, i.e. as a counter-concept to a juridico-discursive conception of project governance that otherwise has been instrumental in organizing and coordinating various aspects of the construction process according to a more or less taken-for-granted regulative schemata of institutional order. Accordingly, it is suggested that the effects of partnering in the first instance stem from a series of interventions in the institutional and regulative context of the construction process, and that future case studies could benefit by paying closer attention to the institutional determinants of management thinking and practice.
SELECTION CRITERIA AND TENDER EVALUATION IN CONSTRUCTION PROJECTS: EQUIVALENT TENDER PRICE MODEL (ETPM)

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Keywords: Equivalent Tender Price, Selection criteria, Evaluation, LCC

ABSTRACT

Several research studies have identified critical success factors and their impact on project success. Central to both success and failure is the issue of selection criteria, and the importance of incorporating qualitative factors when contracting for complex design and construction projects. Empirical findings suggest that price is still commonly used criterion for selecting a winner, even though tendering documents indicate that quality factors are part of the evaluation. In this paper we argue that tender competitions with high focus on price in complex design and construction projects deteriorate both incentives for collaboration and project outcome in terms of cost and quality. Thus, the lowest bid may paradoxically result in the most expensive project from both an investment and a life cycle cost perspective. We offer an alternative approach to evaluating tenders, based on the Equivalent Tender Price Model (ETPM). The aim is to increase the probability of avoiding project failure related to cost overrun, poor quality and lack of functionality, in addition to ensure more transparency in the tender evaluation process. Simulation tests of the model demonstrate that evaluation of tenders through an Equivalent Tender Price model makes selection criteria more transparent and quantifiable and therefore less at risk of manipulation.
EXPLORING THE POTENTIAL TO DEVELOP COLLABORATION AND PARTNERS FOR SUSTAINABILITY DURING AUSTERITY

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ABSTRACT

The last period of economic growth was characterised by continuous improvement initiatives in construction, of which alliances, partnering, integrated teams were advocated as a major component of facilitating improvement (e.g. Egan, 1998). This type of collaboration was a move away from adversarial markets towards markets theoretically underpinned relational contracting (e.g. Macneil, 1980; Williamson, 1985). The era could also be conceived in terms of a focus upon (service) differentiation (Porter, 1985) and opportunity to develop relational contracting experiences into embedded practices that form the basis for core competencies (e.g. Hamel and Prahalad, 1996) and dynamic capabilities (Teece et al, 1997). In practice, initiatives largely fell short of original expectations. Improvements generally remained project specific (Smyth, 2010), hence embedding these as owned by main contractors as part of market positioning and competitive advantage were lost opportunities.

The current market is austere and has shifted from being focused upon differentiation to focused upon cost. Cost savings and driving prices down are the primary client drivers. Whilst this is likely to remain the prevalent agenda, there are two significant underlying trends. First, some main contractors are minded to retain as many of the benefits, especially collaborative practices. These have shifted the culture and residual benefits remain in main contractors, absorbed as informal and formal routines (cf. Chambers et al, 2009; Nelson and Winter, 1982). Second, the sustainability agenda is long-term and in its various dimensions is likely to increasingly drive factors affecting construction in and beyond the current era of austerity (Edkins et al, 2009).

Linking these two trends – the residual routines of collaborative practice and sustainability as it affects construction – creates conceptual space to normatively theorise what could, perhaps should, occur to generate partnering and collaboration towards meeting future sustainability agendas, manifested at inter-organisational and project levels of construction operation. The paper theorises the potential by bringing together two conceptual areas. The first is relationship marketing and management, which has become established amongst some contractors (Smyth and Fitch, 2009) at the project front-end, whereby B2B relationships are forged to improve project execution. The second is the effectual marketing (e.g. Sarasvathy, 2001), which entrepreneurially builds alliances through a series of iterative commitments. It is through combining these conceptual principles in practice that contractors can add value to meet sustainability agendas. Marketing is the starting point as it takes time to develop relationships with substantive commitments at the contractor-client interface and at the contractor-supply chain interface (Keki and Smyth, 2010a; 2010b). The paper articulated the processes to achieve added value to meet the sustainability agendas.

The conclusion focuses upon the extent to which the building blocks are in place in practice, how these can be integrated and recommendations to industry to convert potential to reality. The reality is likely to impact certain market segments of clients and contractors, but these are also likely yield the greatest growth opportunities for leading contractors.
ORGANIZING COLLABORATION IN CONSTRUCTION PROJECTS – FORMAL MODELS MEETING PRACTITIONER PERCEPTIONS

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ABSTRACT

There is a call for new project management approaches that are able to deal with increased flexibility and put people aspects more in focus. In construction projects, formal models for relationship management are increasingly being used. However, these models are often applied and adapted to a specific context by project managers who are engineers with long experience from traditional contracting but little formal behavioural or leadership education. Based on case studies of Swedish partnering projects, this paper discusses how project managers approach this new challenge of integrating formal systems for relationship management with core project processes. Which aspects of the formal partnering models are stressed and implemented, and which are less focused? How are general project processes affected by partnering goals? Which partners are involved and which models are chosen for incentivizing collaboration? What type of knowledge do project managers rely on in making choices about organization and contracts? The findings indicate that project managers have strong personal, experience-based perceptions of how collaboration is best enhanced and their own role in this process. The practices they introduce are often successful, but also tend to be patchy and related to collaboration problems in traditional contracts. The formal partnering processes, on the other hand, seem to be important in providing a basic structure for collaboration and to communicate collaborative intents, but are too general and infrequent to address more specific and pressing problems of process design and organization. We conclude that integrating relational and collaborative competence with project management knowledge still constitutes a significant improvement opportunity in many construction projects and discuss how these competencies may be merged.
REVIEWING CONSTRUCTION STATISTICS IN NORTH CYPRUS

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Keywords: Construction Statistics, Construction industry, North Cyprus

ABSTRACT

Construction is one of the industries of strategic economic importance. Governments using their national institutions are involved in the collection of economic statistics, which indicate the state of their economy in an annual time series. However, the completeness and accuracy of these statistics are always questionable by the stakeholders within the sector. Therefore, there is an increasing need for accurate, manageable and reliable statistics for the sound analysis of the construction sector.

The Annan Plan has had a major impact on the construction industry and its sub-sectors with increasing production, import, and sale volumes compared to previous records in North Cyprus. Between the years of 2003 and 2009, many building and civil engineering projects like hotels, residents, dormitories, and highways were constructed by the private sector initiatives such as owners, investors, developers, and contracting firms. Additionally, many infrastructure projects were constructed under the Grant Program of United Nations Development Programme (UNDP) and the European Union. On the other hand, campus construction of some state universities of Turkey and local private universities are ongoing. Despite these economic developments, a national authority on statistics i.e. State Statistics Institute has not been established yet. This creates a great lack of reaching and accessing updated statistical information needed within the construction sector as in other sectors. State Planning Organization (SPO), Union of the Chambers of Cyprus Turkish Engineers and Architects (UCCTEA) and Association of Cyprus Turkish Construction Contractors are the current public and non-governmental organizations which provide statistical information to the sector. But the statistical reports prepared by these institutions are not timely and not equipped with sufficient information for the needs of the sector. Therefore, all the stakeholders (investors, contractors, architects, engineers, material suppliers) face difficulties in timely access to the information they need and therefore they cannot make sound decisions.

The main objective of this study is to evaluate construction statistics of North Cyprus in order to ascertain their adequacy in terms of scope, portrait, reliability and responsiveness in their coverage of the construction industry. The research includes an extensive review of the construction statistics in North Cyprus, interviews with the key stakeholders (contractors, material suppliers, architects, engineers, consultants etc.) of North Cyprus construction industry, and in light of all these reviews a questionnaire survey to be prepared, conducted and analyzed.

This review of construction statistics will provide a conceptual framework of statistical information to be presented in a more comprehensive content, sufficient portrait, highly reliable in terms of quality, and responsive to dynamic changes of the sector (inflation, structural adjustment policies etc.). Additionally, it is aimed to detect and minimize the uncollected information and thus make contribution for prevention of unregistered activities within the sector.
NEW OUTPUT QUALITY INDICATORS IN CONSTRUCTION PRODUCTIVITY MEASUREMENT

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Keywords: Productivity measurement, Life cycle analysis, Benchmarking, Services

ABSTRACT

Productivity increase in the construction industry is often seen as low. Construction innovation projects could be prioritized partly based on expected contribution to industry productivity. Quality change in construction outputs and inputs is crucial. The purpose is to explore new output quality indicators. The analysis draws upon life cycle analyses for facilities, project benchmarking schemes and environmental assessment systems. Disruption of client core activities due to technology and method choice in construction projects should be taken into account, and also the willingness of clients to pay for risk reduction. The result is a set of output measures. Primary output is identified as ‘useful area’. Secondary output measures, with estimates provided by expert panels, would include effects on future energy consumption, effects on other future operations and maintenance resource needs, effects on client/user disruption, reduction of client/user risk during operation and maintenance, user comfort, architectural quality, and external societal effects.
THE USE OF THE UK BENCHMARK MODEL TO DEVELOP A STANDARD GLOBAL APPROACH TO CONSTRUCTION DATA

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Keywords: Global construction data, UK benchmark model, Gross fixed capital formation, Population, Urbanisation

ABSTRACT

The human population of the world has grown rapidly in the last fifty years. The impact of this growth has been discussed in terms of its sustainability. Invariably the discussion has focused on the natural environment. However, the impact of the population explosion has also had a dramatic effect on the built environment. An unprecedented amount of building work has been carried out over the last fifty years, perhaps more construction in one generation than in the whole of human history.

Still more construction work is needed not only to meet the needs of an increasing population but also to meet the rising expectations of that population in terms of the quantity and quality of the built environment. Increasing urbanisation is changing the way people live and the way society operates. Construction is often seen as a threat. Yet this is a response to growing population pressures and the need to transport people, food and materials. Yet it is difficult to find a source of information on a global scale that combines the data that is available. Unless there is a measure of construction activity throughout the world there is no way of gauging the scale of the issues involved.

There is a need to know the location of activity, the types and quality of output, and the numbers and skills employed in the construction workforce. Only when these measures of the construction industry are found, policies to deal with construction problems, such as homelessness, migration, health and safety, training and skills, trade in materials, carbon emissions and many other issues can be assessed by the international community.

In combining data from different countries, the issue becomes one of making judgements about appropriate exchange rates, the use of purchasing power parities, definitions of terms used and comparing different building standards for different climatic conditions.

Setting these issues to one side, a benchmark model of construction based on the UK construction industry is used to calculate the size and growth rate of the global construction industry and this is used to compare to other estimates of global construction. It is suggested that the global construction industry using the benchmark model can itself then be used as a benchmark to compare more detailed national construction statistics with an international standard.
A COMPREHENSIVE STUDY OF SOUTH AFRICAN CONSTRUCTION DATA SOURCES

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Keywords: Construction Data, Cost, Health and Safety, and Performance

ABSTRACT

This paper examines the numerous documented and undocumented construction data sources available to researchers, construction professionals, clients and government policy makers in South Africa. The paper explores whether the authenticity of these data sources are reliable and accurate because there are assumptions and processes behind the computation of the documented and undocumented data sources which are unknown. The rationale for the examination of these documented and undocumented construction data sources stems from the argument put forth by scholars that a significant number of these data sources have loopholes and black holes and therefore need to be verified. The paper intends to identify authentic South African construction data sources which can be used in construction data analysis and propose possible methods that should be used in preparing valid construction data sources for publication.
A DECADE OF CHANGE AND IMPROVEMENT? AN INDUSTRY VIEW OF CONSTRUCTION INDUSTRY DEVELOPMENT IN SINGAPORE UNDER CONSTRUCTION 21

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Keywords: Construction 21, Change, Construction industry development, Industry perspective, Singapore

ABSTRACT

Sir John Egan’s report on UK construction industry in 1998, Rethinking Construction, inspired a similar review in Singapore in 1999. The Construction 21 (C21) report has served as the blueprint for developing Singapore’s construction industry.

A series of interviews was carried out in late 2009 to investigate the implementation of the C21 report during the ten-year period. The aim was to ascertain the achievements and challenges, and the consequent changes in practices and procedures in the industry. A representative cross section of samples was taken to include policy makers, clients, consultants, professional bodies, and trade associations.

The general perception was that considerable progress had been attained in the development of construction industry, although the achievements had not as much as had been intended in the C21 report. A decade after the publication of the C21 report, although a range of progressive practices highlighted in C21 have been adopted in the industry, some of the initiatives in the recommendations in the report are still in progress and some have been launched but have not been pervasively used in the industry.

Although Singapore has made much progress in developing its construction industry, the extent to which the industry reforms have fulfilled their original intentions is not completely clear. The impact of the initiatives on the way companies and practitioners work is also not clear. Hence, there is a need to revisit priorities and review the progress so far and map out general strategies for the future.
IMPROVING THE DESIGN OF ADAPTABLE BUILDINGS THOUGH EFFECTIVE FEEDBACK IN USE

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Key words: Building appropriation, Design decisions, Feedback, Sustainability

ABSTRACT

For many years the issue of how to design buildings which can adapt to changing demands has posed a considerable challenge. This debate has had renewed significance given the emergence of the sustainability agenda and the need to extract additional value from built assets through life. Developing a better understanding of how buildings change over time is arguably crucial to informing designers concerned with extending the life of buildings. This paper critically reviews literature on adaptability, together with that relating to knowledge feedback and architectural practice, in order to construct a theoretical platform for understanding how knowledge of how buildings change can be used to inform design decisions. A pilot case study is used to illustrate the ways in which building change could inform adaptable design in the future. The work reveals a lack of knowledge in how buildings change and how, if this was fed back to designers, could support design decisions that could increase the life of many buildings.
By adopting a theoretical framework from strategic niche management research (SNM) this paper presents an analysis of the innovation system of the Danish Construction industry. Theories within SNM look upon innovation in a sector as a socio-technical phenomenon and identifies three levels of socio-technical interaction within which sectorial innovation can be explained. Niches form the micro-level where radical novelties emerge. The socio-technical regime forms the meso-level, which accounts for the dominating stabilized socio-technical pattern of interaction which are reproduced by institutionalised learning processes. The macro-level is formed by the socio-technical landscape, an exogenous environment beyond the direct influence of niche and regime actors (e.g. macro-economics, deep cultural patterns, macro-political developments). The analysis shows a multifaceted landscape of innovation around an existing regime, built in the existing ways of working and developing over generations. The regime is challenged from various niches and the socio-technical landscape through trends as globalization. Three niches (Lean Construction, Building Information Modelling (BIM) and System Deliveries) are subject to a detailed analysis showing partly incompatible rationales and various degrees of innovation potential. Based on the analysis the paper further explores how companies can be reintroduced as drivers for innovation in the construction industry. By bridging SNM with business development actives through an adapted Ansoff’s growth matrix, companies continuously can develop a competitive advantage by consciously targeting new and existing markets with new or existing competencies. The paper concludes with a discussion of how this approach can help to solve the challenge of retrofitting the existing building stock and thereby enabling the development a low energy consuming society.
EXPLORING ROBUSTNESS OF ENERGY PERFORMANCE OF DWELLINGS TO OCCUPANT BEHAVIOUR: RENOVATION AND POST OCCUPANCY

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Keywords: Occupant behaviour, Sensitivity analysis, Renovation, Maintenance, Energy performance, Heating energy demand, Monte Carlo method

ABSTRACT

In this paper, we focus on the influence of occupant behaviour on the energy performance of dwellings, before and after renovation process. In this context, ‘ventilation control pattern’, ‘maintenance’, and ‘heating energy demand’ are selected as the key parameters of the study. The aim is to reveal the sensitivity of energy performance of a dwelling to occupant behaviour, considering the pre and post-renovation process. Sensitivity of dwelling energy performance to occupant behaviour is analysed using Monte Carlo method. This method is one of the most commonly used methods to analyze the approximate distribution of possible results on the basis of probabilistic inputs. The inputs are selected as: window and grid operation, and mechanical ventilation set for ventilation control. The data used about occupant behaviour is gathered from OTB Survey [2008]. The Dutch reference building is used as a generic building to test the behavioural patterns. The result shows that a renovated [maintenance] dwelling is more robust to ventilation behaviour of the occupant.
BETWEEN MARKETING AND FINANCIAL SUPPORT: DUTCH MUNICIPAL POLICY INSTRUMENTS TO IMPROVE THE QUALITY OF PRIVATE HOUSING STOCK

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Keywords: Dutch municipal policy instruments; Quality improvement of private housing stock

ABSTRACT

Dutch municipalities are faced with an ageing private housing stock, of which parts show a diversity of quality backlogs, including their energy quality. Dutch municipalities are in the process of developing a combination of communicative and economic policy instruments to seduce private homeowners to invest in their dwellings’ quality. Homeowners’ willingness and capability to invest, and their level of organization play key roles here. This paper investigates, if the applied policy instruments to improve the quality of private housing stock in three Dutch municipalities are effective as well as cost-effective for both municipal governments and private homeowners. First results indicate that municipalities are marketing quality improvements to private homeowners by organizations that support and communicate with homeowners, but yet it seems without the hoped-for large-scale improvements. A multi-level policy approach seems to be needed for private dwelling improvement to become successful. This implies an improved playing field shaped by the national government, in which municipalities can make use of their local long-term oriented economic policy instruments more efficiently, such as property taxes and rebates on such taxes for (e.g. energy) quality improvements.
UPGRADE OR REPLACE? OBsolescence and its influence on demolition decisions from a sustainable viewpoint.

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Keywords: Obsolescence, Sustainability, Renovation, Demolition, Life cycle extension, Energy efficiency, Decision-making, Housing market

ABSTRACT

What is better: improvement or replacement by new construction?
The choice between life cycle extension or replacement of existing buildings is at itself a vital but very difficult decision, involving a wide range of different aspects and affecting several contrary and often conflicting interests.

In the past decade we studied the decision making on demolition in the Netherlands. Based on the available literature and statistical data we analysed the actual practice in the Netherlands and built a conceptual framework for further comparative and case study research. In addition to this research we placed the choice between improvement and replacement in a sustainable context, made an inventory of existing literature about comparative findings, analysed the outcomes and compared them with our own findings. Overlooking the results so far we concluded that life cycle extension by renovation and reuse of existing stock is generally more sustainable, more effective and more efficient as replacement by new construction.

As an often used demolition motive, obsolescence is a vital but complicated variable. Our paper describes its meaning, discusses its influence on the decision making about demolition from a sustainable viewpoint and concludes with recommendations for property management and the decision-making process. Since research references on demolition are scarce and empirical sources rare, the paper has inevitably an explorative character.
ARE OPEN BUILDING PRINCIPLES RELEVANT IN THE SOUTH AFRICAN HOUSING SECTOR? CSIR INVESTIGATIONS AND ANALYSIS OF HOUSING CASE STUDIES FOR SUSTAINABLE BUILDING TRANSFORMATION

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Keywords: Open building, South Africa, Housing, Sustainable building transformation

ABSTRACT

The CSIR Housing Research Group in collaboration with a number of partners has been investigating the concepts of sustainable building transformation in the South African housing sector. Documents such as Medium Density Mixed Housing: sustainable design and construction of South African Social Housing (Osman and Herthogs, 2010); Environments of change: a design solution for an informal settlement in Mamelodi (Gottsmann and Osman, 2010); “Time” as a key factor in design and technical decision-making: concepts of accessibility, affordability, participation, choice, variety and change in the South African housing sector (Osman and Sebake, 2010) are products of these investigations.

These studies have relied heavily on a number of theories, including Habraken’s Supports, Open Building levels, and different approaches to material/component re-use. All of these theories provide approaches with regards to the way in which materials, building components and the buildings themselves are re used or salvaged, based on life cycle analysis. However, it has been noticed in previous studies that uniform definitions for this research field are lacking and many researchers work in small enclaves and do not communicate enough with each other. There are numerous terms used to describe this approach to the design of the built environment and these are sometimes confusingly interchanged.

Thus, this paper presents specific working definitions and then proceeds to carry this investigation further by analysing housing case studies with regards to sustainable building transformation. In this process it is attempted to assess if the theories are relevant and applicable in the South African context. While it is acknowledged that these approaches to design and delivery need to be considered for the whole housing market, there is a pressing challenge to government to deliver low-cost and affordable housing. We therefore saw it as important to try and influence thinking, design and planned delivery approaches at the conceptual stages before future projects proceed in the typical manner which we perceive to be unsustainable.

To demonstrate the above the selected case studies are the K206, Alexandra and Elengeni, both in Johannesburg as well as the Potter’s House development in central Pretoria. The criteria for project selection will be explained and a checklist for assessment with regards to adaptability will be presented.

The capacity for sustainable building transformation will be rationally assessed by studying the internal planning, construction methods, material selection and detailing.

The paper will conclude with recommendations for new projects as well as the possibility for incorporating adaptable features in existing projects.
CONFLICTING FLEXIBILITY

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ABSTRACT

New buildings are designed for its first users. For a sustainable approach there are many advantages in designing in flexibility and adjustability in order to enable and facilitate the other sequential users. For the first investor this flexibility is translated into improved exit values due to increased potential. The second investor is acquiring a building with multifunctional opportunities.

The politically stimulated combination of schools with day care is generating several new design commissions in the Netherlands lately. These projects are characterised by a high level of user related features. At the same time these kind of buildings are confronted with an additional need for flexibility due to (demographic) developments in the neighbourhood. There are some good examples of such projects, but there is a distinguished need for additional workable solutions. One of the design projects of the faculty of Architecture started research by design to establish an architectural approach for the combination of elementary schools with after-school child care in different scenarios: transformation of an existing building in a shrinking village, as a replacement in an urban setting and as a new addition to an existing school in an area with growing potential. The combination of scenarios strongly suggest a focus on flexibility during the building’s life time. The growing area will create a peak demand, so even if it does not become a shrinking city after a while, the combined school will still have a fluctuating capacity need. However in the research by design, executed by architectural students, it can be observed that not the life time flexibility, but the daily flexibility, needed by the combination, takes all the creativity. It is already too complex to create multifunctional spaces to be used for learning zones in day time and play area and child care zones afterwards. Compared to other types of projects, the first user approach related to architectural design is in this function mix getting even more attention with the specific requirements, up to the level of dedicated furniture.

The solutions provided by practice for the life time flexibility are in many cases related to an even more complex function mix. If a new neighbourhood first can be characterised by a peak in delivery, followed by baby care, elementary school and child care, higher education and taking care of the elderly people afterwards, the relation with different care functions becomes more obvious and time related. The synergy between those functions can be very promising in the right combination. Such a view on the neighbourhood suggests social centres developing and changing over time together with their servicing area. The context will lead to certain investors willing to fulfil their social and sustainable ambitions.

The research by design itself will have a satisfactory result for the institutions dealing with the implementation of after-school child care if the proper selection of design suggestions are produced. These institutions will represent the first users. The scientific and social significance will be in the developments clearing the conflict by giving an answer to both the daily as well as the life time flexibility.
IMPACT OF PUBLIC SUBSIDIES ON HOUSEHOLD INVESTMENT DECISION IN ENERGY EFFICIENCY ACTIONS

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Keywords: Energy efficiency, Housing model, Public policy, Household economic behaviour

ABSTRACT

Buildings are responsible for over 30% of carbon dioxide emission in the world. This sector has the largest potential in reduction of energy use demand and CO2 emissions among the IPCC sectors. Besides, rational actors in this sector should have a higher activity as some measures are cost effective, i.e. bills savings stemming from the reduction of energy use over equipments lifetimes are more important than the cost of the measures. In the framework of their climate policy, it is in the interest of public authorities to implement cost effective measures and stimulate investment in energy efficiency actions for housing.

The issue is to merge public aims in the reduction of CO2 emissions on a given territory and household private interest in reducing their energy bill. In theory, households hold interest to invest of efficiency energy of their houses, because of comfort improvement and bill cuts. However, in practice and in spite of public financial help, the diffusion of these measures is limited. How subsidies spur households to implement energy efficiency measures in their housing and which are the main barriers to its implementation? This paper provides answers to these questions, presenting the results of an analysis about the energy efficiency measures pay off (like wall insulation or the installation of a new boiler) with, then without, public subsidies and analyzing with a case study the barriers that prevent households to implement energy saving actions despite their economic interest. The study will be based on the potential reduction in CO2 emissions of Grenoble urban area in France.

Based on the economic literature, the first part of the paper presents household’s investment decision and assesses the potential cuts in CO2 emissions. The segmentation of Grenoble urban area housing sector based on the type of building, its size, age, heating system, and use gives us a sharp view of the cost and potentialities of CO2 emission cuts and energy saving in this area. Then the household’s investment decision and the analysis of public policies targeting energy efficiency provide the equilibrium in this pure, unbiased, rational world.

The second part, based on the empirical study, provides analysis on investment decision when transactions costs, information asymmetries and liquidity constraints are taken into account. This part tries to explain the differences between the equilibrium previously described and reality, and value the potentiality of CO2 emission cuts if biases were removed.

The paper concludes that public subsidies allow reducing payback period, but payoff improvement is not enough to encourage households as a whole to implement measures. Even if, thanks to public subsidies, payback is made sufficiently attractive to force investment of rational households with a high actualization rate, a large part of households are still not investing in energy efficiency actions. Besides, even if economic pressure plays a role, households do not ever choose the best payoff. For example they may prefer to replace windows whereas this solution is not cost effective. Informational asymmetry, transaction costs, liquidity constraints tend to explain households choices.
This paper provides a methodology to assess potential of CO2 emission cuts and energy savings in the housing sector in a given area. Besides, it estimates the amount of money public authorities could spend to remove biases according to the amount of money they spend on payoff improvement and on the price they value the potential of CO2 emission cuts and energy savings in the considered housing sector.
APPROACHES TOWARDS A SMART & SPEEDY IMPROVEMENT OF THE IN SERIES DEVELOPED POST WAR HOUSING STOCK

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ABSTRACT

One third of the current housing stock in The Netherlands dates from the sixties and seventies and a large part of these dwellings are fairly similar (because they were built in series). There is a high need for smart and speedy renovation methods, to improve technical, energy and cost efficiency of renovation projects as well as to limit inconveniences to residents. A considerable number of professionals in the Netherlands currently are making a combined effort to improve these methods and their implementation, in an initiative called Smart & Speedy (‘Slim & Snel’ in Dutch). This article describes this initiative, some results till now and an inspiring already realized renovation project that illustrates the goal of the Smart & Speedy approach.
INTRA-FIRM, INTERDISCIPLINARY NETWORKS IN MULTI-NATIONAL ENGINEERING ORGANIZATIONS

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Keywords: Knowledge Management, Organizations, Networks, Global

ABSTRACT

To gain a competitive advantage, project organizations are interested in sharing knowledge gained through their experiences across the organization. Despite the advantages, this can be particularly challenging for multi-national engineering organizations. These organizations not only encounter typical knowledge sharing constraints due to lack of resources, individual motivations, and a project-based focus; but also the additional challenges of geographical, cultural and disciplinary boundaries. However, gaining knowledge from the diverse environments in which multinational engineering organizations work is a large advantage for working globally. To better understand the networks that exist for sharing knowledge within these organizations, this research employed a case study of a sustainability network within a large multinational engineering organization. The organization selected individuals from 62 offices that were dispersed across 25 countries. These individuals responded to ego-centric social network surveys that contained questions about their background and the people with whom they share knowledge. The results found that geographic distance created large barriers in the knowledge-sharing network. There was a high prevalence for regional knowledge sharing, which resulted in regional and country level silos with weak ties to offices in other geographies. The research also found a significant focus on knowledge centered on the home office and sustainability business center. The network illustrates a transfer bias toward centralized communication with limited connections and knowledge exchange between “emerging” and “developed” countries. The results highlight the need for focused strategic efforts by the firm to encourage knowledge sharing ties between offices and countries separated by geography. In addition, to reap the advantages of working globally, firms must focus on creating low levels of centrality to encourage knowledge flow from offices in emerging countries.
SOCIAL NETWORK ANALYSIS AS SUPPORT FOR STAKEHOLDER ENGAGEMENT WITHIN CONSTRUCTION PROJECTS

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Keywords: Social Network Analysis; Stakeholder engagement; Public-private construction

ABSTRACT

Engaging the right stakeholders at the right time is a key factor to successfully complete a construction project. However, the decision which stakeholders to engage within a project can often be a difficult one and little tools exist that can support project managers in doing so. This research looks into the applicability of Social Network Analysis to support project managers with their decisions of which stakeholders to engage and with the stakeholder engagement process itself. We conducted a case study on a public-private redevelopment project in the Netherlands that initially failed because project managers did not involve the right stakeholders at the right time. To understand the social network on the project we conducted interviews with various stakeholders. Based on the interview information, we then composed a social network of the stakeholders which we then discussed with the project’s project manager and the stakeholders in a second round of interviews. The findings from this second interview round show that representations of social networks give project managers a quick overview of the cliques, key players, and the general position of stakeholders in the social project network. This overview helped the project managers to identify which stakeholders to engage. At the same time, our findings show that representations of social networks give stakeholders clear insights in their own positions. These insights then, in turn, supported the stakeholders to better understand their position in relation to the other project stakeholders. In this way, the social network visualization was also a great tool to support project managers with their efforts to engage stakeholders. Overall, the study illustrate the utility of social network analysis to analyze and engage stakeholders on complex public-private construction and design projects.
INCLUSIVE BUILT FACILITIES: A CASE STUDY OF HIGHER EDUCATION INSTITUTIONS

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Keywords: Barrier-free design, Building performance assessment, Sustainable design, Universal design

ABSTRACT

Building an inclusive society has been a goal with universal appeal. In respect of sustainable design and construction, due consideration in disability inclusion is necessary for it has social, economic, legal and environmental implications. It is not a new subject; however, there is still a long way for our built environment to be inclusive. In this paper, a practicable means to appraise the inclusiveness of built facilities quantitatively, the Building Inclusiveness Assessment Score (BIAS), is proposed. Literature, guides and standards of barrier-free access and universal design are reviewed so as to construct a hierarchy of relevant inclusion attributes. A multiple-criteria analysis technique, the Non-structural Fuzzy Decision Support System (NSFDSS), is then applied to analyse the weightings of attributes. On-site assessments are undertaken to collect data for grading individual inclusion attributes. The inclusiveness of built facilities in the University of Hong Kong is studied.

In BIAS, a hierarchy of inclusion attributes is appraised. The outcomes are integrated in form of a score. Notwithstanding the research project is still ongoing, preliminary findings from on-site assessments are presented. A novel insight is provided to sustainable design and construction which should not only regard environmental and economic sustainability but also social sustainability. Compare with earlier attempts to quantify the accessibility of buildings, BIAS further reduced the subjective elements. The framework of BIAS can also be modified to assess built facilities of other uses.
SUCCESS AND FAIL FACTORS IN SUSTAINABLE REAL ESTATE RENOVATION PROJECTS

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Keywords: Sustainable renovation, Housing, Project management, Process management, Ambition

ABSTRACT

Sustainability remains an important issue for the construction industry. Yet, sustainable real estate developments are still considered as highly ambitious projects. To find out how and why sustainable renovation projects actually became sustainable we systematically evaluated 21 leading Dutch real estate renovation projects. In each project we interviewed the client, consultant, architect and contractor. Based on the results it was concluded that it is not necessary to have a pre-defined (sustainability) ambition in order to realize a project that can be considered sustainable in practice. Most of the respondents indicated that the ambition developed throughout the project, mainly because of the potential sustainable reputation or the parties involved in the project. Ambitions were not set as highly as expected: about half of the respondents consider preservation of the building and recycling as sustainable solutions already. The composition, management and collaboration of the construction team were found to be very important during the process. In this sense sustainable projects do not appear to be any different than regular projects, so then the only question is: Why not sustainable?
SUSTAINABLE CONSTRUCTION WASTE MANAGEMENT IN MALAYSIA: A CONTRACTOR’S PERSPECTIVE

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Keywords: Sustainability, Construction waste management, Malaysia

ABSTRACT

The Malaysian construction industry continues to grow, benefiting the country’s economy and providing essential infrastructure. However, this thriving industry is responsible for one of the single largest waste streams in the country. This paper focuses on the current status of waste management in the Malaysian construction sector. It builds on existing research and assesses the level of sustainable practices on construction sites in terms of waste management. It is a reflective paper examining the attitudes and reaction of Malaysian contractors towards a more structured approach to on-site sustainable resource and waste management, the “Site Waste Management Plan”. The Site Waste Management Plan, is a framework that has been used in Europe and has successfully reduced on-site construction waste generation.

The aim of this study is to gauge the industry’s appetite and commitment to sustainable waste management and ultimately guide the future development of a framework for the management of construction wastes in Malaysia. A number of semi-structured interviews were conducted with Malaysian contractors, with no previous experience of Site Waste Management Plans. This exercise allowed the researchers to explore the industry’s level of awareness and commitment to sustainable waste management, identify current barriers and suggest future recommendations for an implementation strategy.
MANAGING OF CONSTRUCTION-RELATED BUSINESSES IN ENVIRONMENTALLY SUSTAINABLE WAYS - A FOCUSED REVIEW OF 62 CONCEPTS

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Keywords: Business management, Construction, Design, Literature review, Sustainability

ABSTRACT

The main aim is to enhance the managing of construction-related businesses in highly environmentally sustainable ways. It turned out that environmental sustainability is so far being taken into account only within 8 (13%) construction-related business management (BM) concepts within a 62-concept population. These contextual concepts have been published mainly via the journals between the years 1990-2009. In principle, both academic and practicing concept designers can incorporate sustainability in their BM concepts as a dimension, a primary or complementary element, a preferred attribute of managing, and/or one of the main criteria in business decision making. Environmental sustainability is herein enhanced by designing a 5-element, high-sustainability BM concept. The five pioneering firms are used to highlight sustainable elements such as offerings with no negative impacts, business processes with minimal carbon footprints, core competitiveness nurturing based on sustainability foresights, business framing with high-sustainability rules, and dealings only with sustainable collaborators. In turn, CIB related researchers can both individually and jointly incorporate sustainability in their existing and new BM concepts. In turn, this author envisions be able to report on the more positive states of BM affairs by the year 2015.
CONCEPTUAL FRAMEWORK FOR POTENTIAL IMPLEMENTATIONS OF MULTI CRITERIA DECISION MAKING (MCDM) METHODS FOR DESIGN QUALITY ASSESSMENT

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Keywords: Architectural Design Quality, Multi Criteria Decision Making (MCDM), DQI, AHP

ABSTRACT

Design is an ill-defined process since it creates its own problems and produces more while solving them. Architectural design can be considered as a process influenced by many stakeholders, each of which has different decision power. Each stakeholder might have his/her own criteria and weightings depending on his/her own perspective and role. Hence design can be seen as a multi-criteria decision making (MCDM) process.

Considering architectural design, its evaluation and quality assessment within a context of MCDM is not regularly performed within building process. The aim of the paper is to find/adopt proper methodologies of MCDM, used in other domains for assessment of design quality, adapt them to the construction domain and test the applicability.

Current tools (for instance DQI, DEEP, AEDET, HQI, LEED, BREEAM, BQA) for quality assessment will be reviewed and compared with several MCDM methods (ie. AHP, ANP, PROMETHEE, SMART). Advantages and disadvantages of gathered outcomes from comparisons for assessment and applicability within architectural design will be discussed. Finally reflections on the outcomes will be provided for further architectural design quality tool generation.
SUSTAINABLE BUILDING PRACTICES: LEGAL INCENTIVES AND BARRIERS

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Keywords: Sustainable-Building, LEED, Legal, Incentives, Barriers

ABSTRACT

Sustainable building has become the buzz word of commercial construction in the U.S. during the past decade. While sustainable building practices and energy efficiencies have been on the building industries radar screen for a number of years, the media intensity and owner interest seem to ebb and flow with the cost of energy. However since the LEED system has gained such popularity in the commercial construction arena in the U.S., more and more owners are demanding that their project be LEED certified; or owners are at least having serious talks with their architect and builders regarding sustainability and the LEED certification process.

A natural outgrowth of public awareness of energy efficiencies in the building process is governmental pressure to achieve certain prescribed outcomes. Is government leading the charge, following a surge or acting as an impediment to the use of sustainable building practices? Building practices in various countries will be examined to determine if there is a trend towards either of the scenarios. While this research will primarily focus on building practices of developed countries, along with local laws that have an impact on the built environment; a cursory look at the efforts of other countries and their energy practices will be performed to provide some insight into the worldwide efforts towards sustainable building.

As most of the information regarding laws that govern the building practices of countries is available on-line, this research will consist of a web-based analysis of governmental actions and influences such actions have on the design and construction of commercial buildings.
SUSTAINABLE PLANNING AND LAND VALUATION. NEW FORMS OF SUBURBAN GROWTH IN AREAS OF THE SPANISH MEDITERRANEAN COAST.

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Keywords: Territorial valuation; Sustainable planning; Suburban growth

ABSTRACT

The present paper, linked to the analysis of residential models in tourist coast areas, the sustainability of its planning and its repercussion in the urban value, is included in MISBE2011. A study is suggested with the objectives of establishing a methodology for territorial valuation through the analysis of externalities which have had an influence on the urban growth and its impact on the formation of the value of the residential real estate. The objectification of said valuation is established by determining the preferences and necessities of society through the analysis of the real estate’s supply and demand. This will allow the creation of a map for the qualitative valuation of the land, as a result of the combination of environmental, landscape, social, productive and cultural valuation, which will establish a value reference for each one of the areas, as well as their spatial interrelations. The value becomes a guideline for the study of the different territorial scenarios offering a comprehensive view of the field for its urban planning. Once the social requirements and the environmental and economic potentialities are known we would be in a position to set out guidelines which contribute to an improvement of the process for the sustainable territorial planning.

The object of study is located in the Spanish Mediterranean coast, in the region of the Vega Baja del Segura, an area with a large ecologic and landscape diversity, in which a clear distinction between urban space and rural space has existed historically. This dichotomy has changed drastically during the last decades, with a strong demographic and economic growth through tourism, which has become an instrument for the stimulation of the development of a land market extremely dynamic. The residential model as an answer to the tourism phenomenon proposes low density developments with growth of a suburban character, which penetrate from the coastline towards the interior of the region, causing a significant scattering of the population. This process has been accompanied by a clear modification of the population structure and the production sectors. An increasing homogenisation of the space where the rural environment has incorporated to its agricultural function other activities linked to the tourist development such as industry, construction and the service sector.

We are before a transformation process where the rural character which has historically identified the region is not given up. The justification for maintaining the rural space alive can be found in the paradigm of sustainability understood as safeguard of the environment. This environment is used as a mechanism for conservation, for green spaces equipment, as a support for landscape, recreational and touristic resources, and as an essential space to create areas of discontinuity between built-up urban areas. Another question would be whether to keep the framework implies necessarily the sustainability on every level, both economic as well as environmental, of the content.

The development of the region has taken place under criteria responding to the guidelines defined by the land markets against the interests of the sustainable integration of the environmental elements. This has caused a significant increase of residential land which has contributed to a gradual loss of the environmental values of the territory.
Within this context, the city depends on a number of attributes that qualify each location and directly affect your training. Defining this process involves selecting a number of variables of an economic, social, environmental and urban presenting mathematical relationships with the value of the property. It presents a detailed market study, with samples geographically qualified and values of finished product sales to establish the criteria for determining the potential demand. It does so by using methods that allow the territorial level management of data such as analytical cartography and Geographic Information Systems (GIS). Later there will be an econometric analysis based on hedonic pricing models, factor analysis and multiple regression functions to determine whether the distribution of values depends on events for statistical significance with economic and what are the variables with a significance level more or less valued. This is a rating scale urban planning, where the result allows us to establish, through the demand for housing, how the specific characteristics of the coast are valued and how they can be incorporated into a sustainable political development.
Abstracts

SUSTAINABLE VISIONS FOR THE CAMPUS OF THE FUTURE

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Keywords: Energy-efficiency, Higher education, University, Campus, Sustainable Development

ABSTRACT

Since 2008 new long-term agreements on energy-efficiency have become effective in the Netherlands. Participating organisations of forty-six sectors have agreed with the Dutch government to make efforts to realise energy-efficiency of 30 percent in the period 2005-2020 and 50 percent - as a guideline - before 2030. Higher education is represented among these sectors. To achieve the energy-efficiency objectives many sectors and associations of organisations have developed sustainable visions and road maps to implement these visions.

This paper will elaborate on the sustainable vision for the sector ‘higher education’, summarizing the results of a research project, which included an analysis of the higher education sector, scenario studies and strategic choices for the sustainable campus. In the process of developing sustainable campuses energy efficiency is not the only goal, setting a good example for visitors, employees and a new generation of students is another. Consequently, this research aimed at two targets: (1) supporting (strategies for) energy reduction and CO2 reduction in line with the energy-efficiency goals for 2030 and (2) a mindset change for the users of the campus, both students and employees.

The research project consisted of three parts: (part I) the future of the campus, describing the higher education sector, (part II) collecting tools and measures for sustainable development and (part III) combining the components of part I and part II in future models for the sustainable campus. For each part a range of sources was used. Part I and II started with literature review and document analysis, exploring the future of higher education and (strategies for) the Dutch campus for part I and the existing sustainability tools and measures for part II. For part I a scenario study of Agentschap NL was available – developed to support the sustainable visions of many sectors - which comprehensively describes four futures for 2030 in terms of demography, economy, technology, culture, political choices and sociological developments. These scenarios were translated into four futures for higher education and combined with three campus strategies based on campus management research. Combining the four scenarios with the three strategies resulted in twelve future models for the university and campus: the results of part I.

To validate the results of part I and to generate more data for part II, a series of workshops was organised in the last months of 2009 among campus managers, students and other experts and user groups of the campus. Examples are workshops with about forty campus managers and energy coordinators, online questionnaires among students and employees in higher education, replied by about seventy respondents, through network “Sustainable Higher Education” (DHO) and workshops among students specialised in sustainability. The results of these workshops can be found throughout this paper. Part II results in a range of sustainable tools and measures.
Part III combines the results of part I and part II, also supported by a web-based tool to deal with the complexity of combining twelve future models (results part I) with more than a hundred sustainable measures (results part II). The web-based tool is developed to generate management information for the decision-making process towards a sustainable campus. Decision-makers in higher education can either browse through the whole database of measures or select a campus strategy and possible scenario, to generate the most suitable or feasible measures for their sustainable campus vision.

The paper will contain data and conclusions from all three parts and illustrate the process of developing sustainable visions for the university and campus of the future.
SUSTAINABLE TRANSFORMATION OF CITIES: THE CASE OF EINDHOVEN, THE NETHERLANDS

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Keywords: Urban form, Sustainable Cities, Urban transformation, Pragmatics

ABSTRACT

In Western Europe, the question of sustainable urban development is, to a large extent, linked to the issue of urban transformation, given that growth rates and urban expansion in European context is in general limited. The challenge is to make use of the ongoing transformation processes to come to more sustainable urban development.

Hildebrand Frey is the main protagonist of the ‘urban cell theory’ (UCT), a theory that emphasizes pragmatism and focuses on the redesign of the existing cities, through promoting the concept of urban and suburban cores, laying down important arguments for neighbourhood borders and neighbourhoods centres. In short, H. Frey advocates a recalibration of urban components to a higher level of aggregation –urban cells or modules– that might be instrumental to achieve a balanced relationship among transport, urban form and environment; thus a more sustainable city. Urban cells are units on the level of the urban district that establish key criteria for each component of sustainability in the city, categorized into planning, design, environment, social and economic key criteria. Therefore, to meet the objectives of a sustainable city, new methods, strategies and design tools are required as part of a pragmatics-based integrated planning. For decisions to pursue the sustainability path, the pragmatic method will be a practical tool in bringing sustainable considerations to bear in the realm of project decisions, considering each factor converging in the physical, social and economical necessities of a community, connecting them to the environment.

This paper examines the sustainable transformation of the cities upon making a re-mapping of the existing city to identify the potential urban cells, restructuring of the actual city of districts and neighbourhoods –including satellite settlements if relevant- and thus obtaining a principal layer of the map of the sustainable city. The presentation focuses on Eindhoven, specifically the District of Woensel as a case study, describing the operationalization of the UCT, to obtain new directions towards the sustainable development of the cities, focusing on the criteria of UCT as a conceptual framework.

This work is structured in three parts: 1- a preliminary analysis identifying the existing neighbourhoods on the district to analyze how the existing parts of the city meet the criteria of UCT, establishing thus potential and non-potential sustainable areas of the existing city under evaluation of the UCT criteria; 2- the description of how to join non-potential and potential sustainable areas of existing city to create “large units of neighbourhoods”, making a balance of them, to improve non-potential parts by joining them with the potential areas; 3- the elaboration of results indicating that all the parts of the city are part of potential sustainable areas, obtaining hence a principal layer of the map of the sustainable city: by the interaction among non-potential and potential sustainable neighbourhoods: laying down new districts with new borders, main avenues and connections, and district centres if required. The relevance of this approach is to contribute new insights to the debate of sustainable city borders. These insights –referred to methods to redesign the cities- will deliver a new direction to achieve sustainability in the city.
REFERENCES:


THE INEVITABLE AND CONTINUING GROWTH OF REGULATIONS FOR PLANNING AND BUILDING

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Keywords: Legal instruments, Urban development, Sustainability, Regulations, Effects

ABSTRACT

The problem
Property developers often complain about the abundance of regulations regarding sustainability they have to comply to. Sometimes even local authorities express their dislike for the huge amounts of statutory obligations preceding new urban developments. Indeed, it seems that new urban developments today can only be realised if many regulations regarding sustainability have been taken into account. This observation stands in contrast with the feeling of many, that a lot of new urban developments cannot be typified as being sustainable. Apparently the regulations relating to sustainability, according to many, result in the delivery of the usual, non-sustainable urban developments.

Research question
This paper addresses the seemingly discrepancy between the huge amount of regulations regarding sustainability on the one hand and the disappointing physical results on the other hand. The research question is: to what extend do legal instruments promote or hinder the development of sustainable urban areas? This paper is confined to Dutch urban planning. However, it is quite conceivable that other countries are confronted with the same feelings of discrepancy. This is partially due to the fact that many regulations regarding sustainability find their origins in European environmental legislation which, of course, has equal power for each of the member states of the European Union.

Method
To answer the research question an overview of public law regulations regarding sustainable development of urban areas will be provided. This shall include instruments like Environmental Impact Assessment and regulations for the protection of natural habitats. Provisions for energy efficiency shall also be included, as many other regulations. The overview serves to identify the character of each of the regulations: to what extend does it promote or hinder sustainable development?
Apart from public law regulations, attention will be given to private law agreements between property developers and local authorities. To what extend do these agreements reinforce the development of sustainable areas?

Results
This paper argues that even regulations which have the objective to promote sustainability, may in practice limit or even adverse sustainable effects. Furthermore, it shows the limited space for agreements (relating to sustainability) between property developers and local authorities in Dutch urban planning.
Significance
If the results of sustainable urban planning fall short – which, according to many indeed is the case – it is sensible to look for a connection with the regulatory framework. This paper shows that some legal instruments promote the sustainability of new urban areas. However, the research also shows that some regulations have very limited or even adverse effects on sustainability. This calls for a rethinking of some of the legal instruments that are intended for sustainable urban development.
SUSTAINABLE RETROFIT POTENTIAL IN LOWER QUALITY OFFICE STOCK IN THE CENTRAL BUSINESS DISTRICT

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Keywords: Office buildings, Sustainability, Refurbishment, Building adaptation, Australia

ABSTRACT

Given the relationship between energy consumption, greenhouse gas emissions and climate change, the built environment has significant potential to lessen overall emissions. With around half of all greenhouse gas emissions attributed to the built environment; it has a significant role to play in mitigating global warming. With large percentages of office stock structurally vacant in some city centres and only 1 or 2% of new buildings added to the total stock each year; the scope for reductions lay with adaptation of existing buildings. The stock with the highest levels of vacancy and obsolescence offers the highest potential of all.

Many cities are now aiming to become carbon neutral. Successful adaptation demands that social, technological, environmental, economic and legislative criteria are addressed. Buildings have to meet user and community needs. City centres comprise a range of different type of office stock with regards to age, size, location, height, tenure and quality. All buildings present challenges and opportunities with regards to adaptation and sustainability and integrating retrofit measures that reduce energy, water and resource consumption.

Using a selection of low grade office buildings to develop retrofit profiles, this paper addresses the questions; (a) what is the nature of adaptations in relation to low quality office building stock in the Central Business District (CBD) and, (b) what is the extent and scope for sustainable retrofits to low quality office buildings. Using Melbourne CBD adaptation events of low quality office buildings were analysed between 1998 and 2008 to identify the potential for integrating sustainability into retrofits projects.
THE AMSTERDAM GUIDE TO ENERGETIC URBAN PLANNING

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Keywords: Sustainable urban planning, New stepped strategy, Rotterdam energy approach and planning, Energy potential mapping, Energy neutrality

ABSTRACT

The City of Amsterdam has ambitious goals as to become climate neutral. This will only be possible through a structured approach to both new and existing neighbourhoods. Following steps from the New Stepped Strategy - as used in the Rotterdam Energy Approach and Planning (REAP) - and using the methodology of Energy Potential Mapping (EPM), the Amsterdam Guide to Energetic Urban Planning (in Dutch: Leidraad Energetische Stedenbouw, LES) must become the manual that will support urban area (re)development towards energy neutrality.

The Guide clarifies the local Amsterdam energy potentials, both natural and anthropogenic, and gives an extensive overview of measures and data to be used for the sustainable provision of electricity, heat and cold. This is presented in a very tangible manner, practical to urban planners and architects, housing corporations and project developers, public institutions and politician.

The Amsterdam Guide has been tested on two sites, one to be newly constructed and another to be redeveloped, and the incremental approach proved worthwhile, enabling energy neutrality in both cases. The Guide has incited discussions on both short-term actions and long-term visions needed to facilitate real climate neutrality in the city of Amsterdam. The paper will discuss the Amsterdam Guide, its methodology, the cases studied, as well as future perspectives and considerations.
SUSTAINABILITY AND URBAN DENSITY

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Keywords: Sustainability, Built environment, Urban density, Urban design and decision making

ABSTRACT

This paper concerns the definition, construction and application of a decision based design model which enables the integration of the allocation of a variety of urban land uses with the distribution of different urban densities, in particular of residential urban areas.

Urban planning is, among others things about the spatial distribution of human activities and their physical facilities like buildings, roads, green areas etc. in amount, place and time over a well-defined area.

Today, sustainable urban development and sustainability in urban areas are important issues in urban planning. The aspects related to these issues have to be taken in account when developing urban areas. One of these aspects is urban density. Nowadays, it is generally assumed (and accepted) that urban density is related to sustainability. New urban planning approaches, loosely based around new urbanism, are successfully reducing environmental impacts by altering the built environment to create and preserve sustainable cities which support sustainable transport. Residents in compact urban neighborhoods drive fewer miles, and have significantly lower environmental impacts across a range of measures, compared with those living in sprawling suburbs.

Urban density can be expressed in many ways. A widely used measurement is the number of dwelling units per unit area (acre, hectare). This measurement gives only information about the number of dwellings, not about their size or the way they are grouped. More general and precise ways of measuring density are measurements based on built area or gross floor area, respectively named ground space index and floor space index.

Using these measurements in urban design processes cannot guarantee a good or bad urban area because they are only measurements about the ratio of built and non-built spaces and give no information about the activities and functions within these spaces, neither about their distribution. Therefore, the outcome of an urban design model based on only density factors (as the amounts of built and non-built areas) gives no information about contents of these spaces. Consequently, these types of models are not applicable in a context of social oriented decision making, as in urban planning.

As stated above, this paper is about the integration of an urban function or urban activity based model and urban density based model.

The first part will give an overview of the definitions, differences and similarities of both function based and density based models, as well as definitions of the combined model. The second part describes the application of the combined model in a number of tests, including a final conclusion.
DUTCH STRATEGIES FOR THE HISTORIC URBAN CORE, THE HISTORIC INNER CITY, FADED GLORY OR CORE BUSINESS?

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Keywords: Historic urban core, Spatial quality, Interventions

ABSTRACT

After the second world war a long period of steady economic growth started in the fifties, continued in the sixties, peeked in the seventies, had a downswing in the eighties but recovered fully in the nineties. Europe switched over from industry to the service sector as the dominant economic sector.

The economic developments went hand in hand with a growth of the urban area that accelerated to a much higher level then the growth initiated by the industrial revolution. The public and economic functions, traditionally located in the urban core, needed more and more space and moved to bigger buildings on better accessible locations, outside the inner cities. The abandoned urban core was taken over by small scale commercial activities and the housing function became stronger. Functions for which the small scale buildings and organic street patterns were fitting like a glove.

During the period of economic prosperity the mobility of people improved steadily and the growing service sector became foot lose. Cities more and more became competitive for the favour of the consumer. In relation to that cities were and are looking for characteristics that makes them clearly distinctive from each other. The area of the old inner city is seen as to be essential in that context. Selling the city with the unique quality of the urban core as a cornerstone, has placed itself in the limelight of local politics.

What is it that gives the urban core its unique quality? What components of the urban core need to be preserved, restored or renewed? What possibilities does the local government have to modify the changing process of the historic urban core in order to aim for preservation and strengthening of its unique qualities? In what way and to what extent do local governments use their possibilities?

These questions are subject for debate in local politics and form the framework for this article. These questions are placed in the Dutch context. The answers however can function as a reference for strategies to be developed for non Dutch historic inner cities.

To start with a spatial definition is given for the urban core to distinguish the area we are dealing with as the historic inner city. After that the specific characteristics of the urban core is introduced. The main part of this article is about the strategies of Dutch cities for the historic urban core. This part is based on empirical research done on the policy reports of twenty Dutch cities. In addition to the policy reports plans for spatial and functional interventions, initiated by the local government, were analyzed.

The analysis were made in the years 2006, 2007 and 2008. The years just before the start of a possibly long lasting economic recession. Apart from some reflections on this subject at the end of this article no attention is paid to this in an analytical way
CLIMATE CHANGE EFFECTS ON LIVING QUALITY; AWARENESS OF HOUSING ASSOCIATIONS

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Keywords: Awareness, Climate Change, Adaptation, Social Housing

ABSTRACT

A changing climate can have a large influence on the living quality of houses. A case study was carried out on the level of awareness of housing associations. This study forms the start of a research project on governance strategies for adaptation in residential buildings. A content analysis on climate change related topics was pursued on the policy plans and the most recent annual reports of the 25 largest Dutch housing associations. They were classified according to their level of awareness. Based on the results of the analysis it is concluded that the housing associations fall within the lowest category of awareness. In order to reach higher levels of awareness, governance strategies for adaptation have to be developed. The nature of possible strategies will depend on the level of awareness of the housing association. The definition of strategies will be studied in the future.

This research provides basic information on 'climate change awareness’ that is valuable for governmental and non-governmental policymakers on the national, regional and local level, who are dealing with climate change issues.
ARCHITECTURAL DESIGN AND CONSTRUCTION COSTS, TOOLS TOWARDS TERRITORIAL SUSTAINABILITY

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Keywords: Self-development, Sustainability, Design, Costs

ABSTRACT

This paper is presented in CIB: Management and Innovation Sustainable Built Environment 2011, as the study and analysis of the residential model of a rural area from the Iberian Peninsula, specifically applied to the case of the province of Cáceres, in the autonomous region of Extremadura, in Spain. This region, with an eminent rural nature and economic resources traditionally linked to the development of the land, and, specifically, to activities such as livestock breeding and agriculture, has suffered a strong emigration of the population, since the 60’s, towards the most powerful city centres, generally provincial capitals and specifically the capital of the State (Madrid).

For years repopulation policies were carried out (such as the Badajoz Plan) reinventing towns out of nowhere, which did not achieve the expected success, maybe because of the lack of roots before the new, maybe because of the roughness of the agricultural and stockbreeding tasks faced with the opportunities in the city. As a result, in the end of the 80’s many towns were practically deserted.

In this context, Extremadura became one of the most depressed areas in Spain in the 80’s, therefore being one of the least developed areas in Europe, up to the moment when the entrance in the EU and its help policies started to point at the beginning of a stimulating process of the territorial economy. Following this boost, the autonomous government of Extremadura started helping the promotion of housing in the rural area through a substantial economic help with non-recoverable funds (18.000 €) and providing the technical service of the private project commission and the actions management.

As a previous condition the property developer –self-developer– is required to hold the ownership of the site and the stay in the dwelling for at least 10 years; the technical conditions of the building are notably regulated, with a limitation of the maximum surface (95 m2 usable) and a list of specifications for the finishing. However, there is freedom in the program, and in general, in the architectural design as opposed to other figures supervised by the administration, such as state subsidized housing, whose design is more restricted.

This building typology has achieved an important success during the last fifteen years within this territorial scope, with about 2.800 dwellings, fully occupied, promoted from 2001 to 2008. All this makes this public initiative an interesting answer to the socioeconomic problems of the rural environment, specifically in Extremadura, which has produced an occupation of the territory more polycentrist and a distribution of the natural resources more sustainable.

In this context the paper intends to analyse the characterization of this type of dwelling whose success has been the freedom of design and the suitability to the rural environment, so changeable within the different areas of the autonomous region. It is intended to analyse which are the variables of the architectural design that have an influence on the construction cost in an environment of limited economic resources, since the dimensions and qualities of the built product are marked by the subvention’s administrative process.

To this end, from a database made up of building projects whose real costs are known, it is intended to establish the links of the different parameters studied through the corresponding functions of statistical analysis. With this study we intend to determine quickly the real cost of
construction through the development of a parameterization mathematical model, which will allow to anticipate with rigor and accuracy the economic investment to do with a double purpose: on the one hand, the auto developer of the dwelling will be able to control the financing process and, on the other hand, it will make easier for the acting administration to carry out a help policy more suitable for each case.

One of the main objectives of this process is constituted by the possibility of establishing, independently of the type of dwelling (subsidized or not), those design variables of higher economic importance, so as to keep an economic control of these parameters, generally geometrical and typological, from the very start of the project. And, in general, a higher optimization of resources in the construction of dwellings in the rural environment from their design is intended.

Finally, this study will allow the Administration to carry out a sustainable policy of development in the rural environment of Extremadura, by counting with a better knowledge of the construction costs for this type of dwelling, whose success is important in the process of anchoring the population to the territory.
EXPLORING THE BUSINESS CASE FOR MORE ADAPTABLE BUILDINGS: LESSONS FROM CASE STUDIES

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Keywords: Adaptability; Cost-benefit; Flexibility; Risk; Sustainability

ABSTRACT

In recent years there has been growing interest in the issue of adaptable buildings. This interest has been stimulated by a number of factors, including increasing rates of technological change and a desire to make the built environment more sustainable by extending the life of our existing building stock. However, most of the academic literature on the subject has tended to focus on how to design buildings to be more adaptable, rather than trying to understand the reasons why some buildings are designed to accommodate change, while others are not. This paper therefore explores the business case for designing and constructing more adaptable buildings. In doing so, it examines the potential costs, benefits and risks of designing adaptability into buildings and the social, economic, political, legal and commercial conditions under which greater adaptability would either be a more desirable or less desirable design objective.

This paper begins by discussing what is meant by adaptability in the context of the built environment and by reviewing the existing literature on adaptability, obsolescence and the adaptive re-use of buildings. It also examines some of the key theories behind adaptability, the different strategies for designing adaptability into buildings, and the social, economic, political, legal and commercial forces that impact on the capacity of a building to adapt to change. The business case for adaptability is then explored through case studies of buildings from across a range of sectors, including office, industrial, education and residential. The case studies are used to unpack the reasoning behind particular adaptable design solutions. This paper concludes by looking at what would need to change, in terms of current market conditions and industry mindsets, to create greater demand for adaptable design solutions.
MICROGENERATION TECHNOLOGIES IN NEW BUILD HOUSING: TECHNOLOGICAL TRAJECTORIES AND USER EXPERIENCES

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Keywords: Housing, Microgeneration technologies, Technological innovation systems, Technological trajectories,

ABSTRACT

The UK has set a target for a reduction in CO2 emissions by 80% by 2050 compared to 1990 levels (HM Government, 2008). The domestic sector accounts for 25% of UK emissions from the generation of heat and electricity for homes (DEFRA, 2008). For this sector to move to a low-carbon path, it will need to transform the environmental performance of housing. The transformation will require system-wide innovation and change comprising new technologies, new markets and new institutional supporting systems. The supply of new homes to the UK housing stock will have a cumulative impact on the ability of the domestic sector to contribute to the 2050 carbon reduction target.

There is an urgent research need to better understand, therefore, steer this system innovation. The ongoing research project reported on here contributes to this need by addressing the impact of the growing raft of environmental regulations on the UK housing development sector through a technological innovation system (TIS) approach. A broad view is taken of environmental regulations being one part of the institutional context that collectively structure socio-technical interactions and economic transactions through reframing and steering firm behaviour and economic activity in the housing development sector. The primary focus is on microgeneration technology (MGT) field within this sector. The research recognises that the challenge of integrating MGTs is not merely a technical one for housing developers; rather, it has significant technical, social and economic implications for housing developers and their supply chains, as well as for home buyers. The research aims to develop a more nuanced, socio-technical system perspective which seeks to understand the interplay of microgeneration solutions with other system components, such as the interests of market actors to produce them, knowledge needed to integrate them into housing designs and, user practices which fit technical functions.

The research has two related phases. Initially, through a web-based survey and follow-up semi-structured interviews, the work seeks to identify the scale and scope of the microgeneration technologies (MGTs) currently being used by housing developers and to better understand why particular MGTs are becoming dominant (or not) in the new house build sector. The second phase will explore homeowners’ actual day-to-day experience of and attitudes towards different types of MGTs in their homes. The paper concludes with a detailing of future research directions and supporting fieldwork which will be undertaken in this research project.
THE ENERGY PERFORMANCE OF OFFICE BUILDINGS THROUGHOUT THEIR BUILDING PROCESS

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Keywords: Stakeholder, Decision making, Energy measures, Office

ABSTRACT

Many innovative techniques and policy measures have been introduced to reduce energy consumption. Despite the high ambitions and societal pressures, the adoption rate of energy measures in office buildings is still low. Using adoption theories this paper provides a framework to analyse the adoption process of energy saving techniques in building processes. This framework is used to analyse the design and building processes of four Dutch office buildings. In these processes the roles of the stakeholders, in relation to the adoption of energy measures, are identified during every phase of the building projects. It enables us to better understand by which means certain stakeholders can exert influence on adopting or rejecting certain energy concepts and measures. The complex network of temporary relationships among stakeholders makes it hard to turn high ambitions into a broad adoption of multiple energy techniques, which can lower the energy use or which make use of renewable sources.
MODEL OF ECONOMIC JUSTIFICATION OF CONSTRUCTIONS' RENOVATION

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Keywords: Renovation, Sanitation of buildings, Maintenance of buildings, Physical deterioration, Functional obsolescence, Economic obsolescence

ABSTRACT

In the life cycle of constructions we often cope with the problem if it is economic justified to renovate certain construction. On the market we meet growing problem of older constructions which are more and more neglected and unkept. This is the consequence of high number of new apartments and other constructions. General crisis has also an influence on negligence and has forced owners of constructions to economize and consequently at negligence of older constructions what brings to diladaptation. This will also happen to new constructions because owners act too less responsible or economic, therefore the reason of diladaptation is the lack of knowledge of owners. They do not know how to take care of constructions and how to maintain them regularly and when to sanitize them. By originating the damages are often connected high cost which means that the issue of preventing diladaptation is important not only from the view of security and aesthetic but also from the view of national economies and sustainable development. Only with maintenance we ensure further exploitative ability of constructions where it is necessary to execute the renovations at the basis of previous reasons’ finding of beginning of damages and condition of damaged construction. For each construction separately it is necessary to find out costs, risks and advantages of existing constructions’ renovations fundamentally or advantages of new building. Built constructions as fixed property represent important issue of national wealthy of society or country because the aim of each country is to keep functional ability of its fixed property as long as possible which is only possible with suitable relation to fixed property and with good husbandry. Thus we are developing multicriteria decisive model of economic justification of renovation or substitutional building. In this paper we will represent the model of economic justification of constructions’ renovation. We have researched existing multicriteria decisive models and on this basis we decided for new model which will help at deciding whether it is economically justified to renovate certain construction. In this model were also included criteria which reduce the value of construction: physical deterioration, functional obsolescence and economic obsolescence. Physical deterioration is the consequence of exploitation and damages of the construction or fixed property. Each part which is exploitated or damaged can be curable or incurable. Functional obsolescence means that something in or on the construction or fixed property obsolete or it is not appropriate for usage any more. Economic obsolescence means obsolete because of location or environment, which is caused by reasons which are out of construction’s area. In the model is also included profit of the construction at the business constructions while at the non-business construction there is no profit. Therefore it can be expected higher profit at the renovated construction than at unrestored construction. Model does not include constructions which are inscribed in the register of cultural inheritance which means that there are certain architectural changes allowed only on the basis of very reasonable causes and on the basis of fundamental studies where it is necessary to check existing possibilities. Basic guidance at the regular maintenance and investments in the object of cultural inheritance is keeping the genuineness – authenticity. Thus we have to renovate that kind of objects, as a rule not regarding on the costs.
Built constructions as fixed property represent important issue of national wealthy of society or country because the aim of each country is to keep functional ability of its fixed property as long as possible which is only possible with suitable relation to fixed property and with good husbandry. Model gives appropriate results which are very helpful at taking decisions whether to renovate the construction or not and therefore appropriate keep manage. Proposed model was checked in the real situations and we have got positive results in connection with using the model of economic justification of constructions' renovation in practice.
REDESIGN – UPGRADING THE BUILDING STOCK TO MEET (NEW) USER DEMANDS

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Keywords: Offices, Vacancy, User preferences

ABSTRACT

Financial and real estate crises and “new ways of working” reduce the need for office space. As a consequence, office markets become replacement markets without a quantitative need for new office buildings: new buildings drive out bad buildings. In the Netherlands, currently 14% of the office space is vacant, of which 60% is redundant or obsolete. Office users, guided by the government, consider sustainable office space important for their image and status. Besides they want to be accommodated in high quality buildings that fit with their current and future need for space, taking into account expected shrinkage or further development and expansion. Quite often, new office developments were the response to these demands. Public opinion and emerging governmental awareness of sustainability oppose the construction of new office buildings in locations with a high vacancy level, while office users, real estate developers and investors crave for new office developments. Can redesign of existing office buildings answer to the demand for new sustainable office space?

In former research we have revealed that location and building characteristics have a strong influence on office users’ preferences and decisions to move to other buildings. Knowledge about these characteristics is important when determining the potential future use of the existing office stock. Based on foregoing research, we propose new use of existing office buildings and delve into the measures that need to be taken in order to adapt existing buildings to new use.
RETROFITTING COMMERCIAL OFFICE BUILDINGS FOR SUSTAINABILITY:
TENANTS’ EXPECTATIONS AND EXPERIENCES

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ABSTRACT

Introduction
Buildings, which account for approximately half of all annual energy and greenhouse gas emissions, are an important target area for any strategy addressing climate change. Whilst new commercial buildings increasingly address sustainability considerations, incorporating green technology in the refurbishment process of older buildings presents many technical, financial and social challenges. This research explores the social dimension, focussing on the perspectives of commercial office building tenants.

Methodology
Semi-structured in-depth interviews with seven residents and neighbours of a large case-study building undergoing green refurbishment in Melbourne, Australia. Built in 1979, the 7,008m² ‘B’ grade building consists of 11 upper levels of office accommodation, ground floor retail, and a basement area leased as a licensed restaurant. After refurbishment, which included the installation of chilled water pumps, solar water heating, waterless urinals, insulation, disabled toilets, and automatic dimming lights, it was expected that the environmental performance of the building would move from a non-existent zero ABGR (Australian Building Greenhouse Rating) star rating to 3.5 stars, with a 40% reduction in water consumption and 20% reduction in energy consumption. Interviews were transcribed, with responses analysed using a thematic approach, identifying categories, themes and patterns.

Results
Commercial property tenants are on a journey to sustainability - they are interested and willing to engage in discussions about sustainability initiatives, but the process, costs and benefits need to be clear. Critically, whilst sustainability was an essential and non-negotiable criterion in building selection for government and larger corporate tenants, sustainability was not yet a core business value for smaller organisations – whilst they could see it as an emerging issue, they wanted detailed cost-benefit analyses, pay-back calculations of proposed technologies and, ideally, wished they could trial the technology first-hand in some way.

Although extremely interested in learning more, most participants reported relatively minimal knowledge of specific sustainability features, designs or products. In discussions about different sustainable technologies (e.g., waterless urinals, green-rated carpets), participants frequently commented that they knew little about the technology, had not heard of it or were not sure exactly how it worked. Whilst participants viewed sustainable commercial buildings as the future, they had varied expectations about the fate of existing older buildings – most felt that they would have to be retrofitted at some point to meet market expectations and predicted the emergence of a ‘non-sustainability discount’ for residing in a building without sustainable features.

Discussion
This research offers a beginning point for understanding the difficulty of integrating green technology in older commercial buildings. Tenants currently have limited understandings of
Abstracts

technology and potential building performance outcomes, which ultimately could impede the implementation of sustainable initiatives in older buildings. Whilst the commercial property market is interested in learning about sustainability in the built environment, the findings highlight the importance of developing a strong business case, communication and transition plan for implementing sustainability retrofits in existing commercial buildings.
MODELLING OF IMPACT FACTORS ADOPTING PRECAST CONCRETE

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Keywords: Precast Concrete System, Model, Thailand

ABSTRACT

Technology in construction adopting Prefabricated Elements can be recognised as “Precast Concrete System”. In Western Countries, this system has been widely used in constructing Bridges, Office Buildings and Residential buildings. A Precast concrete construction system provides the advantages of construction effectiveness, high levels of quality control, saving of construction time, minimisation of skilled labour, reduced manpower requirement on site, and saving in formwork requirements when compared with the traditional construction method (cast in place). In Thailand, Cast in Place is the traditional construction system that has been mostly used till now. Precast Concrete Slab is only a part of prefabricated elements that is used widely in Thailand. Adopting of fully precast concrete systems are only a few parties in the Thai construction market. However, many factors have an impact on the adopting of precast concrete system. This paper is the primary study stage to present and analyse a conceptual model that accommodate the numerous factors impact on the adoption process effectiveness. The results from 160 construction industry professionals in Thailand are presented and the significant factors which impact on the adoption of precast concrete system have been determined through the numerous statistical analysis. The paper concludes with the refine conceptual model of the adoption of precast concrete elements and system.
SCHEDULING PROCESS: USING ONE-DAY SCHEDULING ON MULTI-FAMILY PROJECTS TO REDUCE DELIVERY TIME

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Keywords: Scheduling, One-day, Multi-family

ABSTRACT

The past fifty years has seen many changes in the construction process, but little has changed in the area of scheduling for most projects. There have been advances in the software used to manage schedules, but the same theories and practices that have been used for decades continue to be used. Activities are identified, defined, assigned durations, and linked by relationships to create a work flow through the project that is effective and manageable. This process works well and will continue to be norm on most projects. Some home builders have incorporated a process “one-day scheduling.” The process views the project as a linear sequence of days and identifies what activity is start and finish on that day. Several large home builders have found that the number of calendar days to construct an individual home as part of a large development has been reduced significantly, giving them a strategic advantage in the market. The following study looks at the implementation of a combination of traditional and “one-day scheduling” on multi-family residential projects as a method of schedule management, resource management, and cost control. The study schedules both vertical and horizontal projects. The study reviews the management of the schedule during construction as well as the scheduling process. The end goal of any construction project is to deliver a project of the greatest value to the owner for the defined cost. The implementation of a method of scheduling which delivers a product more efficiently will conserve resources and enhance the goals of sustainable construction.
A PHASED CITY ENERGY PLATFORM FOR NETWORKED PRECINCT BUILDINGS IN THE CONTEXT OF MANAGEMENT INFORMATION SYSTEMS AND SMART GRIDS

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Keywords: Building energy management; Building information management; Information aesthetics; Green buildings; Urban sustainability

ABSTRACT

This research investigates the context and advantages of energy sharing between networked precinct buildings in the context of pre-existing urban stock. The paper considers whether the sharing of patterns of use and knowledge of buildings’ spatial, architectural and energy-related components can act as a phased prequel to energy sharing and provide a ‘knowledge pool’ to facilitate changes to the technological mix in a building, as well as modes of usage. In the context of energy use and conservation it is well understood that resource sharing can be advantageous across multiple buildings, but less is known about the potential benefits of energy knowledge sharing across buildings. The sharing of energy data across buildings with different owners/operators but offers the advantages of balancing demand across facilities, right-sizing technology components, intelligent planning and future usage pooling – particularly for smart buildings with energy storage and generation capacity. With a focus on the Australian context, this research investigation examines how an initial energy information platform phase could benefit a range of building stakeholders and be lead to a subsequent energy sharing phase. The author argues that there is value in a city energy information platform as a prequel to smart grids and subsequently as a complement to smart grids.
APPLYING THE SHUFFLED FROG-LEAPING ALGORITHM TO IMPROVE SCHEDULING OF CONSTRUCTION PROJECTS WITH ACTIVITY SPLITTING ALLOWED

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Keywords: Optimization, Multi-objective SFLA, Splitting, Leveling, Construction Management

ABSTRACT

In situation of contractors competing to finish a given project with the least duration and cost, acquiring the ability to improve the project quality properties seems essential for project managers. Evolutionary Algorithm (EAs) have been applied as suitable algorithms to develop the multi-objective Time-Cost trade-off Optimization (TCO) and Time-Cost-Resource Optimization (TCRO) in the past few decades; however, by improving EAs, the Shuffled Frog Leaping Algorithm (SFLA) has been introduced as an algorithm capable of achieving a better solution with faster convergence. Furthermore, considering splitting in execution of activities can make models closer to approximating real projects. One example has been used to demonstrate the impact of SFLA and splitting on the results of the model and to compare with previous algorithms. Current research has elucidated that SFLA improves final results and splitting allows the model find suitable solutions.
Abstracts

RELEASING THE POTENTIAL OF BIM IN CONSTRUCTION EDUCATION

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Keywords: BIM, Construction education, Visual and kinetic learning

ABSTRACT

BIM at least in the sense of 3D modelling is fast becoming a reality in the commercial world. It also has the potential to become a powerful tool in the world of construction education. At its simplest it enables construction students to see in a 3D virtual model how buildings are assembled. This in itself is a considerable advance on trying to get students to learn building construction through interpreting 2D information. Beyond this BIM has the potential to allow faculty to radically rethink the teaching and learning process for construction students. If the BIM models provide information, that is readily understood by the student, as to how buildings are assembled, faculty should be able to spend less time “telling” students about construction detailing and thereby create more time for the students to learn by interacting with BIM models in the processes of construction planning, measurement and estimating.

The paper revisits education theory with a focus on how students learn by “seeing” and “doing” rather than “listening”. It then explores how that theory can be combined with the potential of BIM to give the students enhanced learning experiences. A case study of early attempts to unlock the potential of BIM in a construction education setting is presented.
HEURISTIC SOLUTION FOR RESOURCE SCHEDULING FOR REPE TITIVE CONSTRUCTION PROJECTS

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Keywords: Activity network, Precedence Diagramming Method, Resource scheduling, Repetitive construction, Location based scheduling

ABSTRACT

Construction project planning and control are core processes for building project management. In practice project time management is achieved by computer based techniques like Precedence Diagramming Method (PDM). PDM is a network-based planning instrument where building processes are represented topologically by means of an activity network. This is called Activity-Based Scheduling: activities, set of working operations performed by resources i.e. crews, are linked with each other by logical dependencies. Activity network is a time oriented building process model that provides construction planning. Time flow is modeled through the network by performing critical path calculation. Resource flow through project activities is not modeled in a direct way, i.e. resources are simply loaded to corresponding activities as an attribute or a label.

Networking techniques represent the state of the art of construction project planning and scheduling in real life projects, but many researchers and practitioners claims that these techniques do not provide a suitable model for construction process, especially in repetitive projects. This is mainly because activity network is discrete while construction process is basically a continuous flow of working operation performed by specialized resources. A repetitive project is a multi–unit project where resources move through the various similar location of the project (e.g. multi – storey building, housing projects, highway projects), while a non-repetitive project is a building project that has a complex location breakdown structure and is mostly a set of one-off activities.

Construction process modeling, for repetitive projects in particular, needs a more accurate model for resource flow through project activities. Location Based Scheduling is a resource oriented construction process model. In Location Based Scheduling working tasks, set of repetitive activities, are plotted on time / space chart using general principles of the Line of Balance (LOB). The essence of location based resource scheduling is the view of the movement of construction resources through the various project locations as a key to improve project performance. With the aim of improving resource scheduling in repetitive construction projects with Precedence Diagramming Method, an heuristic algorithm for repetitive activity scheduling process is presented (REPNET), based on a precedence network plotted on a resource–space chart. In repetitive-unit projects it is important that repetitive activities are planned in such a way as to enable timely movement of crews from one repetitive unit to the next, avoiding crew idle time. This is known as the “work continuity constraint” and its application during project planning can provide an effective resource utilization strategy that can lead to: maximization of the benefits from the learning curve effect for each crew; minimization of idle time of each crew; minimization of the off-on movement of crews on a project once work as begun.

The heuristics of REPNET carry out resource timing in two phases: in the first phase as soon as possible project schedule is performed; in the second phase the REPNET algorithm search for resource scheduling optimization by minimization of resource idle time in repetitive activity performance. The work continuity constraint is relaxed in order to maintain the PDM
minimum project duration. In this way, besides the classic time critical path, a resource critical path is detected. Space critical path can be highlighted if useful. The REPNET optimization algorithm is performed for a case study, the Galli Theatre refurbishment project, and flow-line view on a time – space chart is also plotted to verify project feasibility. Optimized project schedule is compared with original network scheduling and discussed.
FOSTERING AN ENVIRONMENTALLY RESPONSIVE INDUSTRY – A PUBLIC SECTOR CASE STUDY FROM HONG KONG

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Keywords: Environmentally Responsible Construction Industry, Industry Development Initiatives, Public Sector

ABSTRACT

Well meaning high-level construction industry reviews, and recommendations from those reviews, usually lead to many industry development initiatives. Promoting a safer work place and environmentally responsible industry was one of the seven themes under which recommendations were made in Construction Industry Review Committee (CIRC) Report of 2001 of Hong Kong. These were followed with many related initiatives for industry development by industry stakeholders. The findings reported here are part (limited in focus to environmental responsiveness of construction industry) of a wider research project titled ‘Construction Industry Development Comparison and Acceleration’ (CIDCA) designed to track implementation programmes against the original objectives in the CIRC report and some changing priorities thereafter, actual achievements, drivers, enablers and barriers, residual issues and concerns; in comparison with UK and Singapore scenarios in interlocking studies.

The original CIRC recommendations laid the responsibility of promoting an environmentally responsible industry on public sector agencies with an assumption that the private sector would follow suit. In this regard, a case study of a proactive public sector client was conducted. The data from the case study was supplemented with interviews with key personnel from other stakeholder organisations. The findings reported here identify environmentally responsive initiatives from the case study and isolate high impact initiatives among them. Their implementation is tracked and their impact on the rest of the industry is analysed. Also, key challenges and enablers/ barriers are identified in terms of achieving (i) desired results within the organisation and (ii) desired impact on the industry. Lessons learnt are then discussed with an emphasis on transforming innovative initiatives into acceptable industry norms. The reported findings though specific to the Hong Kong Construction Industry should provide pointers on implementing public sector led initiatives for other countries.
CM-AT-RISK AS A HIGHWAY CONSTRUCTION DELIVERY SYSTEM IN THE SOUTHEASTERN UNITED STATES

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ABSTRACT

State Highway Agencies (SHAs) in the United States discovered long ago that construction delivery systems used by the vertical construction industry could be successfully adapted to highway and bridge work. The main benefit that the SHAs were seeking was less time between project conception and project completion. The adoption of Fast Track contracting methods like Design-Build (DB) and all its sub-systems like Design-Build-Operate, Design-Build-Operate-Transfer, etc. fulfilled the promise of a shorter project duration than the SHAs were accustomed to under the traditional Design-Bid-Build delivery system. However, the newfound speed came at a cost. Not a financial cost, but a cost that SHAs are increasingly interested in eliminating. The cost is the loss of control over the design process. In most Fast Track delivery systems, including all of the DB family of methods, there is no contractual relationship between the design firm and the SHA. This often leads to uncomfortable situations for the SHA. Of course there is always the danger that the contractor and the owner will conspire to deceive the SHA when something goes wrong. Certainly there is the temptation for the designer to tell the SHA that some “problem” with the construction discovered by the SHA was built “as the designer intended” because any cost incurred by the contractor to correct the problem is money lost by the designer as party to the joint venture or whatever agreement has forged the designer and the contractor into one entity. Even if the contractor and designer are of high character and do not set out to deceive the SHA, sometimes they can find something wrong with the project as constructed and set out to fix it without telling the SHA. Even if the failure to tell the owner about the problem is an oversight due to a sincere effort to fix the problem as quickly as possible, the SHA is in the unenviable position of not knowing what is happening on their own project. Now, SHAs are looking for a way to keep the speed of a Fast Track contract while retaining the control over the design process that they have in the DBB contract. Many SHAs are looking to Construction Manager-at-Risk (CMR) as the solution to the problem posed by the question “how do we retain the speed of Fast Track contracting while retaining the control over the design process offered by the DBB delivery system? This research project included interviews with of all the SHAs and other relevant public transportation agencies in the southeastern United States (11 states). Each agency interviewed was asked if they had ever used CMR, or had plans to. If they answered in the affirmative, they were asked a series of questions about the project. If the project seemed especially important or interesting, the research team visited the project for a week, conducting face-to-face interviews with personnel with the construction manager, top-tier subcontractors, sub-subcontractors, design professionals, suppliers, owners, and consultant inspectors. The results of the interviews and case studies are reported in this paper.
CONSTRUCTION SCHEDULING WITH IMPRECISELY DEFINED PLANNING CONSTRAINTS

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Keywords: Construction schedule optimization, Planning constraints, Possibility theory, Fuzzy sets, Fuzzy numbers, Probability

ABSTRACT

The problem undertaken in this paper regards to the scheduling of construction project under imprecisely defined limits of time and resources available for the execution of works. A single-point network model with finish-to-start relations between activities is adopted to represent the course of construction. Durations of works take into account the expected effects of possible interference (bad weather, equipment failures, etc.). The paper presents the principles of modeling imprecisely defined planning constraints using trapezoidal fuzzy numbers and the principles of assessing compliance with fuzzy restrictions using possibility theory. A probabilistic approach in conjunction with the concept of -cuts of fuzzy numbers is proposed for the neutralization of assessments to meet the fuzzy constraints. The paper also presents a numerical example showing the advantages of the use of probability measure to optimize the construction schedule in the terms of imprecisely defined planning constraints.
THE TIME-COST ANALYSIS OF THE CONSTRUCTION PROJECT, TAKING INTO ACCOUNT RISK BASED ON EXPERT KNOWLEDGE USING FUZZY SETS

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ABSTRACT

Main goal for presented analyze is the detailed review of risks, connected with relevant project, before the “go” decision is made, at the pre-feasibility stage. Project cost and time deviations (for relevant tasks) were established for the schedule and cost estimation with use of the fuzzy set theory and experts knowledge.

Set of information – based on experts knowledge was transformed with use of the fuzzy sets theory. Elements of the model are: fuzzification block (for fuzzification of data), inference block (for making conclusions) and de-fuzzification block (for sharpness of results). Model allows for automatic creation of different scenarios for the project (with use of non complicated math, like average value or mass extentricity) – pessimistic and optimistic scenarios for the investment, both from cost and time points of view.

Authors present final results – value of risk, connected with time and costs of the project, which are function of standard deviation and probability of the risk appearance. Assessment of the risk for the whole investment is the aggregate results calculated for the particular tasks of the investment. Model allows for comparison of – for example - different technologies and choice of the optimal variant.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott, Carl</td>
<td>10</td>
</tr>
<tr>
<td>Abd Shukor, Ani</td>
<td>39</td>
</tr>
<tr>
<td>Abdullah, Anis</td>
<td>130</td>
</tr>
<tr>
<td>Abreu, Maria</td>
<td>85</td>
</tr>
<tr>
<td>Achour, Nebil</td>
<td>34</td>
</tr>
<tr>
<td>Achuthan, Armitha</td>
<td>73</td>
</tr>
<tr>
<td>Ahmed, Vian</td>
<td>89</td>
</tr>
<tr>
<td>Aïbina, Aïbade</td>
<td>17</td>
</tr>
<tr>
<td>Akiner, Ilknur</td>
<td>2, 110</td>
</tr>
<tr>
<td>Alauddin, Kartina</td>
<td>2</td>
</tr>
<tr>
<td>Alves, Thais</td>
<td>91</td>
</tr>
<tr>
<td>Ameyaw, Collins</td>
<td>80</td>
</tr>
<tr>
<td>Aouad, Ghassan</td>
<td>10</td>
</tr>
<tr>
<td>Ashuri, Baabak</td>
<td>22, 160</td>
</tr>
<tr>
<td>Baarveld, Marlijn</td>
<td>57</td>
</tr>
<tr>
<td>Bajracharya, Arun</td>
<td>64, 73</td>
</tr>
<tr>
<td>Bargstadt, Hans</td>
<td>20</td>
</tr>
<tr>
<td>Barker, Tom</td>
<td>159</td>
</tr>
<tr>
<td>Bedir, Merve</td>
<td>117</td>
</tr>
<tr>
<td>Bensafrna, Omar</td>
<td>63</td>
</tr>
<tr>
<td>Birgon, Talat</td>
<td>77</td>
</tr>
<tr>
<td>Bismarchi, Luis</td>
<td>81</td>
</tr>
<tr>
<td>Boes, Hans</td>
<td>37</td>
</tr>
<tr>
<td>Boon, John</td>
<td>161</td>
</tr>
<tr>
<td>Boussemaa, Nele</td>
<td>40</td>
</tr>
<tr>
<td>Boyd, David</td>
<td>65</td>
</tr>
<tr>
<td>Bröchner, Jan</td>
<td>111</td>
</tr>
<tr>
<td>Bragadin, Marco</td>
<td>162</td>
</tr>
<tr>
<td>Brandts, Nils</td>
<td>28</td>
</tr>
<tr>
<td>Brewer, Graham</td>
<td>38, 53</td>
</tr>
<tr>
<td>Buyse, Laurie</td>
<td>155</td>
</tr>
<tr>
<td>Cardoso, Francisco</td>
<td>79</td>
</tr>
<tr>
<td>Chan, Albert</td>
<td>75</td>
</tr>
<tr>
<td>Chan, Daniel</td>
<td>75</td>
</tr>
<tr>
<td>Chan, Edwin</td>
<td>78</td>
</tr>
<tr>
<td>Chan, Joseph</td>
<td>75</td>
</tr>
<tr>
<td>Chan, Paul</td>
<td>48</td>
</tr>
<tr>
<td>Choucha, Monika</td>
<td>102</td>
</tr>
<tr>
<td>Cheung, Fiona</td>
<td>47</td>
</tr>
<tr>
<td>Chiara, Nicolao</td>
<td>160</td>
</tr>
<tr>
<td>Chinowsky, Paul</td>
<td>126</td>
</tr>
<tr>
<td>Chua, Mui Hia</td>
<td>1</td>
</tr>
<tr>
<td>Chung, Jacky</td>
<td>93</td>
</tr>
<tr>
<td>Ciri, Angelo</td>
<td>98</td>
</tr>
<tr>
<td>Collins, Beck</td>
<td>65</td>
</tr>
<tr>
<td>Constantini, Maurizio</td>
<td>98</td>
</tr>
<tr>
<td>Costantino, Nicola</td>
<td>76</td>
</tr>
<tr>
<td>Dainty, Andrew</td>
<td>4, 51, 53, 115</td>
</tr>
<tr>
<td>Dassanayake, Dharma</td>
<td>17</td>
</tr>
<tr>
<td>Davey, Calaide</td>
<td>120</td>
</tr>
<tr>
<td>Dewulf, Geert</td>
<td>19, 100, 151</td>
</tr>
<tr>
<td>Dikmen, Irem</td>
<td>77</td>
</tr>
<tr>
<td>Dimitrijevic, Branka</td>
<td>9</td>
</tr>
<tr>
<td>Dobbelsteen, Andy</td>
<td>143</td>
</tr>
<tr>
<td>Dulaaimi, Mohammed</td>
<td>73</td>
</tr>
<tr>
<td>Dunn, Kevin</td>
<td>26</td>
</tr>
<tr>
<td>Durmissevic, Elma</td>
<td>11</td>
</tr>
<tr>
<td>Dursun, Onur</td>
<td>16</td>
</tr>
<tr>
<td>El-Mashaleh, Mohammad</td>
<td>74</td>
</tr>
<tr>
<td>Entrop, Bram</td>
<td>19, 151</td>
</tr>
<tr>
<td>Eriksson, Per Erik</td>
<td>54</td>
</tr>
<tr>
<td>Everts, Paul</td>
<td>7</td>
</tr>
<tr>
<td>Eybpoosh, Matineh</td>
<td>77</td>
</tr>
<tr>
<td>Falagario, Marco</td>
<td>76</td>
</tr>
<tr>
<td>Fang, Dongping</td>
<td>32</td>
</tr>
<tr>
<td>Federico, Garcia-Erviti</td>
<td>147</td>
</tr>
<tr>
<td>Fellows, Richard</td>
<td>87</td>
</tr>
<tr>
<td>Fernie, Scott</td>
<td>43</td>
</tr>
<tr>
<td>Flach, Fernanda</td>
<td>23</td>
</tr>
<tr>
<td>Flier, Kees van der</td>
<td>119</td>
</tr>
<tr>
<td>Fortune, Chris</td>
<td>31</td>
</tr>
<tr>
<td>Gajendran, Thayaparan</td>
<td>38, 53</td>
</tr>
<tr>
<td>Garcia Erviti, Federico</td>
<td>134</td>
</tr>
<tr>
<td>Gibb, Alistair</td>
<td>149</td>
</tr>
<tr>
<td>Glass, Jacqueline</td>
<td>34</td>
</tr>
<tr>
<td>Gluch, Pernilla</td>
<td>55</td>
</tr>
<tr>
<td>Gonzalez, Marco</td>
<td>23</td>
</tr>
<tr>
<td>Gottlieb, Stefan</td>
<td>106</td>
</tr>
<tr>
<td>Graaf, Rein de</td>
<td>144</td>
</tr>
<tr>
<td>Gregori, Tullio</td>
<td>86</td>
</tr>
<tr>
<td>Gruis, Vincent</td>
<td>35</td>
</tr>
<tr>
<td>Gruneberg, Stephen</td>
<td>44, 112</td>
</tr>
<tr>
<td>Gultekin, Tanju</td>
<td>132</td>
</tr>
<tr>
<td>Hagmann, Christopher</td>
<td>88</td>
</tr>
<tr>
<td>Hakfoort, Laura</td>
<td>143</td>
</tr>
<tr>
<td>Hal, Anke van</td>
<td>125</td>
</tr>
<tr>
<td>Halman, Joop</td>
<td>11</td>
</tr>
<tr>
<td>Hannas, Goril</td>
<td>107</td>
</tr>
<tr>
<td>Hansen, Roobert</td>
<td>72</td>
</tr>
<tr>
<td>Harputlugul, Timucin</td>
<td>132</td>
</tr>
<tr>
<td>Hartmann, Timo</td>
<td>37, 127</td>
</tr>
<tr>
<td>Hauptfleisch, Dries</td>
<td>30, 71</td>
</tr>
<tr>
<td>Hegewald, Antje</td>
<td>20</td>
</tr>
<tr>
<td>Heijer, Alexander</td>
<td>136</td>
</tr>
<tr>
<td>Herthogs, Pieter</td>
<td>120</td>
</tr>
<tr>
<td>Heurkens, Erwin</td>
<td>60</td>
</tr>
<tr>
<td>Ho, Daniel Chi Wing</td>
<td>128</td>
</tr>
<tr>
<td>Hobma, Fred</td>
<td>140</td>
</tr>
<tr>
<td>Hoezen, Mieke</td>
<td>100, 103, 104</td>
</tr>
<tr>
<td>Hubers, Hans</td>
<td>97</td>
</tr>
<tr>
<td>Huovinen, Pekka</td>
<td>66, 131</td>
</tr>
<tr>
<td>Ilter, Deniz</td>
<td>69</td>
</tr>
<tr>
<td>Ilter, Tolga</td>
<td>69</td>
</tr>
<tr>
<td>Itard, Laure</td>
<td>117</td>
</tr>
<tr>
<td>Iturrrialde, Kepa</td>
<td>70</td>
</tr>
<tr>
<td>Javernick-Will, Amy</td>
<td>126</td>
</tr>
<tr>
<td>Jensen, Jens</td>
<td>106</td>
</tr>
<tr>
<td>Johansen, Eric</td>
<td>48</td>
</tr>
<tr>
<td>Jong, Peter de</td>
<td>122</td>
</tr>
<tr>
<td>Kadevors, Anna</td>
<td>109</td>
</tr>
<tr>
<td>Kähkonen, Kale</td>
<td>162</td>
</tr>
<tr>
<td>Kamp, Kars van der</td>
<td>90</td>
</tr>
<tr>
<td>Kashani, Hamed</td>
<td>22</td>
</tr>
<tr>
<td>Kawasaki, Atsushi</td>
<td>68</td>
</tr>
<tr>
<td>Ke, Yongjian</td>
<td>1</td>
</tr>
<tr>
<td>Kelly, Graham</td>
<td>115</td>
</tr>
<tr>
<td>Kern, Andrea Parisi</td>
<td>23</td>
</tr>
<tr>
<td>Koch, Christian</td>
<td>116</td>
</tr>
<tr>
<td>Koolwijk, Jelle</td>
<td>46</td>
</tr>
<tr>
<td>Kostrzewa, Bartosz</td>
<td>167</td>
</tr>
<tr>
<td>Koungia, Ioanna</td>
<td>36</td>
</tr>
<tr>
<td>Kovacec, Saso</td>
<td>152</td>
</tr>
<tr>
<td>Kroese, Robert</td>
<td>6</td>
</tr>
<tr>
<td>Kuhlmann, Matthijs</td>
<td>104</td>
</tr>
<tr>
<td>Kulejewski, Jamusz</td>
<td>166</td>
</tr>
<tr>
<td>Kumaraswamy, Mohan</td>
<td>93, 164</td>
</tr>
<tr>
<td>Kurschner, Juliane</td>
<td>143</td>
</tr>
<tr>
<td>Laan, Albertus</td>
<td>104</td>
</tr>
<tr>
<td>Laahdenperä, Pertti</td>
<td>92</td>
</tr>
<tr>
<td>Lam, Patrick</td>
<td>75</td>
</tr>
<tr>
<td>Lau, Wai Kin</td>
<td>128</td>
</tr>
<tr>
<td>Laurenceau, Sylvain</td>
<td>123</td>
</tr>
<tr>
<td>Lees, Tim</td>
<td>150</td>
</tr>
<tr>
<td>Lenferink, Sander</td>
<td>103</td>
</tr>
<tr>
<td>Li, Xiao Xiao</td>
<td>165</td>
</tr>
<tr>
<td>Ling, Florence</td>
<td>1</td>
</tr>
<tr>
<td>Liu, Anita M.M.</td>
<td>12</td>
</tr>
<tr>
<td>Liu, Junxiao</td>
<td>84</td>
</tr>
<tr>
<td>London, Kerry</td>
<td>2, 45, 84</td>
</tr>
<tr>
<td>Loon, Peter Paul van</td>
<td>144</td>
</tr>
<tr>
<td>Loosemore, Martin</td>
<td>26</td>
</tr>
<tr>
<td>Lopes, Jorge</td>
<td>85</td>
</tr>
<tr>
<td>Loschiavo dos Santos, Maria</td>
<td>81</td>
</tr>
<tr>
<td>Lousberg, Louis H.M.J.</td>
<td>99</td>
</tr>
<tr>
<td>Low, Sui Pheng</td>
<td>3</td>
</tr>
<tr>
<td>Lowstedt, Martin</td>
<td>49</td>
</tr>
<tr>
<td>Lu, Jian</td>
<td>22</td>
</tr>
<tr>
<td>Lu, Shuling</td>
<td>25</td>
</tr>
<tr>
<td>Lu, Weisheng</td>
<td>12</td>
</tr>
<tr>
<td>Luis Ramon, Valverde</td>
<td>147</td>
</tr>
<tr>
<td>Mahbub, Rohana</td>
<td>39</td>
</tr>
<tr>
<td>Mahesh, Gangadhar</td>
<td>164</td>
</tr>
<tr>
<td>Mandell, Svante</td>
<td>18</td>
</tr>
<tr>
<td>Manley, Karen</td>
<td>67</td>
</tr>
<tr>
<td>Mantel, Bob</td>
<td>143</td>
</tr>
<tr>
<td>Marx, Hendrik</td>
<td>30</td>
</tr>
<tr>
<td>Matsumura, Shuichi</td>
<td>68</td>
</tr>
<tr>
<td>Meijer, Frits</td>
<td>118</td>
</tr>
<tr>
<td>Meland, Øystein Husefdest</td>
<td>107</td>
</tr>
<tr>
<td>Mensah, Sarfo</td>
<td>80</td>
</tr>
<tr>
<td>Miller, Evonne</td>
<td>155</td>
</tr>
<tr>
<td>Minasowicz, Andrew</td>
<td>167</td>
</tr>
<tr>
<td>Minchin Jr, Edward</td>
<td>32, 165</td>
</tr>
<tr>
<td>Missa, Paul</td>
<td>89</td>
</tr>
<tr>
<td>Mlecnik, Erwin</td>
<td>24</td>
</tr>
<tr>
<td>Mohammad, Mohammad Fadhil</td>
<td>39</td>
</tr>
<tr>
<td>Moor, Rachel</td>
<td>48</td>
</tr>
<tr>
<td>Mulder, Karel</td>
<td>28</td>
</tr>
<tr>
<td>Murdoch, Ian</td>
<td>44</td>
</tr>
<tr>
<td>Murphy, Mike</td>
<td>4</td>
</tr>
<tr>
<td>Nicholson, Ian</td>
<td>34</td>
</tr>
<tr>
<td>Nieboer, Nico</td>
<td>6</td>
</tr>
<tr>
<td>Nijhuis, Steven</td>
<td>7</td>
</tr>
<tr>
<td>Nippala, Eero Kalevi</td>
<td>15</td>
</tr>
<tr>
<td>Nowak, Paul</td>
<td>13</td>
</tr>
<tr>
<td>Nystrom, Johan</td>
<td>18</td>
</tr>
<tr>
<td>Ofori, George</td>
<td>114</td>
</tr>
<tr>
<td>Olander, Stefan</td>
<td>61</td>
</tr>
<tr>
<td>Oliveira, Rui</td>
<td>85</td>
</tr>
<tr>
<td>Oorschot, John van</td>
<td>11</td>
</tr>
<tr>
<td>Opoku, Alex</td>
<td>31</td>
</tr>
<tr>
<td>Osei-Tutu, Ernest</td>
<td>80</td>
</tr>
<tr>
<td>Osman, Amira</td>
<td>120</td>
</tr>
<tr>
<td>Overmeer, Arne van</td>
<td>59</td>
</tr>
<tr>
<td>Oviedo Háito, Ricardo</td>
<td>79</td>
</tr>
<tr>
<td>Ozorhon, Beliz</td>
<td>10</td>
</tr>
<tr>
<td>Padfield, Rory</td>
<td>3, 130</td>
</tr>
<tr>
<td>Palsson, Helena</td>
<td>61</td>
</tr>
<tr>
<td>Pan, Jiayi</td>
<td>32</td>
</tr>
<tr>
<td>Pandis Iverot, Sofie</td>
<td>28</td>
</tr>
<tr>
<td>Papargyropoulou, Effie</td>
<td>3, 130</td>
</tr>
<tr>
<td>Parry, Tony</td>
<td>34</td>
</tr>
<tr>
<td>Pennen, Ton van der</td>
<td>52</td>
</tr>
<tr>
<td>Pestana, Ana Catarina</td>
<td>91</td>
</tr>
<tr>
<td>Phua, Florence</td>
<td>26</td>
</tr>
<tr>
<td>Pietroforte, Roberto</td>
<td>76, 86</td>
</tr>
<tr>
<td>Pinder, James</td>
<td>149</td>
</tr>
<tr>
<td>Pires, Josiane Reschke</td>
<td>23</td>
</tr>
<tr>
<td>Preece, Christopher Nigel</td>
<td>3, 130</td>
</tr>
<tr>
<td>Pries, Frens</td>
<td>7</td>
</tr>
<tr>
<td>Prigg, Chris</td>
<td>161</td>
</tr>
<tr>
<td>Prins, Matthijs</td>
<td>72, 132</td>
</tr>
<tr>
<td>Pryke, Stephen</td>
<td>36</td>
</tr>
<tr>
<td>Psunder, Igor</td>
<td>152</td>
</tr>
<tr>
<td>Psunder, Mirko</td>
<td>152</td>
</tr>
<tr>
<td>Pu, Yang</td>
<td>164</td>
</tr>
<tr>
<td>Qongqo, Pumelele</td>
<td>113</td>
</tr>
<tr>
<td>Raisanen, Christine</td>
<td>49</td>
</tr>
<tr>
<td>Raissbeck, Peter</td>
<td>56</td>
</tr>
<tr>
<td>Ramírez Pacheco, Gema</td>
<td>134</td>
</tr>
<tr>
<td>Rapoport, Elizabeth</td>
<td>58</td>
</tr>
<tr>
<td>Ravesloot, Christoph Maria</td>
<td>82</td>
</tr>
<tr>
<td>Remoy, Hilde</td>
<td>154</td>
</tr>
<tr>
<td>Ren, Zhaomin</td>
<td>4</td>
</tr>
<tr>
<td>Ridder, Hennes de</td>
<td>14</td>
</tr>
<tr>
<td>Riemann, Stefan</td>
<td>105</td>
</tr>
<tr>
<td>Robertson, Karl</td>
<td>107</td>
</tr>
<tr>
<td>Roders, Martin</td>
<td>35, 146</td>
</tr>
<tr>
<td>Rose, Timothy</td>
<td>67</td>
</tr>
<tr>
<td>Rowlinson, Steve</td>
<td>47</td>
</tr>
<tr>
<td>Runeson, Goran</td>
<td>53</td>
</tr>
<tr>
<td>Sackey, Enoch</td>
<td>51</td>
</tr>
</tbody>
</table>
Authors Index

Saker, Jim, 149
Salcedo Rahola, Tadeo Baldiri, 28
Schaap, Aart, 122
Schmidt, Rob, 115, 149
Schonk, Thomas, 127
Sciancalepore, Fabio, 76
Sexton, Martin, 150
Shen, Qi Ping, 94
Shen, Weilin, 94
Siva, Jessica, 45
Smith, Bruce, 158
Smyth, Hedley, 108
Spang, Konrad, 105
Stenberg, Ann-Charlotte, 49
Story, Vicky, 115
Stowijk, Giselle, 62
Stoy, Christian, 16, 88
Straub, Ad, 6, 35, 72, 146
Tambach, Milly, 118
Taneri, Cem, 110
Tavakolan, Mehdi, 160
Taylor, James, 133
Teeuw, Peter, 82, 136
Tennent, Stuart, 43
Teo, Evelyn, 114
Teo, Melissa, 26
Thien, Vui Chau, 17
Thomsen, Andre, 5, 119
Thuesen, Christian, 116
Tienhaara, Pekka Antero, 15
Tillie, Nico, 143
Tjandra, Imelda, 114
Toorn Vrijthoff, Wouter, 145
Topcu, Ilker, 132
Tuuli, Martin, 51

Ulukavak Harputlugil, Gulsu, 117

Vainio, Terttu, 83
Varenio, Celine, 123
Vernay, Anne Lorene, 28, 58
Verster, Basie, 71
Visscher, Henk, 118, 146
Volker, Leentje, 129
Voordijk, Hans, 100
Voordt, Theo van der, 95, 154

Walters, Russell, 32
Wang, Hongdi, 12
Waroonkun, Tanut, 157
Werf, Eefje van der, 125
Wilkinson, Sara, 142
Windapo, Abimbola, 113
Worst, Jan, 41
Wu, Zhongbing, 12

Xie, Brenda Hongbo, 93
Xie, Bo, 164
Xu, Pengpeng, 78

Yau, Yung, 128
Yitmen, Ibrahim, 27, 110
Yoshizaki, Yuri, 68
Zerjav, Vedran, 37, 127
Zijlstra, Sake, 62
Zumelzu, Antonio, 138
Zwart, Johan van der, 95
KEYWORD INDEX

Academia 9
Accuracy 17
Activity network 161
Adaptability 149
Adaptation 146
Added value 95
Agent-Construction System 12
AHP 132
Ambidexterity 54
Ambiguity 53
Ambition 129
Architectural Design Quality 132
Architecture 56
Area development 99
Artificial Neural Network 17
Assessment 41
Asset management 59
Atmosphere 63
Attitudes 65
Australia 67, 142
Awareness 146
Balancing costs and benefits 57
Barrier-free design 128
Barriers 133
Behaviour 87
Belgium 40
Benchmarking 111
Benchmarking 74
Best practice 26
BIM 38, 79, 89, 94, 97, 161
Building adaptation 142
Building appropriation 115
Building assessment 69
Building energy efficiency 78
Building energy Management 159
Building information Management 159
Building performance assessment 128
Building products 66
Building renewal 23
Buildings 24
Built environment 144
Business development 116
Business management 66, 131
Business networks 24
CAD-CAM technology 70
Campus 136
Careers 4
Case study 28
Change 114
Chaos theory 51
China 12
Civil engineering 15
Classification of bidding 76
Client-driven innovation 10
Climate Change 146
Collaboration 40, 48, 92, 195, 106
Collaborative design 97
Collaborative networks 41
Commissioning 62
Communities 65
Community engagement 10
Companies 116
Comparative 40
Competition 43, 92, 103
Competitive dialogue 103
Competitiveness 79
Complexity theory 51
Compliance 80
Conflicts 53, 99
Construction 3, 131, 66
Construction21 114
Construction Data 113
Construction design 37
Construction education 161
Construction industry 26, 43, 67, 75, 85, 110
Construction industry development 114
Construction Innovations 9
Construction Management 160
Construction materials and products 34
Construction organization 31
Keyword Index

Construction process 55
Construction procurement 12
Construction schedule optimization 166
Construction sector 86
Construction speed performance 16
Construction Statistics 110
Construction volume 86
Construction waste management 130
Consumer 19
Contracts 100
Contradictions 53
Cooperative contracting 105
Cost 113
Cost benefit 82, 149
Cost of corridors 30
Cost estimating 17
Costs 147
Costs Planning 88
CPFR-model 41
Criteria 93
Cultural diversity 26
Cultural heritage 57
Culture 38
Data envelopment analysis 74
DBFMO 72
Decision making 119, 151
Decision Support system 74
Demography 88
Demolition 119
Design 23, 56, 66, 131, 147
Design and Construction Process 82
Design decisions 115
Design innovation 10
Development corridor 30
Discourse 58
Discussion 4
Diversity and employment 89
Diversity management 1
DQI 132
Dutch municipal policy instruments 118
Dysfunctionality 99
Eco-city 58
Econometric technique 86
Economic development 3, 85
Economic obsolescence 152
Education 4
Educational programmes 71
Effects 60, 140
Empowerment 51, 62
Energy 22
Energy bill 19
Energy costs 19
Energy efficiency 24, 119, 123
Energy measures 151
Energy neutrality 143
Energy performance 117
Energy Performance Contracting 78
Energy potential mapping 143
Energy saving 6
Energy-efficiency 136
Energy-use 72
Environmentally Responsible Construction Industry 164
Equivalent Tender Price 107
ESCOs 78
Ethical 89
Evaluation 93, 107
Evolution of construction 83
Existing buildings 20
Exploitation 54
Facilities management 71
Facilities management development 71
Feedback 115
Finance 87
Flexibility 149
Foucault 106
Functional obsolescenc 152
Fuzzy numbers 166
Fuzzy sets 166
Ghana 80
Global 126
Global construction data 112
Globalisation 87
Green buildings 69, 159
Green Covered Roofs 82
Green Urban Policy 82
Gross fixed capital formation 112
Gross national product 86
Group housing project 64
Guaranteed maximum price contracts (GMP) 75
Hammarby Sjöstad 58
Health & Safety Management System 98
Health and Safety 113
Heating energy demand 117
High technology 25
Higher education 136
Historic urban core 145
Hong Kong 75
Hospitals 95
Household economic behaviour 123
Housing 59, 120, 129, 150
Housing corporation 46
Housing market 119
Housing model 123
Housing pathology 5
Housing policy 81
Housing stock 5, 20
Housing supply 84
HRM-policy 90
ICT 38
IFC 97
Implementation 6
Incentive based project optimization 105
Incentives 133
Industrialised Building System 39
Industrialized building 55
Industry Development Initiatives 164
Industry perspective 114
Industry structuring 71
Information aesthetics 159
Information Exchange Networks 36
Innovation 40, 45, 56, 64, 67, 72, 81, 116
Innovation diffusion 24
Institutional change 106
Integrated design 37
Integrated supply chain 44
Integration 39, 41
International benchmark 16
International construction 27
Inter-organisational interaction 64
Intervention 65, 99, 145
Investment Analysis 22
Investment appraisal 19
Key indicators 15
Key performance indicators 44
Klushuizen 62
Knowledge Management 36, 55, 126
Labor relations 90
Large-scale housing 63
LCC 107
Leadership 31
Leadership style 1, 31
Lean 46
Lean construction 91
Lean manufacturing 7
Lean office 91
LEED 133
Legal 133
Legal instruments 140
Leveling 160
Life cycle analysis 111
Life cycle extension 5, 119
Light emitting diodes (LEDs) 25
Literature review 131
Localisation 36
Location based scheduling 161
Longitudinal study 4
Maintenance 72
Maintenance of buildings 152
Malaysia 130
Management 60, 82, 106
Management practices 1
Management strategies 26
Market change 15
Marketing 3
MDGs 85
Microgeneration technologies 150
Model 157
**Keyword Index**

- Modeling Pre-tender 17
- Monetary policy 84
- Monte Carlo method 117
- Multi Criteria Decision Making (MCDM) 132
- Multi-criteria evaluation 76
- Multi-family 158
- Multi-objective SFLA 160
- National Specialist Contractors Council 44
- Nepal 64
- Network 28, 126
- New industry 83
- New stepped strategy 143
- Niche 116
- Nodal points 30
- North Cyprus 110
- Observations 48
- Obsolescence 119
- Occupant behaviour 117
- Office 151
- Office buildings 142
- Offices 154
- Old quarters refurbishment 70
- One-day 158
- Open building 120
- Optimization 160
- Organisational motivation 64
- Organisational Paradoxes 56
- Organization 60, 126
- Paradigm shift 5
- Paradox 48
- Parametric design 97
- Partnering 40, 44, 105, 106
- Path dependence 83
- Perception 63
- Performance 95, 113
- Performance measurement 74
- Performance specifications 72
- Performance-based procurement 81
- PFI 72
- Photovoltaic 22
- Physical deterioration 152
- Planning 58, 59
- Planning constraints 166
- Population 112
- Possibility theory 166
- PPP 72
- Pragmatics 138
- Precast Concrete System 157
- Precedence Diagramming Method 161
- Preliminary study 4
- Pre-Occupancy Evaluation 94
- Probability 166
- Procedures 76
- Process management, 129
- Procurement 34, 39, 54, 100
- Procurement climate 104
- Procurement innovation 12
- Procurement procedures 104
- Productivity measurement 111
- Project alliance 92
- Project cooperation 104
- Project management 61, 129
- Project management competences 7
- Project performance 104
- Projectmanagement 7
- Projects 34, 87
- Property development 30, 61
- Public & Private Actors 60
- Public Entities 80
- Public policy 123
- Public private partnership 99
- Public procurement 76, 80
- Public Procurement Act 80
- Public purchasing power 81
- Public Sector 164
- Public-private construction 127
- Quality improvement of private housing stock 118
- R&D 34
- Real Options 22
- Refurbishment 142
- Regulations 140
- Relationship development 100
- Relationships 61
- Renovation 5, 119, 152
Renovation Maintenance 117
Repetitive construction 161
Requirements management 37
Research 71
Resource scheduling 161
Risk mitigation measures 75
Risk 149
Risk assessment 77
Road infrastructure projects 103
Roles 55
Rotterdam energy approach and planning 143
SA 8000 98
Sanitation of buildings 152
Scheduling 158
Selection criteria 92, 107
Self-development 147
Sense making 48
Sensitivity analysis 117
Services 3, 111
Shortlisting 92
Simple linear regression 16
Singapore 114
SMEs 9
SNM 116
Social Diversity 62
Social housing 6, 23, 146
Social Network Analysis 127
Social practices 55
Socio-economic development 30
South Africa 120
Spatial development initiatives 30
Spatial quality 145
Spatiotemporal 51
Specialty Contractors 79
Splitting 160
Stakeholder 93, 151
Stakeholder analysis 57
Stakeholder engagement 127
Stakeholders 95
Statistical adequacy of categorization 16
Stock management 5
Strategic Alliance 27, 43, 46
Strategies 20, 57
Strategy 95
Structural equation modeling 77
Subcontractor selection 74
Subcontractors 44, 79
Submittals 91
Sub-Saharan Africa 85
Suburban growth 134
Supply Chain 36, 37, 39
Supply chain integration 46
Supply Chain Management 43
Sustainability 3, 10, 22, 34, 36, 58, 66, 81, 115, 119, 130, 131, 140, 142, 144, 147, 149
Sustainable 89
Sustainable architecture 97
Sustainable building transformation 120
Sustainable Cities 138
Sustainable construction 23
Sustainable design 128
Sustainable design and construction 69
Sustainable Development 136
Sustainable planning 134
Sustainable practice 31
Sustainable Products 67
Sustainable renovation 129
Sustainable Technologies 65
Sustainable urban development 28
Sustainable urban planning 143
Sustainable Water 82
Sustainable-Building 133
System innovation 25
Systems integration 28
Target cost contracts (TCC) 75
Teams 56
Technical management 20
Technological innovation systems 150
Technological trajectories 150
Technology adoption 24
Temporary Project Organization 53
Territorial valuation 134
Thailand 157
The Netherlands 6, 59
Keyword Index

Time synchronicity 48
Tools 63
Total-cost-of-ownership 41
TPO 38
Trade Contractors 79
Transmission pattern 84
Trust 87
Trustinnovation 103
Turkey 69
Turkish contractors 27
UK benchmark model 112
Unbalanced bidding 18
Uncertainty 37
Unit price contracting 18
Universal design 128
University 136
Urban density 144
Urban design and decision making 144
Urban development 140
Urban Development Project 60
Urban form 138
Urban Infrastructure 88
Urban Planning 61
Urban redevelopment 57
Urban renewal 63
Urban sustainability 159
Urban transformation 138
Urbanisation 112
User activity simulation 94
User preferences 154
Vacancy 254
Visual and kinetic learning 161
Vulnerability 77
Wallisblok 62
Waste reduction 23
Whole life cycle value 93
Women 4
Zzp’er = independent professional = self-employed person 90