Current global, national and regional emerging issues in CPM: innovative responses through research & enterprise

CONSTRUCTING EXCELLENCE Sussex
Moulsecoomb campus
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University of Brighton
• **Research** within the school draws upon the **subject disciplines** of archaeology, built environment, civil engineering, environmental science, human and physical geography, and geology, to generate **new knowledge in the physical, environmental and social sciences**.

• Our **aim is to address key environmental, social and resource issues**, and deliver translational research with **local, regional and international benefit**.

• We supervise over **50 PhD studentships**, across topics ranging from disability aesthetics to the application of nanotechnology in building materials.

• **We work in collaboration** with industrial, charity, regulator, government, NGO and community partners in the UK and internationally.
Our Research in the School is organised into **five linked** and multi-disciplinary **themes**:  
- Applied Geosciences  
- Ecology, landscape and pollution management  
- Society, space and environment  
- Ground, water and structural engineering  
- **Sustainable Construction and Environmental Planning**
Sustainable Construction and Environmental Planning

1. Building Environmental Performance
   - performance monitoring environmental performance
   - sustainable design and materials
   - energy efficiency

2. Sustainable Construction and Development
   - sustainable facilities and construction project management
   - waste management
   - coastal planning and regeneration
   - housing and community

3. Information technologies in built environment, architecture and construction (@BEACON)

The THREE groups collapsed into Built Environment Research Group (BERG)
Today’s Seminar Objectives

- The relevance and value of research to industry
- Access to Research and opportunity including:
  - Current and future research opportunities at the University;
  - How Construction Excellence members can access and apply research relevant to their discipline and interest.
- Current research, directions and needs in Construction and Project Management
The relevance and value of research to industry

To address current and future challenges facing our industry
Current Emerging Issues

- Globalisation
- Speed and affordable
- Culture, Disability and Health and Safety (injury underreporting)
- Sustainability / Sustainable Development (Green construction)
- Disaster Resilience – flooding, earthquakes
- Energy (Sourcing, independence, efficiency) considerations
- New materials
- Infrastructure demand – replacing/new
- Water/Housing for all
- Public health systems (SDGs)
- ICT developments
- Cost and Risk Shifting
- Brexit
- Staff Recruitment Crisis

CITB - To help address staff losses and retirements, and fill new jobs, an additional 120,000 apprenticeships will be required by 2019 – about 25,000 new starts a year
THE GLOBAL CHALLENGES

- Population growth (7 billion);
- Immigration;
- Aging population (developed economies), Urbanisation (developing economies);
- Increase in Awareness thus greater demands for modern public services;
- Environmental awareness (natural- pollution (noise, dust, etc));
- Fiscal conflict between taxation and demand for more social protection;
- Need to replace decaying infrastructure;
- Rate of Technological Advancement;
- Limit of Public Sector Borrowing;
- Freer movements of FDI thus the need to make the economy investor-friendly by lesser taxation and other incentives;
ADDITIONAL CHALLENGES UNIQUE TO DEVELOPING ECONOMIES

- Increase in democratisation;
- Poverty, lack of basic infrastructure, and poor industrial development (e.g. sub-Saharan Africa needs at least $90 billion annually over the next 10 years to service its infrastructure needs);
- Deteriorating infrastructure due to poor maintenance culture;
- Declining funds in real terms;
- Spiral corruption in government projects due to lack of transparency;
- Weak or lack of legal and financial frameworks;
- Poor capacity in managerial & technical expertise especially in the public sector;
- Conflicts and lack of functioning institutional and value systems enablers.
UK government and industry’s plans for the future of Construction

• 33% reduction in cost of construction.
• 50% reduction in time spend on construction.
• 50% reduction in greenhouse gas emissions.
• 50% reduction in the trade gap between exports and imports.
UK Housing Building Industry


- Reduce overall project costs and **improve building performance**
- Reduce overall project duration
- Reduce CO$_2$ emission and environmental impacts

Additional Goals:

- Reduce accidents on construction sites
- **Improve housing output**
- Reduce defects in new housing
Robby Soetanto, Andrew Dainty, Chris Goodier, Chris Harty, Simon Austin, Andrew Price, Tony Thorpe (2006), *Synthesising emerging issues within key futures study reports in construction*  
CIB Conference: Local and Global Challenges, Rome, October 2006

Identified 337 issues using content analysis technique

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<td>General</td>
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<td>R &amp; D and innovation</td>
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<td>Total</td>
<td>337</td>
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“The built environment faces unprecedented challenges and we shall respond with unprecedented fervour, collaboration, creativity and innovation”

Professor Sue Roaf – Centre of Excellence in Sustainable Building Design – Heriot Watt University
Industry needs research to produce Innovative Approaches

- **Design Paradigm Shift** and Improved Design Methods
- Off-Site Manufacturing (OSM) and Construction Equipment Automation [https://www.youtube.com/watch?v=25wS0RihiJk](https://www.youtube.com/watch?v=25wS0RihiJk)
- Earthquake Dampers (Vibrating Control Devices and Vibrating Barriers); Sea defences, e.t.c
- Renewable Materials and Energy Sources
- Lean Construction (Improved Construction Operations)
- Integrated approach of ICT across the sector (BIM)
- Redefining Value for Money (Capex vs Opex) (shift from output to outcomes)
  - RIBA plan of works 2013
  - Public procurement 2015
- Public Private Partnership PPP
FUNDING MIX FOR EACH INFRASTRUCTURE SECTOR (£BN)

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<th>Sector</th>
<th>Taxpayer</th>
<th>Consumer</th>
<th>Both</th>
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<tr>
<td><strong>Overall</strong></td>
<td>18%</td>
<td>8%</td>
<td>16%</td>
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<tr>
<td>£377.1</td>
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<tr>
<td><strong>Transport</strong></td>
<td>46%</td>
<td>46%</td>
<td>8%</td>
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<td>£121.4</td>
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<td><strong>Flood</strong></td>
<td>32%</td>
<td>68%</td>
<td>0%</td>
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<tr>
<td>£3.9</td>
<td></td>
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<tr>
<td><strong>Water</strong></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>£15.1</td>
<td></td>
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<tr>
<td><strong>Energy</strong></td>
<td>95%</td>
<td>5%</td>
<td>0%</td>
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<td>£218.8</td>
<td></td>
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<tr>
<td><strong>Communications</strong></td>
<td>90%</td>
<td>10%</td>
<td>0%</td>
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<tr>
<td>£14.3</td>
<td></td>
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<tr>
<td><strong>Waste</strong></td>
<td>80%</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>£2.3</td>
<td></td>
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<tr>
<td><strong>Intellectual Capital</strong></td>
<td>88%</td>
<td>12%</td>
<td>0%</td>
</tr>
<tr>
<td>£0.8</td>
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Source: HM Treasury, Major Infrastructure Tracking Unit, 2013
Our Approach:

- Define outcomes and measures of success
- Identify and deliver user/operator needs
- Collect and compare actual operational performance against planned targets
- Soft Landings and GSL

Diagram:

- Local Sustainable Built Environmental Envelope
- National Sustainable Built Environmental Envelope
- International Sustainable Built Environmental Envelope

Project Stages:

- Development (Preparations) Stage: Public Sector
- Procurement Stage: Public Sector
- Implementation Stage: Design and Construction - Private Sector, Operations - Public Sector, Contract Termination Stage - Private Sector

Sieves, Hard Gate, Soft Gate

Re-use Re-Cycle Waste
My PhD Research Completion

1. A system designed to improve site investigation procedures and for the reduction of risk associated with uncertain site conditions  Philip Ashton (2003)


5. Indoor Air quality in large spaces  Joanne Ellis (2010)


7. A system to reduce risk and uncertainty in construction projects: the effects of project complexity on project risk at the pre-construction stage  Hannah Wood (2010)

8. Evaluation of the properties of TinGlass as a novel recycled material for applications in construction industry  Vassilios Bugas (2012)

9. The decision to use off-site manufacturing (OSM) systems for house building projects in the United Kingdom  E I Elnaas (2014)


11. Using PPP to deliver affordable housing in Nigeria  Julius Adeniyi (2016)

Ongoing PhD Programmes

- The effect of Saudi Arabian national culture (NC) on the occurrence of delay in construction projects
  Abdullah Alkharmany  Ongoing (completion 2017)

- Assessing the impact of waste prevention interventions on low income households in Jos, Nigeria
  Janet Yakubu  Ongoing (completion 2017)

- Facilities Management: Mitigating Crowd Disaster at the Holy Mosque in Macca.
  Mohammed Alkhadim  (Ongoing completion 2017)

- The Effect of National Culture on using Statutory Control Frameworks (Planning and Building Control) in Fostering Sustainable Built Environment in Nigeria
  Elijah Obadimu  Ongoing (completion 2018)

- Integrating Value, Risk and Environmental Management in Construction Projects.
  Mohammed Alaquad  (Ongoing completion 2018)
At Masters Level, for example: for Highway Engineering, it is about...

- Improved roadway performance to the user/public;
- Improved roadway performance to ensuring longer life highways;
- Minimisation of maintenance needs;
- Reduced congestion;
- Improve safety;
- Boost quality, while
- Minimising environmental impact

1. Optimal delivery model for carriageway pothole reactive maintenance in S.E. England
2. Towards a new business model for cooperation
3. Transformational change in highway sector
My Research

PROJECT COMPLEXITY

- Understanding complex systems:
- to determine what makes a construction ‘COMPLEX’
- to be able to measure Project Complexity

PPP (Public Private Partnership) in Developing Economies

- Impacts/Outcomes:
  - Policy change – enactment of ICRC law; amendment of NPS law; Police Services Fund Bill
Why bother about project complexity?

1. Researches (Bennett and Fine 1980s; Hill, T. 1990s; Bertelsen, S. 2000s.) have all revealed that it is an important issue that must be considered for more accurate prediction of project outcomes and risks.

2. Unfortunately, unreliable subjective methods are still being used to measure the effect of project complexity on project objectives. It is highly unlikely to see a unique justifiable value for a given project but a distribution of subjective values.

Therefore, essential to be able to objectively measure project complexity.
Measure of Project Complexity (Time) in a workflow

- $C_i \propto t_{\text{complex}}$
- $C_i \propto 1/T$
- $C_i = k(t_{\text{complex}}/T)$

where "k" is the complexity factor

- $C = (T_{tot}/T_p) - 1$
  
  $T_{tot} = T_p + e_t$

  $T_p = \text{original estimated project duration}$
  
  $e_t = \text{contingency time} = T_p \times C_0$

Measure of Project Complexity (Cost)

• \( C = \frac{V_{\text{tot}}}{V} - 1 \)

\[
V_{\text{tot}} = V_{\text{tot1}} + V_{\text{tot2}}
\]
\[
V_{\text{tot1}} = V_p(C_c + 1) \quad \text{direct cost}
\]
\[
V_{\text{tot2}} = ((T_{\text{tot}}-T_p)\times(T_p/V_o))+V_o \quad \text{indirect cost}
\]
\[
V = V_p + V_o
\]

\( V_p \) is the project direct cost

\( V_o \) is the project indirect cost

\( C_c \) is the complexity related to direct cost only

Reference:

Further Research

• potential benefits of BIM in reducing construction complexity; i.e. is there a potential of BIM impacting on the measure of project complexity?

• variability of project complexity throughout the overall project lifecycle.
How do Members access and participate in our research?
How do Members access and participate in our research?

• Partnership at postgraduate level:
  • MSc Construction Management – BOVIS
  • MSc Town Planning – SEEDA
  • MSc Highway Engineering Management – SE7

• Consultancy

• Knowledge Transfer Programme

• Part-time Postgraduate Studies – Day release basis

• Research Collaboration
UoB Uniqueness: is what we term PRACTICAL WISDOM

- Focus on Sustainability
  - Sustainable Construction, Design and Management
  - Sustainable Urban Design and Coastal Regeneration- land use regeneration, brownfield sites, urban sprawl, land use diversity
  - Rural & Conservation
  - International Sustainable Development
  - Resilient Design and Construction

- Blend of Practice and Theory through partnerships;

- Collaborate with Industry/Employers Participation for mutual benefit for our city, our region and globally
Links with Professional Bodies

- CIOB ~ Chartered Institute of Building
- APM ~ Association for Project Management
- RICS ~ Royal Institution of Chartered Surveyors
- CIAT ~ Chartered Institute of Architectural Technologists
- CABE ~ Chartered Association of Building Engineers
- BIFM ~ British Institute of Facilities Management
- CIBSE ~ Chartered Institute of Building Services Engineers
- RTPI ~ Royal Town Planning Institute
- ICE ~ Institution of Civil Engineers
- IStructE ~ Institute of Structural Engineers
- CIHT ~ Chartered Institution of Highways & Transportation
- ARCOM ~ Association of Researchers in Construction Management
- EPPM ~ Engineering, Project and Production Management Association
Current research, directions and needs in Construction and Project Management
My view: We need a paradigm shift in **engineering** by focusing design more beyond project and using more innovative standard components and approaches.

We need a New Paradigm in **procurement** using new organisational and institutional setups (may be a new business model).

Thank You