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

CONSTRUCTING EXCELLENCE Sussex
Moulsecoomb campus
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- **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

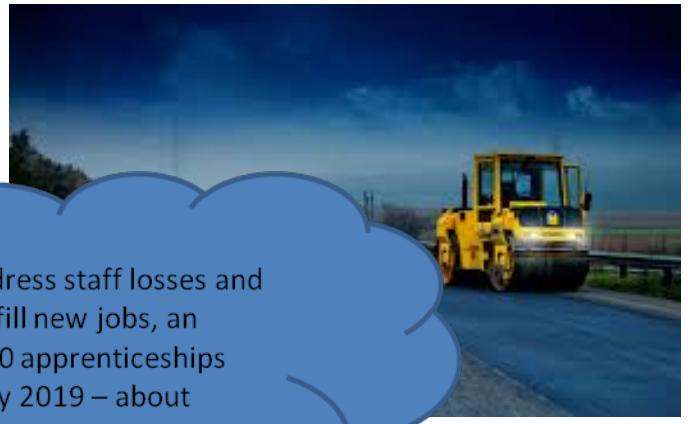
- The relevance and value of research to industry
- Access to Research and opportunity including:
  - Current and future research opportunities at the University;
  - How Construction Excellence members can access and apply research relevant to their discipline and interest.
- Current research, directions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

hs2 engine for growth

UK Housing Building Industry

http://www.parliament.uk/documents/commons/lib/research/key_issues/Key-Issues-Housing-supply-and-demand.pdf

- 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*

Category	Sub-category	Number of Issues
Technological	ICT	8
	Automation	9
	Off-site & standardisation	1
	Material	8
	Medicine	3
Environmental	Sustainability	19
	Settlement	18
	Demography	5
	Climate change	4
	Infrastructure	9
	Land	4
	Water	2
	Energy	11
	General	7
Human	Education	7
	Skills & training	20
	Employment	12
	Social	7
	People and Society	38
Economic	General	13
	Business	52
	Crime	3
Governance		25
Construction Industry-specifc	Structure & Process	20
	Supply chain	2
	Design	12
	Building	11
	R & D and innovation	7
	Total	**337**

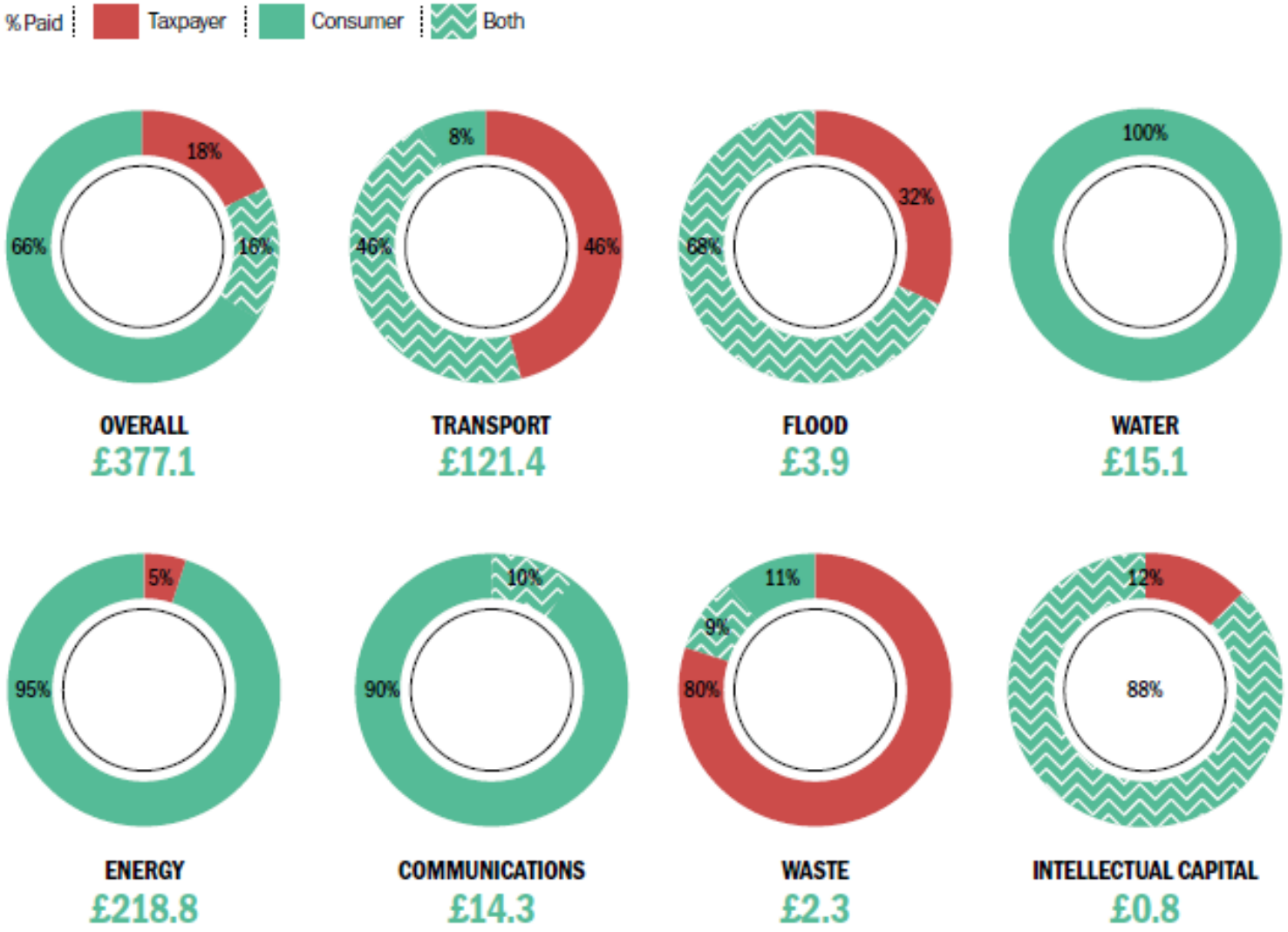
“The built environment faces unprecedented challenges and we shall respond with unprecedented fervour, collaboration, creativity and innovation”

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
- 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)

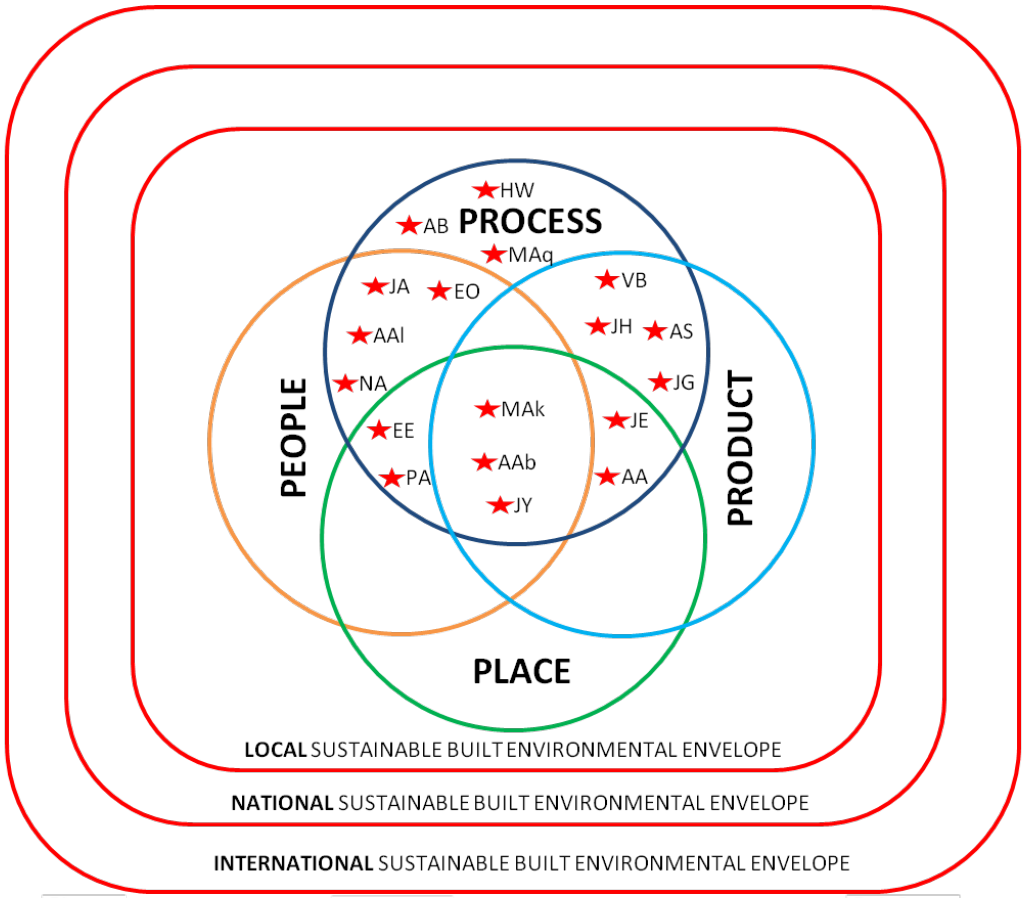


Source: HM Treasury, Major Infrastructure Tracking Unit, 2013

Our Approach:

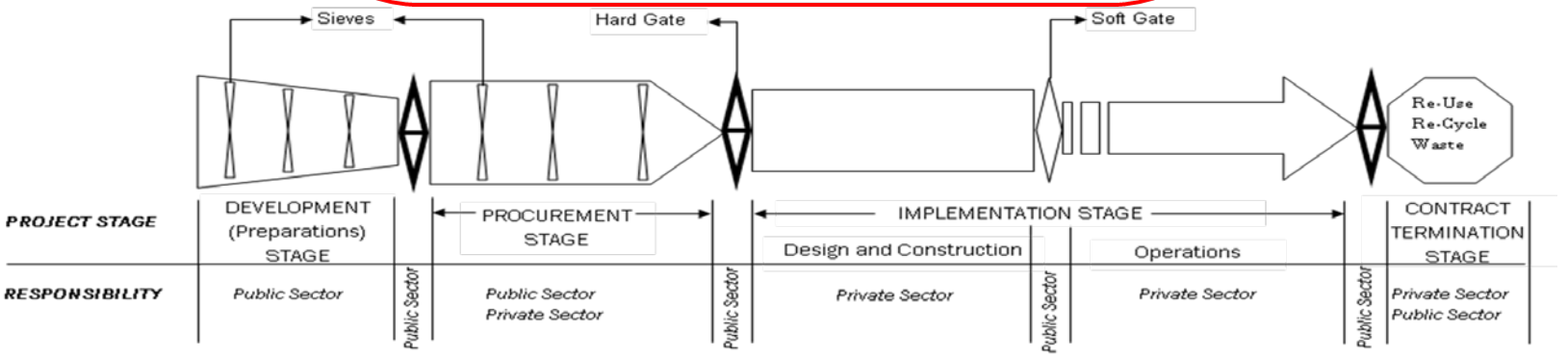
Define outcomes and measures of success

Identify and deliver user/operator needs



Collect and compare actual operational performance against planned targets

Soft Landings and GSL



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)
2. Environmental impact of prefabricated timber frame housing Jennifer Hardi (2008)
3. Earth-Air heat exchangers and their potential for low-energy cooling of buildings in the UK Abdullahi Ahmed (2009)
4. Solar thermal storage using phase change material for space heating in residential buildings Jonathan Roger Gates (2009)
5. Indoor Air quality in large spaces Joanne Ellis (2010)
6. Factors affecting employee productivity in UAE construction industry. Nabil Ailabouni (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)
10. The effect of emerging technologies on the management of built facilities Asad Sindhu (2015)
11. Using PPP to deliver affordable housing in Nigeria Julius Adeniyi (2016)
12. Facilities management: Influence of market place on attitudinal change towards waste management in sub-saharan Africa. Adeni Abigo (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 Alaqad (Ongoing completion 2018)

At Masters Level, Forexample: 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

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

where "k" is the complexity factor

- $C = (Ttot/Tp) - 1$

Ttot = Tp + et

Tp = original estimated project duration

et = contingency time = Tp x Co

Reference: Gidado, K (1996) - *Project complexity : the focal point of construction production planning*. Construction management and economics journal, Volume 14, No. 3, May 1996. E&FN Spon

Measure of Project Complexity (Cost)

- $C = (Vtot / V) - 1$

  Vtot = Vtot1 + Vtot2

  Vtot1 = Vp(Cc + 1) direct cost

  Vtot2 = ((Ttot-Tp)x(Tp/Vo))+Vo indirect cost

  V = Vp + Vo

  Vp is the project direct cost

  Vo is the project indirect cost

  Cc is the complexity related to direct cost only

Reference:

- Gidado, K. (2004), Enhancing the Prime Contractor's Pre-Construction Planning. Journal of Construction Research. Volume 5, Number 1, March 2004. Pages 87-106.

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?

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- 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