System innovation for sustainable built environments

Dr Shu-Ling Lu
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Presentation structure

• **The need of system innovation**

• **Current research**
  – Economic and Social Research Council (ESRC) – innovation challenge of the Code for Sustainable Homes
  – Construction Knowledge Exchange – new product development and diffusion in high technology

• **Future research**
  – Engineering and Physical Science Research Council (EPSRC) – the development, uptake and use of microgeneration technologies

• **CIB TG65 – Management of small construction firms**

Please raise issues / opinions at any time - this presentation is intended to stimulate discussion!
The need for system innovation

• Increasing drive to transform the built environment to an environmentally sustainable one, e.g.
  – Low carbon
  – Renewal energy
• System innovation
  – Need for systemic and integrated policy and action across all levels
Multi-level model of innovation and system transformation

Socio-technical landscape

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties.

New socio-technical regime influences landscape

New configuration breakthrough, taking advantage of 'windows of opportunity.' Adjustments occur in socio-technical regime.

Socio-technical regime

Socio-technical regime is 'dynamically stable.' On different dimensions, there are ongoing processes.

External influences on niches (via expectations and networks)

Technical niches

Small networks of actors support novelties on the basis of expectations and future visions. Learning processes take place on multiple dimensions. Different elements are gradually linked together in a seamless web.

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties.

Time
A socio-technical, transition management perspective – the way forward

- For example, current ‘Energy and Communities’ funding call
  - ‘Transformative innovation, lifestyles and social technical practices’ theme
  - “… there is a clear need for the dynamics of transformative innovation to be explored … through new socio-technical systems”
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ESRC ‘Code for Sustainable Homes’ project

- Example – thermal performance
  - Level 1 - 10% improvement over Building Regulations
  - Level 2 - 18% improvement over Building Regulations
  - Level 3 - 25% improvement over Building Regulations
  - Level 4 - 44% improvement over Building Regulations
  - Level 5 - 100% improvement over Building Regulations
  - Level 6 - Zero Carbon including appliances

12:30 – 2:00 pm. Thursday, 21st Jan. 2010, Building and Real Estate Workshop, Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong
ESRC ‘Code for Sustainable Homes’ project

• The impact of environmental regulation on innovation in the housing sector: the case of the Code for Sustainable Homes

• Research questions:
  • What incentives drive innovation, and how can regulations be designed to provide or strengthen those incentives? Is it simply a matter of raising the performance requirements of the regulations, or is broader policy intervention needed?
  • How do regulations affect long-term corporate market expectations, perceptions of risk and uncertainty, opportunity recognition and selection, and competitive strategies of firms?
  • How should environmental regulations that affect innovation be evaluated? What factors should be taken into account in considering the effects of regulations on innovation?
ESRC ‘Code for Sustainable Homes’ project

• Research methodology
  – Case studies
    • Cross-representative companies - 6 UK housing developers:
      – 3 national (Barratt, Persimmon and Taylor Wimpey)
      – 2 regional (Cala and Redrow)
      – 1 specialist (McCarthy and Stone)
    • Cross-representative interviewees:
      – Board level
      – Programme managers
      – Project managers
  – Data collection
    • Semi-structured interviews
    • Company documentation
System innovation implications

Socio-technical landscape

Carbon reduction policies/ NGOs / etc.

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties.

Socio-technical regime

Destabilise traditional housing design/ production

Socio-technical regime is 'dynamically stable.' On different dimensions there are ongoing processes.

Technical niches

Eco-homes, environmental technologies, etc.

External influences (via expectations and networks)

New configuration breakthrough, taking advantage of 'windows of opportunity.' Adjustments occur in socio-technical regime.

Transition pathways

Elements are gradually linked together and stabilise in a dominant design. Internal momentum increases.

Time

Works of actors support novelties on the basis of expectations and future visions. Processes take place on multiple dimensions. Different elements are gradually linked together in a seamless web.
CKE Development & diffusion of high technology light emitting diodes (LEDs)

- **LEDs technology** – significant performance improvements over incumbent lighting technologies, e.g.
  - Operational life: 50,000 hours compared to 2 – 4,000 hours for halogen lamps
  - Energy efficiency – 300% more efficient than halogen lamps

- **Research questions**
  - How does the lighting supply chain (including LED module manufacturer, luminaire manufacturers, specifiers and end-users) engage with new LED technology?
  - What are the drivers and barriers underlying end-users decisions to adopt / reject such technology?
CKE Development & diffusion of high technology LEDs

• Research methodology
  – Research approach
    • Innovation chain from module developer through to client
  – Data collection
    • Semi-structured interviews
    • Participation in company meetings
    • Company documentation
    • Observations of meetings with original equipment manufacturers (OEMs), specifiers and end-users

Project team

Principal investigator: Prof. Martin Sexton
Project manager: Me!

Case study firms
CKE Development & diffusion of high technology LEDs

Figure 1 New LED product development phases
System innovation implications

**Socio-technical landscape**

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties.

**Carbon reduction policies/targets**

New configuration breaks through, taking advantage of 'windows of opportunity.' Adjustments occur in socio-technical regime.

**Commercial viable lighting solutions**: high colour quality, long service life, low energy, etc.

**Tungsten/compact florescent lights**

Socio-technical regime is 'dynamically stable.' On different dimensions, there are ongoing processes.

**Transition pathways**

External influences on niches (via expectations and networks).

High technology LEDs

Elements are gradually linked together and stabilise in a dominant design. Internal momentum increases.

Small networks of actors support novelties on the basis of expectations and future visions.

New configurations take place on multiple dimensions. Different elements are gradually linked together in a seamless web.

**Time**
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Current bid being refereed: Microgeneration technologies (MGTs) project

- Microgeneration is understood to be the “…onsite generation of low- and zero-carbon heat and electricity in domestic, public and commercial properties” (Bergman and Jardine, 2009: 6).

- The UK National House Building Council (NHBC, 2008) identify the following MGTs as being potentially relevant for incorporation into new houses:
  - biomass systems, solar photovoltaic systems, solar hot water systems, wind power systems, ground source heat pumps, air source heat pumps, absorption heat pumps, small-scale hydroelectric systems, micro combined heat and power systems, and renewable combined heat and power systems.
Current bid being refereed: Microgeneration technologies project

• **Research aim**
  – The broad aim of the work is to better understand MGT socio-technical networks.

• **Research questions**
  – How and why do MGT manufacturers interact with housing developers and end users and how does this shape the strategy and practices of the manufacturers and the design of the MGTs? How does the current market and regulatory context shape this interaction?
  – How and why do housing developers interact with MGT manufacturers and end-users, and how does this shape the strategy and practices of the housing developers and the incorporation of the MGTs in housing designs? How does the current market and regulatory context shape this interaction?
  – How do end-users interact with MGTs and how does this interaction shape the use of the technologies and the end-users’ practices? How do users’ practical needs and cultural understandings shape this interaction?
  – How do socio-technical networks in France and the United Kingdom differ in their uptake of similar MGTs and what does this teach us about the effect of national institutional contexts on the deployment of MGTs?
EPSRC Microgeneration technologies project

- **Research methodology**
  - Research approach
    - Case study
  - Case studies
    - Phase 1: 6 UK housing development case studies (both live and completed projects)
    - Phase 2: 3 UK microgeneration technology case studies
  - Data collection
    - Semi-structured interviews
    - Company documentation
    - Observations of key design and production on live projects
    - Workshop

**Project team**
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TG65: Management of Small Construction Firms

TG65 Website: http://www.buhu.salford.ac.uk/CIBTG65/

Joint co-ordinators:

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- Dr Shu-Ling Lu, University of Salford, UK
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Aims & Objectives

• **Aims**
  – bring together the experience and expertise of researchers and practitioners who would not have otherwise interacted with each other;
  – develop, share and disseminate appropriate research methodologies, and organisation and management theory and practice with regard to the successful management of small construction firms (SCFs) within the CIB network membership and to the wider international academic and industry communities; and,
  – encourage and enable new collaborative, multi-disciplinary research activity to take place through the establishment of a critical mass of interested and diverse researchers and practitioners.

• **Objectives**
  – define the concept and scale of ‘SCFs’ activity in various country contexts;
  – identify generic antecedents to the successful management of SCFs, as well as discern country-specific drivers and constraints; and,
  – focus on developing appropriate methodologies for the study of management of SCFs.
Progress so far..

- Start-up meeting in Rome, Italy Oct. 2006
- Task group meetings in Cape Town, South Africa May 2007; Dubai, UAE Nov. 2008; and, Dubrovnik, Croatia Oct. 2009
- A dedicated session in Dubai, UAE 2008
- Conference theme of Management of Small Construction Firms’ in Dubrovnik, Croatia 2009
Current key tasks

• **TG 65 book** “International Handbook of the Management of Small Construction Firms” – agreement in principle with Blackwell publisher
  
  – Section 1: small construction firms in context  
    • Focus on economic and social roles; understanding the relationships and interactions within and among aggregates of organisations
  
  – Section 2: the organisation and management of small construction firms  
    • Focus on understanding corporate strategy, innovation practices, people, teams, knowledge, tools and tasks that make up small construction companies
  
  – Section 3: research methods for investigating small construction firms

• **Conference theme of ‘Management of Small Construction Firms’** in the following conferences:
  
  – 2010 CIB World Congress, 10th -13th May, Salford, UK
  
  – 2011 CIB W55/65 symposium 2011, Delft, Netherlands
Thank you

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