

Ecole d'Eté RRI
Les nouvelles dimensions des systèmes sectoriels d'innovation
Montpellier 28-31 août 2012



Eco-design as new driver of technological innovation system: the french building and construction industry case

Blandine LAPERCHE

Clersé-Lab.RRI, Université Lille Nord de France

Fabienne PICARD

IRTES-RECITS, Université de Technologie de Belfort-Montbéliard

Plan

2

- Introduction : aim of the paper
- Theoretical background
- Some characteristics of french Building and Construction Industry (BCI)
- Facing sustainable transition with eco-design :
 - hypothesis,
 - research method
 - results
- Conclusion

Aim of the paper

- Environmental concerns expressed are among the chief pressures for change in this industry
- The study of sustainable transition (implying environmentally friendly modes of production and consumption) provides a new research agenda for innovation studies
- According to evolutionnism approach innovation is a key driver of change. But:

“In order to make technological change sustainable, technical change alone is not sufficient. Changes in social dimension -such as user practices, regulation and industrial networks- are inevitable” (Hekkert et al. 2007).

Aim of the paper

- All industrial activities are concerned by environmental pressures and Building and Construction Industry (BCI) are one of the most environmental impacting activity
 - 40% of CO2 emissions in developed countries
 - 37% of energy consumption and 40% of the produced wastes
- The purpose of our research is to analyse:

➔ **How environmental constraints impact the evolution of the technological innovation system (TIS) of the French building and construction industry (BCI) ?**

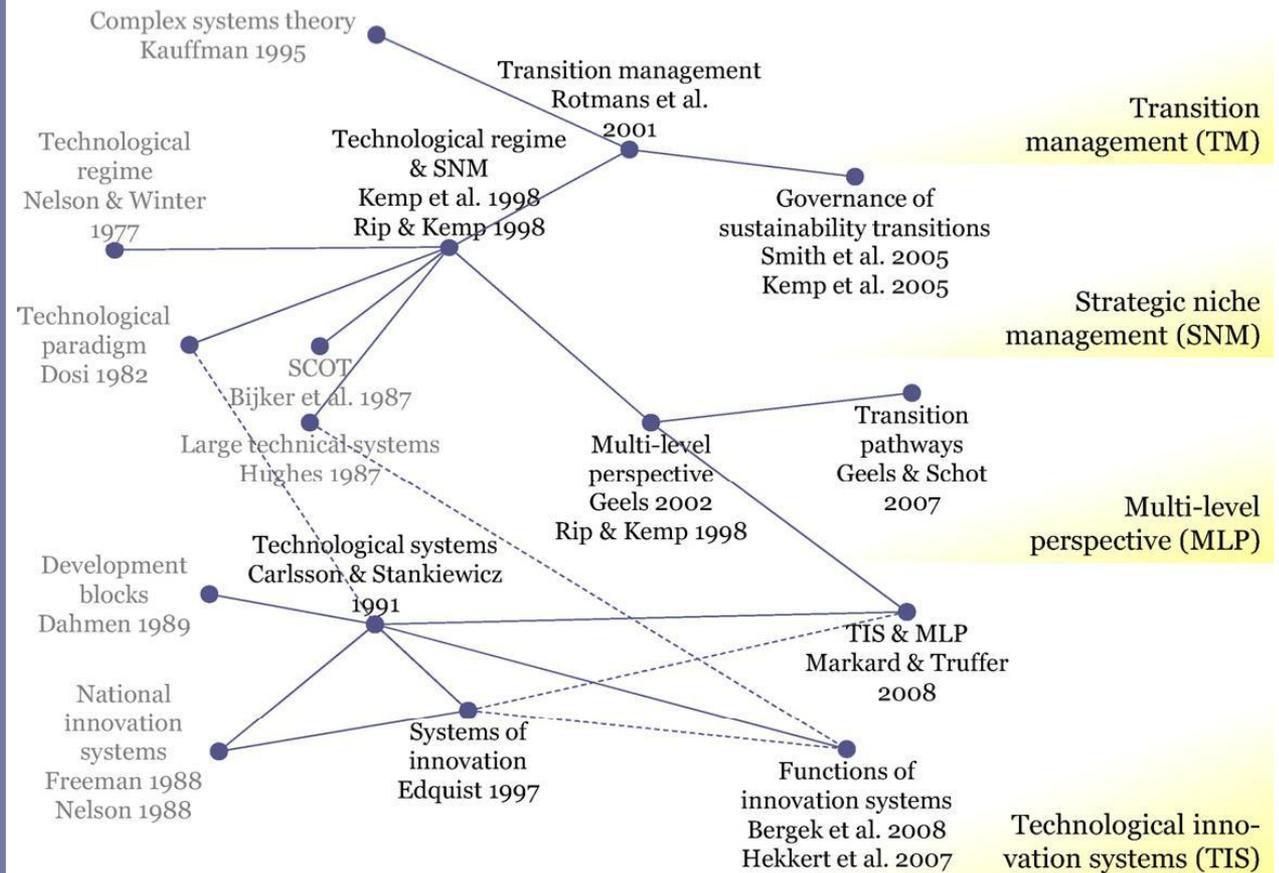


Theoretical background of sustainability transition

- According to Markard et al. (2012) four theoretical approaches of sustainable transitions proposed a systemic view of innovation
 - The Managerial Transition Theory (Kemp and Rotmans 2005, Kern et Smith 2008, Rotmans et al. 2001, Loorbach 2010)
 - The Management of Strategic Niches (Kemp et al. 1998, Smith 2007, Raven et Geels 2010)
 - The Multi-Level Perspectives of socio-technical systems (Geels 2002, Geels et Schot 2007b, Smith et al 2010)
 - The Technological Innovation Systems (Hekkert et al 2007, Bergek et al 2008, Jacobsson and Bergek 2011)

Theoretical background of sustainability transition

« Map of key contributions and core research strands in the field of sustainability transition studies » – Markard et al. 2012



Theoretical background

Technological Innovation System approach

- Technological (innovation) System is
“a dynamic network of agents interacting in specific economic / industrial area under a particular institutional infrastructure (...) and involved in the generation, diffusion, and utilization of technology” (Carlsson et Stankiewicz 1991:93).
- Structural components of TIS are :
 - Actors (firms, universities, research institutes, financiers, consultants, associations, private consumers, public facilities...)
 - Institutions , formal and non formal rules which regulate interactions between actors (technical norms, standards, regulations, values, collective expectations, cognitive frames, culture...)
 - Technology (products, machines, software, process...)
 - Networks link components of system

Theoretical background

Technological
Innovation System
Building

- *“The formation of an innovation system is, therefore, a process of re-configuring as the components co-evolve in a process marked with great uncertainty” (Jacobsson and Bergek 2011).*
- *Building system “includes the creation or re-configuration of value-chains as well as the creation of a supportive environment for an emerging technology in a more general way. System building may be the result of largely autonomous key actors, but more often it is a collective approach, in which organizations coordinate themselves in bilateral or multilateral interaction” (Markard et al. 2012)*

Some characteristics of the Building and Construction Industry

- Building and Construction industry is consisting of all those organisations that participate in building, renovating and refurbish the built environment. The organisations may provide materials, components and/or services (Widen 2009)
- In France the building sector (BTP)
 - Concerns more than 300 000 enterprises
 - Among them more than 90% with less than 20 employees.
 - Around 1,5 millions of employees and more than 10% of GDP...
(Deshayes, 2012, technologies clés, 2015)
- If we consider construction suppliers (around 11 000 enterprises) equipments and other activities that are part of the value chain, the economic importance of BCI is even bigger

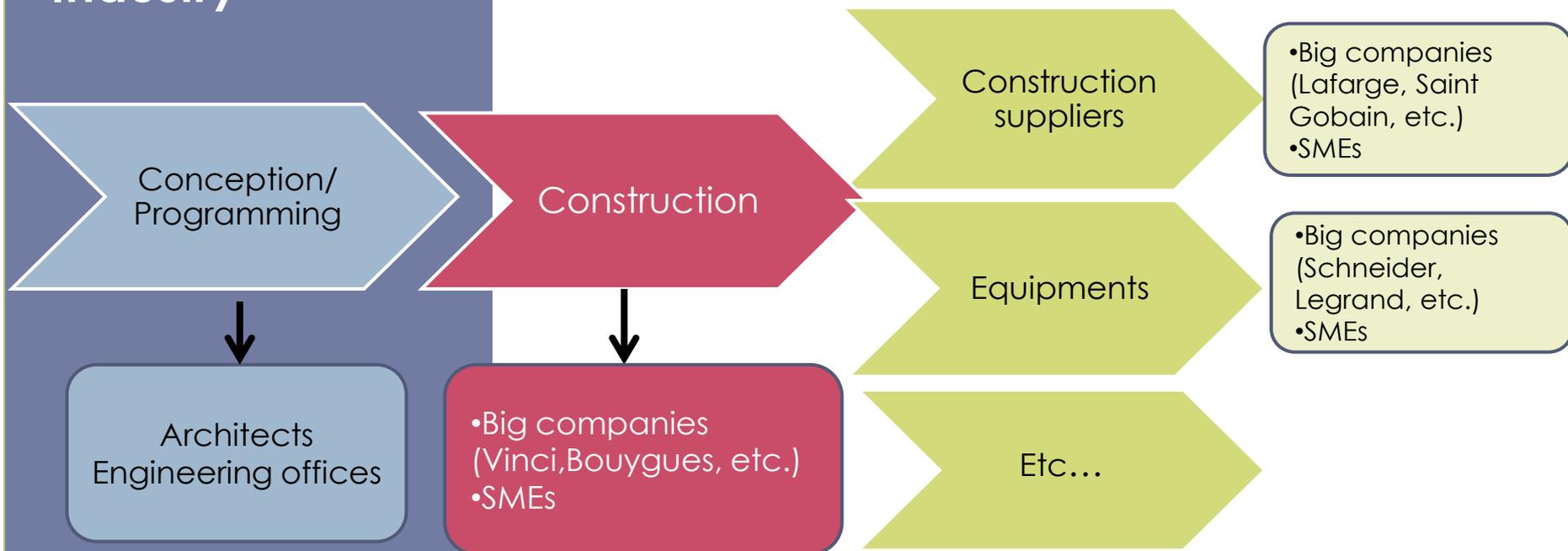
Some characteristics of the Building and Construction Industry

The activity in this industry is a

- Project-based process, relatively complex
- With many different actors working together in ever-changing projects organisations
- A small level of private R&D investment : R&D is not much developed (or only by the biggest companies)....
- Innovation and diffusion of new technologies and new practices are slow: difficult diffusion of R&D to the many small enterprises that compose the industry (Deshayes, 2012)

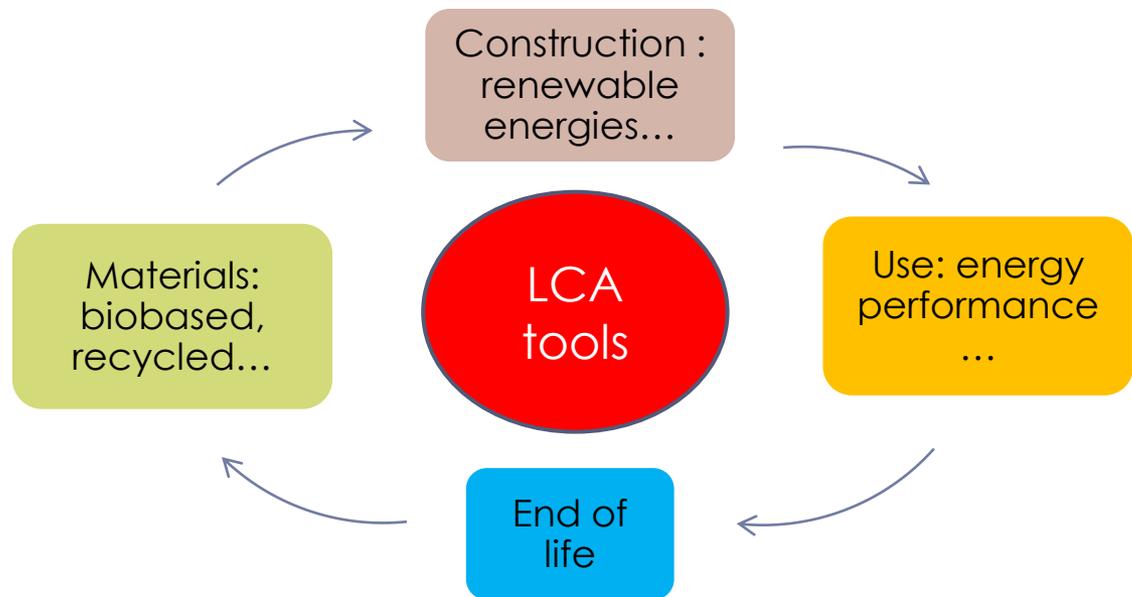
Some characteristics of the Building and Construction Industry

- Compartmentalization of jobs and fragmented value chain :



Facing sustainable transition with Eco-Design

- In order to face to environmental constraint, the construction and building industry develops eco-design process
- Eco-design refers to *“the systemic incorporation of life cycle considerations into the design of products, processes or services”* (Tucker et al., 2000). It is a methodology of design aiming to integrate environmental aspects from the design of a product or system (AFNOR 2002)



Facing sustainable transition with Eco-Design

Hypothesis

- Eco-design process impacts the different parts of Technological Innovation System of building and construction industry
- As a consequence, the environmental constraint and opportunity (which take the form of the implementation of Eco-design) may be considered as a main current driver of the TIS in the building and construction industry

Facing sustainable transition with Eco-Design

Research methods

- Literature review in the field of TIS, Eco-design and the French BIC industry
- Analysis of cases of firms' innovation strategy in this industry (based on a larger study of the environmental strategy of industrial firms part of the CAC 40 index, including some firms active in the BCI : Vinci, Lafarge, Saint Gobain, Schneider – Laperche and Picard, 2012)
- Our study focuses on the changes induced by the environmental constraint/opportunity in the structural components of the building and construction TIS : institutions, actors, technology, networks

Results (1/4)

Impacts of the environmental constraint on institutions

- Evolving norms and new regulations, in France :

Grenelle de l'environnement

Four objectives – four stakes

- Use of energy in construction : new construction with high environmental performance, passive or positive buildings
- Creation of ecodistricts
- Larger and better use of wood in construction
- New management of public engineering

Aim :

divide by 4 the emissions of greenhouse gas

Results (2/4)

Impacts of the environmental constraint on actors's strategies

- Implementation of an environmental strategy in the BCI : development of eco-design (*Technologies clés* 2015)
- Illustration in our studied cases:
 - Lafarge : Building a greenfield cement factory in Maroco (1999) ; Mitigation of CO2 emission (2000) ; 2020 Ambitions (2012), eco-design strategy
 - Saint-Gobain : New strategic focus on Habit markets (2007) ; Creation of the "Sustainable Habitat Mission" in 2010. Eco-design strategy
 - Vinci : Development of eco-design tools, introduction of environmental reporting (mid 2000); Creation of an eco-design team in France (2007)
 - Schneider : Creation of the sustainable development department (2000)
 - Firstly mainly focused on internal stakes, the strategy evolved towards the development of solutions (energy efficiency, access to energy)

Results (3/4)

Impacts of the environmental constraint on technology and supply

- Development of « global solutions » all along the life cycle, mixing several types of products, technologies and services, of « *bouquet des travaux* » (Technologies clés 2015)
- A double aim: mitigate the environmental impact and consideration of use and specificities of these technologies
- E.G. in our study of « product-service systems »
 - St Gobain: insulation “solutions” (mixing different products, technologies and services) to meet all types of insulation needs in new and existing buildings // system of collect and recycle plaster waste.
 - Schneider : Energy-efficient Solutions , Collection and recycling and dismantling services
 - Vinci : develops cycle analysis tools to analyze the environmental impacts of a building all along the life cycle (design, construction and use)

Results (4/4)

Impact of the environmental constraint on networks

- From a fragmented to an increasingly networked BCI ?
Links between firms and universities (e.g.):
 - Vinci : Chair (2008) in the eco-design of building and infrastructure with three ParisTech engineering schools (Mines, Ecole des Ponts and Agro) and development of a Master degree to train its potential future employees.
 - Saint-Gobain (2008) also inaugurated the Innovative Solutions for Sustainable and Responsible Habitat Chair at France's Ecole Nationale des Ponts et Chaussées (ENPC) and signed on to the creation of a master's program in energy at Ecole Polytechnique.
- More globally, creation of collective innovation processes imposed by eco-design : *open innovation strategies (Chesbrough, 2003)*
- Partnerships with labs, other big firms, start-ups (e.g. Nova external venturing Saint-Gobain), participation to and animation of European research programs, clusters, creation of foundations and non-profit (eg. Eco-SD) gathering different actors for the academic and business worlds.

Conclusion

- In the BIC, the environmental constraint is a driver of change in the TIS since the implementation of eco-design implies to develop global solutions mixing various technologies, products and services all along the life cycle of the parts of - and of the whole buildings.
- Thus, it implies:
 - to work « together » with other enterprises and other institutions: less fragmentation and more cohesion in the TIS;
 - to act beyond the boundaries of the enterprises at the level of the neighborhood or the « territory » : eg ecoquartiers

Conclusion - limits

- A very beginning process, still very fragmented sector: need for interoperability and decompartmentalization of jobs and business.
- A learning process which should notably be supported by the development of specific training and financial incentives (Technologies clés, 2015, Plan Bâtiment Grenelle, Building working group)
- The current economic crisis may be an incentive to change but in the same way could also impede the possibilities to invest.

*Thank you for your attention
and feedback*

blandine.laperche@univ-littoral.fr
fabienne.picard@utbm.fr