

# Industrial Ecology and the development of innovative milieu - Theoretical framework

Laperche B., Boutillier S., Uzunidis D.



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**CERSE** Centre Lillois d'Etudes et de Recherches  
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- **Contribution of IE to sustainable development** (Frosch, Gallopoulos, 1989);
  - Industrial complexes should be designed to resemble to natural ecosystems as closely as possible. In natural eco-systems, energy and resources are used optimally and wastes are absent or reduced
- **With two visions** (Buclet, 2011)
  - This will be achieved thanks to technological progress (Allenby, Richards, 1994 ; Erkman, 1998)
  - IE needs a more radical change and a interface between human societies and natural ecosystems (Ehrenfeld, 2004)
- **Conditions of implementation:**
  - *industrial symbiosis* (« engaging traditionnally seprate industries in a collective approach to competitive advantage involving physical exchanges of materials, energy, water, and by-products. The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity », Chertow, 2007) and
  - *industrial metabolism* (analytic and descriptive methodology consisting in the understanding of the flows and the stocks of materials and energy linked to human activities : mass and energy balance calculations, Erkman, 2001)

**Main topics industrial ecology (IE), some elements from an ongoing literature review**

- **Review of experiences**

- Kalundbord (Erkman, 2001 ; Erhenfeld and Gertner, 1997, etc.)
- Eco-industrial parks, and conditions for success (top-down –government initiatives or ... down-top – market forces) (Heeres, Vermeulen, de Walle, 2004 ; Gibbs et al., 2005; Duret, 2007 and many others)

- But, the **contribution of IE to local development** is rarely studied

- **Scopus** (1989-today), Social Science and humanities Article: Title, abstracts, keywords
- « Industrial Ecology »: 1989 articles; but « industrial Ecology » and « regional development/local development » : 0
- « Industrial symbiosis » :134. « Industrial symbiosis» and «regional/local development » : 5
- « Industrial Metabolism » : 221 « Industrial Metabolism » and «regional/local development » : 0
- « Eco-industrial park» 70 and «regional/local development » : 5
- « Circular economy »:153 and «regional/local development » : 2
- « Eco-industrial development » : 44

**Main topics industrial ecology (IE), some elements from an ongoing literature review**

- Linking industrial ecology and innovative milieu
  - Similar aim: local economic development
  - Similar importance of networks: coopetition
  - Similar issues: roles of actors (enterprises, public authorities, institutions) – analysis of their interactions
  - Similar approach of the territory : not only as a stock of resources but as a social construction (French school of proximity; evolutionary approach of territories)
- Applying this analysis to industrial and port economies
  - Less than five articles on Scopus with « Industrial ecology » or « industrial symbiosis » and « harbour » or « port »
  - Port economies : specific case for Industrial ecology

**Our aims**

Industrial Ecology – Industrial symbiosis



Agglomeration economies – short industrial circuits



Stabilisation of current activities /  
Creation of new activities



Reinforcement of local attractiveness



Innovativeness and Diversification of the  
local economy: Towards Innovative Milieu

**How industrial ecology may  
contribute to local development?**

Industrial Ecology

- Enterprises (role of confidence)
- Public policies: environmental, industrial and territorial

Agglomeration

- Entrepreneurial network, local institutions, educational system, R&D and engineering institutions

Stabilisation /Creation

- New entrepreneurs, new units and services

Attractiveness

- Location of new enterprises, R&D institutions, new public services

Diversification

- New sectors, networks of enterprises and of R&D organizations and public institutions

**Actors and Systemic links in territorial innovative perspective**

- Preexistence of flows between enterprises –proximity (geographic, cognitive) between different but complementary enterprises
- Economic opportunity
- Technical feasibility
- Institutional support (communication platforms)
- Pressure of the population
- Role of the State (regulation) and implication of local authorities

**Factors of success**

- Technical (the exchange is technically unfeasible)
- Economic (economically unsound or risky from the company perspective)
- Informational (the needed information is not available)
- Organizational (micro: the organization of the company does not fit with the intended exchange; meso: implication of Smes)
- Infrastructure (the infrastructure is not available to make the exchange possible)
- Regulation (no incentives)

## **Potential barriers to symbiotic exchanges between enterprises**



- The current stakes of industrial harbours
  - Economic stakes: facing global competition, need for differentiation –restructuring of heavy industries
  - Environmental stakes: ecological footprint
- Experiences of industrial ecology in industrial harbours
  - Dunkerque-Grande Synthe. First experiment in France (Erkman, Ray, 2000)
  - Terneuzen, Canal Zone (Spekking, 2013)
  - Rotterdam (Baas, 1998; Baas, Huising, 2008)
  - Gdansk (Lorek, 2012)
  - Zeebrugge The industrial park of Herdersbrug (Block et al., 2011)
  - Le Havre (Association Ecologie industrielle Estuaire)

**Application to the specific case of  
Industrial and port economies**

- Methodological elements of the empirical study (new step)
- Assessment of industrial ecology potential
  - Industrial metabolism: analysis of flows
  - Industrial symbiosis: analysis of exchanges (real or potential)
  - Recycling and valorisation of industrial wastes
  - Analysis of the role of actors
  - Enquiry of leading enterprises and Smes, port authorities and territorial economic and environmental institutions
  - Analysis of factors of success and of (potential) barriers (technical, economic, information, organizational, regulatory, infrastructure)
- Construction of scenarii for the local developement based on industrial ecology

**Next step: empirical study**

- Thank you for your attention!