The role of ICT in industrial ecology projects – The French perspective

Sabrina Brullot
University of Technology of Troyes, CREIDD, Charles Delaunay Institute, CNRS FRE 2848
12 rue Marie Curie, 10000 Troyes, France
sabrina.brullot@utt.fr

Abstract

Many programs aiming at implementing industrial symbiosis have been developed all over the world. However, only few by-products exchanges became operational. Applications that aim at gathering and sharing material and energy flows are more often potential than effective (Gibbs and Deutz, 2007) and this is especially true in France where industrial ecology implementations are quite few. According to the question of the role of ICT in industrial ecology, this paper contains three parts. At first, we will propose an overview of industrial ecology in France from several points of view: when and how did the concept first appear? What about the research and the training centres? Who are the operational actors or experts? And finally what are the main projects? Secondly, we will present a French program called COMETHE and aiming at developing methodological and assessment tool integrated into a global decision-making system. And finally, we will conclude with a reflexion about the role of ICT in industrial ecology from the French point of view, introducing a future project that will take an interest in this question.

1. Industrial ecology in France

Industrial ecology concept became known in France in 1999 thanks to the first European scientific conference in the University of Technology of Troyes, in France. This event was organised by D. Bourg and S. Erkman, just after the publication of the first French book on industrial ecology, written by S. Erkman in 1998. These two happenings symbolise the beginning of operational and research development of industrial ecology. Many researchers, public and private actors attended this conference. The consequences have been very positive. The first research team was created in UTT and the first project was developed in the north of France near Dunkerque only just one year later.

From a research point of view, the first research team mentioned previously (CREIDD: Centre of Research and Interdisciplinary Studies on the Sustainable Development) is always the only one that is specialized in industrial ecology. The three first (and only) French Ph. D. dissertations on industrial ecology have been achieved at the CREIDD (Adoue, 2004; Erkman, 2004; Brullot, 2009).

Some research teams are now going to take an interest to this field from a specific point of view, according to their scientific domain: economic sciences at the University of Lille, geographic sciences at the University of Toulouse, engineering sciences at the schools INSA of Lyon and Ecole des Mines of Ales, for example.

The University of Technology of Troyes (UTT) has a master training program specialized on industrial ecology and ecodesign. It was created in 2001 and proposes a specific program in partnership with the University of Sherbrooke, in Canada, since 2007.

From an operational point of view, some new experts are participating in the implementation of industrial ecology in France. They are associations like Auxilia and Orée or consultancy companies like EIC and Systèmes-Durables. Some are working on environmental management of industrial parks, other are experts on industrial ecology or sustainable development strategies for local authorities (territorial approaches) or private actors (companies). If EIC and Systèmes-Durables have been created especially to work on this field, Auxilia and Orée already existed. In this case, industrial ecology is a new work competence added in their offer to private and public actors.

Industrial ecology projects are emerging all over the France. Some are more developed and operational than others but most of them started being an experimentation area of research or expert actors. These projects can be divided into two types: emerging projects or advanced projects.
1.1 Advanced projects

The first industrial ecology project took place in France just after the conference organised at UTT in 1999 in Dunkerque. It was implemented in two industrial parks called “Grande-Synthe” et “Petite-Synthe”. This project started in 1999 and was funded by local governments and by the company Gaz de France. In 2000, the association Ecopal was created to coordinate industrial ecology project. In charge of the animation of the two industrial parks, at the beginning, Ecopal has been plenty occupied with an environmental management mission and collective action pilot like waste management. Trying to implement industrial synergies between companies, the first years of the project has mainly been devoted to the communication about industrial ecology, the awareness of industrial and public actors, and the creation of organisational behaviours that improve the industrial ecology feasibility. Thanks to the COMETHE project in which Ecopal takes part, and described further, collection of input and output data from companies of the two industrial parks is now in progress. A specific tool (Presteo®) aiming at identifying industrial ecology synergies is actually used and should improve operational implementation of industrial ecology.

This tool, developed by Systèmes-Durables is also used in the second industrial ecology project, considered in France as an advanced program. Implemented at a broader scale than industrial park, it started in 2004 around Troyes in Aube department. It is mainly funded by the government of the department and is coordinated by the UTT. This project is an experimentation pilot of research activity of UTT. Like Ecopal, the first years has been dedicated to the mobilization and the awareness of public and private actors, and then to the definition of a shared goal. From 2004 to 2007, we created an informal club of industrial ecology bringing together several public and private actors. The target was to exchange information and create trust and organisational links between actors. Since 2007, this club has been turned into an association. Some interesting industrial ecology synergies have been developed. One of them, for example, concerns a material flow exchange between two companies: a sugar refinery and a building and public works company. This flow is sand that comes from the washing process of sugar beets before their use in the refinery. In spite of the good quality of the sand, it is considered as a process waste and must be put in a landfill, according to the French regulation. This flow (around 12000 tons by year) is now used by building and public works company, instead of new resources from sandpit.

Other synergy rests on heat production thanks to an organic fuel. It is a waste of pork meat production that must be put in quartering, according to the French regulation. Now, it is used as fuel to cook the product, to heat blocks and to supply an industrial laundry.

These two projects can be considered being at an advanced stage because an association was created. If they were research experimentations of industrial ecology at the beginning, they rest on an institutionalised network today, involving public and private actors concerned by industrial ecology. Research actors are still linking to these projects but as expert or operational actor, and not as a leader.

1.2 Emerging projects

Other industrial ecology projects are emerging in France. They are more or less advanced, stopped or in progress and coordinated by public or private actors. We would not describe all these experiments but just give the main features of three of them:
Table 1: Some industrial emerging project in France

<table>
<thead>
<tr>
<th>Project</th>
<th>Start</th>
<th>Territory</th>
<th>Stage</th>
<th>Funder</th>
<th>Research experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial ecology project in PCOB</td>
<td>2007</td>
<td>“Pays Centre Ouest Bretagne”</td>
<td>in progress</td>
<td>public</td>
<td>No (public initiative)</td>
</tr>
<tr>
<td>« Vallée de la Chimie » Project</td>
<td>2006</td>
<td>chemical companies - south of Lyon</td>
<td>stopped (no more funds and no local governance)</td>
<td>public</td>
<td>Yes (research program from 2006 – 2008 involving researchers, experts and public actors)</td>
</tr>
<tr>
<td>« Port Autonome de Marseille » Project</td>
<td>2001</td>
<td>Marseille port</td>
<td>stopped</td>
<td>public</td>
<td>Yes (6 months project of potential identification)</td>
</tr>
</tbody>
</table>

Implementation of industrial ecology in France is quite weak but we can see a great and growing interest from private and public actors. This lack of development can be explained as follow:

- The introduction of industrial ecology field in France is very young (1999),
- French regulation regarding waste disposal is really restricting. By-product exchange between two companies is very difficult and is not enforced by lower actual and traditional waste treatment costs,
- Many tools and methods are available but are insufficient and unsuitable for French context.

However, we think that we have a successful kind of areas to achieve industrial symbioses in France. They are industrial parks. We estimate that the number of industrial parks is between 25 000 and 30 000, a great potential. They could be successful areas because they are a kind of meeting point between companies, local governments and residents, sharing economic development targets and trying to define sustainable development strategy, but without method. Industrial ecology could provide some guidelines for them and industrial park could provide an organisational context favourable to the start of an industrial ecology project. According to this point of view, we will present the COMETHE project in the following part. It aims at developing methodological and assessment tools integrated into a global decision-making system to improve industrial ecology implementation in France.

2. Presentation of COMETHE project

COMETHE means “conception of methodological and assessment tools for industrial ecology”. It is a French research program launched and funded by the French National Research Agency (ANR). It started in 2008, will during three years and rests on experimentation of industrial ecology in seven pilot areas presented after. Coordinated by the association Oree, twelve partners are involved in this project, divided into two categories:

- Research and expert actors (UTT, University of Lille, Systèmes-Durables, Auxilia and Evea)
- Local actors (local authorities or other public actors, firms or associations that are involved in industrial ecology implementation in their territory.

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2.1 Pilot experiments

The territories on which industrial ecology initiatives will be conducted under the COMETHE project are industrial parks of various types. More of 30 public actors and 1000 companies are concerned by this project. However, they have one thing in common: they want to incorporate industrial ecology principles into their development strategy. Some are new territories; others are in the process of economic revitalization and the rest are at an advanced stage of environmental management or have already specificities regarding collective management and industrial ecology (figure 1).

![Figure 1: pilot experiments](image)

2.1.1 New territories

For these territories, the challenge lies in the choice of activities that will settle in the park, as well as in building it so as to promote the management of shared resources and waste. The goal is to create an eco-industrial park reflecting on the potential industrial ecology synergies. These territories are: the industrial and fluvial site of Pouzin (Ardèche), the business park of the Grand Troyes, and an economic activity zone in Torvilliers (Aube).

2.1.2 Territories undergoing economic revitalization

In this case, the use of industrial ecology permits the identification of new economic activities whose potential synergies with the current local actors are interesting. The goal is to create new businesses while rationalizing the management of materials and energy flow between the companies already established. These territories are: the industrial park of Lagny-sur-Marne (Seine et Marne) and an industrial park of Dunkerque (Nord).

2.1.3 Territories at an advanced stage of environmental management

These territories are already involved in an advanced process of environmental management, and even industrial ecology. The experiment will then carry on and sustain this strategy further. These ter-
territories are: several industrial areas of Dunkerque (Nord), the industrial port site of Nogent-sur-Seine (Aube), and the Savoie-Technolac industrial park (Savoie).

These territories are all very different in terms of their history, their planning stage, their development objectives and their economic sectors. As a first step, the project aims at defining strategies for industrial ecology implementation according to the context of each territory. In a second step, the multiplicity of territorial specificities will allow us to make recommendations regarding the deployment of industrial ecology initiatives on an economic activity zone and according to its contextual characteristics and specificities.

2.2 Expected research results

In terms of research, expected results are, at first, the knowledge of barriers and leverage of industrial ecology implementation from a technical AND a social and economic point of view. Secondly, we will create a methodological handbook applied to industrial park. And finally, an integrated tool aiming at assisting decision-making process of stakeholders in industrial park will be developed. This tool will provide methodologies for:

- Diagnosis of the industrial area (typology of coordination processes, territorial context and survey of public and private actors),
- Feasibility studies and assessment of eco-industrial synergies’ impact:
  - Tool for the risk analysis with an approach based on Failure Mode and Effects Analysis (FMEA),
  - Tool for technical and economic feasibility (What are the costs and the benefits of a synergy for companies and for the territory? What are the technical specification to apply the synergy related to the prevailing policy and regulation?)
  - Tool for regulatory feasibility (what is the current regulation to apply the synergy in terms of transport, use and so on?)
  - Tool for environmental assessment of synergy with an approach based on life cycle assessment.
- Creation of prospective scenario for sustainable development using multi criteria analysis,
- Preservation of the approach on the long term perspective.

Actually, we are collecting input and output data from companies and identifying eco-industrial synergies thanks to the existing tool called Presteo®. This tool will be combined with a GIS based tool actually in progress.

3. Conclusion

COMETHE project aims at developing some specific tools to improve industrial ecology implementation in France, like presented previously. However, our experiments and research works started few years ago let us conclude that specific tool will never be sufficient to implement successful industrial symbioses. Human and organisational factors are indeed at the heart of industrial ecology. Tools are necessary to help decision-making processes of stakeholders involved in industrial ecology projects. However, we have to better understand this decision-making processes. How do public and private actors consider the question of waste treatment, of industrial ecology, and more globally of sustainable development? What is the individual and collective logic face to this question? What are the targets of public and private actors? What are the social and economic criteria providing them to invest in industrial ecology project? What about their perception of innovation? What about the use of specific tool? These questions will be analysed in a future research project.
References


