INDUSTRIAL SYMBIOSIS IN ITALY AS A TOOL FOR SUSTAINABILITY: CASE STUDY ANALYSIS AND REPLICABILITY*

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Abstract

The aim of this paper is to evaluate the opportunities existing on the Italian territory and the useful experiences realized in this area for purposes of development of a joint system (businesses – institutional bodies) intended to apply Industrial Symbiosis and to disseminate the methodology. Pilot projects, undertaken or in progress in the region, targeted to study the potential for application of circular economy by closing production cycles are described and analyzed with a SWOT analysis.

Keywords: circular economy, industrial symbiosis, SWOT analysis, waste valorization

1. Introduction

Industrial Symbiosis, as instrument to optimize the use of resources, requires attention by local and regional economies and institutions. The key to develop Industrial Symbiosis is collaboration, but this requires a thorough study of the area in order to maximize the effectiveness of application of the instrument.

*Selection and peer-review under responsibility of the ECOMONDO
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One of the proposed tools in all documents regarding the EU Cohesion Policy, the European strategies and, recently, also in the Italian Regional Policies, is Industrial Symbiosis. This instrument is also suggested within the waste plan of Emilia Romagna Region as “useful to the reduction of special wastes quantity”.

Many examples of symbiosis processes studied by industrial research could be applied in Italian productive system, so as to reduce waste amount, increase the efficiency and re-use of resources and make related environmental improvement an attractive process for industrial stakeholders (Laybourn and Lombardi, 2012).

2. Materials and work context

2.1. The Italian Effort for economic and industrial growth to achieve the Europe2020 Strategy objectives: SSS Smart Specialization Strategies


Financial instruments are an efficient way of deploying cohesion policy resources in pursuit of the Europe 2020 Strategy objectives.

This programme expects that national and regional authorities develop research and innovation strategies aimed at the "smart specialization". The goal is to allow a more efficient use of structural funds and to increase synergies between EU, national and regional authorities.

Smart Specialization is a strategic approach to economic development through targeted support to Research and Innovation (R&I). It will be the basis for European Structural and Investment Fund interventions in R&I as part of the future Regional and Cohesion Policy's contribution to the Europe 2020 jobs and growth agenda.

In Italy this program was implemented by the Ministry of Economic Development (MISE) in agreement with the Italian Ministry of Education, University and Research (MIUR).

The goal is:

- To support regional governments in designing and implementing their own SSS through the possibility of sharing, at national level, experiences underway in different regions.
- The arrangement of the various initiatives of SSS, with the extent of avoiding overlaps between different levels of governance.

In this perspective of targeted support, every region has worked in order to bring out the excellence of the territory with the prospects of success on the global market, and to identify more effective instruments for economic and territorial growth.

Two Italian regions, Emilia Romagna (INVITALIA, 2014) and Lazio (Regione Lazio S3, 2014), have inserted Industrial Symbiosis in their strategic plans, as tools / specialization in order to reduce waste quantity and to increase regional sustainability, materials reuse and raw materials saving.

2.2. The Emilia Romagna case study: Industrial Symbiosis as a strategic instrument for the Territorial development?

Developing operationally the SSS strategies, in Emilia Romagna five technological specializations were decided to be strategic and considered most relevant for a growth strategy of the territory.

- Agrifood Building Mechatronics and motor design and manufacture Healthiness industries.
Creative and cultural industries.

In the first three specializations, Industrial Symbiosis and resources management are included as important tools to increase efficiency and sustainability in industrial processes.

Industrial Symbiosis has been included in the Waste Management Plan of Emilia Romagna Region, as “instrument for the amount and hazard reduction of special wastes and for the re-use of materials from production processes”. Emilia Romagna Region “is considering whether to activate work tables to study the conditions facilitating the use of by-products and identify possible agreement conditions between involved actors” (Emilia Romagna – PRG, 2014).

In Emilia Romagna an Industrial Symbiosis pilot action was conducted: the “Green Project”, developed by Unioncamere Emilia Romagna and Aster (with the scientific support of ENEA UTTAMB), has been aimed at the dissemination of an Industrial Symbiosis culture in Emilia Romagna, involving traditionally separate industries in a collective approach (ASTER, 2014; Cutaia et al, 2014).

The pilot action results (13 companies, 4 laboratories and 2 institutional bodies involved, 90 symbiosis paths identified) show that Emilia Romagna is a good substrate to start a network of companies involved in Industrial Symbiosis processes: the proactive participation and the feedback received by participants and other representatives of the Emilia Romagna business network is indicative of a widespread interest on the matter. This is undoubtedly a strength with the perspective of replicability and diffusion of the model.

The feedback analysis also allowed to highlight some “resistance”, due to:

- Complex authorization processes (different institutional bodies are involved in the process).
- Reluctance to the sharing of internal data (due to an industrial culture not very accustomed to cooperation): weakness.

In this paper has been analyzed the case study of Emilia Romagna Region in facing Industrial Symbiosis as a tool to reach the National objectives.

3. Methods: SWOT analysis

Looking at Italy as an industrial system, in this paper the working methodology has provided for the application of a SWOT analysis, in order to understand the best strategies to plan a successful implementation of Industrial Symbiosis in our country.

SWOT Analysis is one of many possible strategic planning tools used to evaluate the Strengths, Weakness, Opportunities and Threats involved in a project, or any other situation requiring a decision or a possible implementation.

Consequently, the objective of this paper was to apply this method of planning to Industrial Symbiosis, on the basis of the data obtained from the experiences and studies realized in Italy, with the intent that concepts described here can be used to strengthen and guide this emerging discipline.

Among the methodological prescriptions adopted in implementation phase of SWOT analysis:

- Realism about the strengths and weaknesses of the territory: we have tried to distinguish between current condition and potential for future development.
- Specificity by avoiding grey areas.
- Brevity and simplicity, avoiding complexity and over-analysis, since in SWOT method much of the information is subjective.

In theory, SWOTs parameters (Strengths, Weakness, Opportunities and Threats) are used as inputs to the creative generation of possible strategies, by asking and answering the following four questions numerous times:
1) How can we Use each Strength?
2) How can we Stop each Weakness?
3) How can we Exploit each Opportunity?
4) How can we Defend against each Threat?

In practice, once our objective has been established (estimate the replicability of Industrial Symbiosis methodology in Italy), a multidisciplinary team (representing a broad range of perspectives) has developed SWOT analysis, presented in the form of a matrix. In our analysis, SWOTs are defined based on the following criteria, helpful to the implementation of Industrial Symbiosis:
- Strengths and Weaknesses are internal attributes of the Italian territory (business system and institutional bodies).
- Opportunities and Threats are external conditions (European context, socio-political context, cultural context).

To reap the full benefits of SWOT analysis it is important to use this tool correctly. Firstly, the aim of this work and analysis should provide information that helps institutional bodies, decision makers and opinion groups (professional associations) in operating for the diffusion of Industrial Symbiosis methodology on Italian territory. Consequently we avoided laundry-lists of strengths, weaknesses, etc., that are not in themselves very useful: it is only when the potential implications of this information on the territory/instrument are assessed that meaningful analysis emerges.

Secondly, it is most beneficial to look at the strengths and weaknesses originating within the instrument or territory; we have worked in order to identify some focus points: what do Italian industrial system does better than anyone else, what/where could be improved, what are others likely to see as weakness?

Conversely, the analysis has externally focused opportunities and threats: what trends could Italian territory take advantage of, how can it turn its strengths into opportunities, what trends could do harm?

4. Results and discussion: Industrial Symbiosis SWOT analysis and replicability in Italy

4.1. Strengths (internal)
- Big production districts: areas in which the same kind of production is performed are more able to influence policies and regional regulation.
- Many companies are located in the same area: even if it is not strictly requested, the “geographic proximity” is a key success factor in order to implement Industrial Symbiosis (Jensen et al, 2011).
- High technological skills.
- Trade associations: their capacity to aggregate companies could be a success factor in order to create the exchange network and to influence policies (great decision weight).
- Good response from enterprises in the pilot experiences realized in Italy: proactive participation, widespread interest in the instrument.
- Regional and National policies (e.g. S3 - Smart Specialization Strategies): Industrial Symbiosis recognized as a strategic tool for the territorial growth

4.2. Weaknesses (internal)
- Authoritative problems: different institutional bodies involved in the process.
- Lack or wrong communication towards enterprises.
Industrial symbiosis in Italy as a tool for sustainability: case study analysis and replicability

- Distrust by the companies because of bureaucratic difficulties.
- Weak collaboration between different enterprises: “cultural” problem.
- Lack of links between different production chains.
- Resistance to spread sensitive data about waste fluxes.
- Weak collaboration between industry and research: lack of mutual trust (different timescales and approach).

4.3. Opportunities (external)

- Business opportunities for enterprises: reduction in disposal costs, revenue from the sale of scrap materials.
- EU funding: EU Cohesion Policy (Climate KIC, Horizon 2020, Cosme, LEIT, PPP)
- Positive exiting experiences abroad: NISP programme, KIKOX – South Korea, Kalundborg EIP.
- Social, environmental and economic good perspectives.

4.4. Threats (external)

- Complexity of the regulatory framework.
- Difficulties in the interpretation of waste legislation.
- Possible niche market could be not economically convenient for SMEs.
- Possible conflict of interest with big waste treatment companies.
- Lack of a strong coordination plan from a leader institution.

In Table 1 the SWOT analysis, by crossing internal and external peculiarities of Industrial Symbiosis feasibility process.

**Table 1.** SWOT analysis of Industrial Symbiosis feasibility process

<table>
<thead>
<tr>
<th>SWOT Analysis</th>
<th>Internal analysis</th>
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<tbody>
<tr>
<td></td>
<td>Strengths</td>
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<tr>
<td><strong>External</strong></td>
<td></td>
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<tr>
<td>Opportunities</td>
<td>S–O Strategies:</td>
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<td></td>
<td>Improve communication and collaborations between enterprises using districts and trade associations as a link</td>
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<td></td>
<td>Develop the knowledge of tools such as EU funding and policies both in the productive and the research areas, in order to develop the open data culture and increase the link between industry and research.</td>
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<tr>
<td><strong>Analysis</strong></td>
<td>S–T strategies:</td>
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<tr>
<td></td>
<td>Districts and trade associations has to understand the importance of industrial symbiosis as powerful stakeholders able to influence the improvement of the complex regulatory framework.</td>
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<td>Big production districts and trade associations can plan strategies on the feasibility of niche processes</td>
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5. Conclusions

As a conclusion, Industrial Symbiosis proved to be a quite effective tool in a perspective of increasing sustainability: in this perspective SWOT analysis demonstrated to
be an useful instrument to deepen the actions needed to develop a circular economy culture in the Italian industrial network.

The experiences carried out on the territory underline the general interest by the production system: Italian territory has good potential, but also needs for a strong commitment by a leader institution that coordinates the application of the instrument.

Acknowledgements
This work was carried out by CIRI Energia e Ambiente and Aster, with the cooperation of Emilia-Romagna Region and Emilia Romagna High Technology Network within the POR FESR 2007-2013 funding.

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