
TOWARDS AN INDUSTRIAL SYMBIOSIS NETWORK IN MARCHE REGION: AN EXPLORATORY RESEARCH

Alessandra Bonoli^{1*}, Eleonora Foschi²

¹*Department of Civil, Chemical, Environmental and Materials Engineering, University of Bologna, Italy
(E-mail: alessandra.bonoli@unibo.it)*

²*Department of Management, University of Bologna, Italy
(E-mail: eleonora.foschi3@unibo.it)*

*Corresponding author

ABSTRACT

The enactment of industrial symbiosis (IS) networks requires the creation of synergies between organisations of traditionally separate industries (Chertow, 2000). To encourage inter-organisational collaboration, it is crucial to recognise local needs and make evidence about the potential benefits that IS may generate (Albino and Fraccascia, 2015). It requires a comprehensive investigation of the socio-economic conditions of the area and the identification of the key challenges hampering the exchange, sharing, or transaction of excess resources (including materials, energy, and water). As part of the "Connetti Marche" project, this research aims to explore the potential of an IS network in the hinterland of Macerata. The study is based on primary and secondary data oriented to characterise the economic activities first and engage relevant actors in perception surveys then. Specifically, semi-structured interviews have been performed. Data have been elaborated through SWOT analysis. Results reveal a high presence of manufacturing and artisan companies, mainly SMEs. Although IS represents an inspiring doorway, most companies do not recognise the added value that industrial synergies may provide to the economic rebound of the hinterland of Macerata (Italy). Only organisations operating in the food, chemical, construction and plastic sectors perceive the competitive advantage. The results reveal the need to involve different spheres of knowledge to increase awareness, stimulate new mindsets, and address cultural barriers by promoting a new way of doing business.

Keywords: Industrial symbiosis; network; Marche region; circular economy.

Introduction

Literature on circular economy highlights the role of inter-organisational collaboration in fostering resource efficiency in manufacturing sectors. One of the business models based on this mechanism is represented by Industrial Symbiosis (IS), i.e., the creation of corporate synergies based on services, scraps, energy valorisation and sharing [1, 2]. The first form of IS was applied in 1961 by companies located in the Industrial area of Kalundborg (DK). Started with a cooperative project between the Statoil refinery and the gypsum manufacturer Gyproc, it counts more

than thirty resource exchanges today [3]. The analysis by Jacobsen [4] reveals a yearly reduction of 130.000 t of CO₂ and 15.000 \$ of saving. The demonstrated economic, environmental and social gains have fostered the diffusion of multi-faceted industrial ecosystems worldwide. An emerging industrial practice is represented by Eco-industrial Parks (EIPs) [5,6]. Unlike Kalundborg, this form of IS relies on top-down approach, targeted investments and prior design of business synergies. In the USA, the Federal government encouraged the first EIPs in the Nineties [7]. Consolidated EIPs are primarily present in China today [8]. EIPs exist in UK, Germany, Spain and Italy, too [7]. In this regard, Italian EIPs evolved towards the so-called ecologically equipped production area (EEPA) based on unitary management of industrial facilities, including wastewater, energy plants, R&D and managerial centres. While EEPAs are developed in confined industrial areas, recent forms of IS go beyond geographic proximity [9] and industrial districts to embrace broader territorial areas, higher volume of exchange and consequently, the cost-effective economy of scale [9, 10]. An example is represented by the United Kingdom's National Industrial Symbiosis Programme (NISP) where the median distance materials travelled within a symbiotic relationship is 20,4 miles [11]. In addition to the UK, Italy registers most of the IS initiatives based on facilitated synergies turning on companies' network configurations [12].

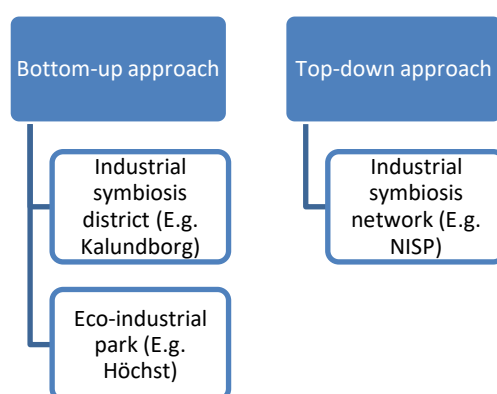


Figure 1. Forms of industrial symbiosis

Like the UK, Italian initiatives are based on the use of interactive platforms and the activation of partnerships [13]. The first experiment was implemented in South Italy, with 80 SMEs engaged and 690 potential matches identified [14]. Other experiments have been done in Emilia Romagna, Lazio, and Veneto [15, 16]. This work presents the results of exploratory research conducted in a not-scrutinised Italian region. As part of the "Connetti Marche" project, the study investigates the potential of IS to revitalise an industrial area hit by an earthquake in 2016. Following the ENEA [13]

methodology, the paper summarises the walkway for an effective IS network implementation in a context characterised by small-medium sized and family-run organisations with diverse industrial settings.

Methods

The ENEA methodology is based on three main steps, including: 1. analysis of the productive sector; 2. data collection and 3. companies engagement and involvement through facilitation processes [13]. In this study, the sectorial analysis has been performed by collecting and elaborating data from the AIDA database.

Network activation relies on a stakeholder engagement plan. A relevance-interest matrix and a net map have supported the classification of target actors and the outline of perception surveys [18]. As opposed to those assessing factual knowledge, the perception survey used in this research aim to a. collect information about how organisations acquire, interpret, and organise the environment in which they operate; b. help measure the extent to which such perceptions affect the potential for a IS network. So, semi-structured interviews were performed. Interviews have been then transcribed and coded. Finally, data have been summarised in a SWOT analysis.

Results

Area of analysis

Around 166,661 economic activities are located in the region, of which 94% are micro-organisations, followed by small (5,3%), and medium (0,5%), while only 0,1% are big corporations. The economic trend from 2010 to 2020 shows the prevalence of wholesale and retail trade organisations, followed by the agriculture, construction and manufacturing sectors. The prevailing manufacturing industries are footwear and leather (19%), metallurgical activities (14%), furniture and wood companies (12%), textile and clothing enterprises (12%), followed by enterprises operating in the food, beverage and tobacco sectors (9%). The hinterland of Macerata contains 1,252 economic activities with a high presence of agricultural, forestry and fishing activities (see Fig.2). The manufacturing industry mainly includes food and beverage, metal, textile and footwear companies. The area is isolated from the rest of the region but contains the excellence of Made in Italy.

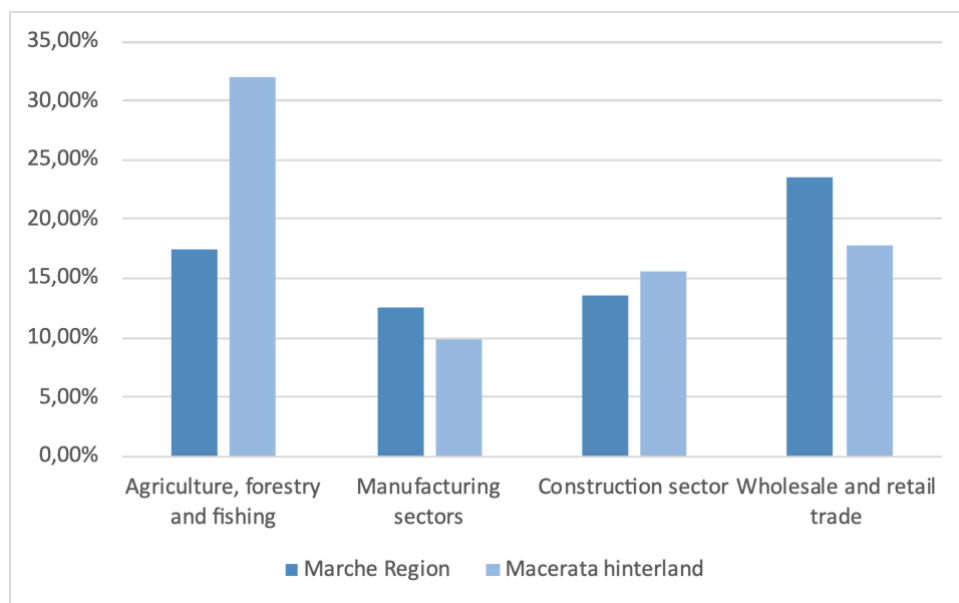


Figure 2. Economic trend in Marche region and Macerata hinterland (2020)

Interviews

The pilot project was based on the engagement of the most relevant organisations, detected after a stakeholder analysis. Specifically, 24 companies have been involved in interviews, of which 33% manufacture metal and glass-based products, 21% come from the furniture industry, and 13% are in the food sector. The remaining companies operate in the textile, plastics, wood and construction industries. The market is mainly international, while suppliers are local or national.

Questions about raw materials and waste have been posed first to stimulate interest and attractiveness towards the efficient use of resources. Regarding the supply chain, only 15 of 24 companies reveal an issue linked to unstable supply and price volatility. At the same time, only seven companies claim to use industrial residues as inputs to production processes. Concerning waste management, all mentioned the problem posed by packaging waste. Only the companies working in the furniture and leather sectors reveal the shortage of waste recycling facilities in the area. Food producers showed a high interest in waste valorisation.

The preliminary questions paved the way to introduce IS and examine the perception of local actors about this model. Most of the respondents showed a genuine interest in the initiative, overshadowed by a sceptical mode about its successful implementation in the area.

The relevance of local settings led the researchers to examine better the context in which the organisations occur. Social, economic, political, spatial and temporal

aspects have been considered. Context data have been integrated with perception information in a SWOT analysis (see Fig. 3).

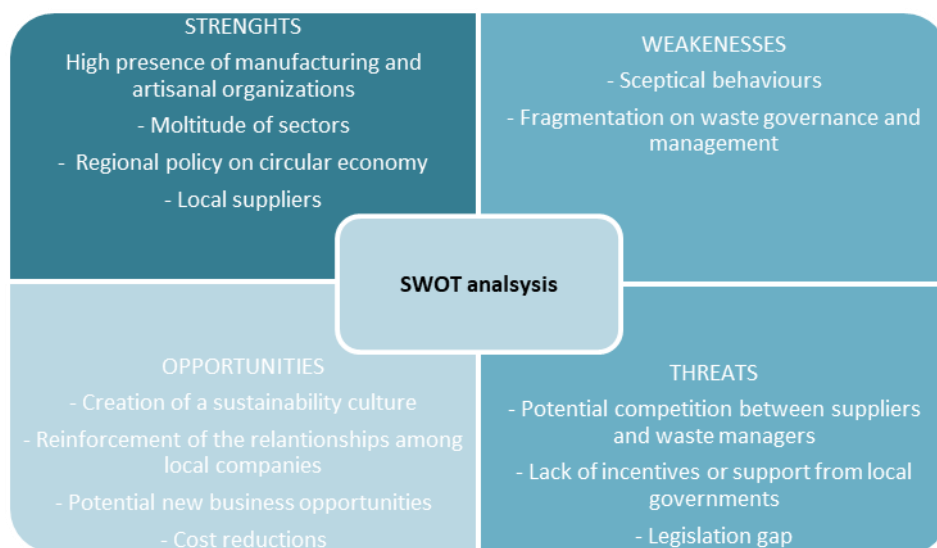


Figure 3. SWOT analysis

The SWOT analysis reveals the presence of a non-supportive environment reflected in the industry's scepticism, mainly motivated by a lack of information and, at the same time, attitude to innovate. The regional law on circular economy represents a good starting point to unlock normative and cultural barriers. However, a continuous, interactive awareness process is necessary to push new organisational models and consequently, new business culture.

Discussion and conclusion

The study highlights the perception of business players in a not-scrutinised industrial towards inter-organisational collaboration. Family-run businesses characterise the hinterland of Macerata with a long tradition in footwear, furniture and quality craftsmanship [18]. Despite the Made in Italy excellence, enterprises struggle to incorporate innovative practices into their organisations. The local supply of raw materials and semi-finished products represents an additional opportunity to design synergies among local businesses. The local business culture makes the implementation of IS network arduous.

Training activities and dissemination actions may increase the interest of local industrial players to rethink their businesses. Additionally, roundtables, focus groups, and more in general, multi-stakeholder dialogue may promote knowledge sharing, which can activate mutual trust and potential business opportunities. All these conditions prove

the necessity of a new research area relying on new forms of IS for distinctive industrial sites where synergies become the outcomes of shared spheres of knowledge. The interplay between public and private entities remains fundamental to stimulating interests across different industries, including not only business and industrial players but also governmental entities, public agencies and research organisations, respectively supporting the provision of incentives, the promotion of innovative territorial processes and the implementation of new organisational models.

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