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Title: Industrial Ecology – Circular Economy: Emerging field of Public Policies? Learning and Perspective view from study based on Industrial Symbiosis Projects in La Rochelle (France) and Kamouraska (Quebec)

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Abstract

For centuries, massive urbanization, industrialization, needs of the population draw the priorities of development. For many years, modern societies "under construction" have failed to correct their development trajectories. This situation has led, over the years, to a growing demand for energy, the consumption of natural resources, an increase in greenhouse gas emissions (GHG) or waste production. This linear model of development has since been called into question for its considerable impact on natural resources, the loss of biodiversity and the increasing greenhouse gas emissions. The, most of existing literature on the energy transition, for example, has been focused on households (as users/ or potential producers) and on emerging or future modes of energy supply, renewable energy, their governance, etc. Other studies show the private sector participation into the hypothetic ecological change of our society, named as "green economy" approaches.

However, since 1970, researchers and practitioners have argued that an economic paradigm change is already possible only in a complex architecture mobilizing many areas of human activities and a diverse actor from private and public sectors (Buclet, 2011). From this perspective, (Frosh & Gallopogoulos, 1989) have been involved to demonstrate that private companies can address their environmental impact through increasingly sophisticated internal environmental work (Starlander, 2003). The concept of Industrial Ecology (IE) has emerged as a way to make critical changes from the linear economic model, by implementing some synergies between companies based on their raw material, energy, water, by-products, other resources, equipment, etc. It has been inspired by the circular approach for natural ecosystem, so as to reduce the pressure of human activities in terms of resource exploitation and pollution (Allenby, 1992; Ehrenfeld, 2004). Years later, various approaches of implementation have been known, and they are considered as circular economy policy, based on eco-systemic designing with an emphasis on new modes of production, consumption and particularly on recycling and reuse. Limited for a long time to the industrial parks, on exchanges exclusively between companies, a new path of industrial ecology is built with the territorial approach of industrial symbiosis offered by the valorization of raw materials, energy flow between any economic actors at the large scale of territory. Among the examples of industrial ecology often cited and studied, the Kalundborg initiative in Denmark in particular, there are several cases where the operationalization of the paradigm is initiated and conducted by the company or the industrial sector. Nevertheless, a large number of synergies are also planned and result from public

initiatives (Costa, Massard, & Agarwal, 2010; Massard & Erkman, 2007). Besides improving their environmental performance, companies may also achieve competitive advantages (Hoffman and al., 2014; Starlander, 2003), and contribute to the attractiveness of territory (Maillefert & Robert, 2017).

In this paper, our purpose is specifically to underline key organizational factors of the success of industrial ecology. It aims to analyze the effects of some factors on the development and implementation of sustainable industrial symbiosis network, and also the contribution of public policy. In fact, the circular economy has emerged as a new field of public policy for further improvements of the environment performance not only of companies but territories. This territorial approach means the increasing the number of stakeholders with various motivations and understandings of the issues. It also can be considered as the main reason for public participation. A large number of stakeholders request a great approach of coordination which can be a right set of organizational factors to facilitate networking. Public participation aims to create inclusion and complementarity between actors, their needs, objectives and resources. The Emerging field of public policy for promoting social and ecological change, circular economy projects are mobilizing various public institutions to help for network structuration, implementation and monitoring industrial synergies. Public action intervenes in the projects by combining measures of coercion (regulations, environmental laws) and incentives (financing, tax measures, technical and organizational support, etc.) (Costa et al., 2010; Jiao & Boons, 2014). Firms cooperation can generate results not only for them but also for the project territories. In France, some spontaneous approaches, mainly carried out by companies, such as those in Dunkerque, have benefited the contribution of public authorities and local actors, in terms of the territorial approach of synergies, or better coordination of exchanges. In Quebec, cooperation between the various players from the private and public sector, involved in industrial ecology initiatives has been facilitating implementation of potential synergies and networking in different places. However, the process of implementation of industrial ecology cannot be based only on public participation. Thus, beyond companies who are driving forces of industrial synergies, many actors from different fields of expertise are active. The collaborations include entrepreneurs, researchers, non-governmental organizations, local authorities, public professional, built on geographical and relational proximity. Then, how public participation influence the development of circular economy? Which kind of impacts on the sufficiency of the industrial ecology network?

In order to answer these questions about public participation, particularly its different forms and methods, and key factors of the implementation of industrial ecology, and largely circular economy, our work is based on comprehensive methodology, analyzing specific industrial ecology projects in La Rochelle (France) and Kamouraska (Quebec). Semi-structured interviews with various actors of both projects and some public institutions have been analyzed to draw lessons and perspectives for industrial ecology network and circular economy development. The study exposes ways and scales of public participation, its strengths and weakness. Whatever, they have a key role for mobilizing territorial expertise, adjust and increase technical, financial and organizational factors. What we learn from these projects: sustainable and long-term commitment of actors to the network, coordination and public/private

partnerships are also important to spread industrial ecology, and more with the circular economy.

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