

Facilitated development of Industrial Symbiosis in Colombia: the pilot experience of the sustainable industrial network program

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Abstract:

The region of Latin America and the Caribbean has faced the challenges of more sustainable and equitable industrial development. One of the strategies that can contribute to the sustainable development of the region is promoting circular economy in the production sector through industrial symbiosis. Industrial symbiosis refers to the collaborative business strategy of exchanging physical resources and sharing services among industrial actors. By connecting industries through physical material flows, it enhances the resource efficiency and reduces the environmental impacts of industrial operations along the network. While industrial symbiosis has been increasingly adopted into the national policies, particularly in Europe and China, or promoted through private initiatives in developed countries, its application and practice have not been well studied in this region. In this study, we present our pilot experience of the industrial symbiosis development in Colombia, which is based on the facilitation model of the Sustainable Industrial Network Program. We particularly analyze the key determinants for industrial symbiosis in our facilitation approach.

Industrial symbiosis is not always easy to achieve. Attempts to replicate Kalundborg, the most popular industrial symbiosis network uncovered in 1989, did not lead to the fruition in many cases, including the abandoned projects in the United States (Gibbs and Deutz 2005, 2007; Heeres et al. 2004). Based on the findings from the previous literature (Mirata 2004; Yu et al. 2014; Walls and Paquin 2015; Sakr et al. 2011; Fichtner et al. 2005), we categorize the key factors into technical, economic, informational, organizational, social, and institutional dimensions and use this framework to analyze the determining factors that drive and/or hinder the industrial symbiosis development in our case.

As a result of the pilot program on industrial symbiosis, nine projects were devised and proposed with considerable potentials for economic and environmental benefits. Two service sharing projects particularly showed relatively high potential economic benefits and a majority of the by-product projects focused on reusing packaging materials made of wood, plastic, or glass. This may show that the projects were first developed around low-hanging fruits that do not require much upfront investment or changes, while there were a lot of technically feasible reuse opportunities that have not yet realized. We also examined how the facilitation approach adopted by the

Sustainable Industrial Network pilot program drove the development of industrial symbiosis projects, by analyzing technical, economic, informational, organizational, social, and institutional factors. Our analysis showed that the facilitation model was effective, particularly in providing favorable organizational, social, and institutional environment. With positive recognition and participants' trust, facilitators motivated companies to participate, guided them through learning-by-doing process, and promoted the relationship building among participants.

We will follow up with the implementation of the proposed projects and continue the program with more companies across various sectors. Over time, the facilitation approach may change and evolve as facilitators gain expertise and experience. Cumulative data and information from the program will also allow us to improve our understanding about the industrial symbiosis dynamics and the underlying decision-making processes. In the pilot program, we found that four out of nine projects were developed among companies that have existing supplier-buyer relationships. With increasingly more data, we can study how the existing supplier-buyer relationships may influence the development of industrial symbiosis and whether there are any patterns of industrial symbiosis development along the supply chain. Further applications of the facilitated industrial symbiosis development would eventually contribute to the sustainable development of Colombia by promoting more resource-efficient and circular flows of materials across industrial network.

Keywords: industrial symbiosis, facilitation, determinants, Colombia, Latin America and the Caribbean