Industrial PhD on industrial symbiosis emergence in Port of Aalborg industrial area

Overall research design

Lucia Mortensen [1,2]

[1] Danish Center for Environmental Assessment, Aalborg university
[2] Aalborg Havn, Langerak 19, 9220 Aalborg

My industrial PhD project is part of a larger project called Miljø++ (Environment^{++}) (Miljø++, 2018), initiated formally in January 2017 and due to last towards the end of 2020. Environment^{++}. It is a strategic initiative in Aalborg managed by Aalborg University, but developed by the partnership between Port of Aalborg (PoA), Aalborg University (AAU), Aalborg Municipality and Energi Forsyning in Aalborg. It engages a multitude of local actors (research institutions, private companies, local, regional and national authorities) in order to catalyze sustainable business development by advancing the emergence of industrial synergistic ties, supported through strengthening spatial framework conditions and local governance. The project is a strategic effort to realize the vision of the Port of Aalborg of being an incubator for sustainable solutions and business models. This involves making environmental awareness and planning opportunities decisive competitive factors in retaining and attracting companies and new jobs. The overall aim is to transform the Aalborg East industrial park into a Smart Industrial Park based on industrial synergies among companies and organizations, called industrial symbiosis (IS).

IS is a systemic way of organizing industrial activities, where output waste materials of some companies become input resources for other companies. It has been recognized at EU level as a mean to implement circular economy and a tool to achieve sustainable industrial development (EU Commission 2011; 2014; Horizon, 2013). It has been appointed in 2012 as 'one of the top priority areas' by The European Resource Efficiency Platform (EREP, 2012) to trigger in this way the transition toward sustainable business development. Furthermore, industrial symbiosis is more and more implemented as a strategy for local and regional development. In this regard, intentional promotion of IS is encouraged at EU level (EIT Rawmaterials, et al., 2017), national, regional and local level. The transition to a sustainable business development calls for a deliberate and intentional coordination of the emergence process of new sustainable businesses based on industrial symbiosis models.

The project addresses this specific phase of IS emergence and *tries* to answer the following overall research question: *What are the critical capacities encouraging industrial symbiosis emergence and how can industrial symbiosis emergence be supported at the Port of Aalborg industrial area?*

Figure 2 describes my overall research design and process.

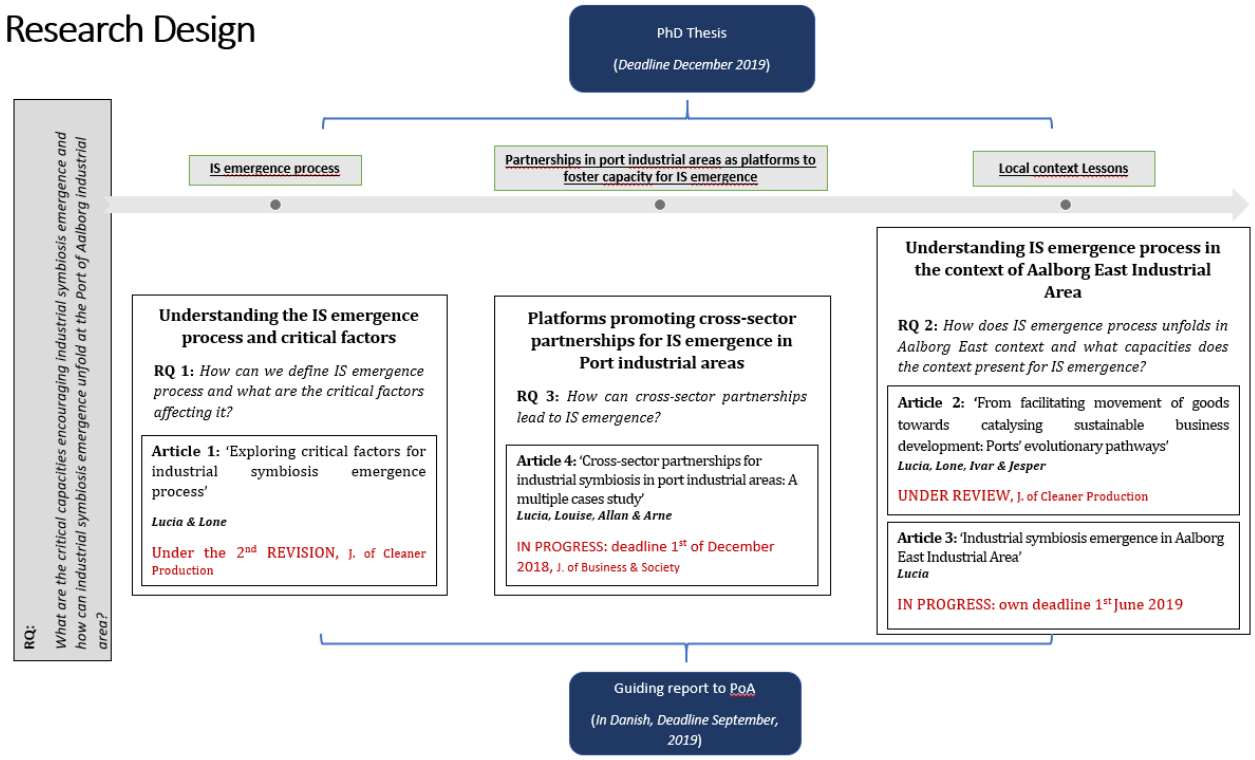

Figure 1: Overall PhD research design.

At first, I was defining the IS emergence process as *the dynamic (social) process where actors are engaged in processes of building awareness and interest in IS, reaching out to new possible partners through interactions that encourage the exploration of new possible connections, and organising new symbiotic ties.* This was based on a systematic literature review of peer-reviewed articles describing IS development processes within multiple cases of industrial parks around the world. Using emergence concept from biology as a theoretical lens.

Then, the broad focus was narrowed to specific context of port industrial areas, as they are most often the cradle fostering IS emergence. A study of three cases of port industrial areas is currently under development, and the platforms encouraging cross-sector partnerships, the actors, the coordinator's role, collaboration across sectors aiming at IS emergence, etc. are mapped and explored. The main methodological approach is a multiple case study. The study views industrial symbiosis as a collaborative business model and makes therefor use of industrial symbiosis theory, collaborative business models' theory and the theory of stakeholder processes.

A further narrowing in my overall research process takes place and focus is set on the local context of the Port of Aalborg Industrial area (Aalborg East) and the process of IS emergence within Environment $^{++}$ is researched. Here, the focus is:

- First on the unfolding of the IS emergence process in Aalborg East and the capacities the local context presents. Here a longitudinal research process is on since the start of my PhD. Data were collected along the process of Environment^{++} through participant observations, reflections, discussions with action

researchers involved in the process. Expert interviews are planned to supply and validate the data collected.

- Then on the Port of Aalborg's role for the industrial symbiosis emergence in Aalborg, addressing the capacities the port has and needs, and the platform model that could encourage the cross-sector partnerships for IS emergence in Aalborg.

PhD project's contribution to local context and IS literature

Answering the overall research question, my project contributes to the Environment $^{++}$ and the IS literature by:

- understanding and defining the process of IS emergence
- identifying the critical factors that are necessary to be fostered in order for IS to emerge
- understanding the role of cross-sector partnerships for IS emergence and the role of ports in building capacity for partnerships creation
- Understanding the characteristics of the IS emergence and the critical factors that has to be fostered in the local, Aalborg context
- Propose a model for supporting the capacity building for IS emergence in Port of Aalborg industrial area

Literature

EIT Rawmaterials, et al., 2017. *European Cooperation for Industrial Symbiosis.* Brussels, EIT Raw Materials.

EREP, 2014. *European Resource Efficiency Platform.* [Online] Available at: http://ec.europa.eu/environment/resource_efficiency/re_platform/index_en.htm [Accessed 07 05 2018].

EU Commission, 2011. *Meddelelse fra kommissionen til Europa-parlamentet, rådet, det europæiske ekonomiske og sociale udvalg og regionsudvalget..* [Online] Available at: http://eur-lex.europa.eu/legal-content/DA/TXT/PDF/?uri=CELEX:52011DC0571&from=EN [Accessed 07 05 2018].

EU Commission, 2014. Towards a circular economy: A zero waste programme for Europe. [Online] Available at: https://www.oecd.org/env/outreach/EC-Circular-econonomy.pdf [Accessed 07 05 2018].

Horizon 2020, 2015. WASTE-1-2014 - Moving towards a circular economy through industrial symbiosis. [Online] Available at: https://cordis.europa.eu/programme/rcn/664555_en.html [Accessed 07 05 2018].

Miljø++, 2018. *Industrielle symbioser i Aalborg.* [Online] Available at: http://www.miljoplusplus.com/symbioser-ressourceoptimering/industrielle-symbioser-i-aalborg/ [Accessed 29 10 2018].