Circular Economy meets Smart Cities: A general data model for waste flows in city regions

Jonathan Cohen

Urban analytics and informatics
Chalmers University of Technology, *Suecia*

edgardo@chalmers.se

Local actors are crucial to meet the Sustainable Development Goals(SDGs), and Circular Economy (CE) strategies have the potential to tackle several of those SDGs. Research is needed to understand how these concepts can be incorporated into Urban and Reginal Planning and more importantly, what are the tradeoffs of adopting Circular Economy Strategies. This Phd project focuses on the flow of secondary resources (waste) in city-regions. As a result of an initial literature exploration, three knowledge gaps were identified: (i) in relation to information management, standardization and capture; (ii) in relation to localized key performance indicators (KPIs) and (iii) in relation to models and scenario building. Progress in these three components is crucial to understand how resources could be better utilized. This project has been divided into 4 main components to address these challenges and contribute in the knowledge domain that intersect between Urban and Spatial Planning, Circular Economy and Spatial Data Science and Analytics. One main assumption of this project is that in order to improve the efficiency of material usage and reduce the damage to the environment, the flow of materials in any city-region need to be managed and the process of digitalization plays a major role. Digitalizing information and storing it using a general data model will provide a common knowledge base to explore scenarios and assess the performance of city-regions in terms of re-use of secondary resources. The processes of digitalization and standardization of information are key enablers to develop tools of analysis and localized KPIs. Progress on the General Data Model of Waste Flows (GDMWF) will be presented at the conference. In this opportunity we will show how the data model can hold different data sources at different geographical scales. Given the complexity and diversity of the urban waste flow system, having a general data model is perceived as a necessary step towards building a robust agent-based model to simulate and calculate Key Performance Indicators (KPIs) of the system. The GDMWF captures the relationship between different actors involved in the waste system: generation, transportation, transformation, storage and re-usage. Departing from a conceptual model that includes the basic components of how waste flows in a city-region, a Unified Modelling Language (UML) class diagram is used to describe the system. Interviews with key actors related to (i) Municipal, (ii) Industrial and (iii) Construction Waste are used to validate and test the potential use of such model through a set of test cases. The interviews help to understand the different challenges that these local agencies face. In parallel, these interviews contribute to advance the second stage of the project: data acquisition and processing. Obtaining data from local authorities helps to validate the formal model by understanding if more attributes are needed and where they should be contained. The opportunity to present the general data model and how it can be used for

different cases is important to receive valuable feedback, before moving forward to the scenario building and agent based simulation phase.