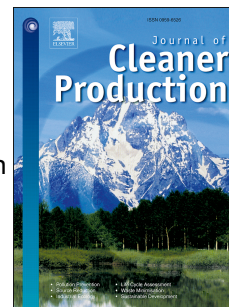


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From Urban Metabolism to Industrial Ecosystem Metabolism: A Study of Construction in Shanghai from 2004 to 2014

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Abstract

Amid the prolific studies on urban metabolism is the relatively sparse research focusing on a specific industrial ecosystem. A general urban metabolism framework disconnected from specific industrial background is at the risk to misunderstand the key drivers of metabolic process, thereby failing to propose applicable measures for improving its sustainability. This paper aims to develop an industrial ecosystem level metabolism framework. This was conducted by following the major analytical tools such as material and energy flow analysis (MEFA) with a focus on the construction ecosystem, which plays a pivotal role in materializing the urban meanwhile generating negative by-products such as greenhouse-gas (GHG), pollutants, and construction waste. The framework was further applied to the construction ecosystem in Shanghai for confirming the major components it includes. Using the data in Shanghai, it was also discovered that the construction industry is generally less efficient in terms of metabolism. It is indicated that *population, urbanization rate, concrete input, real estate investment, and the housing demolished and newly built* are principal determinants explaining massive construction and demolition (C&D) waste generation in Shanghai. The framework can facilitate the understanding of construction ecosystem metabolic process, investigation of C&D waste generation and its main drivers, and evaluating and improving urban sustainability at an industrial scale.

Keywords: Urban metabolism; Industrial Ecosystem Metabolism, Construction; C&D waste; Shanghai; China

1. Introduction

Urban metabolism provides a metaphorical framework for studying the link between natural and human systems (Pincetl et al., 2012). Wolman (1965) first introduced the term of urban metabolism to treat city as an analogous ecosystem. Kennedy et al. (2007) defined urban metabolism as “*the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy and elimination of waste*”. Urban metabolism is widely applied to describe how material, food, water and energy flow into an urban ecosystem, and are consumed to support its metabolism, then grow and reproduce, consequently generating products and by-products (e.g. GHG, pollutants, and waste). Since early 1980s,

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