A REGIONALIZED DATA COLLECTION APPROACH FOR MATERIAL FLOW ANALYSIS AND APPLICATION IN RAILWAY INFRASTRUCTURES IN FRANCE

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Abstract

Material Flow Analysis (MFA) is a tool to systematically assess flows and stocks of a given material within certain temporal and areal system boundaries. It is very useful in calculating the flow of materials throughout their life cycle (Takahiro HIRATO, 2009). There exist many MFA studies to determine the flows of various materials e.g. copper, silver, chromium, iron, aluminum and stainless steel in the USA, Europe, and Japan. Results of MFA studies are easily controllable using simple material balance comparing all inputs, stocks, and outputs of a process which delivers a complete and consistent set of information about all flows and stocks of a particular material within a system. It is also a helpful tool to probe the flows and stocks of any material-based system which gives insight into the behavior of the concerned system (Paul H. Brunner, 2004).

Despite the availability of MFA studies for both, goods and substances, yet there exists a considerable research gap for studies on substances. In contrast with studies based upon goods, which are abundantly available at the national level for Europe and Asia, studies for substances are not plentiful. Likewise, data and information about goods are easily obtainable in the form of economic statistics whereas the same is not that randomly available for the substances. In fact, information on substances often has to be derived through some sophisticated indirect methods or costly measurements (Brunner, 2002).

Similarly, in developing countries where public data statistics are not well organized or less frequently available, in-use stock estimation becomes very challenging. Sometimes available statistical data is not representative of the actual on-ground situation. Use of conventional data set also does not allow geographical localization of the stocks and flows which is a good indicator of the secondary resource availability. Simple MFA studies also fail to give good results on a regional level since there is rarely any material trade or consumption data available (Bailang Yu, 2018).

In order to overcome such short-comings, other tools are needed to be employed for better estimation and understanding of material and substance stocks and flows. Many studies have already been conducted in which some modern tools have been used to address such issues. Recently, a study conducted in China using Satellite Nighttime Light Imaging to determine economic activity in China suggests that China's economy is growing faster than as reported by the statistical record. Similarly, in 2016, a Geographical Information System (GIS) based analysis was done on building in Vienna, Austria to assess the spatial distribution of the material within the municipal area (Fritz, 2016).

In our research, we propose to use the Google Earth Maps tool to improve data collection in an MFA study and this approach is applied for the French Railway Systems. We also propose to use Geographic Information System (GIS) tools to not only enhance the picture of results for the policymakers but to also enable them to geographically locate the material stocks which can be taken as a secondary resource of materials as a replacement of fast depleting primary material resources.

Keywords: *Resource management, Material flow analysis, Data collection, Industrial Ecology*

Biography

Dr. Junbeum KIM is an associate professor in CREIDD Research Centre on Environmental Studies & Sustainability, Department of Humanities, Environment & Information Technology at University of Technology of Troyes (UTT), France. He is conducting studies on environmental science and sustainable engineering and industrial ecology areas (sustainable resource management, material flow analysis, life cycle assessment, waste system, etc.)