



Contents lists available at ScienceDirect

Waste Management

journal homepage: www.elsevier.com/locate/wasman

Temporal evolution of the environmental performance of implementing selective collection in municipal waste management systems in developing countries: A Brazilian case study

Valeria Ibáñez-Forés^a, María D. Bovea^{a,*}, Claudia Coutinho-Nóbrega^b, Hozana R. de Medeiros-García^b, Raissa Barreto-Lins^b

^a Department Mechanical Engineering and Construction, Universitat Jaume I, Castellón, Spain

^b Department of Civil and Environmental Engineering, Universidade Federal da Paraíba, João Pessoa, Brazil

ARTICLE INFO

Article history:

Received 16 May 2017

Revised 18 October 2017

Accepted 21 October 2017

Available online xxx

Keywords:

LCA

Environmental indicator

Developing countries

Brazil

ABSTRACT

The aim of this study is to analyse the evolution of the municipal solid waste management system of João Pessoa (Brazil), which was one of the Brazilian pioneers cities in implementing door-to-door selective collection programmes, in order to analyse the effect of policy decisions adopted in last decade with regard to selective collection. To do it, this study focuses on analysing the evolution, from 2005 to 2015, of the environmental performance of the municipal solid waste management (MSWM) system implemented in different sorting units with selective collection programmes by applying the Life Cycle Assessment (LCA) methodology and using as a starting point data collected directly from the different stakeholders involved in the MSWM system.

This article presents the temporal evolution of environmental indicators measuring the environmental performance of the MSWM system implemented in João Pessoa by sorting unit, for each stage of the life cycle of the waste (collection, classification, intermediate transports, recycling and landfilling), for each waste fraction and for each collection method (selective collection or mixed collection), with the aim of identifying the key aspects with the greatest environmental impact and their causes.

Results show on one hand, that environmental behaviour of waste management in a door-to-door selective collection programme significantly improves the behaviour of the overall waste management system. Consequently, the potential to reduce the existing environmental impact based on citizens' increased participation in selective collection is evidenced, so the implementation of awareness-raising campaigns should be one of the main issues of the next policies on solid waste. On the other hand, increasing the amount of recyclable wastes collected selectively, implementing alternative methods for valorising the organic fraction (compost/biomethanization) and improving the efficiency of the transportation stage by means of optimizing vehicles or routes, are essential actions to reduce the overall net environmental impact generated by the MSWM system.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

In spite of some challenges, Life Cycle Assessment (LCA) (ISO 14040, 2006; ISO 14044, 2006) is the most internationally accepted decision-support tool for quantifying environmental impacts of municipal solid waste management (MSWM) systems, due to its holistic perspective when it comes to identifying appropriate solutions for managing waste (Laurent et al., 2014a,b). However, its application to evaluate the environmental performance of

implemented MSWM systems is still a pending issue in developing countries or developing areas of countries with mixed economies (Laurent et al., 2014a).

According to Goulart Coelho and Lange (2016), main research in this field is related to Asian countries, such as China (Chen et al., 2011; Chi et al., 2015; Woon and Lo, 2016; Xie et al., 2013; Zhao et al., 2012; etc.), Malaysia (Hassan et al., 1999; Saheri et al., 2012; Chien Bong et al., 2017), South Korea (Lee et al., 2007; Yi et al., 2011), Thailand (Chaya and Gheewala, 2007; Menikpura et al., 2012, 2013) or India (Pandyaswargo et al., 2012; Sharma and Chandel, 2017). Case studies in South and Central American countries are even more limited in number: Argentina (Caprile

* Corresponding author.

E-mail address: bovea@uji.es (M.D. Bovea).

Table 1 Review of JCR-indexed publications on applying the LCA methodology to solid domestic waste management in Brazil. (See above-mentioned references for further information.)

REFERENCE	REGION	WASTE						LIFE CYCLE STAGE				FUNCTIONAL UNIT				LCI DATA SOURCE		LCIA											MID-POINT METHOD	END-POINT METHOD						
		Municipal Solid Waste (MSW)	Material fraction from MSW	Industrial / Chemical	Agricultural waste	Sanitary / Medicines	Construction & demolition waste	WEEE / Machines	Generation	Collection and transport	Classification / disassembly	Recovery	Final disposal / Landfilling	1 t or kg of waste	other amount of waste	annual waste generation	secondary product obtained from waste	others	PRIMARY	SIMULATED / ESTIMATED	SECONDARY	Global Warming Potential	Acidification Potential	Eutrophication	Human toxicity / Carcinogens	Ozone layer depletion	Photochemical oxidation	Ecotoxicity (water / land)			Energy demand / embodied energy	Resource depletion	Land use / Land occupation	Others		
Alvarenga et al. (2012)	Southern Brazil	X									X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Ecoindicator 99 (Goedkoop and Spriensma, 2000)
Araújo (2013)	Brazil					X					X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Ecoindicator 99 (Goedkoop and Spriensma, 2000)	
de Souza et al. (2015)	Rio de Janeiro										X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Ecoindicator 99 (Goedkoop and Spriensma, 2000)	
Gatti et al. (2008)	Brazil		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	RECIPE (PRÉ Consultants, 2013)	
Leme et al. (2012, 2014)	Betim		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	RECIPE (PRÉ Consultants, 2013)		
Lopes Silva et al. (2013)	Santa Catarina		X								X	X	X		not specified				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	CML (Guineé, 2002)		
Mendes et al. (2003)	Sao Paulo		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	EDIP (Hauschild and Wenzel, 1998)		
Mendes et al. (2004)	Sao Paulo		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	EDIP (Hauschild and Wenzel, 1998)		
Penteado and Rosado (2016)	south-eastern Brazil										X	X	X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	CML (Guineé, 2002)		
Portugal-Pereira et al. (2015)	Brazil			X							X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	IPCC (2007)		
Reichert and Mendes (2014)	Porto Alegre		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	CML (Guineé, 2002)		
Rubin et al. (2014)	--										X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	EDIP (Hauschild and Wenzel, 1998)		
Moore et al. (2016)	Sao Paulo		X								X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	RECIPE (PRÉ Consultants, 2013), CED (Frischknecht et al., 2007)		
Soares et al. (2013)	Brazil										X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	RECIPE (PRÉ Consultants, 2013)		
Zanghelini et al. (2014)	Santa Catarina										X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	CML (Guineé, 2002), IPCC (2007)		

Download English Version:

<https://daneshyari.com/en/article/8870055>

Download Persian Version:

<https://daneshyari.com/article/8870055>

[Daneshyari.com](https://daneshyari.com)