



Drivers for development of circular economy – A case study of Serbia



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ARTICLE INFO

Article history:

Received 15 February 2016

Received in revised form

1 June 2016

Accepted 2 June 2016

Available online 9 June 2016

Keywords:

Municipal waste

Municipalities

Drivers for development of waste management

Comparative analysis

Circular economy

Zero waste

ABSTRACT

Poor waste management in developing countries indicates that waste generation is mostly associated with the economic status of a society, their weak economy-social factors affected by the absence of proper environmental legislation, financial management and administrative capacities. Over the years, increasing amount of waste without any treatment is mainly disposed of on the existing dumpsites in the municipalities. This practice not allows the exploitation of resources from waste, and represents a huge loss of resources and threat to the environment and human health. Therefore, this problem is very complex and requires constant adjustment of the situation, fluctuations and the needs and demands of innovative solutions. This paper is focused on the drivers that have the biggest impact on waste management in Serbia and improvement of the system by changing the impact of the drivers. The objective is related to waste management drivers in the context of circular economy. This includes establishing baseline data on waste and assessment of the current waste management system, setting future goals, identification of issues, plans for integrated waste management and their implementation. The paper identifies bottlenecks that restrict Serbian's sustainable development, such as low levels of reuse, recycling and recovery of waste, shortage of advanced technology, significant waste disposal amounts and weak economic incentives. The comparison is made with the Municipality of Ljubljana approach to Zero waste practice and circular economy. This analysis depicts real opportunities for more sustainable and efficient waste management in the municipalities and suggests a step forward towards the integrating best Zero Waste practices in the municipalities in developing countries.

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1. Introduction

Waste management is a challenge for the cities' authorities in developing countries mainly due to very limited funds for the solid waste management sector provided by the governments, the absence of understanding the factors that affect the different levels of waste management, the low levels of services quality required for protection of public health and the environment and interdependence necessary to provide the entire handling system functioning (Guerrero, Maas, & Hogland, 2013; Ogawa, 1996). Poor waste management in developing countries indicates that waste generation is mostly associated with the economic status of a society, their weak economiesocial factors affected by the absence of proper environmental legislation, financial management and

administrative capacities (Muniafu & Otiato, 2010). It should be mentioned that increased demand of resources has led to great pressure on the environment and the need to shift from linear to circular economy that will preserve the environment, increase the value of the products, enable new economic growth and employment opportunities, reduction or complete elimination of waste. Minimisation of waste generation and material through recycling and reusing of products, will create economic and environmental co-benefits (EEA, 2016). Now Serbia has an opportunity to accelerate the process of improving waste management, recognizing market failures and bottlenecks already established in over thirty years long development of waste management systems currently in economically developed countries, which have followed a linear model of the economy. It is in a circular economy overlapping economic interests with the interests of sustainable waste management and environmental protection. Republic of Serbia needs to identify and promote the sustainable financial models that could cope with the demands of industrial waste, as a basis for the circular economy (IC, 2015). A practical waste management system aims to provide environmental sustainability, economic

Abbreviations: IWM, Integrated Waste Management; ISWM, Integrated Solid Waste Management; GNI, Gross national income; MSW, Municipal Solid Waste; PET, polyethylene terephthalate; WHO, World Health Organization.

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affordability and social acceptance for any specific region. With a combination of waste streams, waste collection, treatment and disposal methods combined in an optimum way as a part of a single approach. IWM takes into consideration environmental, economic and social aspects of waste management, in another words, the total system and looks for the best applicable treatment methods mix to minimise economic costs and to maximize environmental protection and social benefits. Thus, an IWM system will rather use resources in the most effective way than move up waste management hierarchy (D'Alessandro et al., 2012). This article presents the characteristics of the WM system in the Republic of Serbia in a format that incorporates the complexity of each component of waste management practise. The paper is intended to contribute to filling the gap by proposing a guiding framework, which application and usefulness is illustrated with the experiences of concrete case-study from one municipality in the region.

The contributions of this article are threefold: first, to depicts real opportunities for more sustainable and efficient waste management in the municipalities and suggests a step forward towards the integrating best Zero Waste practices in the municipalities in Serbia; second, to establish baseline data on waste and assessment of the current waste management system, setting future goals, identification of issues, plans for integrated waste management and its implementation; and third, to identify bottlenecks that restrict Serbian's sustainable development, such as low levels of reuse, recycling and recovery of waste, shortage of advanced technology, significant waste disposal amounts and weak economic incentives. Identifying its restricting characteristics and understanding the implications will lead to better waste management performance.

1.1. Example of best practice – zero waste instead of incineration

A lot of recent interest has been paid to the waste management globally, either arising from specific treaties to combat unemployment in developing countries (Ahmeda & Alib, 2004; Wilson, Velis, & Cheeseman, 2006), or from pollution resulting from inadequate waste management which is a major cause of diseases and affect economic growth by increasing treatments cost and cleanup activities (Joseph, 2006; Ekvall, Assefa, Björklund, Eriksson, & Finnveden, 2007; Permana, Towoloe, Aziz, Ho, 2015). Initiatives to improve waste management, require participation of both public and private sectors (Kirama & Mayo, 2016). The municipalities have a key role to play in supporting changes towards achieving a zero waste society (Zotos et al., 2009). If society shift toward zero waste, alternative material pathways like composting and recycling will become more attractive. Furthermore, recycling without composting cannot exist alone in a zero waste strategy, since bio and food waste makes up a portion of the waste which can be treated by composting. To make the best performance, operators must consider factors including source material selection, employees training, public awareness, simplicity of collection, and environmental tradeoffs for different approaches to waste management (Hottle, Bilec, Brown, & Landis, 2015).

Slovenia has been investing in modern waste management infrastructure since 2004 when this country became a member of European Union. At the time, waste management system in Ljubljana was developed, and the national municipal waste management plan included separate collection, regional mechanical biological treatment plants, and two incineration plants (Oblak, 2015a). However, Ljubljana manage to avoid incineration and achieve the highest separate collection rates, high recycling and composting rates and to reduce the amount of waste sent for disposal. Thus, average monthly waste management costs for households is among the lowest in Europe. In ten years Slovenia achieve to increase separate collection and decrease residual waste.

During the mentioned period, 55% of waste has recycled, 7% composted, 1% incinerated and 38% landfilled (Oblak, 2015b). The waste management sector in Ljubljana has been subjected to major changes over the years, with these changes continuing to occur. Ljubljana generate a low amount of waste, 41% less than the EU average, 61% of which was recycled or composted. Furthermore, the quantity of recovered materials is increased by tenfold and the amount of municipal waste landfilled is reduced by 59% (Oblak, 2015a). This significant improvement is the result of the implementation of a Zero Waste Strategy. With the clearly set goals and persistence in implementation of established measures, Ljubljana's waste management system produces excellent results. According achieved, Ljubljana has already provided tools and incentives in line with the circular economy model. From economic and waste management perspectives, transition to a more circular economy includes changes throughout waste value chains, adoption of new ways of turning waste into a resource (EUR-Lex, 2014).

The city began with separate collection of paper, cardboard, glass, other packaging and the residual waste in road-side containers in 2002. In 2006 city started to change the system introducing a door-to-door collection of bio waste and 10.8% of which was collected. Since 2008, ordinary containers have been replaced with underground collection points. In 2012 the roadside containers for paper and packaging was removed and the city started collecting them door-to-door, with the same system as it started collecting biodegradable waste. As a result of Implementation of separate collection in 2012, 41.48% of packaging and paper was collected. Quantities of separately collected fractions continued growing to 55% in 2013 and 61% in 2014 (Oblak, 2015b). This success has been driven largely by direct and indirect of citizens asked to better sort their waste. Intensive communications campaigns such as "Get Used to Reuse" initiative which, with the help of music, a video manifesto, workshops and urban interventions present a combination of digital communication tools and personal contacts with citizens has proven to be a successful formula (EC, 2016b).

2. Presenting the framework

Circular economy is an opportunity for developing countries to come to its principles, to improve waste management through the use of all sorts of materials contained in waste, and their introduction back into productive use in the economy, which will significantly contribute to more efficient use of resources, primarily as a material for energy purposes (IC, 2015). Moving towards a circular economy multiple steps have to be performed that include economic interests with the interests of sustainable waste management and environmental protection. This analysis depicts real opportunities for more sustainable and efficient waste management in the municipalities. Where governmental officials have better awareness and strong drivers to make changes, the actual official's understanding toward circular economy development is higher. In another word, implementation and realization of circular economy development undoubtedly relies on municipal government officials' awareness (Xue et al., 2010).

Wilson (2007) list six broad groups of drivers for the development of waste management, including public health, environmental protection, climate change, the resource value of waste, institutional and responsibility issues, and public awareness. They were defined as groups of related factors that vary between countries depending on local circumstances. Understanding that one alone couldn't have influence sustainable waste management, but all related to the concepts of sustainable waste management. Taking into account the applicability of some drivers of solid waste management in every country, the focus is on other exclusive

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