

BARRIERS FOR ZERO WASTE IMPLEMENTATION IN DEVELOPING COUNTRIES

Sandra M. Mazo-Nix, M.S., LEED AP

Affiliation: SCS Engineers

Address: 322 Chapanoke Road, Suite 101, Raleigh, NC 27603, USA

Phone: +1 919 6623015

Email: smazo@scsengineers.com

ABSTRACT

The present paper discusses the barriers for the implementation of zero waste principles in developing countries. The paper starts with an explanation of what zero waste is and the zero waste hierarchies developed by the Zero Waste International Alliance (ZWIA). The paper then discusses how the recommendations presented as part of the hierarchy are appropriate and feasible for zero waste implementation in developing countries. The paper then discusses the common challenges that developing countries face when trying to implement zero waste and offers some recommendations to deal with the challenges.

KEY WORDS: Zero waste, developing countries, recycling, composting, solid waste management, barriers, hierarchy

INTRODUCTION

Zero waste has become the latest trend in the field of solid waste management (SWM). Around the world there is much talk about zero waste, its importance and ways to achieve it. In principle, the practice of zero waste entails minimizing the generation of waste and maximizing the diversion of discarded materials so these can be recovered and utilized as resources. Zero waste is such a global phenomenon that there are multiple initiatives promoting zero waste principles. One of these initiatives is the Zero Waste International Alliance (ZWIA), which using a peer-reviewed process, has developed an internationally accepted definition of zero waste. There are other environmental organizations that have also defined zero waste and give recommendations on how to achieve it. A quick Google online search indicates 800,000 websites that deal with the subject of zero waste. There are also numerous zero waste programs around the world and at different levels: national, municipal, communal and commercial. This paper will dive in more detail on the comprehensive definition of zero waste and the barriers for the implementation of the diverse principles of a zero waste in developing countries.

ZERO WASTE

Definition of Zero Waste

When most people think of zero waste, they think that of the no-creation of waste and how every residual will be recovered and repurposed. Basically nothing is wasted. However, the philosophy of zero waste is more involved than the perceived idea of zero or no waste. Zero waste involves the life-cycle analysis of products and requires the involvement of all stakeholders, consumers, non-profit organizations, industries and government, to create and manage materials and products that will flow in closed loop cycles. As an example, the Scottish Government has adopted zero waste and states that as a guiding principle. For the Scottish Government, it means “eliminating the unnecessary use of raw materials; sustainable design; resource efficiency and waste prevention; re-using products where possible; and recovering value from products when they reach the end of their lives either through recycling, composting or energy recovery, in accordance with the waste hierarchy.” (Towend, 2010)

Currently though, most zero waste initiatives focus on just the waste management aspect and not aspects like the life-cycle assessment of products, social involvement, and legal framework. Consequently, solid waste management receives the most attention, research and strategy

formulations by different organizations. These organizations provide guidance and recommendations to implementing zero waste programs. Among these organizations, the Zero Waste International Alliance (ZWIA) has become one of the leading global organizations in the world and its standards and guidelines are widely recognized and referenced.

An important thing to keep in mind, when thinking about zero waste, is that materials and products can only be reused or recycled up to certain point so at some point the material or products will need to be discarded. In addition each level needed to repurpose the material will need more energy and thus each new level to repurpose becomes more expensive.

Zero Waste International Alliance (ZWIA)

The Zero Waste International Alliance (ZWIA) has established to find alternatives to the common solid waste disposal options, like landfilling and incineration, and to promulgate the social and economic benefits of utilizing waste as resource. The mission of ZWIA is to promote zero waste by promoting research and information sharing and building capacity. The ZWIA also sets standards for the application of zero waste.

ZWIA started as team of field experts gathering to discuss zero waste in the United Kingdom in 2002. After several meetings, the first official ZWIA planning group meeting was held in Wales in 2003. After that the alliance has evolved to include members that are non-governmental organizations (NGOs), government agencies, institutions, solid waste service providers and individuals.

ZWIA's definition of zero waste

The ZWIA defines zero waste as “a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing zero waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human, animal or plant health.” (Liss, 2013)

ZWIA Hierarchy

Taking into account this definition, ZWIA has created a SWM hierarchy called the “ZWIA Zero Waste Hierarchy of Highest and Best Use”, see Figure 1. The ZWIA hierarchy expands on the principles of the renowned solid waste management hierarchy. This hierarchy is similar to other commonly used hierarchies like the one introduced by the European Union Parliament in the Directive 2008/98/EC, see Figure 2, and the one recommended by the United States Environmental Protection Agency (EPA), see Figure 3. Also, the ZWIA was developed to account for the entire carbon life cycle of materials as well as the embodied energy used throughout the life cycle of the product, including extraction of virgin resources, manufacturing, and transportation to the final market.

The ZWIA's hierarchy is tailored to promoting zero waste by including caveats in some of the waste management options. These caveats have been included in each level of the hierarchy so that each option is the best choice for the materials. These caveats will be explained in more detailed below.



Figure 1. ZWIA Zero Waste Hierarchy of Highest and Best Use. (Liss, 2013)



Figure 2. European Union Directive 2008/98/EC Waste Hierarchy. (European Commission, 2014)



Figure 3. EPA Non-Hazardous Waste Management Hierarchy. (EPA, 2013)

- Reducing and conserving materials

In order to reduce and conserve materials, it is necessary to promote among the citizens less consumption, avoid disposables and buy and use sustainable products. Sustainable products are products that have been designed with the carbon life cycle in mind, are efficient, repairable, and durable, and can be disassembled and repurposed for other uses or products. These products also need to be designed with packaging to be kept at a minimum or that can be reused or recycled.

The top of the highest and best use hierarchy includes reducing and conserving materials, but also recommends the elimination of toxic chemicals. Products should be free of toxics or the less toxic option should be used in its production.

Lastly, systems should be set up so producers and their providers can take back products that have fulfilled their purpose with the consumer. The producer should label products so that consumers can trace the producer in order to know of what materials make up the product and what options are available for its disposal.

- Recycling

At the recycling level, ZWIA provides recommendations on how to recycle discards based on the carbon content and recommends keeping the recycling as local as possible. In order to keep recycling local, ZWIA suggests developing local markets for the recovered materials including resource centers.

Carbon based discards are all organic wastes. ZWIA suggests prioritizing the donation of edible food to food banks and then for animal feed. The recycling alternatives for organics include composting and anaerobic digestion. Composting is an option that can be done at different local levels, like at the residential, institutional, communal and municipal, and at different scales, from small to large commercial. The most important aspect to organic waste recycling is to have lower tipping fees for these types of materials so large and clean volumes of feedstock can be collected and recycled.

Inorganics are residuals with little or no carbon. ZWIA recommends the recycling of all inorganic materials. ZWIA prioritizes using “clean” material recovery facilities (MRF) to sort source separated materials. “Dirty” MRFs should be used to pre-process mixed discards before disposal in landfills. The idea is to extract as much as possible the recyclables from the waste stream destined to the landfill or incinerator.

Lastly, toxic or radioactive wastes should not be recycled into consumer products or building materials.

- Landfilling

The ZWIA hierarchy also recognizes the practice of landfill as an important step of the waste hierarchy, but only as a last step to dispose of non-recyclable discarded materials. These materials need be biologically stabilized before burial. ZWIA does not support bioreactor landfills. Also, ZWIA stresses that the use of organic residuals as alternative daily cover (ADC), or other “beneficial use” to build landfills, shouldn’t be counted as recycling.

- Incineration

Regarding incineration, the ZWIA opposes the burning of many materials, such as tires, wood

from mixed construction and demolition (C&D) waste, and biosolids because the high temperature systems used to burn these materials volatilize heavy metals and produce dioxins and furans. High temperature systems include mass burn, fluidized bed, gasification, plasma arc and pyrolysis.

Implementation of zero Waste in Developing Countries

The implementation of zero waste initiatives around the world has many challenges particularly in developing countries. These barriers have to do with the resources available for solid waste management like the institutional and legal framework, political will, personnel, infrastructure, funding and culture. These barriers will be discussed in more detail below.

CHALLENGES IN DEVELOPING COUNTRIES TO ADOPTING ZERO WASTE

MSW Management in Developing Countries

The responsibility to manage domestic solid waste is delegated to municipalities in most developing countries. Some developing countries have a strong regulatory solid waste framework that attempts to implement best practices for solid waste management for the country. Some of these frameworks include ambitious goals like ordinances banning organics from landfills, as occurred in India, and extended producer responsibility (EPR) in Brazil. However, in most developing countries, such regulations are not implemented because there is no accountability for the offender or enforcement of the laws by the central government. These responsibilities are delegated to the municipalities which in most cases do not have the personnel, technical expertise, and resources to deal with non-abiding entities. The municipalities themselves often are the offenders because they lack the resources and institutional framework to implement the solid waste management strategies set out by the central government such as closing open dumps, providing extensive solid waste collection coverage, and implementing recycling, among others.

Barriers External to the Municipalities

Some of the challenges faced by municipalities in developing countries to enact zero waste initiatives are due to challenges that cannot be controlled within their jurisdiction. These challenges are external barriers, for which the municipalities need the assistance of the central government and also from the global community in order to enact zero waste principles. The text below presents some of those barriers and ideas to address them.

Sustainable products

Developing countries' municipalities often do not have the authority to have an impact on the products sold within their borders. Some municipalities may ban the use of toxic substances or even some materials that are not environmental friendly, like Styrofoam, but the import or availability of this type of materials is difficult to control. This is a role for the central government, which translates into a better control of the materials flowing through and out of the country.

Municipalities need the support of the government in order to encourage the importation and the production of sustainable products (durable, repairable, recyclable, and non-toxic, use and need less packaging and are labeled to identify who made it and what it is made of). Municipalities need to understand well what sustainable products are and promote the purchase and use within their agencies.

Extended producer responsibility (EPR)

The central government can also mandate extended producer responsibility to have producers take-back their products and lessen the burden on municipalities. As part of the extended producer responsibility, producers and their distributors would have to set up systems that include the following:

- Spaces where consumers can take the products and packaging
- Spaces to disassemble the products
- Established markets for local recycling of some of the components of the products
- Coordination with other producers the exportation of components that cannot be reused or recycled within the country.

Incentives for material recovery and recycling

In addition, municipalities also need the government to provide incentives for the cyclical use of materials and disincentives for wasting. These incentives would help finance composting and recycling projects, which in most cases are more costly than landfilling. The incentives could also be used to fund research, public awareness or set up pilot projects for composting and recycling.

The use of recovered materials within the local manufacturing industry should be encouraged with financial incentives and green public procurement (GPP) should be promoted within public agencies. The purchasing power of public agencies is significant and can stimulate the demand of products and services that are sustainable and made from recovered materials.

Barriers Internal to the Municipalities

Even though there are some external barriers that municipalities must deal with in order to implement zero waste initiatives, there are other barriers that are internal to the municipalities that need to be addressed. These barriers have to do with the practicality of the two main strategies to achieve zero waste: minimizing waste generation and maximizing diversion of the residuals. In both of these strategies, the culture of the citizens plays a big role.

Maximizing diversion

Maximizing the diversion of materials out of the waste stream is very challenging due to the plethora of materials that are discarded. At the municipal level, the variety of materials that can be recycled locally is small. Most municipalities do not have the infrastructure to take inorganic recyclables and make new products. Municipalities can seek to expand the range of recyclables that they can process and this would entail assessing the possibility of creating feasible local markets or transporting the recyclables to the available markets, which in some cases can be very far away. In regard to the latter aspect, the creation of a network of regional collection systems could assist in increasing the volume of recyclables delivered to the manufacturer and offsetting transportation costs.

With respect to the organic discards, most municipalities in developing countries can find a space, or series of spaces, to develop a composting project. Also municipalities can promote localized composting, per example in residences, institutions, businesses or as part of a community. Nevertheless, municipalities need to make sure that any composting operation is well operated. A poorly operated composting project creates problems like methane emissions, odors, leachate and vectors.

Municipalities can start to increase the diversion of materials by enacting legislation that would ban

certain materials, like organic waste and C&D, and certain recyclables from the landfills. This should be done in phases and with plenty of public outreach and continuous communication. As municipalities find markets and other uses for other recyclable materials, the banning of these materials from disposal in landfills or incineration should be implemented.

Culture of the citizens

Another barrier has to do with the culture of the citizens. For the diversion aspect of zero waste, there are multiple levels of environmental concern among the population; from people that have a deep environmental concern and are devoted to living “green” to those that have no concern for the environment. Problems abound in the whole spectra of environmental concern when it comes to zero waste. Pro-recycling folks that want to do the right thing and divert as much waste as possible are often confused on what is recyclable. They hear that a certain material is recyclable, but since it is not included in the local recycling program then it goes in the trash bin. Some people lose hope and discard all their waste in the trash bin or decide to put in the recycling bin what they deem is recyclable even if the recycling program does not include it. Another problem is that some products are not labeled with information on what they are made of so the citizen does not know whether it is recyclable. The municipality needs to communicate, constantly and clearly the different aspects of the solid waste management program in the city and where the public can get more information. Informational websites should provide links to other local zero waste efforts by NGOs and the private industry. Lastly, trying to change the beliefs of those citizens with no environmental concern can be a daunting task; in that case the municipality may consider mandating public participation in material recovery programs.

Minimizing waste generation

In general, the priorities of most people are not aligned with the principles of minimizing waste. Particularly in developing countries, people are concerned in finding products that satisfy their basic needs, food and clothing, and that are economical. The environmental impact of a product for the most part is not considered. It will take a cultural shift for people to prioritize the environment in their consumption practices. The municipality or other stakeholders can provide environmental education to try to persuade non-environmentalists, but local governments cannot mandate its population to consume less, repair damaged products, reuse or refurbish, or buy sustainable products. The municipality can lead by example by procuring sustainable goods and services for its agencies.

An option to prevent the generation of waste is by developing product service systems (PSS). In these systems, the ownership of products is replaced with the utilization of a service. It is similar to a lease where the vendor or distributor provides a package that includes the product with the services of maintenance and repair. At the end of the contract, the customer can decide to change the product or the vendor. The responsibility of final disposal of the product falls on the vendor and not on the public.

CONCLUSIONS

Zero Waste needs to be considered a resource conservation and management strategy. In its holistic approach it includes focusing at the ‘upstream,’ at the production of the goods, and ‘downstream’ at the end of the life of the good. Zero waste needs the involvement of all stakeholders and in particular of the central government in developing countries. All over the world, the government needs to enact regulations and provide subsidies that can provide support for zero waste initiatives,

like banning toxics from products, promoting sustainable procurement, disincentivize waste, and establishing EPR.

In conclusion, in order to improve solid waste management and create a sustainable future, municipalities should strive to implement zero waste practices in their communities. There are many barriers to fully implementing a zero waste scheme, particularly in developing countries, but many of the zero waste concepts can be incorporated into a municipal solid waste management plan. The zero waste planning process is similar to the preparation of a community general plan: establish guiding principles, goals and timeline, involve stakeholders and policy makers, conduct needs assessments, research and evaluate options, develop scenarios, assign resources and estimate costs, and develop the implementation plan. It is important to engage the central government to establish an institutional and legal framework conducive to zero waste like EPR, promotion of the availability of sustainable goods, incentives for recycling and composting and disincentives for wasting. Lastly, there are numerous zero waste initiatives that can provide recommendations and considerations for developing a zero waste plan that can be implemented at the local level and at the national level.

REFERENCES

- Anthony, R. (2013). The Zero Waste International Alliance (ZWIA): A Chronology. Retrieved from <http://zwia.org/aboutus/zwia-history/>
- Bartl, A. (2012). Barriers and Limits for Recycling and Moving Towards “Zero Waste”. ISWA World Solid Waste Congress 2012.
- Brunner, P. (2013). Cycles, Spirals and Linear Flows. *Waste Management and Research*, n. 31, 1-2.
- European Commission. (2014). Directive 2008/98/EC on Waste (Waste Framework Directive). Retrieved from <http://ec.europa.eu/environment/waste/framework/>
- Liss, G. (2013). Zero Waste International Alliance adopts Zero Waste Hierarchy. Retrieved from <http://www.zwia.org/standards/zero-waste-hierarchy/>
- MacBride, S. (2012). Book Review: Recycling Reconsidered: the present failure and future promise of environmental action in the United States. *Waste Management and Research*, n. 30, 1320-1322.
- Navia, R. and Ross, D. (2009). Sanitary Landfills, Foundation of the Waste Hierarchy Inverted Pyramid. *Waste Management and Research*, n. 27, 407-408.
- Towend, W. (2010). Editorial. *Waste Management and Research*, n. 28, 1-3.
- United States Environmental Protection Agency. (2013). Non-Hazardous Waste Management Hierarchy. Retrieved from <http://www.epa.gov/waste/nonhaz/municipal/hierarchy.htm>