Chapter 8
Zero Waste: A Sustainable Approach for Waste Management

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ABSTRACT

Zero waste management means the holistic concept of waste management which recognizes waste as a resource produced during the interim phase of the process of resource consumption. Zero waste strategies may be applied to companies, to communities, industrial sectors, to schools, and homes since they include many stakeholders, not only those of the environment, but also technological aspects. Sustainability is also strongly supported by environmental protection, cost reduction, and additional jobs when it comes to waste management and handling back into the industrial cycle. Lowering global resource requirements force us to consider resource management and product management. The management of zero waste is therefore a holistic view of the sustainable avoidance and management of waste and resources. Although there are many null practice approaches and null waste approaches in the modern world, zero waste is a very complex system, and in the future, there are still many works.

INTRODUCTION

In 1973, Dr. Paul Palmer first applied the term "zero waste" to recover chemicals (Palmer, 2004). Zero waste approach is one of the most widely studied concept but still the most controversial topic in recent decades in waste management research (LaBrecque et al., 2015; Greyson et al., 2007). Zero Waste (ZW) is defined as "a system to design and management of products and processes for waste removal and

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material retention and rehabilitation, not burning or burying" (Zero Waste International Alliance, ZWIA, 2004). ZW is therefore concerned with waste prevention through sustainable design and consumption practices, optimal waste recovery and not waste management by landfill or incineration (Zaman, 2015). ZW supports waste prevention and avoidance rather than waste treatment and disposal strongly. It is understandable; It may however not be feasible, under the existing resource consumption and waste management systems, to achieve nil incineration and nil landfill targets. Waste was dealt with as a burden and social problem and was therefore largely managed by "end-of-pipe" solutions such as waste disposal systems (Zaman et al., 2015). The traditional waste management system, which mainly relies on sites, significantly pollutes our environment, thus requiring an improved and efficient waste management system with a limited exception in developed countries. Thus the zero-waste objective, using industrial symbiosis, recycling or "up cycling," is to use and consume resources within a circular economic model with minimum environmental degradation, based on the "no-waste" principle from nature. Local governments and business organizations frequently use strategic waste management plans to manage waste issues (Liao et al., 2011). For a successful implementation of a waste management plan it is essential to establish an effective planning process (King et al., 2016). Several studies on the development of waste management frameworks have been conducted, including decision frameworks, legislative frameworks and hierarchical frameworks (Sentime et al., 2013). A framework assists decision-makers in understanding, improving, assessing and guiding waste management systems. The 3R principles (reduction, recycling and reuse) are among the top three in the waste hierarchy and are regarded as the founding principles of the sustainable waste management system (Murphy & Pincetl, 2013; Mason et al., 2003; Colon & Fawcett, 2006). The "3R" principles were extending to five steps in the waste hierarchy in the European Union Waste Framework Directive 2008, including prevention (avoidance), recycling (including recovery of energy) and disposal. Waste prevention is a major problem of zero waste and calls for collective social sensibility and knowledge of waste, innovation in production and business models (Cox et al., 2010). Awareness and transformative knowledge in relation to the choice of pro-environmental lifestyle are often believed to motivate behavior change (Jackson et al., 2005). Waste management and processing technologies have been used over centuries to solve waste problems (Greyson, 2007; Matete & Trois, 2008). Zero waste believes that technology alone cannot solve waste problems on the basis of community participation, service infrastructure, regulatory policy and ecological treatment technology in a sustainable manner. Nevertheless, it limits the application of waste energy (WTE), which consumes waste to make electricity (heating and electricity) and waste disposal in an "ideal" zero waste environment, between traditional waste handling and non-residual waste management. Figure 1 shows the symbolic material flux of a circular waste system, when the end-of-life product or output waste is treated and used as metabolism process (Curran & Williams, 2012; Matete & Trois, 2008).

Zero Waste Strategy and Solid Waste Management

Continuing population growth, booming economy, rapid urbanization and rising standards of community living have greatly accelerated the generation of solid waste worldwide, particularly from developing countries (Guerrero et al., 2013). Solid waste is now a global ecological issue (Seng et al., 2010) as global volume of solid waste is estimated to be around 11 billion tons per year (2.5 tons of trucks can rotate around 300 circles around the equator) in 2011, with solid waste production per capita at about 1.74 tons / year worldwide. The large volume of waste has also created enormous pressure on the waste management authority to be more sustainable way to achieve sustainability (Cheng & Hu, 2010). Cur-