Zero Waste Management: A perspective of sustainable approaches

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ABSTRACT

Zero waste management is an all-encompassing strategy that recognizes decomposition as a resource that is produced as a result of human consumption. This concept is applicable in numerous contexts, including households, communities, organizations, and industrial sectors; it also incorporates technology and environmental stakeholders. Through waste treatment and recycling back into the industry, sustainability yields environmental benefits, cost savings, and employment opportunities. Zero-waste management comprises resource management and sustainable refuse avoidance. Although achieving zero waste can be achieved in a variety of ways, it remains a complex system that necessitates continuous maintenance.

Keywords: Stakeholders, Sustainability, Zero Waste Management

INTRODUCTION

In 1973, Dr. Paul Palmer coined the phrase "zero waste" to delineate the procedure of chemical recovery. Despite extensive investigation, the zero-waste approach continues to be a subject of contention in the field of waste management studies (LaBrecque et al., 2015; Greyson et al., 2007). The concept of Zero Waste (ZW) entails the development and administration of products and procedures that collect, retain, and rehabilitate waste materials, as opposed to utilizing combustion or burial methods (Zero Waste International Alliance, 2004). Zaman (2015) asserts that ZW places waste prevention above landfill or incineration by emphasizing optimal waste recovery and sustainable design and consumption. ZW advocates vehemently for waste avoidance and prevention as opposed to refuse treatment and disposal.Existing resource consumption and waste management systems may prevent the realization of zero incineration and zero landfill goals, which is illogical but not insurmountable. Waste management was burdensome. Zaman et al. (2015) discovered that waste disposal systems and other "end-of-pipe" solutions were utilized primarily to address this societal issue. Traditional waste management approaches have a detrimental impact on the environment, which, with few exceptions in affluent nations, requires an updated and more effective system. Implementing industrial symbiosis, recycling, or "upcycling" to utilize resources in a circular economic model with minimal environmental impact, in accordance with the "no-waste" principle derived from nature, constitutes the zero-waste objective.In order to tackle waste-related issues, local governments and businesses frequently implement strategic waste management approaches (Liao et al., 2011). Effective planning is a prerequisite for a successful waste management strategy (King et al., 2016). Several studies on the development of waste management frameworks, including legislative, decision, and hierarchical frameworks, were conducted by Sentime et al. (2013).

A framework facilitates the comprehension, enhancement, evaluation, and direction of waste management systems by decision-makers. Murphy and Pincetl (2013), Mason et al. (2003), and Colon and Fawcett (2006) assert that sustainable waste management is built upon the 3R principles, which include reduction, recycling, and reuse.The "3R" principles were extended to five waste hierarchy stages by the European Union Waste Framework Directive in 2008: prevention, recycling, energy recovery, and disposal. Innovative manufacturing and economic strategies, in addition to social awareness and knowledge, are necessary for waste avoidance to reach zero waste (Cox et al., 2010). According to Jackson et al. (2005), behavior modification could be prompted by transformative knowledge and consciousness regarding pro-environmental lifestyles. In order to tackle waste problems, waste processing and management technologies have been in use for centuries (Greyson, 2007; Matete & Trois, 2008).Supporters of zero waste advocate for environmentally friendly solutions that incorporate service infrastructure, community engagement, regulatory reforms, and ecological treatment technologies. refuse energy (WTE), which converts garbage into electricity and facilitates refuse dispersal in a "ideal" zero-waste setting, is, nevertheless, constrained. This is a subset of non-residual refuse management and standard waste treatment. The material flux of a circular waste system is illustrated in Figure 1. This system treats and repurposes output garbage or end-of-life products for metabolic purposes (Curran & Williams, 2012; Matete & Trois, 2008).

The Strategy and Management:

Garbage production has increased, particularly in developing countries, as a result of rapid urbanization, global population growth, and rising living standards (Guerrero et al., 2013). The environmental problem of solid waste is worldwide (Seng et al., 2010). With a per capita production rate of 1.74 tons, the global volume of solid waste was estimated to be 11 billion tons in 2011. This is equivalent to the rotation of 300 circles around the equator in 2.5 tons of vehicles. Waste management authorities are under greater pressure to embrace sustainable practices due to the volume of waste (Cheng & Hu, 2010). In light of the human lives impacted by global climate change, sustainability has become a societal priority. As global resources become more limited, resource and product management strategies must be considered. Phillips et al. (2011) proposed a zero-waste approach as a resolution to these difficulties. As environmental demands increase and resources become scarcer, zero pollution may become an imperative objective. Effective zero-waste methods are proposed and implemented by GAIA (2013) for municipalities, enterprises, individuals, and waste recycling industries. In addition to inspiring private, municipal, and waste recycling companies to engage in zero-waste initiatives, the subsequent case studies can provide organizations and individuals with investment and implementation strategies.

ZERO WASTE CITIES

- **Adelaide, Australia**

The capital city of South Australia, Adelaide, comprises 19 municipalities on an area of 8415 km2 and is home to 1,089,728 people (UNHABITAT, 2010). City Council (ACC) of Adelaide is responsible for waste management. Zero Waste SA (ZWSA) was instituted by the South Australian government in accordance with the Zero Waste SA Act. ZWSA advocates for waste management and recycling practices in industries, households, and workplaces (ZWSA, 2011). The proportion of waste collection and management systems in Adelaide is greater than that of other capital cities in Australia. Since the legislation governing container deposits was not implemented until 1977, it has been more than three decades since the last recycling of various containers. Zero Waste SA strives to attain zero waste in Southern Australia (Zaman, 2013).

Community Action, Taiwan, China:

During the 1980s, Taiwan encountered a waste crisis as a result of insufficient land availability to accommodate further deposits. Community opposition to the government's choice to employ mass incineration led to the elimination of a considerable number of burners, in addition to the implementation of waste prevention and recycling initiatives (Allen, 2012b). Massive waste reductions were the result of effective policies and initiatives, despite the growth of population and GDP. An estimated 48.82 percent of waste was disposed of by landfill, resulting in an annual waste per capita expense of $25.40. By maintaining policies that support both incineration and waste prevention, the government has constrained the effectiveness of waste prevention methods. This is because significant investments could be allocated towards the development and expansion of incinerator discharge resources.

Zero Consumption Waste: The Strategy

Construction, an age-old human endeavor, influences socioeconomic development and environmental sustainability significantly. It has substantial effects on the environment and society's economy. Long-term effects of construction activities extend to the region's aesthetics and natural resource management. Innovation is essential for both regional economic expansion and the immediate benefit of all participants. As an alternative, enhancing quality of life and influencing economic growth are no longer predicated on production. In order to ensure opportunity equality, responsible resource management is essential, given that the majority of natural resources are non-renewable and unrestricted. The objective of the European Union's sustainable development plan is to sever the connection between waste production, natural resource consumption, and economic expansion (Hart, 2007). Environmental factors are integrated into the recycling notion of lightweight aggregate construction detritus.

In order to reduce construction waste and enhance environmental performance, a model was devised to recycle lightweight aggregates utilizing expanded glass. At present, the significance of the quantity of refuse lightweight concrete (LWC) composed of expanded glass is diminished, which prompts an inquiry into the most efficient and economical means of collecting it. Due to reduced electricity, sewage, and renovation expenses, in addition to the utilization of fewer resources, recycling or repurposing a structure is more ecologically sustainable than completely demolishing it. Grant et al. (2003) report that life cycle assessment (LCA) is increasingly being used to evaluate the environmental impacts of solid waste management. Kirkeby et al. (2006) state that the application of LCA to solid waste management systems encompasses all waste management impacts, including those of upstream and downstream processes. In the last ten years, a multitude of approaches have been introduced to assess the ecological consequences of municipal solid refuse treatment and disposal. In order to calculate life cycle inventory, the IWM (McDougall et al., 2001) method for municipal waste management combines a chart with a more sophisticated model. The inquiry commenced with a life cycle assessment (LCA). LCA is a standardized instrument utilized to mitigate resource, health, and environmental impacts. Due to the omission of economic considerations, stricter boundaries are established (Hansen & Gilberg, 2003; Kirkebyet al., 2006). A fresh viewpoint has emerged as a result of innovative collaboration and a revised waste management strategy: construction and resting materials are now considered raw materials. Multiple basic materials are combined to form cement, which is manufactured with lightweight aggregates. LWC containing expanded glass aggregates is one such material. Millions of tonnes of LWC are manufactured annually in the Federal Republic of Germany using expanded or recycled glass as the primary material.The extended glass aggregates produced by LWC involve costly raw materials, including fine glass fragments, which are unusable by the glass industry in the production of new products. This practice, which involves the utilization of enlarged glass aggregates, substantially promotes the expansion of glass recycling and protects natural resources. LWC containing expanded glass aggregates is becoming increasingly popular for non-traditional construction applications. LWC waste from aggregates containing expanded glass is illustrated in Figures 2a-2c.

Zero Waste Approach Via Bio-Refinery

Biorefinery is an environmentally friendly process that converts lignocellulosic resources into products with added value. Lignocellulosic detritus has been the subject of endeavors to convert into valuable products, including enzymes, pulp and paper, biofuels, and composites (refer to Figure 3). Lignocellular biotechnology has witnessed recent progress that has prompted novel investigations into lignocellulose, fungal consortiums, and ligninolytic enzymes including manganese peroxidase (MnP), lignin peroxidase (LiP), and laccase (Lac). These enzymes have also been subjected to purification and immobilization processes in preparation for diverse biotechnological applications (Asgher; Iqbal et al., 2013).To rival the market for petroleum-based products, which is presently the subject of extensive research, bio-refiners are devising eco-friendly and sustainable products. Biorefineries possess the capability to extract value from a wide range of biomass sources, including those derived from agriculture, industry, municipalities, and algae. Producers of bio-based products generally concentrate on value-added products, chemical platforms, and niche markets that demand multifunctionality in order to accomplish their objectives. Multiple studies (Langeveld et al., 2012; McCormick et al., 2013) provide evidence in favor of the adoption of sustainable bio-refinery systems as an alternative to petrochemical processes.

- To prevent excess dependence on petrochemical products
- To avoid price increases
- To avoid over - consumption of petroleum, gas, coal and other potential minerals
- To enhance and diversify bio - renewable sources
- In addressing global climate issues
- Greenhouse gas emissions
- To safeguard the natural ecosystem and
- To boost regional and rural greener growth

Fermentation of sugars, such as C5/C6, from a variety of feedstocks, including natural polysaccharides, is a common process in biorefinery. A multitude of bio-refineries have been conceptualized and implemented by scientists, utilizing diverse raw materials and processing methodologies (Parajuli et al. 2015). Utilizing dimethyl ether to assess a thermochemical bio-refinery comprising twelve processes to generate ethanol, methyl acetate, hydrogen, and power led to advances in energy efficiency of as much as 50.20 percent.The profitability of thermochemical bio-refineries surpasses that of conventional thermochemical processes that produce numerous products, according to economic research (Haro et al., 2013).

Green biomass, including that obtained from grazing, is utilized in a green bio-refinery system to produce fibers, fuel, animal feed, and as a component of the lignocellulose bio-refinery. It is a fully incorporated, sophisticated, and multifunctional system. Additionally, novel resource protection technologies that maximize the utilization of residual biomass were investigated. Biorefineries that are environmentally friendly aim to produce ethanol. Scholey et al. (2016) investigated ethanol bio-refineries for animal feed production utilizing starch, milling (wet or dry), and fermentation. Karlsson et al. (2015) suggested that Faba legumes could be utilized in a green bio-refinery to produce animal feed and ethanol. Fuel components, edible fungal biomass (N. intermedia), and ethanol were all byproducts of an integrated biorefinery that utilized field bean seeds (Pietrzak et al., 2016). A diverse range of natural, agro-industrial, and lignocellulosic polysaccharide substrates can be utilized in industry and biotechnology to manufacture products of significant value. Considerable progress has been achieved in the domain of integrated bio-refinery methodologies for the forthcoming decade.As a result of socioeconomic concerns, targeted markets for alternative energy, industrial enzymes, and platform compounds have emerged in recent years. It is possible to bioconvert natural compounds to meet the demands of industry and society, according to research (Sakamoto et al., 2012; Shahsavarani et al., 2013).

Zero-Waste Design:

Widespread use of zero-waste design as a sustainable manufacturing technique. In numerous additional manufacturing regions. A number of corporations, including Subaru, Procter & Gamble, DuPont, and Caterpillar, boast about operating facilities that eliminate the need for landfill disposal of waste. Additionally, it may present a highly imaginative challenge. In addition to generating a creative reflection, the designer is also accountable for employing innovative stitching techniques, seam closures, and seam structure. The concept of zero-waste apparel seeks to eradicate the production of any superfluous garments. Produce designs utilizing an entire length of the material in the process, ensuring that no refuse is disposed of. The standard goal of clothing manufacturers is to achieve a 15% reduction in material waste (Rissanen, 2011; Townsend & Mills, 2013).

Parts used in clothing design frequently exhibit irregular shapes and may malfunction when assembled, reminiscent of puzzle pieces. The fashion industry employs various strategies to minimize wastage, such as coordinating model cutting portions with software and merging multiple sizes and designs during the cutting process. These solutions fail to entirely eradicate refuse present on the floor of the cutting room. The paper primarily examined the challenge of producing garments that minimize waste during the cutting process. The remaining materials utilized in the construction process were recycled appliqués, pillow filling, or repurposed denim insulation. Zero-waste indigenous apparel has existed for centuries. It is customary to recall the lengthy Indian sari, which was coiled and draped around the wearer without the use of stitching or cutting. Similarly, the Japanese kimono is a zero-waste product; however, it is constructed from cut and sewn fabric fragments. As a result, sustainable designers face the challenge of creating designs that are functional in western fashion while adhering to zero-fabric waste restrictions.

The garment industry is estimated to contribute 7% of worldwide carbon emissions; therefore, waste reduction is critical (Ericson, 2010).As opposed to waste reduction, the eco-mode movement (Thomas, 2008) has redirected sustainability discussions to organic textiles and equitable labor standards. Designers Tara St. James and Yeohlee Teng employ zero-waste methodologies in addition to the development of solutions. In 2012, the Sustainable Design Award was bestowed upon aspiring designer Titania Inglis in recognition of her implementation of zero waste design principles throughout her collection sartorial runs (Swanson, 2012). As the first of ten techniques for sustainable fashion design identified by the Textiles Environment Design Project (2012), "design to minimize waste" is implemented. In contrast to alternative sustainable methodologies like organic dyes and recycling, the body of literature pertaining to the design of zero waste textile garments is notably scarce. According to a study by Townsend and Mills (2013), contemporary designers including Julia Lumsden and Holly McQuillan primarily offered guidance on zero-waste pattern cutting.

In contrast to alternative sustainable methodologies like organic dyes and recycling, the body of literature pertaining to the design of zero waste textile garments is notably scarce. According to a study by Townsend and Mills (2013), contemporary designers including Julia Lumsden and Holly McQuillan primarily offered guidance on zero-waste pattern cutting. The authors conducted research on the literature and design of zero-waste clothing, incorporating contemporary and historical instances. In conducting research on the design of non-discharge apparel, the authors examined pertinent literature and current and historical examples. As a consequence of adjusting the puzzle's design shapes to secure and share cut edges, there is no waste. McQuillan and Timo Rissanen are both esteemed for their exceptional craftsmanship. Seasonal designers can easily create set designs, including sleeves, pant legs, and other established pattern components, by utilizing puzzles. The raglan sleeve of the black PARTY dress is designed in the form of a cursive lowercase letter r (r). The alphabet P-A-R-T-Y was intended to be formed by the pattern. The remaining models were concurrently developed in the form of illustrations and designs.

The Approach of Multiple Cloth

McQuillan explains that this method entails concurrently developing multiple designs for distinct textiles. This may be the procedure that most closely resembles mass production methods for pattern marking.Integrating various aesthetics into a unified design. While McQuillan's method for producing multiple costumes requires only two hooded jackets and two t-shirts, the incorporated puzzle technique can generate an extensive variety of ensembles from a single marker. Repeated textiles are necessary to achieve aesthetic harmony when designing for bulk consumption. It is efficient and waste-free to cut multiple apparel patterns from the same fabric. The focus of this research is zero-waste approaches to individual apparel. During zero residue design surveys, McQuillan's zero-waste design technique should be adopted as a creative benefit for uncertain design processes. It is anticipated that zero-waste apparel design will increase as an increasing number of designers investigate sustainable methods and seek out novel creative challenges. Difficulties are present in the implementation of viable mass production processes. Further experimentation is required to enhance zero-waste practices within the fashion industry, which ranks as the second largest polluter globally..

Economic Growth, Sustainability, or Zero Waste:

A number of corporations have made "zero waste" commitments, including Interface, DuPont, Fuji Xerosox, Collins Pine, Ricoh, Konika-Minolta, NEC, Toyota, Hewlett Packard, and Epson. In addition to China, South Australia, Victoria, and Western Australia, New Zealand, and Lebanon are all participating in the movement.

This exemplifies substantial progress in proactive cognition, technological prowess, and notable initiatives. In practice, however, attaining zero waste requires a gradual reduction in waste. A preventive purpose is not sufficient; a preventative strategy is also necessary. It is undesirable to employ prevalent terminology when describing social objectives. Frequently, economic expansion is employed to undermine sustainability. However, rather than effect, sustainable economic growth is frequently pursued through excessive regulation. The concepts of "sustainable development" and "sustainability" are often misapplied by governmental bodies and organizations seeking approval for incremental progress. These terms are seldom used by the general public. The notion of zero waste is generally considered unattainable due to the necessity of implementing novel economic signals worldwide. Implementing preventive measures can result in sustainable development and zero waste. Economic expansion may also be compatible with an underappreciated preventive strategy. The counterproductive nature of the conflict between economic, social, and environmental objectives emphasizes the necessity of evaluating and modifying societal goals, as opposed to depending on compromise and equilibrium. Renewing societal objectives fosters global perspectives and innovative thought.

A Goal-Set and Actions to Achieve the Goal-Set:

Establishing a target and undertaking measures to achieve itIn most cases, the gradual approach yields plans that lack any connection to long-term objectives. We discern prevailing patterns and select tactics to enhance the circumstances. The term for this type of planning is "foresight." A preventive method known as backcasting (Robinson et al., 1990) places emphasis on future objectives rather than the current situation. Backcasting is analogous to selecting a preferred destination over an unfavorable environment. Backcasting does not impede the attainment of long-term objectives by diminishing immediate consequences. By employing backcasting, measures to mitigate immediate impacts do not compromise long-term objectives. Achieve the Objectives.Economist Kenneth Boulding introduced the concept of a "circular economy" in 1966 with the intention of fostering sustainable development, zero-waste operations, and long-term economic expansion. In 1988, social marketing manager Maureen O'Rorke introduced the phrase "circular economy" to delineate the requisite actions to achieve its realization. Objectives and undertakings serve as the foundation for economic and societal progress, the formulation of plans for projects, and the execution of daily decisions.

Action to Prevent a Range of Problems:

At the present time, recycling knowledge incorporates initiatives undertaken by households, communities, retailers, businesses, and industries that are product-driven (Baldwin et al. 1997). Precycling is an all-encompassing process that incorporates diverse industrial, social, environmental, and economic contexts in order to produce new resources from used products. Product capacity can be increased by expanding the infrastructure for reduction, reuse, recycling, decomposition, and pyrolysis. Strengthening industrial autonomy from recognized accumulated chemicals, such as persistent synthetics, heavy metals, fossil fuels, and radiation, can be achieved through their elevation, which would enable the substitution of them through precycling. By diversifying and expanding environmental habitats, excess effluents and emissions can be converted into natural resources. By expanding society's capacity to fulfill every need, there is potential for universal precycling. A circular economy enables the concurrent fulfillment of environmental, social, and economic objectives. A "recycled planet" could potentially supply humanity and the environment with new resources at a rate comparable to the current waste crisis. Precycling comprises a variety of practices aimed at mitigating ecological harm. Precycling is a form of recycling in which materials are recycled prior to their discharge into the environment. In contrast to recycling, precycling exhibits a greater degree of ambition. At present, the criterion for amending errors is pre-cycling, as all products are recyclable (Boulding et al., 1996).

Zero Waste Index:

The Zero Waste Index evaluates the viability of substituting virgin materials for zero waste alternatives. A principal objective of the zero waste concept is the eradication of natural resource depletion. The resources that are recovered, utilized, relinquished, recycled, and ultimately replaced with new materials and mitigate waste disposal solutions are utilized to determine the efficiency of a zero-waste municipality. Nevertheless, the effectiveness of waste management systems in substituting virgin materials, a critical aspect in the global preservation of natural resources, is not adequately reflected in waste diversion rates. The zero waste index is an innovative approach utilized to assess waste management systems that substitute virgin materials. The zero waste global index quantifies potential compensation for depletion of natural resources and virgin materials. Comparing waste management systems and determining the city's future demand for materials, energy, CO2, and water are both facilitated by the ZWI. The ZWI evaluates the efficacy of waste management systems as a whole.

A number of municipalities, including Stockholm, San Francisco, and Adelaide, strive to attain zero-waste status through the off-site diversion of all refuse. Zero-waste initiatives necessitate further actions than mere waste reduction and recycling. Behavior changes, legislation, and waste avoidance through industrial design are not incorporated into the diversion rate. Consequently, evaluating the zero waste performance of the municipality is inadequate (Zaman et al., 2013).

Conclusion:

Profound waste and environmental issues have resulted from globalization and rapid economic expansion, such as unauthorized disposal, transboundary transportation of industrial refuse, haphazard electronic waste recycling, food wastage, greenhouse gas emissions, and resource depletion. "Zero waste" is an efficient strategy for the management of solid refuse. The objective of zero waste is to reestablish resource life cycles and repurpose products. Individuals, businesses, and municipalities are exerting considerable effort to promote zero-waste production. Professionals and decision makers evaluate the efficacy of refuse management systems using a variety of metrics. Trash diversion, green town, and zero waste indices have been utilized as critical performance indicators for municipalities over the past decade. From the extraction of basic materials to their final disposal, implement critical concepts such as eco-design and eco-labeling in order to attain zero waste. Alternatives to recycling that contribute to zero waste management for construction, industrial, solid, and electronic refuse include clean production, closed loop chains, eco-design, and eco-labeling. Anxieties toward mitigating global issues may impede preventive measures. It is unlikely that current practices will result in zero waste, long-term economic growth, or sustainability. While the suggested alternative may seem credible at first glance, it necessitates a change in viewpoint. Although human innovation has revolutionized the globe, the degree to which minds can readily adjust is yet to be determined. Many individuals are experiencing worsening repercussions on a global scale. Everyone may not be able to manage these consequences unless they are adequately prepared.

References

Allen, C. (2012). Taiwan: Community action leads government towards zero waste. Retrieved from http://no-burn.org/downloads/ZW%20Taiwan.pdf

Anastas, P., & Warner, J. (1998). Green Chemistry: Theory and Practice. Oxford University Press.

Asgher, M., Ahmad, Z., & Iqbal, H. M. N. (2017). Bacterial cellulose-assisted de-lignified wheat straw-PVA based bio-composites with novel characteristics. Carbohydrate Polymers, 161, 244–252. https://doi.org/10.1016/j.carbpol.2017.01.032

Baas, L. W., & Huisingh, D. (2008). The synergistic role of embeddedness and capabilities in industrial symbiosis: Illustration based upon 12 years of experiences in the Rotterdam Harbour and Industry Complex. Progress in Industrial Ecology. International Journal, 5(5–6), 399–421.

Baldwin, J. H. (1997). Describes industrial design and reuse as precycling. Conservation. Encarta Online Encyclopedia. Retrieved from http://www.encarta.msn.com

Borghi, A. D., Gallo, M., & Borghi, M. D. (2009). A survey of life cycle approaches in waste management. The International Journal of Life Cycle Assessment, 14(7), 597–610. https://doi.org/10.100711367-009-0111-7

Boulding, K. (1966). The economics of the coming spaceship Earth. In H. Jarrett (Ed.), Environmental quality in a growing economy, resources for the future (pp. 3–14). Johns Hopkins University Press.

Brezet, H., & Hemel, C. V. (1997). ECODESIGN – A promising approach to sustainable production and consumption. UNEP.

British Standards Institution (BSI). (2008). PAS 2050:2008, Specification for the Assessment of the Life Cycle Greenhouse Gas Emissions of Goods and Services. Retrieved from http://www.bsigroup.com/en/Standards-andPublications/Industry-Sectors/Energy/PAS-2050/PAS-2050-Form-page/

Cheng, H., & Hu, Y. (2010). Municipal solid waste (MSW) as a renewable source of energy: Current and future practices in China. Bioresource Technology, 101(11), 3816–3824. https://doi.org/10.1016/j.biortech.2010.01.040

Chertow, M. R. (2000). Industrial symbiosis: Literature and taxonomy. Annual Review of Energy and the Environment, 25(1), 313–337. https://doi.org/10.1146/annurev.energy.25.1.313

City of Toronto. (2012). How we calculate waste diversion rates. Retrieved from http://www.toronto.ca/environment/initiatives/wdt.htm

Colon, M., & Fawcett, B. (2006). Community-based household waste management: Lessons learnt from EXNORA's 'zero waste management' scheme in two South Indian cities. Habitat International, 30(4), 916–931. https://doi.org/10.1016/j.habitatint.2005.04.006