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SUSTAINABLE WASTE MANAGEMENT FOR CLEAN AND SAFE ENVIRONMENTS

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ABSTRACT

Sustainable waste management aims to keep materials in use for as long as possible and minimize the amount of solid waste that is disposed of in landfill or through incineration. Sustainable waste management relies on the waste management hierarchy, a system that focuses on avoidance, reduction, reuse, recycling, energy recovery, and finally, treatment or disposal. Here, we look at how the waste management hierarchy is central to sustainable waste management. It involves several strategies which include avoiding and reducing the amount of waste generated by maximizing efficiency and reducing consumption, Purchasing products that can be reused or repaired, as well as education around how to reuse waste products, Recycling of materials and avoiding the need to extract virgin resources as well as negating some of the negative impacts of simply disposing of waste, Energy recovery, which is the conversion of waste into usable heat, electricity, or fuel such as biogas, Treatment or disposal means landfills or incineration without energy recovery. Simple ways to start implementing sustainable waste management in homes and businesses would include scraping or replacing single-use items with reusable ones, switching as much paperwork as possible to digital versions, offering a trash alternative by providing recycling and compost bins alongside regular trash and having services to properly manage this waste. A business can also donate any materials that would otherwise go to waste to improve sustainability. Waste management can be sustainable in both businesses and homes if the right framework is implemented. But more importantly, the consequences, if waste is left unchecked, are too great not to consider.

Key Words: Sustainable, Management, Environments

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CHAPTER ONE: INTRODUCTION

1.1 Definition of sustainable waste management

Waste management refers to the activities and actions that handle waste materials. It includes collection, transportation, processing and disposal of waste (Demirbas, 2011).Waste prevention, recycling, reuse and recovery are important waste management strategies that eases the burden on landfills, conserves natural resources and saves energy. This helps utilize resources more effectively and sustainably (Wan et al., 2019).

Sustainable waste management aims to keep materials in use for as long as possible and minimize the amount of solid waste that is disposed of in landfill or through incineration. However, in our existing linear economy, waste begins even before products are manufactured, and a more in-depth approach to sustainable waste management must focus on the entire lifecycle of a product to enable us to help reduce the negative environmental, social, and financial impacts of 21st-century consumption (Menon, 2010).

Sustainable waste management relies on the waste management hierarchy, a system that focuses on avoidance, reduction, reuse, recycling, energy recovery, and finally, treatment or disposal. It aims to prioritize actions for the most efficient use of resources, placing renewable and less wasteful practices at the top of the pyramid. Here, we look at how the waste management hierarchy is central to sustainable waste management (Wan et al., 2019).

1.2 importance of sustainable waste management

With the deteriorating Earth state that we live in nowadays, waste management appears to be one of the most important environmental protection strategies . This practice has, in fact, several benefits both on the environment and the society. In particular, the main benefits of waste management are:

Environmental protection and pollution reduction . One of the primary benefits of waste management lies in its ability to minimize the environmental impact of human activities. Proper waste disposal and recycling reduce the amount of waste that ends up in landfills or incinerators, thereby decreasing greenhouse gas emissions and air pollution. By diverting waste from landfills, we conserve valuable space and reduce the risk of harmful substances leaking into the soil and contaminating water sources, protecting both human health and ecosystems.

Resource conservation . Waste management fosters resource conservation through recycling and reusing materials, reducing the total amount of material reaching final disposal. Recycling allows us to reclaim valuable resources from discarded items and, by doing so, we minimize the need for

raw material extraction, thus conserving natural resources and mitigating the environmental impacts associated with the extraction and processing of raw materials.

Economic benefits. There are plenty of economic benefits deriving from waste management: not only this practice reduces the overall cost of waste disposal, but also fosters the creation of job opportunities. Last but not least, investing in waste management processes boosts companies' reputation, attracting customers and investors.

Enabling a circular economy. Waste management is a key enabler of the circular economy, a model aimed at reducing waste and optimizing resource use. In a circular economy, products and materials are designed for longevity, reuse, and recyclability. This transition from a linear "take-make-dispose" model to a circular one is fundamental in achieving a sustainable and greener future, and it is evident how waste management plays a big part in it (Allen, 2023).

CHAPTER TWO: SUSTAINABLE WASTE MANAGEMENT STRATEGIES

2.1 Avoidance and reduction

Avoiding and reducing the amount of waste generated is the first priority. This can be achieved by maximizing efficiency and reducing consumption. First, businesses and individuals should choose products that require the fewest resources to produce (including the packaging). Additionally, single-use or disposable goods should be avoided wherever possible— these materials are the embodiment of linear waste in which resources are extracted, processed, and distributed only to quickly become waste.

Production of waste is closely associated with human behaviors such as consumption patterns and lifestyles; it is a mixed result of cultural, economic, and social environment where human behaviors are taken place (Hansen et al. 2002).

Informational interventions aim at changing individuals' attitudes, awareness, knowledge, perceptions, and norms which influence individuals' motivations for taking a behavior (Steg & Vlek, 2009). There are different types of informational interventions. Providing information is the most commonly used intervention. Disseminating information about waste problems increases individuals' awareness and knowledge of the problem; it offers possible solutions of the problem for individuals to follow (Abrahamse & Matthies, 2012). This can be done by launching education and promotional campaigns. Another strategy accompanying with information dissemination is prompting. It is usually a spoken or written message which reminds individuals to behave in an appropriate way, for example, a recycling slogan which draws individuals' attention to participate in recycling practices. Prompting information can also be presented in the form of picture, photos, or cartoon to increase its attractiveness. Our behaviors are partly influenced by people around us. It has always been the pressure of individuals

2.2 Reuse

If the consumption of a product can't be avoided, then there should be a focus on purchasing products that can be reused or repaired, as well as education around how to reuse waste products. Reusing is preferred to options lower down the hierarchy since it can be done without processing new materials, which takes money, energy, and often other resources. Reuse, which is also one of the central tenets of the zero-waste philosophy, can come in the form of having shoes repaired, donating clothes and items for others to use and even researching recipes for food leftovers rather than throwing them in the trash.

Reuse is a key component of waste prevention; it is also the second prioritized strategy for achieving sustainable development according to the waste hierarchy. Reuse of products can extend products' life span and reduce the amount of waste directed to landfills or incineration. Procurement policy which includes the requirement of selecting long life-span products would be structurally important (Zhang et al., 2011). Besides, establishing exchange center in campus that offers

2.3 Recycling

If an item can't be reused, then the next best option is to recycle. This is where the process starts to look like conventional waste management since we are now dealing with materials that have reached the end of their usable life in their current form. Recycling, like reuse, keeps materials in the loop, avoiding the need to extract virgin resources as well as negating some of the negative impacts of simply disposing of waste.

Recyclables provide economic value and further enhances the efficiency use of materials. The practice also reduces the volume of waste being dumped into landfill sites or incinerated, and thus causes less harmful effects on the environment. It involves processes that separate collected waste and convert recyclables into useable materials or new products. A large proportion of waste is recoverable (Armijo de Vega et al., 2008; Anacio, 2017). Common examples of recyclables in university context are paper and paper products for administrative and academic purpose, disposable beverage containers, and food packaging materials.

Recycling is considered less desirable than the previous options since it requires energy, money, and resources to turn waste back into usable materials.

That said, the benefits associated with recycling varies dramatically from material to material, with the likes of aluminum more than covering the cost of its own recycling while saving more than 90% of the energy required as compared with using virgin metal. Glass, on the other hand, has energy savings of only 10 to 15%, still being a better alternative to simple waste disposal.

Composting is also found at this step of the hierarchy since it allows organic waste to be diverted from landfill and turned into something that can be useful in growing new produce.

2.4 Energy recovery

The next step is energy recovery, which is the conversion of waste into usable heat, electricity, or fuel such as biogas. This is achieved through a variety of processes such as incineration (with energy collection), gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery, which has some crossover with the last step of waste management.

Combustion is a common method of energy recovery for non-hazardous waste, and while obviously less preferable than reuse or recycling, it does reduce the physical volume of waste that will be sent to landfills and also provides energy from the burning process that would otherwise require fossil fuels to generate. In the United States, there are currently 75 facilities that recover energy from the combustion of MSW, each of which generates around 550-kilowatt hours (kWh) of energy per ton of waste. Having said all this, energy recovery is not included on the list zero waste priorities, and is viewted by some in the waste management industry as an unacceptable compromise.

Recovering waste is an option after all previous strategies have been considered. Recovery refers to the processes of extracting energy or materials from the waste. For example, waste can turn into energy through thermal treatment; recovery of organic waste can be converted into energy and compost; materials recovered through recycling are of economic value. Although recovery is prioritized in a relatively low position in the waste hierarchy, the strategy contributes to sustainable development by reducing the demand of using resources as well as the amount of waste being buried in landfill sites. Food waste from campus canteens is a common substance used for recovery. For example, Ithaca College, USA, uses 5 tons of food waste per week to produce compost (Armijo de Vega et al., 2008). Since materials used for recovery (e.g. food waste) usually occupy a large space for storage and need effective odour control measures, facilities and space for storage and advance technologies for recovery (e.g. reducing energy consumption during recovery processes) are required.

2.5 Treatment or disposal

The last and least desirable step in the hierarchy is treatment or disposal. This generally means landfills or incineration without energy recovery. This will inevitably happen to some waste but should be avoided for as long as possible through sustainable waste management.

Disposal is perceived to be contradictory to sustainable development because it is inefficient in making use of potential resources, making energy consumption during waste collection and transportation, causing harmful effects to the environment and public health. However, not all waste can be prevented, reused, recycled, or recovered. With appropriate informational and

structural inventions, disposal can also be a strategy that complies with the principle of sustainable development. (Arizona State University, 2012).

CHAPTER THREE: WAYS OF IMPLEMENTING SUSTAINABLE WASTE MANAGEMENT TO HOMES AND BUSINESSES

There are several ways of implementing sustainable waste management in homes and businesses. This include Scraping single-use items and replacing them with reusable ones. Instead of cardboard coffee cups, get mugs or glasses; Switch to digital to improve sustainable waste management for example switching as much paperwork as possible to digital versions. Offer a trash alternative by providing recycling and compost bins alongside regular trash and having services to properly manage this waste and donate any materials that would otherwise go to waste is a great way to improve sustainability. This could be overstocked foods in stores and restaurants, old hardware from offices, out-of-promotion goods from non-food stores, or even materials from renovations.

CHAPTER FOUR: CONCLUSION AND RECOMMENDATION

In conclusion, sustainable waste management is crucial for maintaining clean and safe environments. Proper waste management practices not only help in reducing pollution and environmental degradation but also promote public health and well-being. It is important for individuals, communities, and governments to work together to implement sustainable waste management strategies.

To achieve sustainable waste management, it is recommended to prioritize waste reduction and recycling efforts, promote composting, invest in waste-to-energy technologies, and enforce strict regulations on waste disposal. Education and awareness campaigns should also be conducted to encourage responsible waste disposal practices among the public.

Overall, by adopting sustainable waste management practices, we can create a cleaner and safer environment for current and future generations. It is imperative that we take action now to address the growing waste management challenges and work towards a more sustainable and environmentally friendly future.

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