ISSN 2278-3091
Volume 10, No.6, November - December 2021
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse101062021.pdf
https://doi.org/10.30534/ijatcse/2021/101062021

Framework for Digital Technology Application in Sustainable Waste Management

Collins C. Ngwakwe [1], Sipho K. Mokoena[2]
[1]University of Limpopo, Graduate School of Leadership, South Africa, Email: collins.ngwakwe@ul.ac.za
[2]University of Limpopo, Graduate School of Leadership, South Africa, Email: sipho.mokoena@ul.ac.za

Received Date : October 09, 2021 Accepted Date : November 11, 2021 Published Date : December 06, 2021

ABSTRACT

This paper provides a novel framework for envisioning digital technology application in sustainable waste management. The approach inclines on a mini-conceptual framework, which is rooted in the bourgeoning of diverse software innovation, which offers numerous digitalization of waste management recess. It first concedes that digital age brings to fore some enabling technology that offer a lift to transform traditional waste management to an unprecedented quick and cleaner dimension. Although not exhaustive, it highlights some popular digital apparatuses available for individuals, organisations and the government to take advantage for reforming traditional waste management techniques. These include ultrasonic trash can sensor, solar-powered trash compactor, image-based trash can sensors, toogoodtogo, digital mapping and cloud-based life-cycle waste cost calculator. Accordingly, this mini-framework for digital application to waste management provides a stepping ground to enable further expansion of the framework for enhanced policy, practice and scholarship.

Key words: Digital technology, waste management software, cost software, trash software

1. INTRODUCTION

The current era of unprecedented innovation and advancement in digital technology is bourgeoning in tandem with global advocacy for corporate environmental management enhancement. The target is that a blending and application of digital technology in corporate environmental responsibility – chief amongst which is waste management is a catalyst to desired sustainable development by 2030. Aside from compliance criteria, corporate waste management has numerous cost and revenue benefits along with positive image creation that begets corporate goodwill. Hence, corporate investment and application of digital technology in waste management is sine qua non for achievement of efficient and effective cleaner production in a seamless milieu. Corporate environmental management accounting (EMA) has two major variants of accruable information namely the physical information and monetary information variant. Whilst the main objective of the firm is analogous with the latter variant, it is taken as a given that the corporate has more penchant for environmental activities that offer better monetary reward to grow the shareholder wealth. However, from wider stakeholder perspective, corporate physical information (wastes, materials, energy flow and water), which are derivable from EMA are occupying the forefront of environmental management strategy to bolster corporate resilience in growing sustainable challenging and competitive business environment. Hence, the objective of this paper focuses on creating a framework for digital technology application in corporate environmental accountability – with concentration on digital application to waste management. The dearth of such framework in current literature makes this paper a novelty and hence bridges a gap with a vivid contribution of the framework to existing literature on corporate environmental management accountability via the application of digital technology. Consequently, it draws the attention of managers on the need to take advantage of the advancement in digital technology to support the growing pressure to enhance corporate environmental accountability regarding sustainable waste management.

2. DIGITAL AGE AND WASTE MANAGEMENT

Digitisation of processes and operations in the 21st century is blossoming to bolster actualisation of somewhat difficult area in organisational operations and practices, which is waste management. Policymakers, specialists, and researchers have long-lauded computerized advancements even before now that digitisation has engulfed the waste management terrain. Thus a break-through in digital technology holds a broad promise for even more future digitalisation in the art storing, categorisation, collection and recycling of diverse wastes [1]. Currently, the advances in the use of digital technology in waste management is more evident in development countries. In In their empirical research on waste management digitisation insight from German companies, authors find reasonable percentage acceptance that digitalisation is making an impact in German companies [1]. Experts suggest that enhancement of advanced life in a sustainable world is dependent on waste management and recycling of wastes associated with high technology advancement. In doing this, it

is exceptionally vital to control and minimize the administration costs inside the imperatives required by legislation. Therefore, to attain this objective, a company needs brilliant waste management innovation and technology devices, which includes advanced hardware for collecting and preparation and strategic application [2]. Empirical research has shown that the Information Technology and Communication advances offers the advantage of improving waste management in tandem with the massive production and usage technological and information gadgets. For instance, in France, special vehicles are in use for collection of wastes and these are under the monitoring of Geographic Information System (GIS). The GIS is a modern computerised equipment which assists for apprehending, storage, inspecting, and presenting data associated to locations on Earth's surface [3].

3. CONCEPTUAL FRAMEWORK

Digital technology advancements is dictating all ramifications of corporate strategy amidst environmental exigencies. Corporate environmental accountability is not only a buzz word for the 21st century good corporate citizenship, it is also a practical sine qua non for navigating and remaining resilient in a digitalised global business [4]. In no previous decades was digital technology application flourishing than in the current dispensation, where speed, precision and clean technology is being pivoted digitally to enhance production of goods, services and delivery of same to consumers.

Although a variety of digital technology have come to the fore for assisting in waste management, this paper presents a framework of some of the popular names in the literature. These include *inter alia*:

- MyWaste digital management and software
- Ultrasonic trash can sensor
- Solar-powered trash compactor
- Image-based trash can sensors
- Toogoodtogo
- Digital mapping
- Cloud-based life-cycle waste cost calculator

3.1 Digital Mapping

This is a digital technology that enhances the ability of community members to participate and lend their voices in corporate environmental management decisions. This is important because any corporate environmental approaches in the absence of the community would be lacking in stakeholder inclusivity and hence may fail to satisfy the community environmental expectations [4].

3.2 Cloud-based Life-cycle Waste Cost Calculator

amongst other difficulties associated with effective and efficient waste management, cost and revenue tracing appear to be the leading handicap as companies engaged in waste management would want to have a first-hand understanding of where and when their costs of waste management overshoots the revenue implicit. This is important, as managers prefer a waste management option with associated higher revenue to the cost implication at the end of the life cycle. Given the convolutions involved in waste management, cost and revenue tracing of waste management activities are somewhat intractable; hence, a digital cloud based cost calculator becomes a veritable solution to assist sustainable managers in their waste management activities. Therefore, in addition to using the modern digital waste management alternatives, organisational managers should also consider easing the difficulties of cost and revenue analysis by innovating their cost and revenue tracing activities toward the installation and usage of cloud-based life-costing waste management calculator [5]. This innovation would help managers to visualise and compare the full cost and revenue involved in alternative waste management and therefore decide on the option that affords the lowest cost in addition to achieving sustainable waste management objective. The foregoing is an effort to match digital waste management with digital cost and revenue estimation to strive toward a balance between ecologically sustainable operations with financial objectives of the organisation.

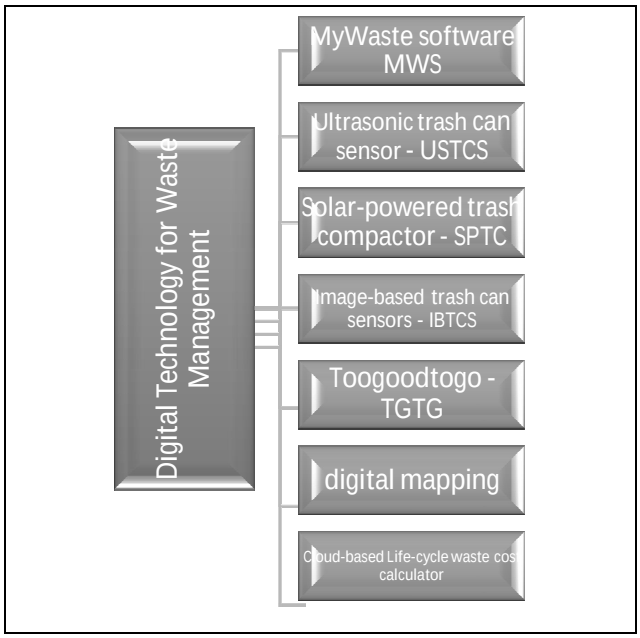

Figure 1: Framework for Digital Technology Application in Corporate Environmental Management

3.3 Mywaste Digital Management and Software

MyWaste is part of the ongoing innovation brought about by technology innovations of the 21st century, which is rooted on the platform of internet of things (IoT) technology. My waste application is built to enhance the user's ability to spot nearby

waste sites where waste can be disposed, including time scheduling of waste collections, container capacity monitoring, and etcetera. Given the ability of the application to offer options and varieties, citizens are able to engage in an improved sustainable and healthy form of waste disposal [6].

3.4 UltrasonicTrash Can Sensor

Ultrasonic trashcan sensors are digitally connected waste bins, which enables the user to have an interface with the bins for enhanced waste disposal. The sensors have digital antennae that are capable of detecting the volume of waste filling in the waste bins. On detection of the level, it automatically transmits information signal, which alerts the disposal office through a mobile software about the site. This instant alert about the status of waste containers elicits prompt waste removal action from the concerned local council office in charge of waste removal [7].

3.5 Other Technology

The Solar-powered trash compactor is a waste management design, which has the ability to compress the quantity of waste more to less than 6 times the original size. The aim, amongst others is to create more space in the waste tank and to ease transportation cost. The system is solar-powered and has an inbuilt wireless system for automatic alert [8]. A tedious job in waste management, which the digital technology is assisting to reduce is manual sorting of plastics and bottles. The Image-based trashcan sensors are equipped with digital sensors to identify trashcans or bags with plastics or bottles and send signal to the staff in charge. In addition, a mobile application developed in Europe popularly referred to as TGTG or (toogoodtogo) is used to avoid throwing away good but unsold food from restaurants [9].

4. CONCEPTUAL FRAMEWORK

Given the foregoing discussions on emerging digital technology application to waste management, this paper prepares the below conceptual framework for future empirical research analysis. It hinges on the speed, exactness and cleaner effects accruable from digital application and proposes (in the framework) that a joint combination of these digital apparatuses has the potential to enhance a more sustainable waste management (see Figure 2).

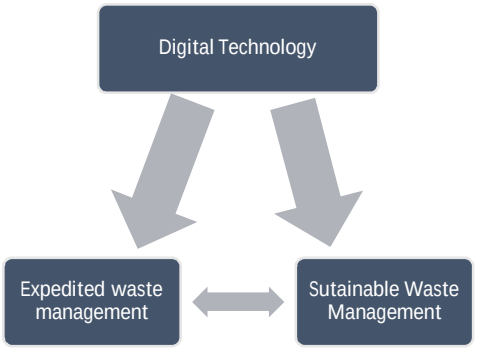

Figure 2: Conceptual Framework Of Digital Impact On Waste Management

5. CONCLUSION

The accelerating development of digital application to waste management provides exciting revolution to sustainable waste control. Thus, information technology is proving buoyed toward unlocking new opportunities for waste management practitioners, public policy on waste to accelerate waste management and education for the academy and students to achieve enhanced technology-driven waste control careers and enrich the lives of citizens through a healthy environment. This paper highlights the importance of utilising the unprecedented digital technology boost to widen the current and future trajectory of waste management and accountability. The interesting dimension is that the emerging waste management technology is not only of the high-tech genre, rather it is diversified, simplified and tailor-made for application by majority of citizens that have access to digital gadgets such as cell phone, IPad, laptops and etcetera. This paper has only opened an avenue to theorising digitalisation of waste management through a miniature framework. A diversification of this maiden framework is apposite to provide a much broader and perhaps an interdisciplinary cohesion in waste management via digital technology. Despite the minute nature, it does provide a catalyst to pummel further thoughts and writings in this important dimension of sustainable development goal. For the government and policy makers, it is incontrovertible that finance and education is a fundamental recipe to unlock the wealth of values, which digitalisation may offer to the campaign for sustainable waste management.

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