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Sustainable Waste Management and Organizational Performance of Food and Beverage Firms in Nigeria

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Abstract
The Indonesian government is currently focused on improving the quality of Human Resources (HR), particularly in the fields of science and technology, to address the challenges of the Industrial Revolution 4.0. In response, the Ministry of Education, Culture, Research, and Technology (Kemendik budristek) launched the Merdeka Belajar-Kampus Merdeka (MBKM) policy through Permendikbud No. 3 of 2020, reinforced by Permendik budristek No. 53 of 2023. This policy encourages universities to develop flexible curricula, allowing students to take learning experiences outside their study programs for up to three semesters. One of the MBKM initiatives is the Teaching Assistant Program (Kampus Mengajar), where students contribute to strengthening literacy, numeracy, and technology application in partner schools, including those in remote areas.

This study analyzes the implementation of the Teaching Assistant Program at SD Negeri Masangankulon, Sidoarjo, focusing on improving the learning quality of 5th-grade students in subjects such as Bahasa Indonesia, Mathematics, Science and Social Studies (IPAS), and Civics (PKN). The research method includes participatory observation, learning mentoring, and competency-based evaluation. The results show an increase in student motivation, mastery of literacy and numeracy, and creativity in the learning process. Student participants also experienced improvements in pedagogical skills, environmental adaptation, and social awareness. The main challenges include technological infrastructure gaps in partner schools and the need for intensive mentoring by supervising lecturers.

This study recommends strengthening the program through: (1) pre-participation training for students, (2) collaboration with local education offices, and (3) the use of digital technology to support learning. With optimal implementation, the Teaching Assistant Program not only contributes to educational equity but also prepares students to become competent and character-driven future leaders.

Keywords: Waste reduction; Resources conservation; Waste recycling; Employee health and safety

1. Introduction

Waste is any substance or material which requires to be disposed of as being broken, worn out, contaminated or otherwise spoilt and as such lost its usefulness (Nnadi & Uba, 2022) [13]. It could be in liquid or solid form and could be hazardous. These classification ranges from garbage or refuse from homes and other places where human or animal lives exist. Good waste management practices have a significant impact on a company's operational performance because they increase service delivery efficiency, lower operational costs through effective operations, shorten the time it takes to provide services, improve service quality, and increase productivity (Yamima, Osei, & Adzati, 2024) [22]. As a result, organizations image is improved in the eyes of the public enhancing company's competitive advantage.

Any organization's success is heavily reliant on its ability to adapt to an ever-changing internal and external environment. Implementation of optimal waste management systems minimizes operational cost through waste minimization and efficient manufacturing processes (Amin, Alabi & AbdulRasheed, 2024) [4]. Waste management also helps organizations improve their hygiene standards, which in turn improves the quality of their services and products. Waste management is concerned with the input of resources as well as the totality of systems and processes involved in the operation of any organization. Firms must practice best waste management practices in order to manage costs effectively, manage operations efficiently, and have a flexible undertaking (Nwosu & Chukwueloka, 2020) [14]. Thus, waste disposal methods used by businesses have an impact not only on the environment but also on operational performance. As large users of consumer goods, the growth of the manufacturing industry in Nigeria,

The significance of manufacturing waste reduction in Nigeria has the potential to save companies up to 20% in operational costs with help of waste reduction strategy (Chikezie, Adedeji, Onihunwa, Meduna, Joshua, 2023) [8]. Effective waste management practices may have the capacity to improve sustainability and drive profitability. Key strategies for manufacturing waste reduction in Nigeria include adopting lean manufacturing principles, utilizing advanced technologies for real-time monitoring, and fostering employee involvement through targeted training. These efforts not only enhance resource efficiency but also elevate a company's reputation among eco-conscious consumers. The waste reduction strategies can lead to sustainable growth and operational success.

In the Nigerian food and beverage industry, implementing effective waste recycling strategies can significantly improve performance by reducing operational costs, enhancing environmental sustainability, and boosting resource efficiency. Waste generated by the food and beverage industry contributes significantly to environmental degradation. Globally, nearly 1 billion tonnes of food is wasted each year, and food waste is responsible for 8-10% of global GHG emissions (Bullem & Essien, 2018) [7]. As the volume of waste and its consequences escalate, effective waste management in the food and beverage industry will be crucial, not only for reducing the sector's environmental footprint, but also for ensuring its long-term profitability and sustainability.

1.2. Statement of the Problem

Over time, these solid packaging items used by the food, beverage, and brewery industries have constituted nuisance to the human environment and have become hazardous to ecosystems, water animals, and wildlife (Dieke & Ugwu, 2024) [10]. The global population around the world is increasing, and protecting public health and the environment has become a matter of concern (Sunarti, Nuryana, Buyamin & Permatasari, 2024). The food packaging industry's solid waste pollution poses significant environmental and health risks, including air and water contamination, resource depletion, and potential harm to wildlife and human health, especially in areas with poor waste management.

Irresponsible disposal of food packaging materials leads to soil, water, and air pollution. The production of packaging materials, especially plastics, relies heavily on non-renewable resources like fossil fuels, contributing to resource depletion. Landfills, where much of this waste ends up, can contaminate soil and release harmful leachate, impacting agricultural land and ecosystems. The production and disposal of packaging materials, particularly plastics, can contribute to greenhouse gas emissions, exacerbating climate change. Plastic waste can harm wildlife by ingestion, entanglement, or habitat destruction, leading to biodiversity loss. Plastic packaging ends up in oceans, harming marine life and ecosystems, and impacting fisheries and tourism. Landfills containing food packaging waste produce methane, a potent greenhouse gas, contributing to climate change.

The main challenges facing waste management include inadequate financing, poor infrastructure and technology, a lack of public awareness of good sanitary practices, and inadequate legal and regulatory (Anokye, *et al*, 2023) [5]. Proper management was not a major issue as the population was within the control range of society, and a vast amount of land was available to the population at that time for land fillings. The environment can easily absorb the volume of waste produced without degradation (Ahmed & Ahmaruzzaman, 2022) [3]. It is against these developed assertions that this study was carried out to investigate the effect of sustainable waste management on organizational performance of Food and Beverage Firms in Nigeria.

1.3. Objective of the Study

The main objective of this study was to examine the effect of sustainable waste management on organizational performance of Food and Beverage Firms in Nigeria. The specific objectives were to:

1. Evaluate the effect of waste reduction strategy on resources conservation of Food and Beverage Firms in Nigeria.
2. Ascertain the effect of waste recycling strategy on employee health and safety of Food and Beverage Firms in Nigeria.

1.4. Research Questions

The study aimed to answer the following questions

1. What is the extent to which waste reduction strategy affects resources conservation of Food and Beverage Firms in Nigeria?
2. To what extent does waste recycling strategy affects employee health and safety of Food and Beverage Firms in Nigeria?

1.5. Significance of the Study

This study would be beneficial and important to the following groups of individuals and groups namely: government, staff and customers

1.5.1. Government: It would assist the government to see the need to promote manufacturing firms especially in the area of environmental changes that will enhance and sustains the firms for growth.

1.5.2. Organizations: Irrespective of how proper their programmes were articulated they had to take cognizance of their environment because of consequence of poor waste management can bring to environment. It was on this perspective that the significance of this work could not be understated;

1.5.3. The Researcher: The researcher also stands to gain from the work because it will give a direction to the researcher on how to scan the environment before starting any business for better economic development.

1.6. Limitations of the Study

Waste includes solid, liquid, and gas components. However, prior studies have focused on other forms of waste and industrial goods manufacturing firms, specifically liquid and solid waste, as the interest area covered only food and beverage manufacturing firms.

2. Conceptual Literature

2.1. Sustainable Waste Management:

The conventional approach of waste management has been to manage the removal of solid discards from the immediate vicinity of human settlements. This resulted in the mechanized systems of collection and transportation of waste in the industrialized countries and landfills to bury waste. In the later part of the twentieth century, it was realized that societies will not be able to master the waste avalanche. The waste management has to change it focus from "efficient removal" to waste avoidance, minimization and recycling options with higher priority. Solid waste contains organic waste, plastics, papers, glass, mental and inert substance (Benjamin, Regasa, Wellalage & Marathamuthu, 2020) [6].

Carbon and nitrogen-based organic waste from kitchen, market and abattoir is a source of rich organic manure or energy. Plastics, papers, glass and metals are recycled into new products. Debris can be recycled and earth and inert waste used as landfill cover. This helps in conserving natural resources and also generates employment. Promotion of waste recycling sector and providing that with an institutional support can therefore be in tune with the goals of sustainable development ()Gollakota, Gautam & Shu, 2020) [11].

The concept waste management could be described as the appropriate method of disposing wastes safely in such a way that makes it less harmful. It could come in form of treatment and energy conservation. It refers to the process of collecting and treating solid waste. It also offers solutions for the recycling items that do not belong to garbage or trash (Davidson, 2021) [9]. Solid waste management consists of all the activities required to manage waste from its inception to it final disposal. The concept of sustainable waste management describes the basic principles and recent advances for handling waste in an environmentally sustainable way. It refers to efficient, safe, treatment and disposal of hazardous and other waste. It is a strategy for achieving environmental quality in both the developing and developed world (Abubakar, *et al* 2022) [1].

Most common types of waste in the food and beverage industry

Waste in the food and beverage industry is endemic with far-reaching environmental consequences. The disproportionately large amount of food and packaging waste that accumulates in landfills and waterways, coupled with the sector's highly water-intensive nature, means this industry will have an important part to play in combating the ongoing environmental crisis. Gollakota, Gautam and Shu, (2020) [11] enumerated most common types of waste in the food and beverage industry.

Food waste

Food waste occurs throughout the *supply chain*. For instance, agricultural produce can be rejected at source, due to cosmetic or quality control standards, or during storage and transportation, where it is frequently damaged or spoiled. Later, at a retail level, food may be discarded for any number of reasons including inaccurate demand forecasting, inventory mismanagement, or the need to dispose of unsold food nearing its expiration date. Additionally, food manufacturers and service establishments often contribute to waste during the processing and preparation stages, where significant amounts of food or byproducts are discarded.

Packaging waste

The food and beverage industry also generates a significant amount of packaging waste. While packaging is necessary to protect and preserve food and beverages, the amount of packaging waste that is generated by the food and beverage industry is enormous. For instance, it is estimated that *food packaging* materials make up almost half of all municipal solid waste in the USA.

Food packaging also has a detrimental effect on the world's oceans, with single-use bottles, food wrappers, take-away food containers, disposable cups, and single-use straws and cutlery accounting for 35% of the litter found in marine ecosystems.

Water waste

The food and beverage industry is also highly water intensive and faces mounting pressure to reduce its water usage. At present, the food and beverage industry accounts for as much as 75–80% of global freshwater consumption. This is particularly concerning given the looming global water crisis, with experts within the United Nations predicting a 53% shortfall in global water supply by 2050, and a 40% global freshwater deficit as early as 2030.

Waste management strategies

The most waste management strategies includes waste prevention, placing it above the following less favourable options, reuse, recycling, recovery, and disposal.

Prevention

Waste prevention is naturally the preferred option for food and beverage businesses. This involves reducing waste generation at source, as well as throughout the supply chain. Some of the most common waste prevention strategies include lean manufacturing techniques, such as Value Stream Mapping (VSM), Just-In-Time (JIT) management, and Six Sigma. Collectively these techniques help businesses visualise the flow of materials within the production process, identify where waste occurs, minimise production defects and ultimately reduce waste at each stage of production (Tonye-Barasin, 2020) [18]

Recently waste prevention has been further enhanced by advanced technologies. Increasingly, AI and smart sensors are being used to optimise stock levels, prevent overproduction, reduce food spoilage, and alert food and beverage manufacturers to potential issues before waste occurs. While further up the supply chain, these technologies are being used to reduce waste via improved harvesting techniques and enhanced crop monitoring (Nnadi & Uba, 2022) [13].

Waste prevention also extends to water use and many food and beverage companies are taking steps to reduce water consumption. These steps include: Training employees on water conservation techniques, optimising clean-in-place systems and more precisely calibrating filling machines. Such initiatives have brought about notable reductions in water withdrawal, with numerous clients reporting a 20% decrease in water usage following process optimisations (Yamima, Osei & Adzati, 2024) [22]. In addition to this, other companies, such as Coca-Cola and PepsiCo, have gone one step further and established local watershed conservation projects and community access initiatives that aim to achieve long-term water security within neighbouring communities.

Reuse

Reusing products or materials is considered the next best option, as it extends their lifespan and avoids disposal. At the manufacturing level this often takes the form of repurposing food byproducts for *animal feed*, while further down the supply chain the most common examples are food retailers, restaurants and cafés redistributing surplus food to charities or food banks (Ugwu, Ozoegwu, Ozor, Ndukwe & Mbohwa, 2021) [20].

In addition to reusing surplus foods, many food and beverage manufacturers are resisting the temptation to switch to new machinery by refurbishing existing equipment. Machinery maintenance programs have proved to be particularly effective in this regard. They reduce capital expenditure, improve overall equipment effectiveness and contribute to food waste reduction. They also extend the life of machine parts and materials, preventing them from ending up in incinerators or landfills.

Recycling

Many of the food and beverage industry's biggest players are designing their packaging with materials that can be easily recycled and are incorporating a greater proportion of recycled materials into their packaging. For example, Coca-Cola has pledged to make 100% of its packaging recyclable by 2025 and use 50 percent recycled PET resin in its bottles by 2030 (Onamade, Alagbe, Dare-Abel & Daramola, 2022) [16].

At the same time, a growing acknowledgement of the operational risks associated with the global water crisis has prompted many food and beverage companies to undertake water recycling Initiatives. Reverse osmosis and numerous other wastewater treatment options, such as ultrafiltration and nanofiltration, have become widely adopted within the food and beverage industry as producers look to recycle wastewater and improve water use efficiency.

Recovery

Waste recovery typically involves extracting energy (or other resources) from waste that cannot be reused or recycled. The most common form of this happens within bioreactors. Using anaerobic digestion, numerous food and beverage companies have been able to recover energy from wastewater and organic solid waste, use this power to fuel other processes within the company (Ogunmakinde, Sher & Maund, 2019) [19]. For instance, in Fort Worth, Texas, the Molson Coors Brewing Company's on-site anaerobic waste pretreatment system supplies about 10% of the gas needed for the brewery's steam boilers. Elsewhere, innovative enterprises are working on everything from converting coffee waste into biofuels to processing animal waste into compressed natural gas (CNG).

Disposal

Disposal is the least preferred form of waste management in the food and beverage industry as it involves discarding waste without recovering any value. Naturally, this has significant environmental drawbacks, including greenhouse gas emissions and groundwater contamination. In the United States, food waste accounts for about 22% of all municipal solid waste in its landfills. This waste costs ~1.9 billion USD in disposal fees and contributes ~340 million tonnes of CO2 emissions (Lu, Zhang, Hai & Lei, 2017).

Globally, the stakes are equally high, and the opportunities for improvement are substantial. Preventing, reusing, and otherwise valorising industrial food waste within the food and beverage industry could help mitigate approximately 190 million tonnes of CO2 equivalent greenhouse gas emissions and recover billions in lost revenue.

2.2. Organizational Performance

Organizational performance refers to the degree to which the organization, with some informational, financial, and human resources, positions itself effectively on the business market (Yamima, Osei &Adzati, 2024) [22]. Organizational performance comprises the actual output or results of an organization as measured against its intended outputs (or goals and objectives). Amin, Alabi and AbdulRasheed, (2024) [4] stipulated that organizational performance is also the success or fulfillment of an organization at the end of a program or project, as intended. According to Chikezie, Adedeji, Onihunwa, Meduna, Joshua, (2023) [8] organizational performance encompasses three specific areas of firm outcome: (a) financial performance (profits, return on assets, return on investment, etc.), (b) product market performance (sales, market share, etc.), and (c) shareholder return (total shareholder return, economic value added, etc.). Achieving organizational performance depends largely on how an organization adapts to changes in its external environment. Agbo and Egbunike (2024) added that the financial performance of organization is greatly dependant on climate change of distinct countries. According to Dieke and Ugwu, (2024) [24], performance within an organizational setting includes integrating a pleasant work environment that is safe and secure for employees to bring out their best qualities, positive relationships, and communication within organizations, and highlighting a significant positive sense of work (Udodiugwu, 2024) [19].

2.3. Contextual Literature

2.3.1. Waste Reduction Management and Resource Conservation

Waste reduction is anything that reduces waste by using less material in the first place. Reducing waste can be as simple as using both sides of a sheet of paper, using ceramic mugs instead of disposable cups, or buying in bulk rather than individually packaged items. The end result for producing less waste is money saved, resources conserved, pollution reduced, and landfill space saved (Unwana & Idongesit, 2023) [21].

The idea is *not to generate waste*, but to *reduce waste at or near the source of generation* (in our homes, businesses, and institutions). Practicing waste reduction and reuse are the best ways to divert the growing volume of waste. Reducing waste

reduces needless consumption. Reducing needless consumption preserves renewable and non-renewable resources. Reducing waste conserves energy and reduces the air, soil, and water contamination that is often caused by the manufacture of those materials and supplies that become waste, and from the fossil fuel powered transportation that delivers those goods and hauls them away after they become waste. Reducing waste also reduces the use of landfills and resource recovery facilities (Sunarti, Nuryana, Buyamin, Permatasari, 2024).

In the option of Udodiugwu, (2024) [19], waste reduction, also known as source reduction, means minimizing the amount of waste generated by decreasing or eliminating the use of materials and resources in the first place. Waste reduction focuses on preventing waste from being created in the first place, rather than just managing it after it's been generated. The strategies for waste reduction include buying products in bulk instead of single servings; choosing products with less packaging, avoiding single-use items; composting food waste, suing reusable containers and bags. The benefits derived from waste reduction were reduces the need for landfills and waste disposal facilities; conserves resource and reduces environmental impact and can save money by reducing the need to purchase replacement items.

2.3.2. Waste Recycling/Compositing and Employee health and safety

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials, such as empty beverage containers, which can be in plastic or aluminum forms (Ahmed & Ahmaruzzaman, 2022) [3]. However, this process involves breaking down and reusing materials that are otherwise discarded as waste or trash. There are several benefits of recycling, and with so many new technologies making even more materials more recyclable, it is possible to clean up the Earth surface through the invention of recyling (Benjamin, Regasa, Wellalage, & Marathamuthu, 2020) [6].

According to Davidson, (2021) [9] recycling not only benefits the environment but also positively affects the economy of a nation. The materials from which items are made can be converted into new products. Materials for recycling may be collected separately from general waste using dedicated bins and collection vehicles in a procedure called kerbside collection. In the option of Gollakota, Gautam and Shu, (2020) [11], recycling reduces the need for purchasing raw materials and minimizes the cost of waste disposal, allowing businesses to allocate resources more efficiently. Recycling helps conserve natural resources, reduces pollution, and promotes a more sustainable approach to production, which can improve the industry's image and attract environmentally conscious consumers.

In the option of Ogunmakinde, Sher and Maund, (2019) [15], recycling transforms waste materials into valuable resources, improving the overall efficiency of the industry and reducing reliance on virgin materials. Efficient waste management systems can lead to better hygiene standards, improved production processes, and enhanced employee morale. Recycling can create new economic opportunities, such as the development of recycling industries and the creation of jobs in the waste management sector. Implementing sustainable waste management practices can improve the brand image of food and beverage companies, making them more attractive to customers and investors. As environmental regulations become stricter, companies that implement effective waste recycling strategies are better positioned to comply with these regulations and avoid potential penalties.

Onamade, Alagbe, Dare-Abel and Daramola, (2022) [16] opined that recycling reduces the amount of waste sent to landfills, which can help mitigate the negative environmental impacts of waste disposal, such as pollution and greenhouse gas emissions. By prioritizing waste recycling, the food and beverage industry can ensure its long-term sustainability by conserving resources and reducing its environmental footprint. Recycling can also drive innovation in the food and beverage industry, as companies explore new ways to use recycled materials and develop new products.

2.4. Theoretical Literature

2.4.1. The Zero Waste Theory

The term ‘Zero Waste” was first coined in 1973 by Paul Palmer, a chemist whose company, Zero Waste Systems, was established to reduce the amount of chemical waste in laboratories across the United States. Following the success of the assignment, the term which later became a practice rose into a movement in the late 1990s and has been adopted as a theory for explaining the process of sustainable waste management over the years (Walsh, 2017).

The theory posits that getting rid of or disposing of the waste is not the best form of waste management but rather, such waste is maximized through recycling and conserved through responsible production, consumption, reuse and recovery, packaging with burning them to prevent the risks of discharges to land, water, or air that threaten the environment or human health. The theory proposes a whole systems approach that aims for a massive change in the way materials flow through society, resulting in no or zero waste. This approach is the 5R approach which is defined as refuse, reduce, reuse, recycle, and rot (Vrachovska, 2022).

Extensively, the theory states that sustainable waste management does not only involve the recycling and reuse or proper disposal (which is also known as “rot” in the 5R) of waste but first, the refusal of wastes. The refusal of wastes here refers to the rejection of wastes or products that would constitute wastes from entering the household or an individual’s possession through certain preventive behaviours. For instance, carrying a refillable water bottle and hot drink cup to refuse plastic bottles and single-use cups is one of the strategies of refusal. With this in place, other aspects of sustainable waste management like reduction, recycling and reuse, and rot would be easier, and would substantially reduce or eliminate the act of sending wastes to landfills, incinerators, oceans or other parts of the environment, thereby causing harm to individuals and affecting socio-economic development (Bell, 2020, Snow & Dickson, 2001; Vrachovska, 2022). The theory has however been criticized for focusing too much on sustainable living which is dependent on a privileged amount of disposable income and time (Matossian, 2023).

The theory is relevant for the study in that it entrenches a systematic approach to sustainable waste management which reduces the impacts of waste on the environment, while also promoting the conversion of such wastes into new products which would be beneficial to society. In both facets, the reduction of impacts of waste on the environment means the attraction of socio-economic development through the reduction of health risks, promotion of job creation and revenue generation through industrialization and

manufacturing, accelerating urbanization, and promoting ease of business for food and beverage firms in a particular entity.

2.4.2. Empirical Literature

Udodiugwu, (2024) [19] investigated the impact of waste management on the performance of food and beverage firms in Nigeria. The specific objectives of the study were to: identify the influence of waste incineration on resources conservation and ascertain the influence of recycling on employee health and safety of food and beverage firms. The study surveyed nine (9) food and beverage firms, and data were collected with the use of questionnaire from a sample population of one hundred and fifty-one (151) respondents, through a simple random technique. The multiple regression was used to analyze the data obtained from the field of study. The findings from this study revealed a positive significant impact of recycling on resource conservation, while the second finding showed a negative impact of waste incineration on employee health and safety. The study recommended that solid waste in the form of leftover raw materials should be gathered during production processes in food and beverage firms and adequately utilized for new production, instead of throwing away. In addition, other solid waste materials in the form of beverage cans, bottles, and tins after usage should be landfilled and sent to parent companies for recycling.

Yamima, Osei and Adzati, (2024) [22] investigated the relationship between sustainability practices and operational performance within the oil and gas industry of Ghana. Specifically, the study sought to examine the influence of social, economic and environmental sustainability practices on operational performance within the oil and gas industry. Using a cross-sectional design and a simple random sampling technique, the study targeted a population of 569 participants, of which 168 usable questionnaires were returned. The data analytical technique descriptive statistic (mean deviation). The study findings reveal that sustainable management practices significantly and positively predicted operational performance of firms in the oil and gas industry. It was further revealed that economic and environmental sustainability were highly embraced while social sustainability was poorly practiced. The study recommends future studies should focus on finding more efficient and sustainable management approaches to improve social sustainability practices, thereby enhancing operational performance in the oil and gas sector.

Amin, Alabi and AbdulRasheed, (2024) examined the strategies of environmental protection policies on sustainable waste management in Kwara and Oyo states in Nigeria. The specific objective of the study was to evaluate waste minimization and recycling strategies on environmental protection in Kwara and Oyo states. The population of this study was 11,170,478 while the sample size was 400. Out of 400 questionnaires distributed, 363 were correctly filled, retrieved and analyzed. Despite growing concerns about the adverse environmental impacts of improper waste management practices, many regions and communities continue to struggle with inadequate strategies for waste disposal and recycling.

It is presumably observed that there is a lack of effective strategies for the implementation of environmental protection towards sustainable waste management in Kwara and Oyo States. The report suggests that the governments of Kwara and Oyo states develop recycling and treatment facilities as well as more dumpsites. Priority should be given to environmentalists during the hiring, placement, and selection processes.

Chikezie, Adedeji, Onihunwa, Meduna, Joshua, (2023) [8] determine waste management practices influencing the operational performance of hotels in Lagos State, Nigeria. The specific objective of the study was to identify the influence of waste reduction, reuse, recycling, waste collection and depositing and waste composing. The 120 structured questionnaire that was administered to 20 hotels. Results showed that waste management practices in hotels are very important (3.83), while levels of their operational performance are to a large extent (3.16). Linear Regression showed that waste reduction, reuse and recycling practices ($\beta = 0.383$), waste collection and depositing practices ($\beta = 0.413$) and waste composting and treatment practices ($\beta = 0.258$) significantly ($p<0.05$) influenced the operational performance of hotels in the study area. The study concluded that waste reduction, reuse, recycling, waste collection, depositing, composting and treatment practices are important contributors in determining the operational performance of hotels. It was recommended that waste management guiding principles, framework and policies be developed and communicated to all stakeholders for proper and effective implementation.

Tonye-Barasin, (2020) [18] examined the relationship between recycling and marketing effectiveness of food and beverages firms in Rivers state, Nigeria. An extensive literature review was carried out covering the study variable and measure. The study adopted cross-sectional survey framework. Fourteen (14) food and beverage firms in Nigeria, listed in the Nigerian Stock Exchange Facts Book of 2017/2018 constituted the population of our study. Eighty-Four (84) respondents were drawn from the Fourteen (14) food and beverage firms under review. A self-administered, structured questionnaire was employed to obtain primary data and data was analyzed. The research hypotheses were tested with the Pearson product moment correlation statistical tool to establish the degree of relationship. The data analytical technique was descriptive statistic (simple percentage and mean). The study found that; recycling is positively and significantly related to marketing effectiveness. Based on the results of the analysis, the paper concludes that recycling has a positive and significant relationship with marketing effectiveness. The study recommends that; effort should be made by the organizations in the food and beverages industry to develop better understanding of recycling strategies as a matter of necessity.

2.4.3. Literature Gaps

There exists research gap between this study and past researches.

The research gap covers subject gap, gap on geographical location of the study, gap on the variables and contents of the study and gap on methodology.

Contents of the study: This study addresses one of the major issues related to global warming that occurs as a result of waste dumping and excessive burning. This study has helped curb these challenges by recycling waste and conserving untapped resources for sustainable performance and the healthy coexistence of humans.

Subject gap: The subject matter of this work and some reviewed empirical studies has some differences. There are

limited studies on effect of sustainable waste management on organizational performance of Food and Beverage Firms in Nigeria. The study is geared to bridge the time gap in literature.

Gap on geographical location of the study: This work covers Food and Beverage Firms in Nigeria and specifically Food and Beverage Firms that operate in South East. None of the past studies used the Kaptain Foods Ltd, Emerald Food and Nutrition Intl, Nestlé Nigeria Plc, International Breweries Plc as mentioned and most of the past studies were done outside South East Nigeria.

Gap on the variables and contents of the study: The variables used in this study includes waste reduction strategy and waste recycling strategy (for independent variable) and resources conservation and employee health and safety (for dependent variable) were not used by past researches.

Gap on methodology: The data analytical techniques used in this work in some ways differ from what was employed from past researches. The data analytical technique of the study was single regression method. The statistical technique was chosen because of its basic properties of best Linear, unbiased and efficient (BLUE) estimators. It is best for impact analysis.

3.1. Methodology

Study area was Nigeria. The research design of the study was descriptive survey design. The study used structured questionnaire to obtain data. The choice of location was based on proximity, effective coverage and cost minimization. The population of the study comprised of 153,000 staff of 17 quoted Food and Beverage Firms in Nigeria. Simple random technique was used to select four Food and Beverage Firms namely: Kaptain Foods Ltd, Emerald Food and Nutrition Intl, Nestlé Nigeria Plc, International Breweries Plc. The sample size of 321 respondents was drawn from population of the study using Freund and Williams sampling technique. Research questions were answered using frequency, mean and standard deviation. The hypotheses stated were tested using single regression statistic.

3.2. Data Presentation and Analysis

Table 1: Comprehensive Demographic distribution of Respondents

Title	Frequency	Percentage
Questionnaire Distribution		
Questionnaires Distributed	321	100%
Returned Questionnaires	290	82%
Not Returned Questionnaires	31	18%
Gender		
Female	164	56.6%
Male	126	43.4%
Age Bracket		
20-30 Years	90	31.0%
31-40 Years	126	43.4%
41-50 Years	71	24.5%
51Years – above	3	1.0%
Marital Status		
Married	205	70.7%
Single	58	20.0%
Widow/widower	24	8.3%
Divorce	3	1.0%
Educational Qualification		
OND/NCE/HND	54	18.6%
B.sc/B.Ed	236	81.4%

***Sources*:** Field Survey, 2025

Three hundred and twenty-one (321) copies of questionnaire were designed and distributed to the respondents. Out of the 321 Questionnaires distributed, 290 (90%) were completed and returned while 31 (10%) were not returned. Therefore, 90 percent respondents were a good representation. The table showed the respondents profile in frequency and percentage distribution of gender, age bracket, marital status, and educational qualification.

3.2. Data Analysis

Question (1) What is the extent to which waste reduction strategy affects resources conservation of Food and Beverage Firms in Nigeria?

Table 2: Responses of respondents on what is the extent to which waste reduction strategy affects resources conservation of Food and Beverage Firms in Nigeria

S/N	Question Items	SA 4 (%)	A 3 (%)	DA 2 (%)	SD 1 (%)	Total	Mean	SD
1	Practicing waste reduction and reuse are the best ways to divert the growing volume of waste. Reducing waste reduces needless consumption.	99 396 (34)	119 357 (41)	42 84 (14)	30 30 (10)	290 867 100%	2.99	0.0287
2	Reducing waste conserves energy and reduces the air, soil, and water contamination that is often caused by the manufacture of those materials.	120 480 (41)	78 234 (27)	62 124 (21)	30 30 (10)	290 868 100%	2.99	0.0917
3	Practicing waste reduction eliminate cost of transporting waste to incineration and also reduces the use of landfills and resource recovery facilities.	123 419 (42)	101 303 (26)	56 112 (35)	10 10 (3)	290 844 100%	2.91	0.0389
4	Waste reduction focuses on preventing waste from being created in the first place, rather than just managing it after it's been generated.	190 760 (66)	50 150 (17)	26 52 (8)	24 24 (8)	290 986 100%	3.40	0.0528
5	Practicing waste reduction conserves resources and reduces environmental impact and can save money by reducing the need to purchase replacement items.	100 400 (34)	140 420 (48)	26 52 (8)	24 24 (8)	290 896 100%	3.09	0.0109
	Grand Mean						3.08	0.0446

Mean Score = $\frac{30*4+42*3+119*2+99*1}{290}$ = 2.010

This table shows that the respondents indicated their option on what is the extent to which waste reduction strategy affects resources conservation of Food and Beverage Firms in Nigeria. The respondents are in agreement with all the items. The research items 1,2,3,4,5 have mean score of above 3.5 point respectively and it was rated great extent by respondents. The study revealed that waste reduction strategy has significant effect on resources conservation of Food and Beverage Firms in Nigeria since waste reduction focuses on preventing waste from being created in the first place, rather than just managing it after it's been generated (Grand mean (3.08) is greater than cut-off mean (2.5).

Question (2) To what extent does waste recycling strategy affects employee health and safety of Food and Beverage Firms in Nigeria?

Table 3: Responses of respondents on what extent does waste recycling strategy affects employee health and safety of Food and Beverage Firms in Nigeria?

S/N	Question Items	SA 4 (%)	A 3 (%)	DA 2 (%)	SD 1 (%)	Total	Mean	SD
1	Recycling helps conserve natural resources, reduces pollution, and promotes a more sustainable approach to production.	101 404 (35)	144 432 (49)	30 60 (10)	15 15 (5)	290 911 100%	3.14	0.250
2	Recycling transforms waste materials into valuable resources, improving the overall efficiency of the industry and reducing reliance on virgin materials.	112 448 (37)	102 306 (35)	40 80 (14)	36 36 (12)	290 870 100%	3.00	0.293
3	Recycling can create new economic opportunities, such as the development of recycling industries and the creation of jobs in the waste management sector.	109 436 (38)	98 294 (34)	45 90 (16)	38 38 (13)	290 858 100%	2.96	0.2693
4	Practices waste recycling can improve the brand image of food and beverage companies, making them more attractive to customers and investors.	112 448 (38)	98 294 (33)	50 100 (17)	30 30 (10)	290 872 100%	3.01	0.314
5	Recycling reduces the amount of waste sent to landfills, which can help mitigate the negative environmental impacts of waste disposal, such as pollution and greenhouse gas emissions.	114 456 (39)	106 318 (36)	50 100 (17)	40 40 (14)	290 914 100%	3.15	0.306
	Grand Mean						3.05	0.291

This table shows that the respondents indicated their option on what extent does waste recycling strategy affects employee health and safety of Food and Beverage Firms in Nigeria. The respondents are in agreement with all the items. The research items 1,2,3,4,5 have mean score of above 3.5 point respectively and it was rated great extent by respondents. The study revealed that waste recycling strategy has significant effect on employee health and safety of Food and Beverage Firms in Nigeria since practices waste recycling can improve the brand image of food and beverage companies, making them more attractive to customers and investors. (Grand mean (3.05) is greater than cut-off Mean (2.5).

4.1. Test of Hypotheses

The three hypotheses were formulated for this study and will be tested and a decision taken is based on the rule below.

4.2. Decision rule: Reject Hi if P-value > 0.01

4.2.1. Hypothesis One

H_2 = Waste reduction strategy has no significant effect on resources conservation of Food and Beverage Firms in Nigeria?

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.931[a]	.866	.865	.26055
a. Predictors: (Constant), Waste reduction strategy				

ANOVA[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	57.077	1	57.077	18.604	.000[b]
	Residual	886.652	289	3.068		
	Total	943.729	290			
a. Dependent Variable: Resource conservation						
b. Predictors: (Constant), Waste reduction strategy						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	1.614	.089		18.111	.000
	Waste reduction strategy	.529	.082	.931	6.446	.000
a. Dependent Variable: Resource conservation						

In testing this hypothesis, waste reduction strategy was regressed against resources conservation. The result of the single-regression analysis showed the model to evaluate the effect of waste reduction strategy on resources conservation of Food and Beverage Firms in Nigeria.

4.2.2. Resource conservation = 1.614 + 0.529 Waste reduction Strategy

The empirical result showed that the coefficient of waste reduction strategy has positive impact on resources conservation; it means that waste reduction strategy has positive and direct impact on resources conservation. The results of the t – statistics denoted that the coefficient of waste reduction strategy was statistically significance. This is because observed values of t – statistics (6.446) was greater than its P-values (0.000). The results of the F – statistical test showed that the overall regression of the hypothesis two was statistically significance. This was because observed value of the F – statistics (18.604) was great than its P-value (0.000). Again, our empirical result showed that the Pearson product moment correlation analysis (r) was 0.931. The strength of relationship between the two variables was high. However, we rejected the null hypothesis and concluded that waste reduction strategy has positive and significant effect on resources conservation of Food and Beverage Firms in Nigeria.

4.3. Test of Hypothesis Two

H_2 = Waste recycling strategy has no significant effect on employee health and safety of Food and Beverage Firms in Nigeria.

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.931[a]	.866	.865	.26055
a. Predictors: (Constant), Waste recycling strategy				

ANOVA[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	43.789	1	43.789	9.184	.000[b]
	Residual	1377.952	289	4.768		
	Total	1421.741	290			
a. Dependent Variable: Waste recycling strategy						
b. Predictors: (Constant), Employee health and safety						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.418	.075		5.568	.000
	Waste recycling strategy	.201	.017	.969	11.826	.000
a. Dependent Variable: Employee health and safety						

In testing this hypothesis, waste recycling strategy was regressed against employee health and safety. The result of the single-regression analysis showed the model to ascertain the effect of waste recycling strategy on employee health and safety of Food and Beverage Firms in Nigeria.

4.4. Employee health and safety = 0.418 + 0.201 Waste recycling strategy

The empirical result showed that the coefficient of waste recycling strategy has positive impact on employee health and safety; it means that waste recycling strategy has positive

and direct impact on employee health and safety. The results of the t – statistics denoted that the coefficient of waste recycling strategy was statistically significance. This was because observed values of t – statistics (11.826) was greater than its P-values (0.000). The results of the F – statistical test showed that the overall regression of the hypothesis three was statistically significance. This was because observed value of the F – statistics (9.184) was greater than its P-value (0.000). Again, our empirical result showed that the Pearson product moment correlation analysis (r) was 0.931. The strength of relationship between the two variables was high. However, we rejected the null hypothesis and concluded that waste recycling strategy has positive and significant effect on employee health and safety of Food and Beverage Firms in Nigeria.

4.5. Discussion of Findings

Effect of waste reduction strategy on resources conservation of Food and Beverage Firms in Nigeria.

The findings of the study revealed that waste reduction strategy has significant effect on resources conservation of Food and Beverage Firms in Nigeria since waste reduction focuses on preventing waste from being created in the first place, rather than just managing it after it's been generated (t-statistic; 6.445; P-value; 0.000 < Sig-value; 0.05). The outcome of the study is in line with the study of Udodiugwu, (2024) [19] that investigated the impact of waste management on the performance of food and beverage firms in Nigeria. The specific objectives of the study were to: identify the influence of waste incineration on resources conservation and ascertain the influence of recycling on employee health and safety of food and beverage firms. The study surveyed nine (9) food and beverage firms, and data were collected with the use of questionnaire from a sample population of one hundred and fifty-one (151) respondents, through a simple random technique. The multiple regression was used to analyze the data obtained from the field of study. The findings from this study revealed a positive significant impact of recycling on resource conservation, while the second finding showed a negative impact of waste incineration on employee health and safety.

4.6. Effect of waste recycling strategy on employee health and safety of Food and Beverage Firms in Nigeria.

The findings of the study revealed that waste recycling strategy has significant effect on employee health and safety of Food and Beverage Firms in Nigeria since practices waste recycling can improve the brand image of food and beverage companies, making them more attractive to customers and investors.(t-statistic; 11.826; P-value; 0.000 < Sig-value; 0.05). The outcome of the study is not in line with the study of Yamima, Osei and Adzati, (2024) [22] that investigated the relationship between sustainability practices and operational performance within the oil and gas industry of Ghana. Specifically, the study sought to examine the influence of social, economic and environmental sustainability practices on operational performance within the oil and gas industry. Using a cross-sectional design and a simple random sampling technique, the study targeted a population of 569 participants, of which 168 usable questionnaires were returned. The data analytical technique descriptive statistic (mean deviation). The study findings reveal that sustainable management practices significantly and positively predicted operational performance of firms in the oil and gas industry. It was further revealed that economic and environmental sustainability were highly embraced while social sustainability was poorly practiced.

5.1. Summary of Findings

The following are the major findings of the study**:**

1. The study revealed that waste reduction strategy has significant effect on resources conservation of Food and Beverage Firms in Nigeria since waste reduction focuses on preventing waste from being created in the first place, rather than just managing it after it's been generated (t-statistic; 6.445; P-value; 0.000 < Sig-value; 0.05).
2. The study revealed that waste recycling strategy has significant effect on employee health and safety of Food and Beverage Firms in Nigeria since practices waste recycling can improve the brand image of food and beverage companies, making them more attractive to customers and investors.(t-statistic; 11.826; P-value; 0.000 < Sig-value; 0.05).

5.2. Conclusion

This study concluded that there is positive and significant effect of sustainable waste management on organizational performance of Food and Beverage Firms in Nigeria. Waste management is imperative for a sustainable environment and corporate growth. Management of organic and inorganic waste is strategically necessary for corporate sustainability.

This study revealed that waste management is crucial to the performance of food and beverage organizations by ensuring that waste materials are adequately recycled into useful resources, paving the way for the conservation of untapped natural resources. The study concludes that food and beverage firms should endeavor to queue into the technology of recycling waste and waste reduction and also avoid the waste management method of incineration of waste because it has a greater negative impact on the environment and humans. Elimination of waste in beverage industry has become a national and global issue as it affects the economy of nations. Therefore, the search for techniques that can completely eliminate waste in beverage industries in continuous.

5.3. Recommendations

Based on the findings of this study, the following recommendations were made.

1. Management of Food and beverage Firms should gather leftover raw solid waste during production processes and adequately utilized for new production, instead of throwing away. In addition, other solid waste materials in the form of beverage cans, bottles, and tins after usage should be landfilled and sent to parent companies for recycling.
2. Management of Food and beverage Firms should introduce waste separation at source, which has led to more effective waste management and also can help to recover valuable materials, reduce the volume of waste going to landfills, and minimize environmental pollution. The health and safety of employees and their communities is vital, so the idea of reducing solid waste by combusting it in incinerators should be totally avoided to eradicate its negative health consequences.

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