



WASTE MANAGEMENT AND MARKETING IN FEDERAL POLYTECHNICS: IMPLICATIONS FOR SUSTAINABLE HEALTHY ENVIRONMENT AND REVENUE GENERATION

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ABSTRACT: *The proportion of waste generated across Nigerian campuses is so large and what seems to be a gold mine for most public tertiary institutions in terms of revenue generation has continued to constitute health hazard for both staff and students in the school environment. If properly harnessed, waste generated within federal polytechnic environment is capable giving her financial freedom and boost employment creation. Broadly, this study examines waste management and marketing in federal polytechnics: implications for sustainable healthy environment and revenue generation. Specifically, the study examines the level of waste generated across federal polytechnics in southwest Nigeria; find out the health hazard posed by waste materials generated in federal polytechnic across southwest Nigeria; investigate the economic value of objects that constitute waste in federal polytechnics across South west Nigeria and ascertain the extent to which federal polytechnics in southwest Nigeria reduce, reuse and recycle waste on campuses. The researchers adopt survey research design in this study while primary data was elicited through questionnaire. The population of the study consists of all federal polytechnics in southwest Nigeria while the unit of analysis comprises of all the officers in charge of waste management in the selected federal polytechnics. Data collected was processed using the Statistical Packages for Social Sciences (SPSS version 25.0). The processed data analyzed using descriptive statistics. The study found that the health officers are aware of environmental and health implications of poor waste management but their approach to waste management pose threats to the health of both staff and students in the polytechnics under focus. Plastic constitute the majority of waste generated in federal polytechnics. This shows the consumption rate of soft drinks is very high among polytechnic students. Waste managers are also aware of the vast opportunities in waste management but these opportunities are not converted to wealth to boost the IGR of federal polytechnics in Nigeria. It was majorly recommended that management of federal polytechnics should set up structured waste management system, including waste sorting points, recycling centers and waste-to-wealth units on campus. These should be managed by trained environmental officers and supported by student volunteers or interns.*

KEYWORDS: Waste, Waste Management, Marketing, Healthy environment, Revenue generation.



INTRODUCTION

Waste has become daily part of human's life and the amount of waste generated daily has continued to be on the increase. According to Jakobsen (2022), the world generates 2.01 billion tonnes of municipal solid waste annually and that number is estimated to rise to 3.40 billion tonnes by 2050. It was also noted by Jakobsen (2022) that vast majority of these wastes are generated in public places such as schools, market, worship centres and residential apartments. Poor management of waste is not only causing the planet harm through the contamination of oceans, clogging drains and causing floods but it is also affecting daily health, productivity, and cleanliness of communities. Improper management of waste can constitute hazard to the environment while proper management and marketing of it can avert health crises on campus and create wealth.

Although waste is not the only issue that affects health, neither does it only create unmanageable problems for the environment; it is now a valuable resource that can be converted to wealth in the areas of providing raw materials for production, nutrients for agriculture, and a source of energy.

According to Global health report (2022), about 91% of plastics produced is not recycled while 8 million tonnes end up in the oceans every year. An empty bottle of average size has an energy potential of about 1 kWh, while an empty can has about 0.46 kWh but if this is thrown into residual waste, the energy is lost.

In Norway, 42% of municipal solid waste is recycled and with the introduction of the deposit recycling scheme, Norway now recycles 97% of all its plastic bottles and this has contributed significantly to the Gross Domestic Product (GDP) of the country.

Algeria generate an average of 18.5 million tonnes of Organic, plastic, and paper/cardboard waste in the urban areas and the revenue accrued from this urban waste contributes 14 percent to the GDP of the country (Algerian National Agency for waste, 2023).

In Sweden, 949,000 tonnes of waste is produced and approximately 78kg of food waste is produced per person annually in Swedish households. In 2017, 741,280 tonnes of Sweden's household waste went to biological treatment – anaerobic digestion or composting. Similarly, The Swedish government has been making fortune to boost their GDP through waste management and marketing.

The waste generated in Nigeria is large enough to compete with the amount of waste in Norway and Algeria combined together. Regrettably, waste has continued to constitute health hazard and nuisance to the Nigerian environment and the opportunities that abound in managing waste has not been adequately exploited in the country.

The largest waste category in most tertiary institutions in Southwest Nigeria include papers, plastics, food and green waste which a study by Jakobsen (2022) claims is responsible for 44% of all global waste. Converting this disadvantageous situation on our campuses to wealth through efficient management and marketing will help to overcome the challenge of paucity of fund facing federal polytechnics in Nigeria.



Statement of Problem

Waste has become an inevitable part of human life and the amount of waste generated by human being has continued to rise on a daily basis. According to Jakobsen (2022), the world generates 2.01 billion tonnes of municipal solid waste annually and that number is estimated to rise to 3.40 billion tonnes by 2050. The proportion of waste generated across Nigerian campuses is so large and what seems to be a goldmine for most public tertiary institutions in terms of revenue generation has continued cause health hazard for students and staff in the school environment. Worse still, many institutions spend humongous amount in disposing waste thereby making an income generator to become a cost-centre.

More so, studies from Norway, Algeria, Sweden and China indicated that urban waste contributes significantly to Gross Domestic Product (Global health report, 2022; Jakobsen, 2022). Regrettably, improper waste management in Nigerian campuses has become a total embarrassment.

Furthermore, there are very few literatures about waste management in Nigeria; among them are: Ebikapade and Jim (2019) who applied general criteria for human development to the study of different waste management solutions in Ijebu Ode, Ogun State, and they tested the feasibility of a decision-making method developed for application under particular conditions in which environmental and social aspects must be considered. Ogwueleka (2020) pointed trends and problems of waste management in Enugu city in Nigeria and he showed the prospects for a sustainable development. Additionally, Bouanini (2022) assessed the management of waste for well-being fulfillment in Nigeria and she found that there were a poor culture with respect to the 3R Principles (reduce, reuse, recycle) in Nigeria. However, all the aforementioned studies only concentrated on waste management and its effects on the society. At present, there appears to be no systematic study that has been carried out to investigate the extent to which waste management and marketing can reduce health hazard on polytechnic campuses across South-West and boost revenue generation. This study therefore aim at bridging the gap in literature and come up with empirical findings and recommendations capable of mitigating the menace improper waste management on federal polytechnic campuses in Southwest Nigeria.

Objectives of the Study

Broadly, this research is on waste management and marketing in federal polytechnics in southwest Nigeria: Implications for sustainable healthy environment and revenue generation. Specifically, the research pursued the following objectives:

1. To examine the level of waste generated across federal polytechnics in South-West Nigeria.
2. To find out the health hazard posed by waste materials generated in federal polytechnic across South-West Nigeria
3. To investigate the economic value of objects that constitute waste in federal polytechnics across South west Nigeria.
4. To ascertain the extent to which federal polytechnics in South-west Nigeria reduce, reuse and recycle waste on campuses.



LITERATURE REVIEW

Waste Management and Marketing

Wastes, mostly regarded as unwanted and harmful materials, are produced as a result of man's interaction with nature in an unsustainable manner. The interaction conflicting becomes constant due to the increasing human needs and desire to satisfy endless wants which in turn makes waste management an indispensable task in achieving sustainable development. Wastes are not prime products – produced for the market, do not occur in normal commercial and utility circles but possess potential for further use in production, transformation or consumption (EIONET, 2019 cited in Abiti, 2023). Waste can be understood based on three cardinal processes – source, effect on humans/environment and the control which are appropriate to deal with it. In this study, reference is to the source and control of waste, which will have the possible effects to reducing negative impact on human environment. Here, waste management is identified as the effective use of waste available, as waste is considered as posing a threat to human health or environment. The manner in which it may be disposed of and partly because the holder no longer has the same sense of obligation in relation to it.

Waste can come in different forms; it could be solid-metal, gaseous-chemical or liquid. Akaninyere and Atser (2021) cited in Fakere, Fadairo and Oriye (2022) examined the typology, characteristics and future trends of solid waste in selected Nigerian urban cities (including Ijebu-Ode) and asserted that the major components of waste are degradable materials (food remnants, paper, and rags) and non-biodegradable (plastics, tins, metals, bottles, glass, and bones). The finding was further buttressed by Fakere, Fadairo and Oriye (2022) who submitted that most activities which affect the environment stem from the need for food; its production, processing and preparation. As such, some of the wastes are likely to have socio-economic potentials if effective urban mining mechanisms are designed.

The Waste Situation in the Polytechnic Community

Waste generation is certainly a challenge in most federal polytechnics across Nigeria. The challenge has continued unabated in spite of some very obvious steps taken by government in curtailing the problem posed by the waste generated by the citizens. A major challenge noticed in most campuses is that 'the solid waste challenge being encountered in most polytechnics presently stems from disparity between the rate of solid waste generation and the rate of collection and evacuation, thus leading to solid waste accumulation across the nooks and corners of the some campuses. Waste materials ranging from used papers, broken bottles, plastic bottles, aluminum, metals, non-functional equipment, sachet water nylon e.t.c are visible in every nook and cranny of most federal polytechnic campuses across South-west Nigeria. For example, at the federal polytechnic, Ado-Ekiti, all these waste materials can be found along at the back of hostels, classrooms, major and minor roads across the length and breadth of the institution are not exempted. Therefore, there is need to search for viable market where waste can be converted to cash and improve the financial status of polytechnics in Southwest Nigeria.



Theoretical Framework

This study is anchored on the stakeholders' theory, proposed by Freeman (1984), emphasizes that organizations must consider the interests of all parties affected by their operations- internal and external stakeholders. These may include students, academic staff and non-academic staff, community members, regulatory bodies and environmental agencies. The theory is relevant to this study because effective waste management requires active participation from all stakeholders within and outside the polytechnic community. Additionally, marketing strategies for recycled waste products must consider stakeholders interests, cultural values, and willingness to adopt suitable practices. The theory supports participatory governance in environmental decision-making, enhancing institutional accountability and transparency. The implication of the theory is that stakeholder engagement enhances both the success and sustainability of waste management initiatives, while supporting revenue generation through inclusive marketing strategies.

Empirical Review

Several empirical investigations have been conducted both locally and globally and many findings have emerged in the area of waste management and marketing.

Ogbonna, Amangabara and Ekere (2018) conducted a study on solid waste management in Nigerian tertiary institutions. The study assessed the types and volumes of waste generated within the institution, examined existing waste disposal practices and evaluated the institutional capacity for managing waste sustainably. Survey research design was employed and 150 questionnaires were administered to 150 staff and students. Physical observation and waste sampling were also carried out across blocks, hostels and cafeterias. Data were analyzed using descriptive statistics and thematic analysis. It was found that waste was disposed of through open dumping and burning, with no formal waste segregation or recycling program.

Akinwale & Gboyega (2019) investigated waste-to-wealth initiative in Nigerian Higher Education. The study examined the revenue and employment potential of institutional waste recycling. A mixed-methods approach was used, combining quantitative data from 120 questionnaire responses and qualitative interviews with facility managers and student leaders. Field observation were conducted at the polytechnic pilot recycling unit. It was revealed that revenue generated monthly from recyclables averaged N30,000, while 10 students interns were involved in the process.

The duo of Eze & Umeh (2021) examined waste disposal and environmental sustainability in Nigeria federal polytechnics. The study ascertained the impact of waste disposal practices on the environmental quality of the polytechnic and also investigated the level of awareness and participation staff and students in waste management. The study adopted a case study design involving questionnaire distributed to 200 randomly selected students and staff. Interview were also conducted with environmental health officers. The study discovered that a high volume of mixed waste was dumped at various points on campus, causing blockage of water channels and increased risk of disease outbreaks.



METHODOLOGY

This study adopts descriptive survey research design. Descriptive survey research design is adjudged to be appropriate for this study because it provides an accurate account of the behaviour, opinions, beliefs, and knowledge of a particular individual or group through the use of questionnaire. The choice of the survey method is consistent with Hair, Money, and Samuel and Page (2017) submission that such a method is usually interested in the assessment of the characteristics of the population of study. Besides, the survey research design helps to evaluate the implications and interrelationship between concepts in the study. The study was conducted in southwest geopolitical zone of Nigeria. The Southwest is one of the zones of Nigeria representing both a geographic and political region of the country's Western Coast. It comprises six states- Ondo, Osun, Ekiti, Oyo, Ogun and Lagos. The zone was selected because it has the presence of federal Polytechnic in each of the states (NBTE, 2023). In addition, each of these polytechnics has waste management and disposal unit where needed data for this study were sourced.

The target population of the study comprises of all staff in charge of waste management in all federal polytechnics in South-West, Nigeria.

List of Waste Mgt. Staff in Federal Polytechnics in South-West, Nigeria

Table 3.1: List of Waste Mgt. Staff in Federal Polytechnics in SWN

| S/N | State Domiciled | Names of Polytechnics | Year Established | Waste Mgt staff |
|--------------|-----------------|----------------------------------|------------------|-----------------|
| 1 | Ondo | Federal Polytechnic, Ile- Oluji | 2016 | 18 |
| 2 | Ekiti | Federal Polytechnic, Ado-Ekiti | 1977 | 22 |
| 3 | Osun | Federal Polytechnic, Ede | 1992 | 21 |
| 4 | Ogun | Federal Polytechnic, Ilaro | 1979 | 22 |
| 5 | Oyo | Federal Polytechnic, Ayede. | 2021 | 10 |
| 6 | Lagos | Yaba College of Technology, Yaba | 1947 | 21 |
| Total | | | | 120 |

Source: *Field Survey (2025)*



Therefore, total enumeration (census) of all federal Polytechnics waste management staff in the selected institutions were used in this study. Israel (2022) proposed the use of census in determining sample size for a small population that could be successfully managed by researcher. Hence, the sample size would consist of all the one hundred and twenty (120) waste management officers from the federal Polytechnics in Southwest, Nigeria.

Both primary and secondary data were used in this study. Primary data were sourced through the use of research instrument. Also, several secondary data were collected, screened and used in the study. Accordingly, secondary data for the study were sourced from already existing materials, including journals, discussion papers, conference proceedings, online data base and other relevant publications.

Data collected from respondents were described, summarized, coded and analyzed with descriptive and inferential statistics using the Statistical Package for Social Sciences (IBM-SPSS) version 24.0 software. The four research questions were answered using descriptive statistics such as frequency distribution, percentages displayed in tables and charts. These statistical methods were used because they would be sufficient and appropriate to answer the research questions.

Ethical Considerations

In any survey research, it is vital to seek due permission from respondents and it is duty of the participants to weigh the benefits and risks associated in participating in such research, and deciding whether or not to partake in the study. Prospective participants in this study were well informed about the purpose and objectives of the study. Appropriate permission was sought from the sampled institutions. Ethical clearance were obtained from the institution by the researchers. Official letters were be written to the prospective polytechnics which explained the purpose of the study to the respondents. An informed consent of the prospective research participants were also sought by the researchers by providing adequate information concerning the study. Researchers informed participants that their participation was voluntary and Researchers ensured that the physical, social and psychological well-being of research participants were not adversely affected by the research. The confidentiality of the respondents was maintained through anonymity.

RESULTS AND DISCUSSION

Table 1: Socio-demographic characteristics of Study Participants

| Demographic Characteristics | Frequency f | Valid Percentage % |
|-----------------------------|----------------|-----------------------|
| Sex | | |
| Male | 48 | 40.0 |
| Female | 72 | 60.0 |
| Total | 120 | 100.0 |
| Age group | | |
| 21-30 | 20 | 16.7 |
| 31-40 | 56 | 46.7 |
| 41-50 | 32 | 26.7 |



| | | |
|----------------------------------|-----|-------|
| >50 | 12 | 10.0 |
| Total | 120 | 100.0 |
| Educational Qualification | | |
| Primary | 12 | 10.0 |
| Secondary | 32 | 26.7 |
| Tertiary | 72 | 60.0 |
| Others | 4 | 3.3 |
| Total | 120 | 100.0 |

Table 1 presents the socio demographic characteristics of the respondents in the study area, it is significant in explaining and understanding patterns and structures of relationship and the way it influence the outcome of the study. A total of 120 waste management staff was surveyed as shown in Table 1 above. Majority of respondents were female with 60% while the male accounted for 40% of the respondents. This implies that more women than men work in the waste management units of the institutions been researched. The results of the study also show that most of the respondents (46.7%) were between 31 and 40years, 16.7% were within 21-30years age range while 26.7% and 10% respondents were aged 41-50years and above 55years respectively. The results mean that the organizations tend to lean towards younger people between the ages of 21 and 50 to form the basis of their workforce. The table further shows the educational qualifications of the respondents. The result indicates that more than half (60%) respondents were holders of tertiary education certificates, 10% had First School Leaving Certificate, and 26.7% had School Certificate while 3.3% possessed other qualifications. This indicates that majority of the employees in Federal Polytechnics are well educated and it is assumed that they should have a solid understanding of waste management and marketing in Federal Polytechnics and its implications for sustainable healthy environment and revenue generation.

Table 2: Awareness of waste management across polytechnics in southwest in Nigeria

| Variable | Frequency | Percentage |
|--|------------|--------------|
| How familiar are you with waste management? | | |
| Very familiar | 84 | 70.0 |
| Somewhat familiar | 32 | 26.7 |
| Not familiar | 4 | 3.3 |
| Total | 120 | 100.0 |
| Are aware of environmental and health implications of poor waste management? | | |
| Yes | 116 | 96.7 |
| No | 4 | 3.3 |
| Total | 120 | 100.0 |
| What type of waste is most commonly generated in your polytechnic? | | |
| Plastic | 72 | 60.0 |
| Paper | 44 | 36.7 |
| Metals | 4 | 3.3 |
| Total | 120 | 100.0 |
| Do you practice waste segregation in your polytechnic? | | |
| Yes | 36 | 30.0 |
| No | 84 | 70.0 |
| Total | 120 | 100.0 |



Table 2 presents the level of awareness of waste management across federal polytechnics in South-West Nigeria. The result indicates that 70% of the respondents were very familiar with waste management, 26.7% were somewhat familiar while 3.3% were not aware. Majority (96.7%) of the study participants were aware of environmental and health implications of poor waste management while the remaining 3.3% were not aware. Regarding the type of waste most commonly generated in the polytechnics, 60% respondents; representing the majority indicated 'plastic' waste', closely followed by paper (36.7%) while metal (3.3%) was the least in the ranking order. Less than one-third (30%) respondents practice waste segregation in their polytechnics while majority (70%) had not.

Table 3: Waste management practices in federal polytechnic across southwest Nigeria

| Variable | Frequency | Percentage |
|---|------------|--------------|
| How do you dispose of waste in your polytechnic? | | |
| Open dumping | 32 | 26.7 |
| Burning | 68 | 56.7 |
| Recycling | 12 | 10.0 |
| Composting | 8 | 6.7 |
| Total | 120 | 100.0 |
| Are there waste collection services in your institution? | | |
| Yes | 100 | 83.3 |
| No | 20 | 16.7 |
| Total | 120 | 100.0 |
| If yes, how often are wastes collected in your institution? | | |
| Daily | 68 | 68.0 |
| Weekly | 16 | 16.0 |
| Monthly | 12 | 12.0 |
| Rarely | 4 | 4.0 |
| Total | 100 | 100.0 |
| Do you face challenges with waste disposal in your polytechnic? | | |
| Yes | 80 | 66.7 |
| No | 40 | 33.3 |
| Total | 120 | 100.0 |

Table 3 presents the waste management practices in federal polytechnic across South-West Nigeria. The result shows that majority (56.7%) of the respondents disposed waste by burning while 26.7%, 10% and 6.7% reported open dumping, recycling and composting respectively. On whether waste collection services are available in federal polytechnics, more than three-quarter (83.3%); representing the majority agreed while 16.7% respondents disagreed. Out of 100 respondents who indicated availability of waste collection services, 68% disposed their waste daily while 16%, 12% and 4% reported weekly, monthly and rarely waste disposal respectively. However, two-third (66.7%) respondents faced challenges with waste disposal in their polytechnics.

**Table 4: Marketing and Economic Opportunities in Waste Management in federal polytechnic across South-West Nigeria**

| Variable | Frequency | Percentage |
|--|------------|--------------|
| Do you know that waste can be source wealth creation? | | |
| Yes | 112 | 93.3 |
| No | 8 | 6.7 |
| Total | 120 | 100.0 |
| Are you aware that waste generated in your institution can be recycled or repurposed? | | |
| Yes | 112 | 93.3 |
| No | 8 | 6.7 |
| Total | 120 | 100.0 |
| What types of products or services do you think could be derived from the waste generated in your polytechnic? | | |
| Compost farming | 28 | 23.3 |
| Recycled plastics | 72 | 60.0 |
| Artisanal or handcrafted goods | 4 | 3.3 |
| Renewable energy | 8 | 6.7 |
| I don't know | 8 | 6.7 |
| Total | 120 | 100.0 |
| Do you think your institution should invest in waste management as a business opportunity? | | |
| Strongly agree | 64 | 53.3 |
| Agree | 52 | 43.3 |
| Neutral | 4 | 3.3 |
| Total | 120 | 100.0 |

Table 4 presents the marketing and economic opportunities in waste management in Federal Polytechnic a cross South-West Nigeria. The result shows that majority (93.3%) respondents agreed that waste can be source of wealth creation while 6.7% disagreed. Similarly, 93.3% respondents were aware that waste generated in their institutions can be recycled or repurposed. Regarding the types of products or services that could be derived from the waste generated in the polytechnic, 60% respondents indicated recycled plastics, followed by compost farming (23.3%) and artisanal or handcrafted goods (3.3%), 6.7% indicated renewable energy while 6.7% did not know. Majority (96.6%) respondents agreed that institution should invest in waste management as a business opportunity while 3.3% disagreed.

Table 5: Implications for Sustainability and Health in Federal Polytechnic a cross South-West Nigeria

| Variable | Frequency | Percentage |
|--|------------|--------------|
| Do you think poor waste management has a direct impact on health in your polytechnic? | | |
| Yes | 100 | 83.3 |
| No | 20 | 16.7 |
| Total | 120 | 100.0 |
| How would you rate the environmental impact of current waste management practices in your institution? | | |



| | | |
|---|------------|--------------|
| Excellent | 12 | 10.0 |
| Good | 44 | 36.7 |
| Fair | 44 | 36.7 |
| Poor | 8 | 6.7 |
| Very poor | 12 | 10.0 |
| Total | 120 | 100.0 |
| In your own opinion, what measure(s) do you think should be taken to ensure sustainable waste management? | | |
| Public education | 88 | 73.3 |
| Government policies | 16 | 13.3 |
| Investment in recycling plants | 16 | 13.3 |
| Total | 120 | 100.0 |
| What do you think are the major barriers to effective waste management in your polytechnic? | | |
| Lack of awareness | 48 | 40.0 |
| Insufficient infrastructure | 16 | 13.3 |
| Poor management policies | 36 | 30.0 |
| Lack of funding | 20 | 16.7 |
| Total | 120 | 100.0 |

Table 5 presents the implications for sustainability and health in Federal Polytechnic a cross South-West Nigeria. The result shows that 83.3% respondents agreed that poor waste management has a direct impact on health in the polytechnic while 16.7% disagreed. More than one-third (36.7%) respondents indicated 'good' and 'fair' ratings of environmental impact of current waste management practices in each case, 10% rated the impact as being 'excellent' while 6.7% and 10% indicated 'poor' and 'very poor' respectively. Regarding the measure(s) to be taken to ensure sustainable waste management, majority (73.3%) advocated public education while 13.3% recommended government policies and investment in recycling plants in each case. Regarding major barriers to effective waste management in polytechnics, 40% respondents; representing the majority reported lack of awareness, closely followed by poor management policies (30%), lack of funding (16.7%) and insufficient infrastructure (13.3%).

Implication for Sustainability Environmental and Revenue Generation.

Improved campus cleanliness and sanitation reduce littering, clogged drainage and unsanitary condition which are common causes of disease outbreak (e.g. malaria, typhoid)

Recycling and proper disposal of hazardous and non-biodegradable waste (e.g. plastic, metals) reduces air pollution, water and soil pollution, ensuring a healthier ecosystem within and around polytechnic. Waste-to-energy practices like biogas generation and composting reduce greenhouse gas emissions from open burning and dumping.

In the area of revenue generation, marketing recyclable waste (e.g. plastic, paper, metals, etc) can create alternative income streams for federal polytechnics through partnership with recycling firms or local artisans. Similarly, establishing waste processing units provides training and employment for students in recycling, compost production, and waste-to-energy technology. Additionally, efficient waste management reduces the cost of frequent waste evacuation and environmental remediation, freeing funds for other developmental projects in these institutions.



CONCLUSION

This study examined the role of waste management and marketing in federal polytechnics and its implications for promoting a sustainable healthy environment and generating institutional revenue. The findings underscore that most federal polytechnics in Nigeria lack structured waste management system, resulting in environmental degradation, health hazard and missed economic opportunities. However, the study also revealed that with the right institutional policies, stakeholder engagement, and entrepreneurial mindset, waste can be transformed into a valuable resource.

Theoretical perspective such as the stakeholder theory provides strong justification for integrating waste management into institutional sustainability frameworks. Empirical evidence from local studies further validates the feasibility and benefit of converting waste into health through recycling, composting and responsible of marketing strategies. In conclusion, effective waste management in federal polytechnics is not only critical to achieving a clean and healthy campus environment but also offers a viable pathway for revenue generating and student empowerment. To fully harness these benefits, polytechnics must adopt a holistic approach that combines environmental responsibility with economic innovation, policy support and educational integration. Such a strategy will position these institutions as drives of sustainable development in line with national and global environmental goals.

Recommendations

1. Federal polytechnics should set up structured waste management system, including waste sorting points, recycling centers and waste-to-wealth units on campus. These should be managed by trained environmental officers and supported by student volunteers or interns
2. The polytechnic curriculum should include practical modules on entrepreneurship projects on waste recycling, green business, and environmental marketing, especially for science, engineering and management students.
3. Policies makers and school management should collaborate with private recycling firms, NGOs and local government to commercialize waste products and attract technical or financial support. Clear institution policies should govern waste collection, segregation and revenue sharing



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