

ASSESSMENT OF PROBLEMS IN FURNITURE WASTE MANAGEMENT: PROPOSING SUSTAINABLE SOLUTIONS FOR SELECTED HIGHER EDUCATIONAL INSTITUTION

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ABSTRACT

Waste management has emerged as a significant issue in contemporary society due to its profound environmental consequences. Consequently, it has drawn considerable attention in various domains, such as plastic waste management, water waste management, and solid waste management. Nevertheless, the management of furniture waste is still in the process of gaining visibility. Furniture waste treatment currently relies only on conventional practices such as landfill disposal, incineration, and storage in both open and closed facilities. However, these procedures pose significant health risks and contribute to land occupation. This renders the furniture waste a burden on both the economy and the environment. These challenges give rise to durable and inventive answers. Due to the extensive infrastructure and student population, educational institutions produce a significant amount of furniture waste. This research paper seeks to implement sustainable furniture waste management uses in specific educational institutions by utilizing the principles of the 3Rs - Repurpose, Redesign, and Reutilize. Educational institutions have the potential to significantly influence the adoption of sustainable practices among students, staff, educators, parents, and the broader community. This study aims to measure the amount of furniture waste, analyze the problems faced by educational institution in managing furniture waste, providing sustainable solutions by creating products from furniture waste, and evaluate the efficacy of the proposed solution. This study employs an action-oriented research methodology, using purposive sampling and employing observation sheets, interview schedules, and content analysis as research instruments. The findings emphasize the significant volume and variety of furniture waste produced, as well as the problems encountered by educational institutions. The results indicate that implementing the 3Rs (repurpose, redesign and recycle) is a feasible and environmentally friendly method to decrease furniture waste in educational settings. The study seeks to enhance the advancement of inventive

and enduring practices for managing furniture waste, applicable not just to educational institutions but also to other domains.

Keywords: repurpose, redesign, reutilize, furniture waste, educational institution

INTRODUCTION

Presently, waste management has emerged as a worldwide issue due to various variables including population expansion, escalating urbanization, and shifting consumer behaviours, leading to a substantial rise in waste generation. The advent of contemporary lifestyles and manufacturing techniques has led to intricate and varied streams of waste, including E-waste, plastic waste, agricultural waste, demolition debris, and many more. Storage, landfill dumping, and incineration are all common methods for waste disposal, but they pose significant risks including soil contamination, air pollution, and land waste, among other concerns as suggested by various research. The increase in waste variations has prompted an investigation into numerous alternatives such as waste-to-energy operations, material recovery from waste, upcycling, and others as ways of living sustainably.

Effective waste management can contribute to the achievement of the Sustainable Development Goals (SDGs), which are a collection of worldwide objectives aimed at addressing social, economic, and environmental issues. It can contribute to Sustainable Development Goals (SDGs) such as SDG-3: “Ensuring good health and well-being”, SDG-11: “Promoting sustainable cities and communities”, SDG-12: “Encouraging responsible production and consumption”, SDG-15: “Protecting life on land”, and SDG-17: “Fostering global partnerships”. In recent times, the G20 has been increasingly popular as a platform for acknowledging the importance of implementing sustainable waste management strategies to accomplish the Sustainable Development Goals (SDGs).

Numerous studies and articles have investigated Solid Waste Management and its impacts on the environment extensively. Tangwanichagapong et al., 2017 described “the effects of 3R (reduce, reuse and recycle) waste management initiatives on a campus community” and also investigated behavioral responses to waste management initiatives. Moqbel (2018) studied “Solid Waste Management at the University of Jordan” including the estimation of waste generation rate and characterization of the solid waste generated on campus. Jayapriya & Jagadeesan (2019) enlightened the “importance of solid waste management in educational institutions” and the responsibilities of the institution for proper waste treatment. Danieli Braun (2020) explores “Waste Management in Higher Educational Institutions”. Filho et al., 2021 investigated “Sustainability practices at higher education institutions in Asia” offering insights into how Asian universities incorporate the theory or practice of sustainable development (SD) in their research and education programs. De Souza Pinho et al., 2023 “Wood Waste Management from the Furniture Industry: The Environmental Performances of Recycling, Energy Recovery, and Landfill Treatments”. These studies collectively contribute to our understanding of the term Waste Management, contributing factors, and its impacts.

However, there is a need for research specifically on the unique context of Furniture Waste Management in higher educational institutions as the management of furniture waste is now in its early phases of development, and has great potential for promoting sustainability while building a resilient future. Due to large infrastructure requirements and a huge student population educational institutions generate a high volume of furniture waste. Thus, the study is undertaken to assess the problems faced by selected higher educational institution and propose sustainable solutions.

According to Michele Calabrese (2012), “In 2009, Americans produced around 243million tons of municipal solid waste, or about 4.3 pounds of waste per person per day (EPA). Over 9 million tons of that waste in our landfills is from furniture (EPA). This is a massive amount of waste from our furniture products. Many furniture products are created from wood, and therefore the furniture industry is one of the major industries contributing to deforestation”. Also, according to Dolatowski (2021), “About 10 million tons of furniture were landfilled in 2018, according to the U.S. Environmental Protection Agency (EPA), and the disposal rate is likely higher today as furniture waste has been on the rise for as long as EPA has tracked it.” Improperly disposing of furniture materials presents environmental hazards due to the presence of elements such as wood, plastic, metals, and foam, which emit toxic fumes when burned. Moreover, a huge piece of furniture takes up a considerable amount of space in landfills, making it even more difficult to identify appropriate locations for waste disposal.

This study focuses on proactively researching the sustainable management of furniture waste in a specific educational institution. The research highlights a significant deficiency in the current body of literature on the management of furniture waste, specifically in educational settings. The study employs an action-oriented approach, focusing on the implementation of the 3Rs waste management principles—repurpose, redesign, and reutilize—as a method to accomplish sustainable furniture waste management. In the study, the terms used are-

Repurpose: The act of adapting or modifying furniture waste originally intended for one purpose to serve a different purpose or function. Instead of creating something entirely new, repurposing involves finding innovative uses for existing resources, materials, content, or items.

- **Redesign:** The act of significantly altering or improving an existing furniture design. This typically involves re-evaluating and modifying multiple components to enhance functionality, aesthetics, usability, or overall effectiveness.
- **Reutilize:** The act of reusing furniture or other items that have been discarded or are no longer needed, but with alterations or adaptations that enable them to be used in the same or a different location.

Educational institutions possess the capacity to serve as exemplars by advocating for sustainable waste management and fostering educational opportunities for students, while also fostering community engagement towards a sustainable environment and a more aware society. The researcher employs the previously described 3Rs technique to evaluate the effectiveness of a new solution for using furniture waste found at a specific educational institution. The study also aims to identify any obstacles that may arise in future implementations. The study also addresses the

problems faced by educational institutions in managing furniture waste and suggests strategies to enhance the long-term management of such waste.

STATEMENT OF PROBLEM

To assess the problems faced by selected higher educational institution in Furniture Waste Management.

OBJECTIVES OF THE STUDY

1. To assess the problems associated with Furniture Waste Management in selected higher educational institution.
2. To assess the types and quantity of furniture waste present in the selected higher educational institution.
3. To propose sustainable solutions to manage furniture waste using 3Rs - Repurpose, Redesign, and Reutilize.
4. To check the efficacy of the implemented solutions to manage furniture waste in selected higher educational institution.
5. To make recommendations for enhancing Furniture Waste Management in higher educational institution.

DELIMITATIONS

1. The study was limited to higher educational institution located in Vadodara city.
2. The study was limited to that higher educational institution that has an establishment of a minimum of 15 years.

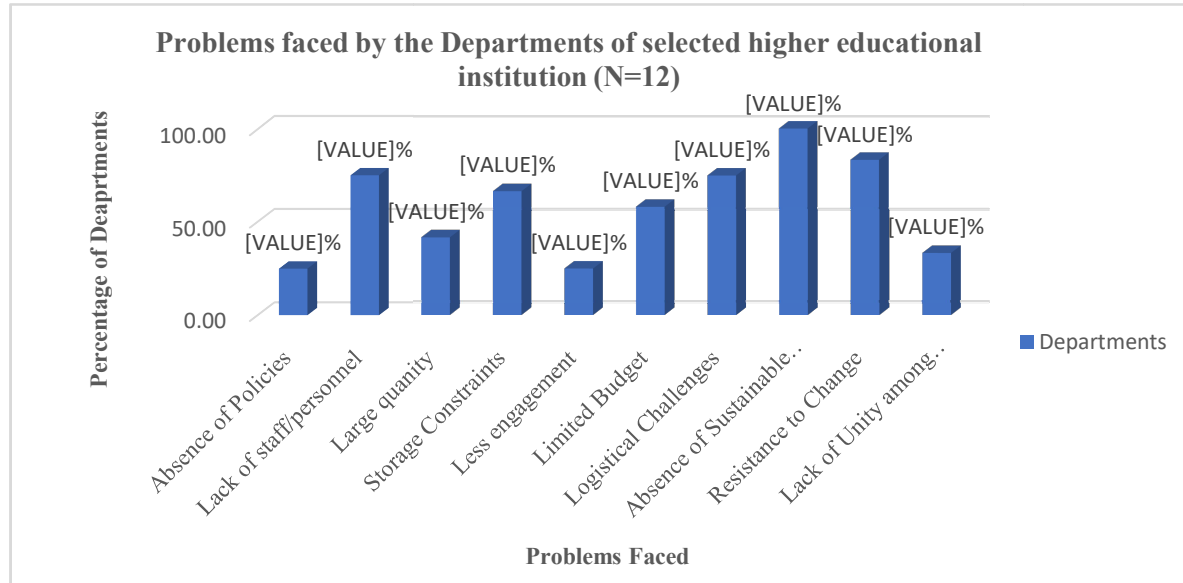
METHODOLOGY

For this study, an action research design was employed to propose and implement sustainable solutions to manage furniture waste in selected higher educational institution, and a descriptive research design was employed to assess problems faced by selected higher educational institution in furniture waste management. The investigation was carried out in selected higher education institution located in Vadodara city. A random purposive sampling technique was employed to select the higher educational institution, with a total of 12 departments willingly taking part in the study. Data was gathered through a 20-minute interview schedule in English and an observation sheet to assess the amount of furniture waste in selected higher educational institution, which was developed based on existing literature to ensure clarity and comprehensiveness. The Heads of the Departments within selected higher education institution were reached directly for interview, which facilitated the collection of responses from all 12 departments. Subsequently, content analysis was conducted, primarily involving the use of descriptive statistics to derive valuable insights and conclusions from the survey findings.

FINDINGS AND DISCUSSIONS

Problems faced by the selected higher educational institution –

Graph 1: Problems faced by Departments in selected higher educational institution (N=12)



Graph 1 shows that 25% of the departments did not have policies for managing Furniture Waste, while 75% of the departments had insufficient manpower to handle furniture waste at the selected higher educational institution. In addition, 41.67% of the departments had a significant amount of furniture waste to manage. Additionally, 66.67% of the department experienced limitations in storage capacity for furniture waste. Regarding engagement and participation, 25% of the departments expressed dissatisfaction with the authorities' lack of involvement in furniture waste management. Furthermore, a majority of 58.33% of the departments acknowledged having a restricted budget for the treatment of furniture waste. Moreover, a significant proportion (75%) of the departments have logistical obstacles when it comes to transferring furniture waste. Significantly, all departments lacked sustainable protocols in their operations. Furthermore, 83.33% of respondents showed resistance to transitioning from traditional methods to new, innovative strategies for managing furniture waste. Additionally, 33.33% acknowledged a lack of cohesion among departments in the selected higher educational institution when it comes to furniture waste management.

Quantity of furniture waste found in the selected higher educational institution –

Table 1 – Types and quantity of furniture waste found in the departments of selected higher educational institution

Departments	Iron chair	Plastic chair	Wooden chair	Table	Iron shelf	Wooden Shelves	Drawers	Display	Window Frames	Doors	Cabinets	Desk
i.	3	60	35	2	2	1	1	3	0	6	1	0
ii.	0	0	1	0	0	0	0	0	18	2	0	2

iii.	2	0	3	2	1	3	1	0	1	5	3	2
iv.	2	0	0	1	1	1	0	0	1	1	1	0
v.	6	0	0	1	0	0	0	2	0	1	1	3
vi.	0	1	0	2	2	0	1	1	0	1	0	4
vii.	6	0	0	3	0	2	0	1	0	0	1	2
viii.	0	0	0	0	0	0	0	0	0	0	0	0
ix.	0	0	0	0	0	0	0	0	0	0	0	0
x.	1	1	2	2	0	1	0	0	0	2	0	0
xi.	4	0	6	2	2	1	0	0	0	0	1	0
xii.	0	0	20	2	1	0	1	0	4	1	1	2
TOTAL	21	62	67	17	9	9	4	7	24	19	9	15

Table 1 reveals that Chairs made up of plastic, iron, and wood were the most common type of furniture found in the waste making a total of 150 chairs. Also, it was found that there were 17 tables, 9 iron shelves, 9 wooden shelves, 4 drawers, 7 displays, 24 window frames, 19 doors, 9 cabinets, and 15 desks making 263 furniture pieces in total as waste.

Table 2 – Weight of the furniture waste found in the departments of selected higher educational institution (approximate)

Departments	Furniture Waste Found approx. (KG)
Department-1	663
Department-2	100.9
Department-3	268.8
Department-4	79.3
Department-5	146
Department-6	161.3
Department-7	129
Department-8	0
Department-9	0
Department-10	89.8
Department-11	140
Department-12	266.2
TOTAL	2044.3

Table 2 presents data encapsulating the quantities of furniture waste, measured in kilograms (approx.), generated by various departments within the institutional framework. Department-1 leads with a substantial amount of 663 kg of furniture waste, followed by Department-3 with 268.8 kg, and Department-12 with 266.2 kg. Conversely, Department-8 and Department-9 report no recorded instances of furniture waste generation. The cumulative total of furniture waste across all departments amounts to 2044.3 kg.

STAGES OF CONDUCTING THE PROJECT

1. Problem Identification:

A significant problem faced by the selected educational institution was the long-term accumulation of furniture waste. The researcher employed a 20-minute semi-structured interview technique, utilizing a pre-established series of questions, to collect data on the categories, volumes, and origins of furniture waste produced within the selected educational institution. During this phase of the study, further concerns regarding the handling of furniture waste were identified.

2. Planning:

At this point, the researcher devised an action plan that utilized the methods of repurposing, redesigning, and reutilizing furniture waste to address the problem of furniture waste management in the selected higher educational institution. The action plan functioned as a thorough manual indicating the essential tasks to be carried out throughout the implementation phase. The processes involved in this project were the collection of furniture waste, the transformation of the waste into usable products, the organization of people for carpentry work, the calculation of cost estimations, and the setting of a deadline for project completion.

3. Action:

The next step involved executing the plan, which involved converting furniture waste into practical products. The goal was to encourage sustainable management by applying the principles of Repurpose, Redesign, and Reutilize, also known as the 3Rs.

4. Observation and Reflection:

The observation indicated that furniture waste has a significant capacity for reuse because of the unexpectedly excellent quality of the wood, resulting in the creation of durable products. The reutilization of these products is feasible as a result of the exceptional wood quality, hence facilitating the formation of a circular economy. According to Bakar & Salim (2023) "Wood wastes have the potential to be utilized in the manufacturing of a wide range of products, such as engineered wood products, energy generation, and additive manufacturing". Despite the possibility for developing more profitable items, the researchers were unable to do so due to financing limits. The production of furniture waste was significantly reduced inside the allotted storage area, leading to an improved visual attractiveness of the institution. The expenses related to acquiring newly manufactured functional products were discovered to be cheaper in comparison to obtaining pre-existing alternatives that are offered on the market. The researcher encountered two main challenges throughout the study: constrained financial resources and a certain level of staff members' hesitancy to participate in collaboration.

Figures 1 & 2 – Furniture waste found in the selected educational institution



Figure 1



Figure 2



Figure 3 – Collection and sorting of furniture waste

Figure 3

Products developed by furniture waste found in selected higher educational institution

i. Coasters from Chair back-rest



ii. Wall Piece from Chair back



iii. Birdhouses from Chair seat



iv. Storage Table from drawer piece and Chair Legs



v. Key and Pot Holders from Chair handrest



vi. Partition from Display



vii. Coffee cum Book Table from Chair Seat



5. Result of Action Project

A total of 104 products were developed from furniture waste found in the selected education institution which resulted in the reduction of furniture waste from the department.

FINDINGS AND DISCUSSION

Using an observation sheet, it was discovered that various types of furniture were present in various departments of the educational institution, such as iron chairs, plastic chairs, wooden chairs, tables, iron shelves, wooden shelves, drawers, display, wooden frames, wooden doors, cabinets, and student's desks. The investigation revealed that Department 1 exhibited the highest volume of furniture waste pieces, amounting to a total of 114 items. Additionally, it was determined that the educational institution possessed a cumulative quantity of 2044.3 kilograms approximately of furniture waste throughout the period under inquiry. Furthermore, it was determined that out of the total of 266 pieces categorized as furniture waste, a significant portion of 162 items were constructed using wood materials.

Through the use of an interview schedule involving departmental staff members, it was ascertained that all departments encountered problems with the storage of furniture waste, and this issue was observed to be progressively deteriorating. Notably, Department 1 possessed a comparatively larger storage area, leading to other departments occasionally transferring their furniture waste to the storage room of Department 1. Consequently, a substantial accumulation of furniture waste occurred within Department 1. The survey revealed that resistance to change was observed in 10 departments, while only 2 departments agreed in their willingness to collaborate. Additionally, it was discovered that there were no established protocols for the sustainable handling of furniture waste at the departmental level. Consequently, all furniture waste was required to be transported to an open storage facility within the University premises following its write-off. Additionally, it was discovered that one department lacked a storage facility for furniture waste. Consequently, they resorted to open storage within the department, resulting in exposure to sunlight and rain. This exposure led to the degradation of the furniture's

quality, thereby diminishing its potential for reuse. Additionally, it was discovered that two departments possessed storage facilities within their classrooms rather than in separate rooms.

RECOMMENDATIONS

1. Implement the 3Rs Principle:

- Implement the concepts of Reduce, Reuse, and Recycle (3Rs) into furniture waste management techniques.
- Promote the refurbishment and reutilization of furniture objects to prolong their durability before considering disposal.

2. Establish and implement policies:

- Develop comprehensive furniture waste management rules that provide detailed recommendations for the disposal, recycling, and reuse of furniture.
- Incorporate sustainability concepts into institutional policy to cultivate a culture of sustainable waste management.

3. Enhance awareness and expertise:

- Organize awareness programs to enlighten students, professors, and staff about the significance of sustainable handling of furniture trash.
- Deliver training programs focused on improving involvement and participation by teaching effective garbage sorting and disposal methods.

4. Establish Dedicated Staff Roles:

- Assign specialized professionals or personnel to supervise furniture waste management projects, guaranteeing a concentrated and effective approach.
- Offer training and provide resources to staff workers to improve their proficiency in handling waste.

5. Improve the efficiency and effectiveness of collection and transportation systems:

- Create and implement efficient methods for gathering and conveying furniture materials to assigned recycling facilities.
- Seek collaborations with waste management firms to enhance logistical operations.

6. Promote interdepartmental collaboration:

- Promote the integration and exchange of ideas amongst various departments to establish a cohesive strategy for managing furniture waste.
- Formulate interdepartmental committees or working groups to exchange optimal techniques and synchronize efforts.

7. Encourage the implementation of donation and reuse initiatives:

- Implement furniture donation initiatives to provide pieces in excellent shape to nearby charitable organizations, community groups, or other internal divisions of the institution.
- Develop a centralized mechanism to facilitate the redistribution of reused furniture among several departments.

8. Assess and analyze performance:

- Develop a method for supervising and evaluating the effectiveness of furniture waste management projects.
- Consistently evaluate the efficacy of policies and programs and modify them accordingly based on performance assessments.

9. External Stakeholder Engagement:

- Engage in partnerships with local waste management authorities, community organizations, and businesses to investigate cutting-edge approaches and remain up-to-date on the most effective methods employed in this industry.

10. Integrate sustainability into procuring practices.

- When buying new furniture, it is crucial to consider sustainability criteria. This entails choosing products that are manufactured using recycled materials, including eco-friendly certifications and are engineered for durability and recyclability.

CONCLUSION

The researcher's data underscores the substantial volume of furniture waste generated over time and the problems encountered by selected higher educational institution in managing such waste. These problems include constraints in storage capacity, inadequate transportation resources, budgetary constraints, insufficient personnel to handle bulky furniture items, and a lack of authorities engagement in effectively managing furniture waste. The study analyzed the many categories of furniture waste produced by selected higher educational institution, including items such as chairs, tables, doors, frames, shelves, and cabinets. The findings indicated that the disposal strategies employed for furniture waste were predominantly confined to conventional approaches such as prolonged storage in open or closed facilities. Upon contemplation of the implementation process of the solution, specifically about the sustainable management of furniture waste within the selected higher educational institution, the researcher discovered that wooden items within the furniture waste possessed greater potential for utilization. According to Besserer et al., (2021) "Wood Waste has many advantages with the concepts of the bio-economy and circular economy. It is a material of natural and renewable origin, biodegradable, with remarkable mechanical and thermal characteristics". This was primarily attributed to their superior quality and the relative ease with which they could be redesigned. The researcher discovered that a crucial determinant of the study's success was the interdepartmental teamwork in embracing the proposed change. The study successfully implemented sustainable furniture waste management practices inside the department of a selected higher educational institution, with the cooperation of heads of the departments. The researcher successfully produced a total of 104 useful products, including but not limited to seating arrangements, birdhouses, key holders, art pieces, partitions, planters, coasters, paperweights, tables, and book holders. The implementation of the 3Rs (Reduce, Reuse, Recycle) in Department 1 led to the sustainable management of roughly 526.3 kg of furniture waste. The potential augmentation of this quantity

may have been further realized in the absence of financial limitations encountered by the researcher. The positive consequences of repurposing, redesigning, and reutilizing furniture waste at educational institutions are clear. These practices result in a reduced need for purchasing new products, create additional room for conducting various activities, and foster the promotion of eco-friendly practices among students. The aforementioned conclusions can serve as a basis for future investigations in several domains.

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