

# Punah Avirbhav: Innovative Designs Give New Life To Recycled/Upcycled/Discarded Materials

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## Abstract

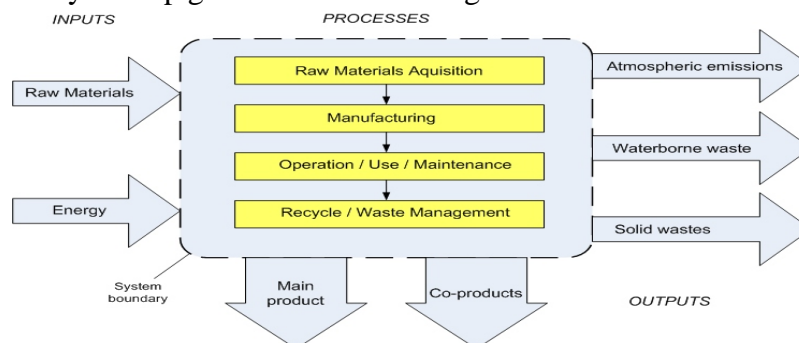
The seed of the idea for the writing of this research article was planted in an innovative activity As part of Swachhata Hi Seva (SHS) and Special Campaign 3.0, NID AP, Inspired by the "Swachhata hi Seva" campaign's call to action, this research article explores the transformative potential of recycled and discarded materials in innovative design. We delve into the world of designers who are breathing new life into waste, crafting furniture from mushrooms and architecture from reclaimed plastic. These creations showcase not only beauty and functionality but also a path towards a more sustainable future.

This paper goes beyond aesthetics, examining the possibilities of life cycle assessment (LCA) in quantifying the environmental impact of using recycled materials. By analyzing the entire lifespan of a product, from its creation from waste to its eventual disposal, LCA empowers designers to make informed choices that minimize environmental footprint. This research highlights the potential of innovative design, coupled with LCA, to significantly reduce landfill waste, lower energy consumption, and ultimately, create a more responsible and sustainable future.

**Keywords:** Circular economy, Discarded materials, Life cycle assessment (LCA), Material reuse, Recycled materials, Sustainable design, Upcycled materials and Waste reduction.

## 1. Aim of the Paper

Currently, natural resources are consumed at an alarming rate than their production. This article aims to examine the designs in the context of a life cycle assessment and their potential to decrease environmental impact. LCA provides a competitive tool for designers to assess their effect. Figure 1 depicts the main method for conducting LCA investigations. Even the financial burden and marketing difficulties may be incorporated into the study to help guide decision-making.



**Figure 1.** The main stages and typical inflows and outflows are considered in the lifecycle assessment. Credit: Mark Fedkin, <https://www.e-education.psu.edu/eme807/node/690>

## 2. Introduction

Design thinking's 360-degree approach challenges us to see waste differently. Traditional design often overlooks environmental impact. This paper explores a solution: merging design thinking with recycled materials and Life Cycle Assessment (LCA). LCA analyzes a product's environmental footprint. By combining these, designers can make informed choices about recycled materials, minimizing environmental burden and creating commercially viable sustainable designs. This approach paves the way for a future where design fosters creativity from waste and shapes a more responsible world.

An innovative initiative as a run-up to Swachh Bharat Diwas on 2nd October 2023, a day that the nation celebrates the birth anniversary of Mahatma Gandhi, the Ministry of Housing and Urban Affairs (MoHUA) and Dept. of Drinking Water and Sanitation, Ministry of Jal Shakti organised the 'Swachhata Hi Seva' campaign from 15th September to 2nd October 2023, in collaboration with other Ministries, to celebrate 9 years of Swachh Bharat Mission, to reaffirm the commitment of all to make India clean and garbage free. The theme for SHS 2023 is "Garbage Free India". and activities included Cleanliness drives at institutional campuses, religious places, parks, and National Highways, Competitions on essay writing and awareness programs among employees, students, and the general public, Shramdaan activities for officers and staff of the Department on October 1, 2023 at 10 AM and Skits, poems, and songs by school children. (1)

At present the raw materials are considered Critical Raw Materials (CRM) and CRM are principally extracted from natural resources and secondary raw materials (SRM) are urban and industrial landfill sites, and extractive waste facilities. Further to this, and together with environmental and human health aspects, the economic and societal aspects need to be integrated and therefore common cost-benefit analysis (CBA) and life cycle assessment (LCA) methodologies should be also used. A more sustainable and integrated approach in the management of the extractive industry at large, also thanks to proper Guidelines, is needed to boost waste recycling. (2)

Recycled materials are often seen as a way to reduce waste and conserve resources. However, they are often perceived as being of lower quality than their virgin counterparts. One solution to this issue is to incorporate innovative designs that can transform recycled materials into high-quality products that are appealing to consumers. By doing so, these materials can be given new life and value. This can help to promote the circular economy and reduce the need for resource extraction. As a result, both the environment and the economy can benefit from the use of recycled materials.

## 3. Literature

The basic principle of life cycle thinking is that the environmental impacts of a product include not only the environmental impacts of the manufacturing process, i.e. direct impacts but also all the environmental impacts that a product has at other stages of its life both before and after manufacture, i.e. indirect impacts. The objective is to establish the impacts that result from the manufacture and use of a product. Life cycle thinking has changed people's understanding of environmental impacts and how environmental impacts are studied. It also forms the basis of many national and international sustainable development and environmental policies and has become a widely recognized approach to dealing with environmental issues. In addition to standardized life cycle assessment (International Organization for Standardization, ISO 14040, 2006a), there are several other methods for evaluating environmental impacts that are based on life cycle thinking these days. Simplified footprint calculation tools have been adopted in recent years, which focus on specific environmental impacts or emission classes, such as water, carbon or phosphorus

footprints (Finnish Environment Institute SYKE, 2014). Global warming, agricultural land use, eutrophication and the use of different chemicals are also often included in reports based on life cycle philosophy (Nielsen & Nielsen, 2009). LCA connects people from business, government, non-profit and international organizations, investors and academics to create a dynamic learning community to escalate change in possibilities for entrepreneurs to influence environmental impact (Water Footprint Network, 2016). (3)

From the studies of Atul Manohar “The complete lifecycle of the product is Raw material → Final Product → Reached user → Usage cycles → Discarded at death → Ends up in a junkyard, partially recycled and partially reaches Landfill.”

Throughout a product's lifecycle, hundreds of natural resources are consumed, with water being the largest resource consumed. All nature's creations disintegrate into nature without leaving much trace. Humans have used rituals to accelerate the process of dead body disintegration, either buried or cremated, based on religious beliefs, to completely disintegrate into nature.

Here are some thoughts about this death and the afterlife of the products.

- Value for the usage lifecycle: Good balance in the usage lifecycle and product costing
- Respectful death: Develop a product that dies a respectful death after the usage cycle is over
- Well-defined afterlife: Products should have a defined afterlife, after the official death
- Disintegrate in nature: Products could disintegrate into nature completely as if they never existed.

Consumer goods and food processing companies often neglect the environmental impact of their products. Manufacturers should define death scenarios for their products, such as taking back dead products to salvage and reprocess components for new products. This would save raw material costs and create brand value. Policymakers should make it mandatory for industries, especially battery manufacturers, to manage their dead products, such as battery recycling.

#### **4. Drawbacks and Limitations of Recycling**

The process of recycling materials has limitations and drawbacks, which often have huge consequences for the environment. Another problem that is common with recycling materials is the separation and sorting processes, which are often tedious and time-consuming. Waste pickers mix various types of waste, making it difficult to sort during recycling. An example is plastic waste made from natural and synthetic sources or a combination of both sources for improved properties and performance (8,9,10). Among the recent methods of packaging is mixed material packaging, which comes with the challenge of recycling due to the difficulty of separating the materials for recycling and reuse (11). Various materials have different recycling methods and drawbacks (12).

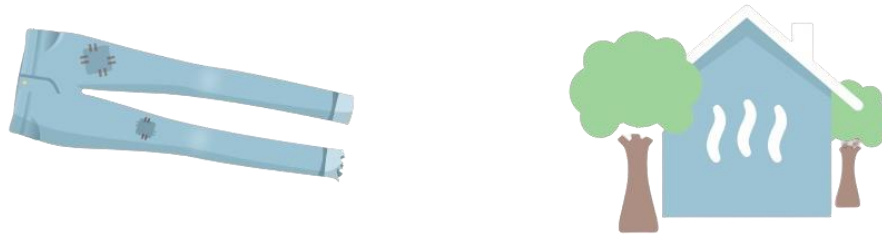
#### **5. Methodology**

The theoretical framework consists of theories dealing with environmental effects assignable to products and services by quantifying all inputs and outputs of material flows and energy and assessing how these materials flows and uses of energy have an impact on the environment. The research approach is qualitative and is based on case studies.

The first case study presents the philosophy and thinking model for the LCA technique. The case study comprises “The 'Blue Jeans Go Green program' by Cotton Incorporated for recycling denim products.”

**6. Case studies:**

Case study 1 (13) describes the idea and thinking model for the LCA approach, which focuses on two products: jeans and insulation. The quantity of the savings is determined by how the energy is created and, as a result, by the amount of flue gases produced throughout the process. The savings have an influence on global warming, acidification, and eutrophication, among other impact areas. (14)



**Figure 2: Jeans to House Insulation**

Source: <https://www.coglude.com/research/afterlife-effect>

The Blue Jeans Go Green™ program by Cotton Incorporated promotes the recycling of cotton denim, ensuring it is kept out of landfills and given a new life. The denim fashion process involves harvesting, spinning, weaving, and preparing it for garment manufacturing. Once worn out, consumers can recycle denim, diverting it from landfills where millions of pounds of textiles are thrown out annually. This sustainable approach protects and comforts consumers.

Cotton fibre is crucial for denim production and is expensive, requiring 20,000 litres of water to produce 1 kg of cotton. Sustainability is essential for the future of cotton fibre, and it's time to make cotton circular and designed for recycling. The Blue Jeans Go Green programme supports the transformation of pre-owned cotton into insulation and other creative new products. Cotton Incorporated has been working with Bonded Logic, Inc. for over 15 years to create new uses for old denim.

Cotton Incorporated has successfully recycled over 2,100 tons of denim, transforming it into thermal packaging insulation for fresh and cold food. The program has not only reduced landfill waste but also helped preserve the fabric's original fibre state, ensuring its long-term sustainability. This program is helping to build homes with Habitat for Humanity affiliates, organising recycling drives and raising awareness of sustainability.



**Figure 1 to 4: Process of After-Life jeans to building insulation blocks and other building products**

Image sources: <https://bluejeansgogreen.org/insulation/>



Case study 2 (16) The Art of Upcycling: Giving New Life to Old Items by Amarrdep Gulri, founder Deco-Arte Published Jul 19, 2022. From the summary of his publication, upcycling is a growing movement aiming to combat the disposable nature of our consumer-driven society by promoting sustainable and creative consumption. Upcycling is the process of repurposing old or discarded items into new, useful items, allowing us to explore hidden possibilities in common items that might otherwise end up in landfills. Upcycling can transform various décor and design items like furniture, clothing, and textiles into functional, eco-friendly items like plastic bags, advertising banners, and paper and books.

Upcycling is a growing trend that encourages problem-solving, creativity, and resourcefulness by transforming discarded items into functional and ornamental objects. It involves techniques like etching, painting, or elaboration, reducing waste and adding eco-recognition to homes. Upcycling is not limited to specific skills or inventive abilities, and anyone can participate in upcycling initiatives, regardless of age or historical background. Recycling often involves simplicity and accessibility, allowing people to broaden new skills and discover hidden talents. By embracing the beauty and character of discarded items, upcycling not only reduces waste but also promotes a second chance for waste reduction.



**Examples of upcycled designs**

**Image sources: <https://www.linkedin.com/pulse/art-upcycling-giving-new-life-old-items-amarrdep-gulri>**

Finally, the art of Upcycling fosters social interest, promoting collaboration and knowledge exchange through conferences and events in communities and corporations, thereby improving the cost of group projects. Upcycling offers a sustainable and innovative solution to our throwaway culture, reducing waste and environmental impact. It encourages creativity and problem-solving, making one-of-a-kind products and contributing to a more sustainable way of life. By repurposing old objects, we can discover their hidden potential and contribute to a more sustainable and aware lifestyle.

Findings from the case studies are reduction in energy, Water Consumption, contribution to Climate Change, Sustainability, Materials, production and Consumer use findings

## 7. Design Ideas / Prototype:

As a part of Swachhata Hi Seva, Special Campaign 3.0 which is held at the National Institute of Design Andhra Pradesh, as a faulty, designer of an institute of national importance, and as a responsible citizen would like to contribute and participate in the campaign and designed a prototype of created trash cans made of recycled materials.

### Step 1: The idea



### Step 2: Researching the product



### Step 3: Get ready for Usage





Materials used to make this prototype are discarded bamboo, rice bags to tie the joints Nails.

**Process:** After the first phase of ideation is accomplished, materials are collected by the ideation. The ideation began with witnessing the waste of bamboo and rice bags dumped in the backyard. In the second phase, a few passionate students were brought in to complete the product research. After overcoming several difficulties and failures in the next phase, final step 3, user testing, we placed our prototype in the main circulation area so that people could efficiently utilize it.

Prototype trash cans made from recycled materials can be a great contribution to the following parameters: Promotes Sustainability: Recycling materials helps conserve resources and reduce landfill waste, aligning with the spirit of Swachhata Hi Seva, promoting waste reduction and resource conservation.

**Cost-Effective:** Recycled materials are cost-effective and easily replicable, making trash cans a cost-effective and scalable solution for institutes.

**Educational Tool:** The trash cans serve as a constant reminder to students and staff about the importance of recycling and responsible waste management.

**Design Inspiration:** This prototype, set by a faculty member at a top design institute, serves as a powerful example of sustainable solutions, inspiring others to explore recycled materials and create innovative solutions.

**Durability:** Chosen recycled materials that are strong enough to withstand daily use as trash cans.

**Usability:** The size, shape, and lid mechanism of the trash can be carefully considered for efficient waste collection and odour control.

**Aesthetics:** Even though they're made from recycled materials, the trash cans can be designed to be visually appealing.

**Signage:** Added clear signage to encourage proper waste disposal and highlight that the can is made from recycled materials.

The NID AP institute's campaign focused on diverse initiatives and creative solutions. The prototype involved presenting a waste management solution, gaining feedback from students, staff, and faculty, and collaborating with other sustainability-minded students or departments. If successful, funding options like grants or college administration could be explored to produce more trash cans. The campaign emphasized the importance of diverse initiatives and creative solutions.

## 8. Conclusion:

The Swachhata Hi Seva campaign at NID AP led to a project to design a prototype trash can made from recycled materials. The project involved collaboration, problem-solving, and user testing, ultimately leading to the creation of a new design from the waste. The waste was upcycled from the institute's backyard using discarded bamboo and rice bags. Despite setbacks and failures, the lessons in design thinking were embraced and refined. The prototype was placed in the main circulation area for feedback, and user testing was crucial for identifying practical issues and ensuring the design functions effectively in real-world scenarios.

The prototype at NID AP can serve as a foundation for a larger-scale solution, design thinking, problem-solving, promoting responsibility, sustainability and resource conservation. By showcasing the design, incorporating user feedback, and collaborating with students, faculty and other departments, the project can be amplified. The success of this project demonstrates the power of design thinking and sustainability,

inspiring future projects across communities. By embracing our role as designers and responsible citizens, we can contribute to a cleaner and more sustainable future.

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