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# Utilization of Recycling and Upcycling in Interior Design: Reusing Waste Materials to Create Functional, Sustainable Spaces

Kiran Saleem
*Faculty of Art & Design, Interior Design, Indus University, Karachi, Pakistan*

## ABSTRACT

The over-consumption of natural resources and the accumulation of human-made waste have created severe environmental pressures, while the construction and interior-fit-out sectors remain among the largest generators of solid waste and carbon emissions. This paper examines how recycling, reuse, and upcycling of waste materials can be used to produce functional, aesthetically coherent, and environmentally responsible interior spaces. Using a mixed-methods design, the study combines a survey of 72 respondents, structured interviews with three practising architects, and three case studies of reuse-driven projects, and translates the findings into an applied interior-design proposal a "Recycling Hub" community space on Karachi's Sea View. The survey shows strong pro-recycling sentiment: 81% of respondents recycle, paper, glass and plastic are the materials most often reused, and a majority believe recycling or renovation can save substantial cost against demolition and rebuilding. Practitioner interviews reveal a persistent gap between attitude and habit, with architects still inclined toward demolition despite acknowledging the cost and environmental benefits of reuse. Read against the most recent 2025–2026 literature on circular design and construction-and-demolition (C&D) waste, the study argues that interior designers are pivotal actors in shifting the built environment from a linear "take–make–dispose" model to a circular one, and offers design considerations for specifying reclaimed, durable, and disassemblable materials.

**Keywords:** recycling; upcycling; interior design; circular economy; adaptive reuse; reclaimed materials; sustainability; Karachi

## 1. INTRODUCTION

Recycling is the process of converting waste materials into new materials and objects, often including the recovery of energy from waste. Recyclable materials include many kinds of glass, paper, cardboard, metal, plastic, tyres, textiles, batteries, and electronics. The idea rests on completing and restarting the life-cycle of a material or product: rather than ending in a landfill, a material is diverted back into productive use. Recycling promotes the sustainable use of natural resources, encourages community development, saves new land use, prevents pollution, conserves energy, and reduces greenhouse-gas effects, while lowering costs and creating employment in recycling and manufacturing industries.

Reuse and recycling matter especially in construction and interior fit-out, given the volumes of waste and energy involved. The construction industry is a major contributor to global environmental pressure: recent analyses estimate that it consumes around half of all extracted natural resources and generates roughly a fifth of global greenhouse-gas emissions (Javed et al., 2025). Construction-and-demolition (C&D) waste is one of the largest waste streams on earth on the order of ten billion tons generated worldwide each year (Zhu & Feng, 2026) and is projected to reach about 2.2 billion tons annually in the most rapidly urbanising regions, with over three-quarters of it still not repurposed (World Economic Forum, 2025). Making construction elements

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by re-designing the role of old products or materials is a concrete route toward a more responsible future.

Recycled and reused materials carry history and character; having already served a purpose in one life, they take on a second while retaining their story. Furniture and decorative objects can be repurposed, restored, or repaired; tiles, floor coverings, textiles, and even sinks and counters can be produced from recycled content. Reclaimed wood air-dried timber left after demolishing older buildings gives an interior a distinctive character and is frequently stronger than virgin wood. Recycled plastics can be formed into almost any shape and used for cladding, decking and furniture, and can even be used to make concrete structures reportedly up to 15% stronger than conventional concrete, allowing longer-lasting and more eco-friendly construction.

The problem this research addresses is that, despite these benefits, the reuse logic seldom extends to the parts of a building that become rubble, and interiors in particular rarely showcase recovered materials they are usually hidden behind finishes. Early interior design paid excessive attention to aesthetic effect while neglecting ecological and environmental protection; today, occupants demand higher environmental performance from private and public space, which advances green construction and the 3R idea Reduce, Reuse, Recycle. This study asks how recycling and upcycling can be embedded in interior space itself, both to conserve natural resources and to produce distinctive, functional environments.

### 1.1 Aims and Objectives

The study pursues four aims:

- To clarify what is meant by the use of recyclable materials in interior and exterior design, and to identify which materials are involved.
- To assess attitudes toward recycling among designers and the wider public, and to surface the barriers that keep reuse from becoming habitual.
- To analyse, through case studies, the challenges and success factors of designing with reused and upcycled materials.
- To translate the findings into applied design considerations and a demonstrator interior-design project.

## 2. KEY DEFINITIONS

The study distinguishes a family of related terms that are often conflated in practice.

*Table 1. Core waste-hierarchy terms used in this study.*

| Term | Meaning |
|---|---|
| Reuse | Using a material again for the same purpose it was originally made for; the item is largely unchanged (e.g. second-hand furniture, clothing). |
| Upcycling | Using a material again for a different purpose, keeping its form and structure but raising its value (e.g. tyres as swings, pallets as furniture). |
| Recycling | Collecting and processing materials that would be discarded and transforming them into new products, often breaking them to base components. |
| Incineration | Burning or gasifying waste; may produce energy but destroys the original product at the molecular level. |
| Landfilling | Burying waste; preserves material inertly but recovers nothing, |

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| | |
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| | apart from occasional methane capture. |
| Reduce | Lowering overall consumption of goods and resources at source the first and most effective 3R action. |

Three further terms describe where in the supply chain waste arises: post-industrial waste is generated in a factory during manufacturing (scrap, trim, punch-outs); pre-consumer waste is generated from finished but misprinted, defective, or excess products; and post-consumer waste is generated after a product has been used and discarded by a consumer the waste people are most familiar with.

## 3. LITERATURE REVIEW

### 3.1 Fast Furniture and the Environmental Cost of the Linear Model

The linear "take–make–dispose" model is vividly illustrated by "fast furniture." Where Americans discarded roughly 2 million tons of furniture in 1960, the U.S. Environmental Protection Agency now estimates that more than 12 million tons of furniture and furnishings are thrown out annually, only a small fraction of which is recycled because the mix of materials especially in upholstered pieces and mattresses is hard to clean and reprocess. Growth in furniture waste has far outpaced population growth, driven by cheap, quickly produced home goods analogous to fast fashion. Lightweight filler materials such as particleboard, flat-pack logistics, and globe-spanning supply chains reduce price but inflate furniture's carbon footprint. Alternative models furniture subscription and rental, reclaimed-wood lines, and take-back schemes have begun to emerge as the industry acknowledges its sustainability problem.

The most recent literature reframes this as a circularity challenge. A 2025 study of circular design strategies in interior architecture argues for rethinking furniture through reuse, recycling, and waste materials, highlighting recycled polypropylene, textile waste, 3D-printing techniques, and Design for Disassembly as emerging tools (Burkut, 2025). A 2026 industry analysis similarly contends that the highest value comes from keeping products in use repairing, reupholstering, and redeploying a chair across projects rather than shredding it for recycled content after a short service life (LX Design Studio, 2026). This value-retention view directly informs the design considerations proposed later in this paper.

### 3.2 Recycled Materials in Commercial and Contemporary Interiors

Commercial spaces are powerful vehicles for influencing attitudes, and prominent brands increasingly feature recycled materials to signal environmental commitment. Early examples include restaurants and retail interiors built from reclaimed packaging wood, shipping containers, ropes, wheels, and U-shaped iron frames. Because many natural resources are finite, recycling is presented not merely as an ethical gesture but as an efficient process that supports long-term economic growth alongside social and ecological benefit. Contemporary practice has moved from novelty to system: a 2025 review of recycled and upcycled materials in architecture and civil engineering documents rising EU recycling rates and a maturing set of applications for recycled steel, glass, concrete, and plastics (ScienceDirect review, 2025), while 2025–2026 sustainable-interior guidance frames adaptive reuse reclaimed wood, recycled glass, salvaged architectural features as a core strategy that conserves resources and preserves a space's character (Terra Selene, 2026; Andreu World / ArchDaily, 2025).

## 4. METHODOLOGY

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The study adopts a mixed-methods design that combines communication-based and evaluative techniques. Hypothesis and concept development drew on reviews of scholarly work to generate approaches to the design problem. Three instruments were used. First, a survey questionnaire (closed-ended and Likert items) captured the attitudes and habits of the general public and design students toward recycling. Second, structured interviews with practising project architects captured professional attitudes toward demolition versus reuse. Third, case studies of reuse-driven projects were analysed qualitatively to identify challenges and success factors. Qualitative methods (interviews, observation) yielded verbal analysis themes, ideas, and issues while the survey provided descriptive quantitative measures. Data were analysed with descriptive statistics (frequencies and percentages).

The survey drew responses from up to 72 participants (item counts vary from 47 to 72 because some questions were conditional or optional). Respondents skewed female (63.9%) and male (36.1%). This is a small, convenience-based, primarily student sample, so results are indicative rather than statistically generalisable a limitation revisited in Section 7.

## 5. RESULTS AND FINDINGS

### 5.1 Recycling Behaviour and Materials

A large majority of respondents recycle: 81.4% answered “yes” and only 18.6% “no” (Figure 1). When asked how often they consider recycling on an interior-design project, most answered “often” (59.2%), with 16.9% doing so on every project and 23.9% unsure indicating that recycling is a frequent but not yet default consideration. Regarding materials (Figure 2), paper leads at 71.8%, followed by glass (66.2%) and plastic (63.4%), then textiles (47.9%), aluminium (36.6%), and electrical items (35.2%); only 5.6% recycle nothing.

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**Figure 1. "Do you recycle?" (n = 70)**

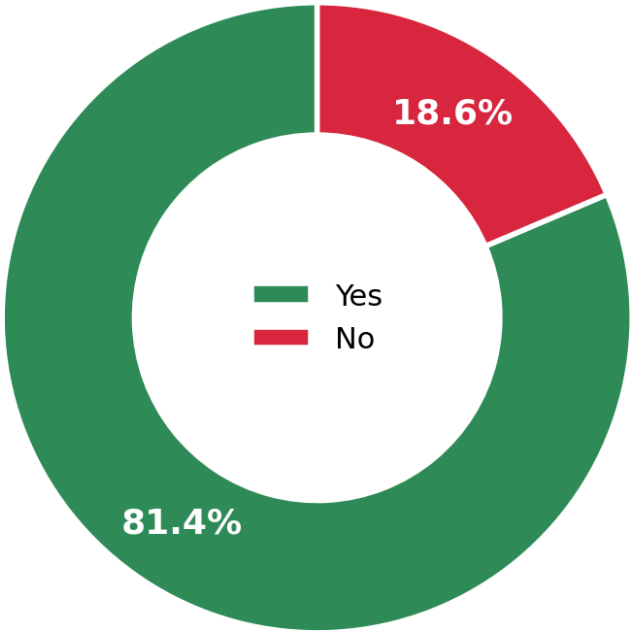



*Figure 1. Share of respondents who recycle.*

**Figure 2. Materials respondents recycle in interior projects (n = 71)**

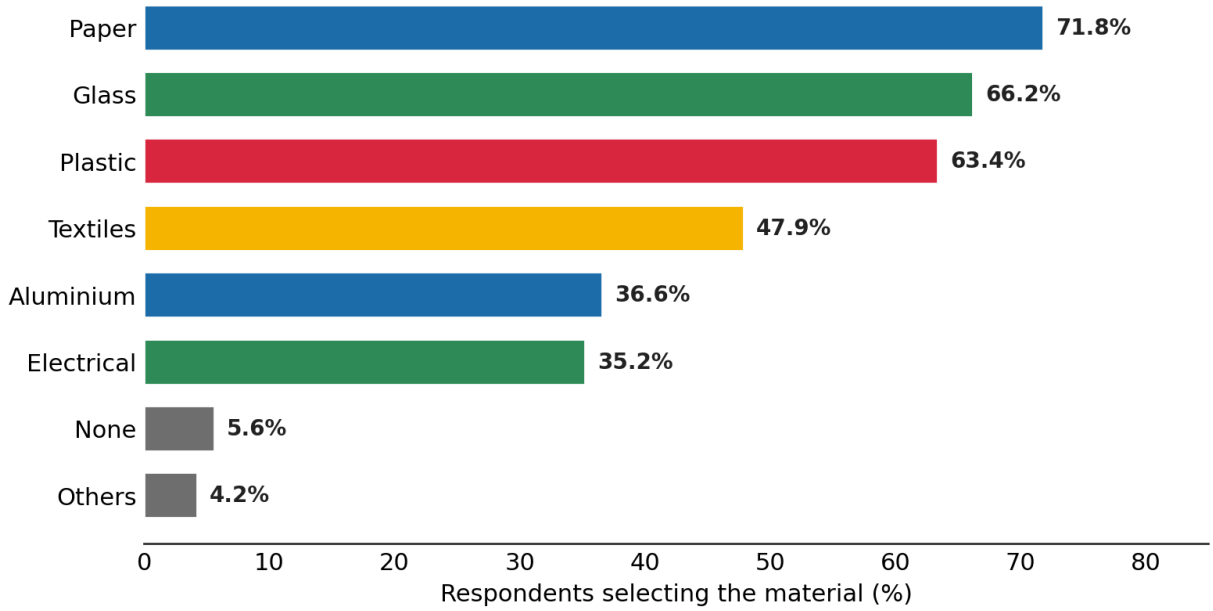



*Figure 2. Materials respondents reuse or recycle in interior projects (multiple selection).*

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### 5.2 Motivations and Barriers

Motivations are broad-based and environmentally framed (Figure 3): the most cited reason is that recycling helps with climate problems (66.7%), followed closely by "good for the economy" (63.9%), "saves energy" (62.5%), "preserves resources and protects wildlife" (62.5%), and "reduces landfills" (51.4%). Among the minority who do not recycle (Figure 4), the leading barrier is that it is "too hard to do" (36.2%), followed by the perception that trash is an eyesore (34.0%), a lack of incentive "if they paid me" (34.0%) and the belief that recycling "makes no difference" (27.7%). These barriers are attitudinal and logistical rather than technical, which is encouraging for intervention.

**Figure 3. Reasons respondents choose to recycle (n = 72)**

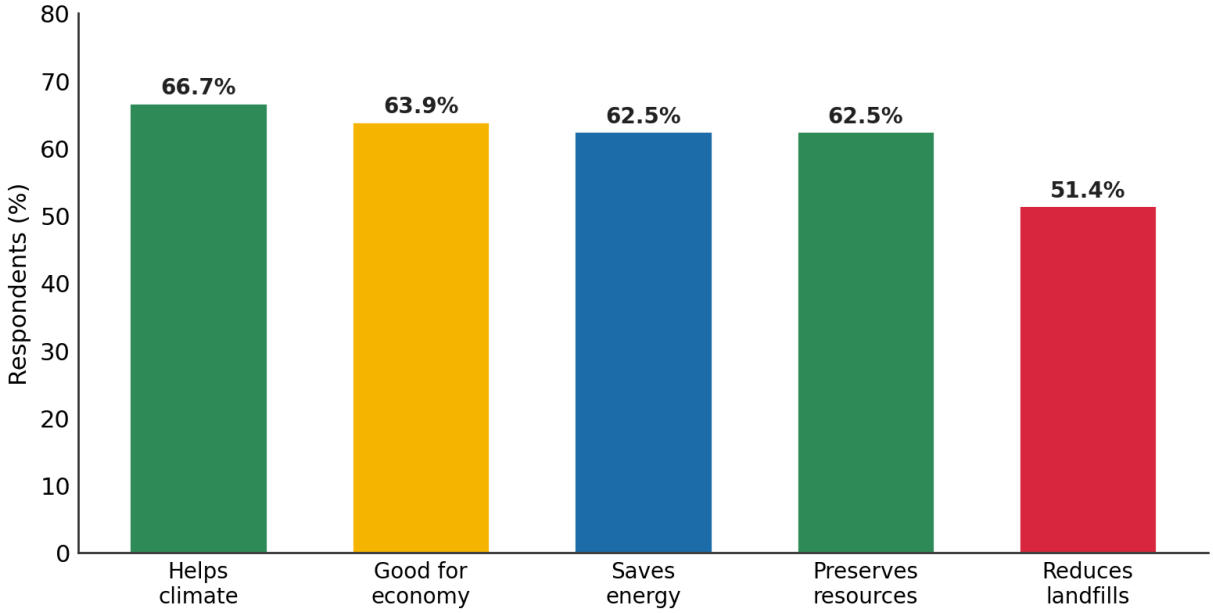



*Figure 3. Reasons respondents give for recycling.*

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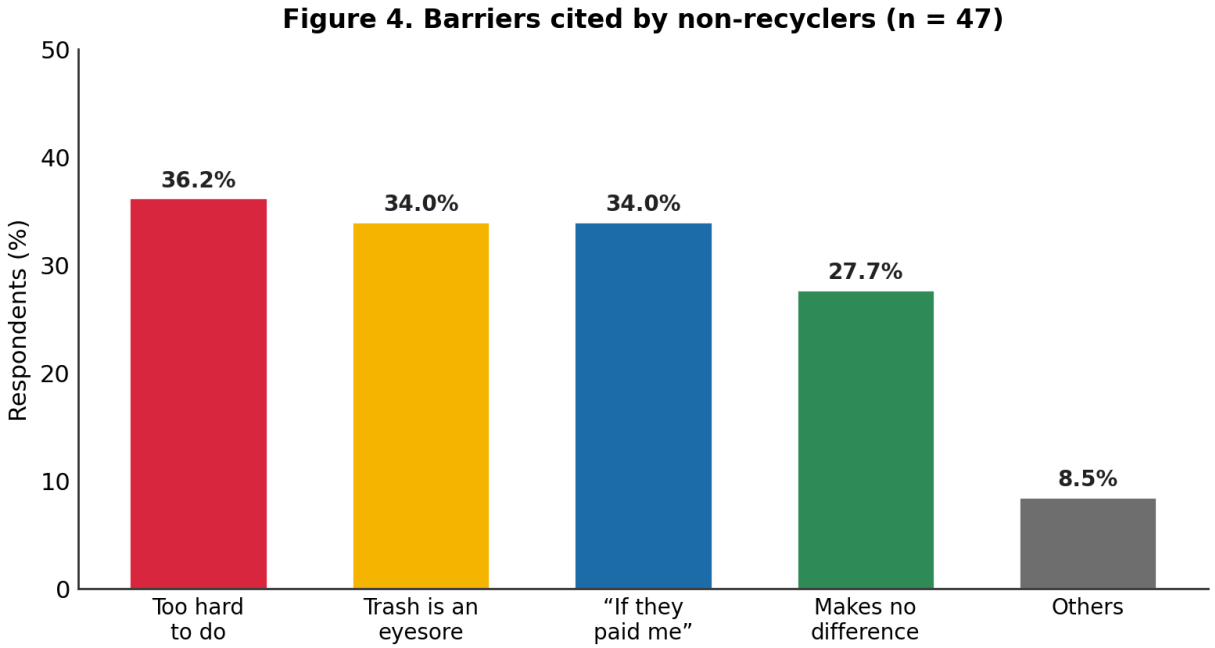



*Figure 4. Barriers cited by respondents who do not recycle.*

**5.3 Convenience and Perceived Cost Savings**

Recycling is generally seen as workable within design practice (Figure 5): 43.1% find it convenient and 16.7% very convenient, with 36.1% neutral and only about 4% finding it irritating or avoidable. On cost (Figure 6), when asked how much could be saved by recycling or renovating instead of demolishing and rebuilding, 31.9% estimated a 50% saving, 25.0% estimated 70%, 25.0% estimated 25%, and 15.3% estimated 40%. Although these are perceptions rather than measured costs, they align strikingly with 2025 industry evidence that adaptive reuse can deliver roughly 12–15% cost savings by avoiding demolition and new construction (World Economic Forum, 2025) and in the respondents' view the savings are potentially far larger.

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**Figure 5. Perceived convenience of recycling in design (n = 72)**

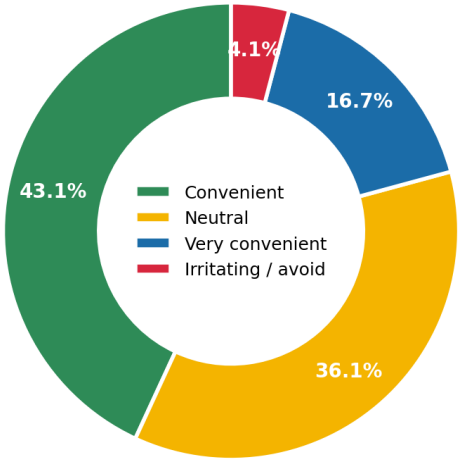



*Figure 5. Perceived convenience of incorporating recycling into design.*

**Figure 6. Cost savings respondents attribute to recycling / renovation (n = 72)**

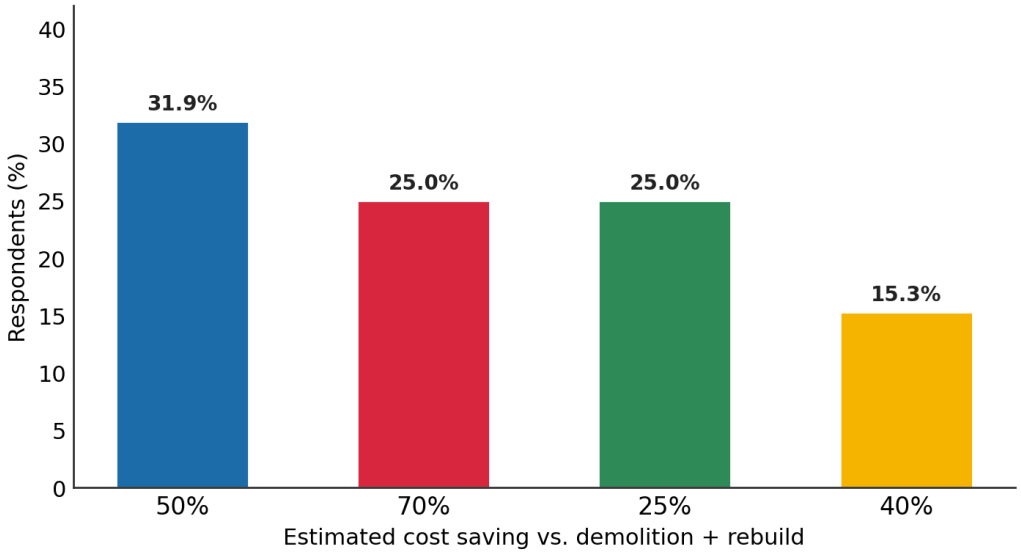



*Figure 6. Cost savings respondents attribute to recycling / renovation over demolition.*

### 5.4 Practitioner Attitudes (Interviews)

The three architect interviews reveal an attitude–behaviour gap (Figure 7). Two of the three (Nadir Ali and Faris Aftab) reported a strong inclination around 90% to demolish and rebuild from scratch, and the third (Sameer Siddique) about 70%. Willingness to reuse pre-existing structures was correspondingly limited (10–40%). Yet all three agreed that recycled materials are cost-efficient, and all endorsed introducing recycling schemes in schools. Their views on feasibility diverged sharply: one held that a house cannot reliably be built from recycled plastic, while another who had prior recycling-project experience was confident it could. The pattern suggests that experience with reuse, more than principle, predicts willingness to specify it.

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**Figure 7. Practitioner attitudes: demolition vs. reuse (interviews, n = 3)**

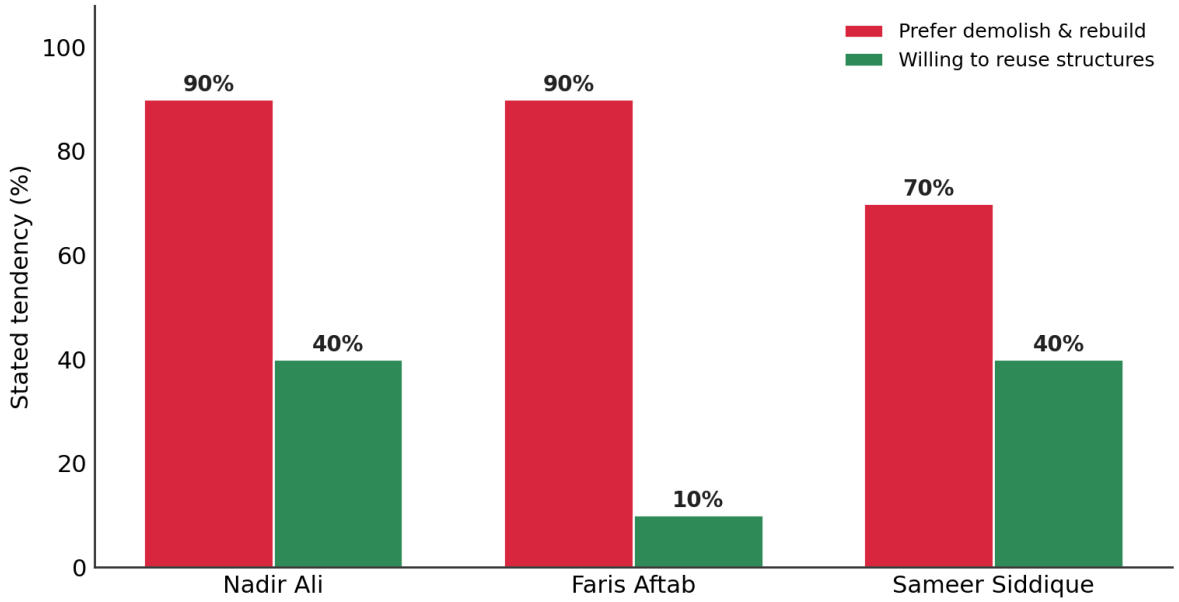



*Figure 7. Practitioner attitudes toward demolition versus reuse.*

*Table 2. Summary of the three practitioner interviews.*

| **Practitioner** | **Demolish & rebuild** | **Reuse structures** | **Prior reuse experience** | **House from recycled plastic?** |
|---|---|---|---|---|
| Nadir Ali | 90% | 40% | No | Considers it unreliable |
| Faris Aftab | 90% | 10% | Yes | Confident it is feasible |
| Sameer Siddique | 70% | 40% | Yes | Comfortable with the idea |

## 6. CASE STUDIES

### 6.1 Zero Carbon Cultural Centre, Makli, Pakistan

The Zero Carbon Cultural Centre a giant bamboo pavilion in Makli built by local people with architect Yasmeen Lari's Heritage Foundation of Pakistan demonstrates low-carbon, community-built architecture. Completed in 2017 on a 1.6-hectare site beside the Makli Necropolis (a UNESCO World Heritage Site), it is reportedly the largest bamboo structure in Pakistan and among the largest in the world, measuring 27 m long, 18 m wide, and 11 m at its highest point. It is composed of large prefabricated bamboo panels (8 m × 1.5 m) made under workshop supervision, which allowed construction in just ten weeks. Embodying Lari's philosophy of "barefoot social architecture," its open plan and thatched roof keep the space cool without air conditioning, and it hosts workshops teaching locals to make terracotta tiles, smokeless mud-and-lime stoves, and compostable toilets. The lesson for interior practice is that local, low-impact materials and prefabrication can deliver a functional, dignified public interior at minimal environmental cost.

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### 6.2 Giving Demolished Building Materials a New Life

In the United States, demolition is culturally equated with progress, sustaining a multi-billion-dollar demolition industry; in 2010 an estimated 104 million tons of material flowed from project sites into the waste stream, accounting for just under 40% of the nation's annual solid waste. More recent figures are larger still: the EPA reported over 600 million tons of C&D debris in a single recent year, some 23% of the U.S. waste stream (Waste Advantage, 2025). Salvageable elements doors, windows, high-end finishes are often not preserved because of compressed schedules, lack of storage, and no obvious buyer, so it is easier to repeat the demolish-and-dump cycle, especially where landfills are cheap. The case makes the point that the barrier to reuse is largely logistical and economic, not physical.

### 6.3 Deconstruct, Do Not Demolish

The third case reframes demolition as deconstruction. In 2019 the civil-construction sector responsible for about 38% of global energy-related $CO_2$ emissions reached a historical maximum, according to the 2020 Global Status Report for Buildings and Construction. Because roughly two-thirds of today's building stock will still exist in 2040, the sector must convert its linear use of materials to a circular model: stop demolishing and begin to disassemble. Life-cycle assessment indicates that reusing construction materials for the same purpose can have an impact 2–12 times lower than using new equivalents, while disassembly preserves local construction knowledge and the cultural value of existing buildings. Specialist firms such as Arquivo in Brazil and the Belgian cooperative Rotor DC now act as facilitators of material reuse, and the concept of Design for Disassembly (DfD) argues for joining materials with mechanical fittings so they can be taken apart later. The most recent 2025–2026 literature strongly corroborates this direction, with adaptive-reuse projects diverting up to 87% of construction waste from landfill and the circular-economy view of C&D waste now dominant in the research field (World Economic Forum, 2025; Zhu & Feng, 2026). Figure 8 consolidates the environmental case.

**Figure 8. The environmental case for reuse over demolition (2019–2026 data)**

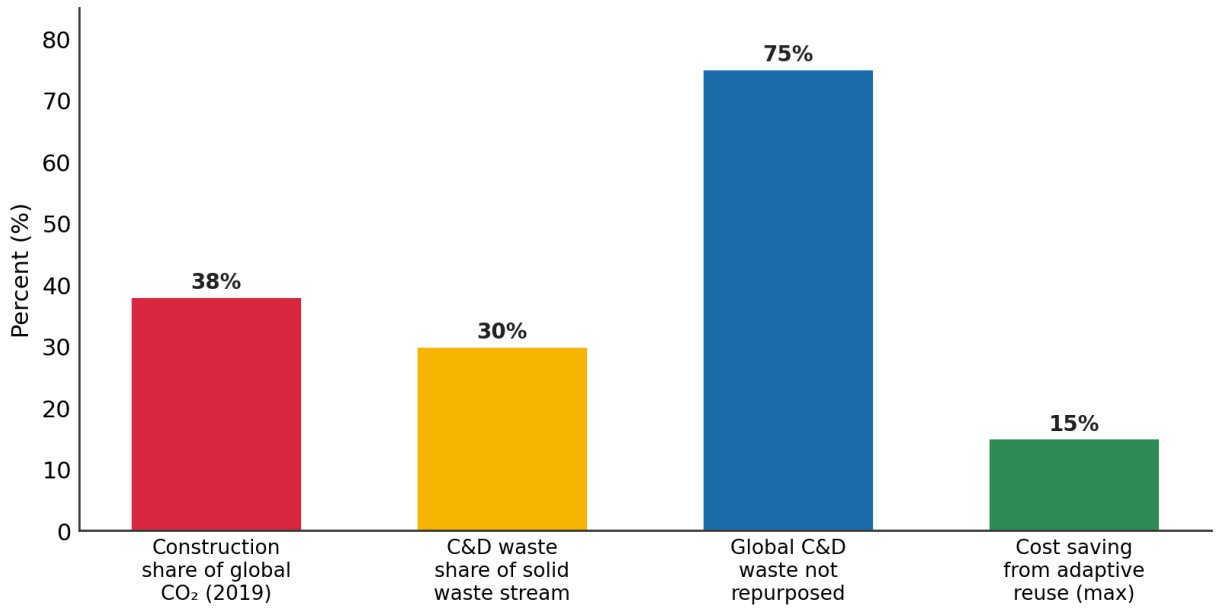



*Figure 8. Consolidated environmental case for reuse over demolition.*

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## 7. DESIGN CONSIDERATIONS AND APPLIED PROPOSAL

Synthesising the findings, the study identifies design considerations for embedding recycling in interior space. Cladding and surfaces can be made from a wide range of recovered materials wood, metal, brick, and composites blending cement with recycled polystyrene or wheat- and rice-straw fibres while attending to fire vulnerability. Waste plastic can be compressed into building blocks, and layered newspaper-and-glue panels can imitate wood grain for various applications. Beyond material selection, the guiding principles are accessibility (ease of use for people with disabilities), low cost, durability, and extensibility designs that can be maintained, adapted, and extended over time, minimising production, operational, and end-of-life waste. Crucially, windows and doors must be handled with care during dismantling and inspected for viability before reuse.

These principles were applied in a demonstrator project: a "Recycling Hub" community and cultural space on the Sea View Service Road, Clifton, Karachi (site area ≈ 23,190 ft²). The program includes a café and reading room, an interior display area, a central activity space, a workshop, prayer areas, and stalls, organised around a circular activity core. The design specifies reclaimed wood structures and flooring, used tyres as hanging planters and casual seating, wooden shipping pallets as platforms and benches, steel drums and shovel-handles repurposed into furniture, and a signature exterior mural made from mixed recycled objects. Winter- and summer-wind analysis informed an open, naturally ventilated section, echoing the Makli precedent. The proposal thus operationalises the paper's central claim: that reused and upcycled materials can produce a functional, characterful public interior while conserving resources.

## 8. DISCUSSION

Three themes emerge. First, public sentiment is ahead of professional habit. Respondents recycle widely, find it convenient, and believe it saves money, yet the architects interviewed still defaulted to demolition. This attitude–behaviour gap mirrors the wider construction sector, where circular-economy awareness is high but linear practice persists (Burkut, 2025). Second, the barriers are addressable: they are logistical and economic storage, schedules, incentives, and the perception of difficulty rather than technical, which is precisely where policy levers such as recycled-content requirements, tax credits for deconstruction, and reuse marketplaces can act (American Recycler, 2026). Third, experience matters: the one interviewee with hands-on reuse experience was markedly more confident about feasibility, suggesting that exposure through education and pilot projects is the most direct route to changing practice consistent with the respondents' near-unanimous support for recycling schemes in schools.

The applied proposal shows that the design vocabulary already exists: reclaimed wood, pallets, tyres, drums, and mixed-waste murals can be composed into a coherent, contemporary interior. What the recent literature adds is a hierarchy of value reuse and refurbishment above recycling, and Design for Disassembly so that today's interior does not become tomorrow's landfill (LX Design Studio, 2026).

## 9. LIMITATIONS AND FUTURE RESEARCH

The study's limitations are chiefly methodological. The survey sample is small (up to 72), convenience-based, and skewed toward students, and the interview sample comprises only three practitioners from a single firm, so neither is statistically generalisable. The analysis is descriptive, without inferential testing, and the cost-saving figures are perceptions rather than measured life-cycle costs. Future work should use larger, more representative samples; pair

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stated attitudes with measured life-cycle cost and carbon data for specific reuse strategies; evaluate the durability and safety (including fire performance) of upcycled interior materials; and post-occupancy-evaluate demonstrator projects such as the Recycling Hub to test whether reuse-driven interiors perform as intended over time.

## 10. CONCLUSION

Why should we waste when we can be inventive and challenge ourselves through upcycling? Reusing and recycling waste offers one of the simplest ways to furnish a space with the things already around us, transforming discarded objects in creative ways while raising awareness of environmental responsibility. It is a mutually beneficial arrangement for people and nature alike. This study has shown that the public is broadly willing, that the barriers to reuse are practical rather than technical, and that a compelling interior vocabulary of reclaimed and upcycled materials already exists demonstrated here in a Recycling Hub proposal for Karachi. Although many still take the faster route of buying new, it is designers who bear the responsibility, and the opportunity, to make circular, upcycling-led practice both practical and desirable. By fully understanding the roles and benefits of reuse, recycling, and upcycling, the profession can conserve natural resources and, at the same time, create interiors with genuine character.

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