Sustainable Furniture Design in Guangdong Province Using Recycled Materials

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Abstract

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With the deepening of sustainable development concepts, the reuse of waste materials in furniture design has become a key pathway for driving the green transformation of the furniture industry. As a major furniture manufacturing region in China, Guangdong Province is representative in terms of industrial scale, policy guidance, and design practices. This study employs literature review, field research, and case studies to explore the current state, design pathways, and sustainable development strategies for waste material furniture design in Guangdong. Findings indicate that waste material furniture design in Guangdong primarily follows two pathways: primary design emphasises preserving the material's original form, achieving low-carbon renewal through artistic decoration, structural restoration, and functional extension; secondary design relies on material reshaping, modification, and modular integration to create innovative and scalable redesign solutions.

Introduction:

Today, intensifying global resource constraints and environmental degradation are propelling the design industry to deepen its commitment to sustainable development principles (Khayyam & Tariq, 2022). As one of humanity's most frequently used products, furniture design involves substantial resource and energy consumption while generating waste, placing pressure on ecological environments. The 2024-2029 China Home Furnishings Industry Panorama Research and Development Prospects Forecast Report indicates that green and low-carbon practices will become core competitive advantages for enterprises. Driven by the ‘dual carbon’ policy and green consumption trends, enhancing material utilisation and achieving resource circulation have become pivotal research topics in design.

Among various approaches, the reuse of waste materials has garnered attention for its dual significance in environmental protection and design innovation (Nandy et al., 2022). However, challenges persist, including difficulties in material acquisition and limited methodologies, necessitating deeper exploration at both theoretical and practical levels. Guangdong Province, a major furniture manufacturing and export hub, stands at the forefront of green transformation. Designers in cities like Shenzhen and Foshan have experimented with repurposing recycled materials, offcuts, and discarded furniture. Yet limitations such as limited methodologies and insufficient sustainability hinder broader adoption and market acceptance.

Against this backdrop, this paper examines Guangdong's furniture industry practices to explore how systematic design strategies can promote the effective utilisation of waste materials in furniture design under sustainable principles. Drawing on literature and case studies, it proposes regionally adaptable design methodologies to provide theoretical guidance and practical support for sustainable furniture development in Guangdong and beyond.

Literature Review

Research into the Design for Reuse of Waste Materials

With the intensification of resource scarcity and environmental pollution, the reuse of waste materials has progressively become a significant theme in furniture design. As early as the 1960s, Papanek proposed ‘ecologically conscious design’ in Design for the Real World, emphasising the fulfilment of basic needs and the avoidance of consumerism (Papanek, 1972). Entering the 21st century, theories such as the ‘circular economy’ and ‘cradle-to-cradle’ have driven furniture design to consider reuse and recycling from the earliest stages of its lifecycle.

Existing research predominantly focuses on material properties and processing innovations. Guo (2013) categorised the redesign of waste timber into refurbishment, deconstruction, raw material retention, moulding, and modification; Fu (2015) proposed pathways for component and colour reprocessing based on nostalgic psychology. Gao et al. (2019) utilised polymer materials to optimise waste corrugated cardboard, enhancing load-bearing capacity and stability; Wang et al. (2023) employed microwave expansion to prepare textile-starch composites, achieving a balance between strength and biodegradability. Regarding design strategies, Vezzoli et al. (2018) proposed modularity to enhance repairability and recycling rates; Binder et al. (2011) emphasised evoking users' lifecycle awareness; Lidenhammar (2015) noted reuse constraints stemming from economics, convenience, and culture, while highlighting that eco-sharing cultures foster acceptance of refurbishment and leasing among younger demographics.

Despite substantial achievements, challenges persist: a lack of unified methodology (Lu & Yuan, 2011), unsystematic research on material classification and performance (Rahim et al., 2020), and an abundance of case studies coupled with insufficient regional systematic investigations. Consequently, there is an urgent need for interdisciplinary integration of material properties, design methodologies, and social acceptability to provide actionable theoretical support for sustainable furniture design.

Sustainable design

The concept of sustainable design can be traced back to the mid-20th century notion of “green design”. In Design for the Real World, Papanek emphasised that design should fulfil basic human needs while minimising environmental impact (Papanek, 1972). Subsequently, the 1972 Stockholm Conference on the Human Environment and the 1987 report Our Common Future introduced concepts of environmental protection and ‘sustainable development’ (Sohn, 1973; WCED, 1987), marking the emergence of sustainable design as a distinct discipline from green design (Holden, 2021).

Entering the 21st century, sustainable design has progressively evolved into a comprehensive approach encompassing ecological, economic, social, and cultural dimensions. The US Office of Technology Assessment (1992) defined it as ‘incorporating environmental attributes into design objectives’; Manzini (2015) emphasised community participation and systemic transformation; Shi and Liu (2019) proposed integrating health, safety, and regional adaptability; while Geng et al. (2020) underscored its social embeddedness and the equilibrium between humanity and nature.

Recent research has pivoted towards life cycle assessment (LCA) and the circular economy. Malabi Eberhardt et al. (2020) advocated integrating renewable materials and low-carbon manufacturing into design to achieve the closed-loop objective of ‘cradle to cradle’; Bărbulescu et al. (2025) emphasised educational promotion, cultivating sustainable thinking through project-based learning.

In summary, sustainable design has evolved from green design into an interdisciplinary concept encompassing resource management, innovation, and social responsibility. It demands both environmental optimisation of materials and processes, and emphasises systemic and innovative thinking.

Research methodology

This study adopts a qualitative research approach, integrating literature review, case analysis, and field investigation to systematically explore design methodologies for reclaimed materials within Guangdong's furniture industry and their sustainable development pathways. It endeavours to deepen theoretical and practical understanding of the interplay between furniture design and sustainability.

Regarding methodology, the literature review will examine themes such as ‘sustainable furniture design’ and ‘reclaimed material reuse’ to provide theoretical underpinnings for problem definition and case/interview design. Field investigations will concentrate on furniture design firms and manufacturing enterprises in Guangdong, synthesising industry practices through interviews and site visits. Case studies will select representative projects, analysing their experiences across dimensions including materials, structure, functionality, craftsmanship, and environmental orientation, while evaluating their implications and value for the industry's green transformation.

Finding

Analysis of case studies involving selected furniture brands, studios, and independent designers in Guangdong Province reveals that the utilisation of waste materials primarily falls into two categories: primary utilisation and secondary utilisation. The former emphasises preserving the material's original form, extending its lifespan through minimal processing; the latter involves reshaping or extracting specific properties to create new products.

I.Primary Utilisation

Primary utilisation is the most prevalent approach, as it preserves the material's form, structure and texture while aligning with the principles of low carbon footprint and minimal intervention. This method imbues furniture with cultural resonance and authenticity. Drawing upon case studies, this research identifies four typical techniques employed in primary design:

1. Artistic Re-decoration

This approach employs surface art re-decoration to imbue discarded materials with renewed visual and cultural significance without altering their structure, constituting a form of surface visual reactivation within primary design. For instance, designer Li Yuyou utilised discarded benches as a medium, preserving their structure while applying the ‘RICHFLOWER’ motif. By integrating symbols with high-saturation colours, an urban aesthetic is cultivated. Such approaches achieve both material reuse and the infusion of cultural and aesthetic value into furniture. This straightforward methodology is applicable in educational, community, and exhibition settings, enhancing public awareness of sustainable design while fostering individuality and a sense of belonging.

Figure 1: Artistic Re-decoration of Furniture Design

2. Functional Refurbishment

Functional refurbishment enhances furniture comfort and adaptability by adding cushions, backrests, and slipcovers while preserving the original structure, adhering to the principle of ‘non-destructive restoration’. Taking the traditional Guangdong ‘provincial stool’ as an example, designers addressed the inherent hardness of solid wood by fitting yellow foam padding to its frame and covering it with fabric slipcovers, achieving ‘non-destructive

optimisation of contact surfaces'. This approach suits households with limited resources while offering a sustainable upgrade path for ageing furniture.

Figure 2 Functional Adaptation Furniture Design

3. Structural Restoration and Functional Extension

In Guangdong, a culture of salvaging and repurposing old items known as 'Stooping' is gradually gaining traction. Derived from the term 'Stoop', it refers to placing discarded furniture outside one's door for free collection, with those who gather and transform these items termed "Stoopers". This practice reflects young people's embrace of low-carbon, eco-conscious lifestyles and personalised living. Take the 'Magic Capsule Band' project, which repurposed an antique television cabinet, employing a strategy of 'structural restoration and functional extension': Preserving the solid wood frame, they sanded and reinforced it before applying a fresh coat of paint. Frosted glass panels were embedded, rattan doors fitted, and hardware replaced, transforming it into a kitchen cabinet that combines storage with decorative appeal. This approach, through partial restoration and functional upgrades, breathes new life and aesthetic value into old objects with minimal intervention. It proves particularly suited to household scenarios where resources are limited yet needs are diverse.

Figure 3 Structural Restoration and Functional Extension in Furniture Design

Three primary design pathways form a system progressing from "visual enhancement" to "structural reconstruction", both promoting the reuse of waste materials and conveying the rediscovery of old objects' value, thereby providing strategies for sustainable furniture design.

II.Secondary utilisation

Secondary utilisation involves deep processing such as cutting and modification, transforming waste materials beyond their original form to acquire new value. Such designs are more innovative and experimental in nature, yet demand advanced technical expertise and equipment. They are predominantly found within enterprises or workshops possessing the requisite resources and manufacturing capabilities.

1. Material Remodelling

Material reformation refers to the process of transforming waste materials into new design elements by severing them from their original structural form through techniques such as cutting, disassembling, pressing, and joining. For instance, the RePlastic Stool by design firm Local Creation is crafted entirely from recycled plastic. Utilising common urban plastic bottles, packaging, and containers as raw materials, it undergoes collection, cleaning, sorting, crushing, and regranulation to transform into reusable material. The retained granular texture not only imbues the product with artistic qualities but also reinforces consumers' awareness of "environmental regeneration".

Figure 4Material Reimagining in Furniture Design

2. Material Modification

Material modification optimises the properties of waste materials through physical or chemical means, rendering them more suitable for furniture manufacturing. Common methods include decomposition, filling, and blending, with the option to incorporate bio-based adhesives to produce foundational materials for conventional processes. For instance, the ‘Hafu Air-Cushioned Health Chair’ exhibited at the Canton Fair, jointly developed by B4K Studio and Shengao Technology, employs recycled plastic composite technology. This process transforms marine waste fishing nets, ropes, and airbags into high-performance eco-friendly base materials, achieving breakthroughs in structural strength, formability, and comfort. It demonstrates the conversion of pollution sources into premium furniture materials.

Figure 5Material-Modified Furniture Design

3. Modular Integration

Modular fusion design achieves systematic furniture upgrades and cross-material innovation through the modular reconfiguration of discarded materials, balancing environmental sustainability with aesthetic appeal. Taking Guangdong's ‘Local Creation Studio’ as an example, designers combine coconut wood, discarded fishing nets, plastic fragments and recycled aluminium into furniture. The recycled aluminium not only enhances structural strength but also reduces carbon emissions, as its production requires merely 5% of the energy consumed by primary aluminium. The design emphasises detachable and interchangeable components for ease of maintenance and recycling, presenting a minimalist modern aesthetic. Overall, this approach enhances material reuse efficiency and offers a practical pathway for sustainable development within the furniture industry.

Figure 6 Modular Integrated Furniture Design

Discussion

This study centres on the sustainable utilisation of waste materials in furniture design, focusing on the design practices and developmental trends within Guangdong Province's furniture industry. Through a literature review, field research, and case studies, it systematically explores design strategies.

In terms of design strategy, the research identifies two core approaches to designing furniture from waste materials: primary design and secondary design. Primary design emphasises preserving the material's original form, extending its service life through colour reconfiguration, functional expansion, and structural restoration. Secondary design, conversely, focuses on reprocessing, modifying, and integrating materials to enhance their adaptability and functionality. Both approaches demonstrate furniture designers' renewed appreciation for material value while providing practical foundations for resource conservation and waste reduction. This offers valuable insights for advancing the green transformation of the furniture industry.

Limitations and future research directions

Guangdong Province, as a vital frontier and core region for China's furniture industry, leads the nation in the reuse of waste materials. It has established a relatively comprehensive industrial foundation and innovative ecosystem, serving as an industry benchmark. However, despite accumulating considerable experience in designing furniture from waste materials, the province's overall utilisation methods remain somewhat limited. Efforts are primarily concentrated in exploratory initiatives by small workshops, yet a systematic, large-scale industrial framework has yet to emerge across broader sectors. Looking ahead, Guangdong's furniture industry may further explore the application of emerging technologies such as artificial intelligence, 3D printing, and big data analytics in the redesign and reproduction of furniture from waste materials. This would drive innovation in design methodologies and upgrade the industrial chain, thereby maintaining and consolidating Guangdong's technological leadership both nationally and internationally.

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