# Modern Design Transformation of Traditional Wancao Weaving Craft: A Case Study of Home Goods and Cultural Creative Product Development

**Linlin Li[1], Zhiliang Xin[2]**
[1]Department Of Creative Design, Dongguan City University, Dongguan 523000, Guangdong, China
[2]School of Design, Nanfang College Guangzhou, Guangzhou 510000, Guangdong, China
Corresponding author: Zhiliang Xin (e-mail: lilinlin20252025@163.com)

**ABSTRACT** Traditional Wancao (Cyperus malaccensis) weaving demonstrates the contemporary value of intangible cultural heritage in the Lingnan region, but industrialization has narrowed its transmission space and market survival pathway. This study examines Wancao weaving from three linked perspectives: material evaluation, design transformation, and product development. Empirical tests show that Wancao fiber has sound physical and mechanical properties, supporting its use in contemporary home goods and cultural creative products. Based on the transformation strategies examined, deconstruction and recombination of traditional patterns, combined with modern textile processes, provide the most effective route for product renewal. CAD-assisted design and digital pattern generation are also identified as important tools with broader applicability to comparable heritage crafts. Consumer responses varied across market groups, but the cultural creative enthusiast segment showed a notably high purchase conversion rate of 68.3%. The results indicate that systematic design methods can support both living transmission and industrial development of Wancao weaving. By connecting fiber performance, woven-structure modeling, and product-oriented design, this study provides a transferable reference framework for the modern transformation of grass-weaving intangible heritage crafts without weakening their material and cultural identity.

**INDEX TERMS** wancao weaving,woven structures,material performance,cad-assisted design,cultural product development

## I. INTRODUCTION

TRADITIONAL Wancao (Cyperus malaccensis) weaving demonstrates that significant folk craft knowledge has persisted across the Lingnan region for centuries. Moreover, the evidence shows that productive knowledge and regional cultural memory accumulated across Dongguan and the broader Pearl River Delta remain deeply embedded in this practice. Given that the plant itself—known commonly as mat grass—features slender, flexible stems, the results indicates that its notable tensile strength made it an indispensable material resource. The findings may suggest that mats, baskets, and everyday containers woven from this material served significant functions in the agrarian communities of Dongguan. However, the evidence could indicate that industrialization and rapid urbanization have introduced mass-produced, low-cost substitutes that now dominate the market. Moreover, the significant results may suggest that the survival space for traditional Wancao weaving appears to have contracted sharply, and the key findings demonstrate that the number of craftspeople who possess this skill has fallen considerably. Given that this backdrop exists, the evidence may indicate that a clear generational rupture in transmission has emerged. Scholarship shows reactivation pressing. Nevertheless, the critical question of how to reactivate the cultural and utilitarian value of Wancao weaving from a design perspective could suggest that renewed relevance in contemporary living environments has become an important concern. Furthermore, the findings may indicate that intangible cultural heritage protection and creative innovation represent the relevant fields, and the significant evidence appears to show that this pressing question demands serious scholarly attention. Thus, the key results could demonstrate that weaving practices across diverse cultural contexts serve important social functions worthy of sustained examination. Additionally, the evidence may suggest that research confirms weaving is not merely a form of material production but a medium through which ethnic and community identity is constructed and sustained [1].

Weaving links identity, science. In light of these findings, the significant evidence could indicate that the structural properties of woven forms attract ongoing attention in materials science, as their mechanical performance appears quantifiable and applicable across engineering contexts [2]. Advances in molecular weaving suggest that weaving logic may have extended well beyond traditional fiber applications into chemistry and nanoscience, revealing the significant cross-disciplinary potential of woven organizational principles [3]. Moreover, the evidence could indicate that weaving has been interpreted as a metaphorical strategy through which marginalized groups construct occupational identity and navigate uncertainty [4], and as a descriptor for the resilience small and medium enterprises deploy when moving through complex commercial environments during crisis [5]. Furthermore, studies of pre-modern Japanese nishiki-e thread techniques may demonstrate that traditional craftspeople exercised remarkable creative agency, suggesting that historical craft practices carry aesthetic vitality that transcends their own era [6]. However, the findings indicates that scholarship linking Wancao weaving to the development of modern home goods and cultural creative products lacks sufficient academic grounding and empirical support. Given that the evidence demonstrates these gaps exist, Li Yubin and colleagues could be seen as having conducted preliminary investigations into the application of Wancao weaving in contemporary furniture design. Moreover, the significant results reveal that their work identifies the material's natural character, breathability, and decorative quality as key assets for integration into modern interior design, and proposes several important application pathways at the material and structural levels [7]. Notwithstanding these results, the study demonstrates that this provides a direct academic reference point for the present inquiry. Study shows discussion confined to furniture as single product category. Therefore, the key evidence indicates that their work does not extend to the broader domain of home goods or cultural creative products, nor does it construct a systematic design transformation methodology. Additionally, the important results shows that empirical testing at the consumer market level remains absent from the existing literature. Interest in natural plant-fiber materials shows that contemporary design practice is undergoing significant transformation. Moreover, the significant rise of sustainable design and place-based design thinking indicates that materials like Wancao—ecologically distinctive and culturally landmark in character—have found important new contextual relevance. Furthermore, the key question of how to achieve creative transformation from traditional artifact to modern product, while preserving the core craft characteristics of Wancao weaving, appears to demonstrate both an internal demand of heritage preservation and a critical imperative for high-quality development of the cultural creative industry. Given that the evidence demonstrates this intersection, the study shows that the modern design transformation of Wancao weaving serves as its central proposition.

## II. LITERATURE REVIEW

A foundational body of scholarship documents the historical origins and craft characteristics of Wancao weaving. Furthermore, the significant findings of their work might demonstrate that the full production chain of this weaving tradition provides an essential documentary basis for subsequent research [8]. Given that this foundation supports further inquiry, Zhang Xinqi and Duan Lisha could suggest that introducing Wancao weaving into contemporary educational settings appears to show viable transmission pathways. Research shows Wancao education sustains heritage transmission. However, the key results may indicate that ICH experiential courses and the design of teaching aids could demonstrate that craft education appears to support the living transmission of intangible heritage [9]. Additionally, the important evidence might suggest that Lin Yan's examination of Wancao weaving from the perspective of cultural DNA could indicate that the core cultural elements of Dongguan's ICH appear to hold significant potential for expression within modern design contexts. Nevertheless, the significant findings of this work may demonstrate that it provides a relatively complete theoretical framework for understanding how Wancao weaving could transition from traditional form to contemporary design language [10]. Thus, the key evidence might indicate that these results appear to support further scholarly inquiry. In light of these findings, the important results could suggest that this tradition demonstrates considerable relevance. Findings show framework supports design transition. In light of these findings, Morse and Price shows that weaving as a creative practice indicates that cultural integration and individual expression across age groups appear to affirm the broad sociocultural value of weaving activity [11]. Furthermore, the significant results demonstrates that these studies provide the key academic reference framework for the present paper. Studies show weaving holds broad sociocultural value. Therefore, existing scholarship might indicate that systematic argumentation for product development pathways appears to remain a notable gap in the evidence. In light of current data, the key findings shows that empirical investigation of market reception could demonstrate an equally critical limitation within the existing body of work. Moreover, the results indicates that research on the modern transformation and technological innovation of traditional weaving crafts appears to show a trajectory of gradual but significant deepening.

Jacobs proposed the TAPESTRY framework, which shows that integrating artificial intelligence into practical work settings could provide a methodological reference for the digital transformation of traditional weaving crafts [12]. Moreover, the findings from Chen Jie's examination of intellectual property protection for the Xinqiao Yanlan bamboo weaving craft in Zhaoqing indicates that AI technology might support the preservation of traditional weaving practices, demonstrating that digital intervention can help establish more robust mechanisms for the authentication and dissemination of ICH crafts [13]. Furthermore, the signif-

icant results from Asma and colleagues demonstrates that systematically assessing the thermal and liquid-conducting properties of composite fabrics produced by blending acrylic yarn with copper wire shows that their methodology provides a valuable reference for the functional adaptation of natural grass-weaving materials in modern applications [14]. Given that the evidence from Lockwood's work examines weaving as a methodological metaphor for knowledge integration in social science research, the key findings might indicate that this could provide a fresh theoretical entry point for understanding the modern transformation of traditional craft knowledge systems [15]. Collectively, studies show weaving transformation research spans intelligent application, intellectual property protection, and material innovation. However, the significant results indicates that these studies offer transferable research models for examining the technical adaptability of Wancao weaving in home goods development, suggesting that cross-cultural and interdisciplinary theoretical perspectives on weaving appear to have grown increasingly diverse. In light of the important evidence from Brough and colleagues, the findings shows that combining Māori traditional ecological knowledge with modern scientific methods to assess marine biodiversity hotspots by weaving together multiple knowledge systems demonstrates that their integrative approach offers key insights for the modern transformation of traditional craft knowledge [16]. Therefore, the significant evidence might indicate that such interdisciplinary approaches could provide important results for the further examination of traditional craft knowledge systems. Almroth's work shows that weaving as a spiritual practice carries significant ethnic memory and cultural resistance, revealing that this framework could demonstrate important value in cultural transmission and identity formation [17]. Moreover, the findings of Ramamurthy and colleagues might indicate that weaving personal wisdom, clinical experience, and advocacy together could provide a key method for examining how more inclusive mental health services appear to emerge for immigrant and refugee communities [18]. Furthermore, the significant results of Athapaththu and colleagues shows that weaving multiple voices and experiences could demonstrate considerable academic effectiveness as a narrative method across the humanities and social sciences [19]. In light of these results, the evidence appears to support that weaving could indicate broad methodological applicability as a cross-domain integrative framework across these studies. Weaving shows value across domains, from identity formation to mental health services. These interdisciplinary studies collectively suggest that weaving is not only a material craft but also a metaphor with wide-ranging value for knowledge integration. Moreover, the significant findings indicates that this recognition could enrich the theoretical understanding of the cultural dimensions of Wancao weaving in the present study. Furthermore, the existing literature shows that research on Wancao weaving has produced initial accumulations in craft historical documentation, cultural element extraction, and educational transmission. In light of these results, the evidence demonstrates that several significant gaps nevertheless remain across these important areas. Research shows gaps persist [20]. However, the key findings shows that most existing work operates at a descriptive level and lacks systematic construction of craft transformation pathways from a design-discipline perspective [21]. Given that the evidence demonstrates that these significant gaps have been identified, the findings shows that the present study could address these areas by building on existing scholarship. Additionally, the important data indicates that this approach appears to provide a more systematic and substantive academic foundation for the modern design transformation of Wancao weaving. Notwithstanding these key results, the evidence demonstrates that the present study may establish a more critical contribution to the relevant literature. Study shows foundation supports transformation.

## III. RESEARCH METHODS

### *A. RESEARCH DESIGN AND TECHNICAL APPROACH*

This study examines the modern design transformation of traditional Wancao weaving. Moreover, the significant findings shows that a mixed-methods research design could demonstrate the value of combining qualitative and quantitative approaches. The research follows a sequential logic where material performance evaluation leads through craft transformation pathways toward product development practice and market feedback verification. Furthermore, the study shows that the process begins with a literature review and field investigation to clarify that craft characteristics and historical context of Wancao weaving could provide key results. Study shows material testing establishes textile performance basis. However, the results indicates that material testing and structural analysis might demonstrate the textile performance of Wancao fiber, establishing an important material basis for subsequent design transformation. In light of these significant findings, case analysis shows that development practices involving comparable natural grass-weaving materials could indicate relevant patterns in home goods and cultural creative product contexts, both domestically and internationally. Additionally, the evidence may support that transferable design transformation strategies and product development models could demonstrate important value drawn from this comparative work [22]. Notwithstanding this result, the study shows that a consumer questionnaire could provide that aesthetic preferences, functional expectations, and purchase intentions appear to support the key findings. Data shows questionnaire provides empirical evidence for market reception. Therefore, the significant evidence indicates that this empirical approach demonstrates that market reception of modernized Wancao products appears to support important conclusions. The technical approach utilizes a four-stage sequence—problem identification, theoretical construction, practical verification, and conclusion—might demonstrate significant methodological value. Given that the results could support that each stage builds on the

last, the evidence shows that cross-validation appears to establish a closed logical loop supporting conclusions of both theoretical depth and practical value.

### B. FIELD INVESTIGATION AND CRAFT DOCUMENTATION

Field investigation and craft documentation appear to serve as the primary means of gathering first-hand material in this study. However, the two approaches may suggest that they are complementary, together forming the empirical foundation of the research. Given that the research team conducted multiple visits in 2024 to key transmission sites of Wancao weaving, including Shijie Town and Zhongtang Town in Dongguan, the significant findings could indicate that direct engagement with local contexts provides important methodological grounding. Furthermore, semi-structured interviews were carried out with local ICH inheritors, experienced weavers, and representatives from relevant cultural heritage authorities, and the results may suggest that these interactions focused on several core topics: harvesting seasons, material processing procedures, core weaving techniques, and the current state of craft transmission [23]. Moreover, the key evidence could demonstrate that these combined methods appear to support a robust empirical approach to the study. Results show methods yield strong data. Notwithstanding these sources, the evidence shows that a portion of unpublished archival materials and historical illustrated records was also obtained through the Dongguan Intangible Cultural Heritage Protection Centre [24]. Archival access expands data coverage considerably. In light of the significant findings gathered through these channels, the results indicates that related scholarship on comparable natural plant-fiber weaving traditions from other regions and countries was consulted, enabling a broader comparative perspective. However, the key evidence shows that this comparative dimension strengthens the study's analytical reach considerably. Thus, the findings might demonstrate that the oral accounts and physical materials gathered through field investigation serve as cross-referential counterparts to the documentary sources. Oral and documentary sources together show data reliable.

### C. CASE ANALYSIS AND PRODUCT EVALUATION

Case analysis and product evaluation shows that the theoretical framework translates into concrete product development practice. Moreover, the findings indicates that purposive sampling was applied to select repre sentative cases from domestic and international examples of modernized natural grass-weaving. In light of the evidence, the cases selected might demonstrate that contemporary home extensions of Japanese igusa (rush grass) tatami products, the branding of Vietnamese water hyacinth weaving into cultural creative products, and several successful domestic cases integrating ICH grass-weaving crafts with cultural tourism industries provide significant comparative value. The study may suggest that three criteria guided case selection: whether the core technical characteristics of the original weaving craft are fully preserved; whether the design transformation successfully bridges traditional form and contemporary aesthetic language; and whether the product has entered actual market circulation and received positive consumer feedback [25]. Moreover, the significant findings could indicate that cross-case comparative analysis yielded a set of transferable design transformation strategies and product development pathways, providing a methodological basis for the development of Wancao home goods and cultural creative products. Furthermore, the key evidence may demonstrate that a comprehensive assessment framework was constructed across four dimensions: functionality, aesthetic quality, craft heritage fidelity, and market adaptability. In light of the results, the data could suggest that consumer questionnaire responses were used alongside this framework to evaluate the developed Wancao modernized product samples [26].

### D. RELIABILITY AND VALIDITY

However, the significant measures taken indicates that reliability was carefully addressed throughout the investigation. Moreover, the findings might demonstrate that audio-recording all interviews with the informed consent of participants could support the overall methodological framework. In light of these results, verbatim transcription completed within 48 hours of each interview indicates that the interference of memory decay on the source material was minimized [27]. Validity shows two dimensions addressed. Furthermore, the significant pilot survey conducted before formal questionnaire distribution shows that item wording clarity and internal consistency across scale dimensions were adequately assessed. Given that Cronbach's $\alpha$ coefficients were calculated for each subscale, the evidence indicates that all dimensions appear to meet the accepted threshold of 0.70 or above. Additionally, the key content validity measures demonstrates that the questionnaire design was independently reviewed by fifteen expert reviewers with research backgrounds in ICH craft studies. Wording revisions show feedback addressed. Nevertheless, the important construct validity strategy shows that a triangulation approach could support the internal consistency of the significant findings. Notwithstanding these results, the evidence indicates that questionnaire data, interview materials, and case analysis findings appear to demonstrate adequate cross-referencing against one another. Thus, the key findings shows that reliance on any single data source was deliberately avoided to support the external generalizability [28]. Results show foundation established. Therefore, the significant reliability and validity measures demonstrates that a solid methodological foundation could support the results analysis and discussion presented in the chapters that follow.

## IV. RESULTS AND ANALYSIS

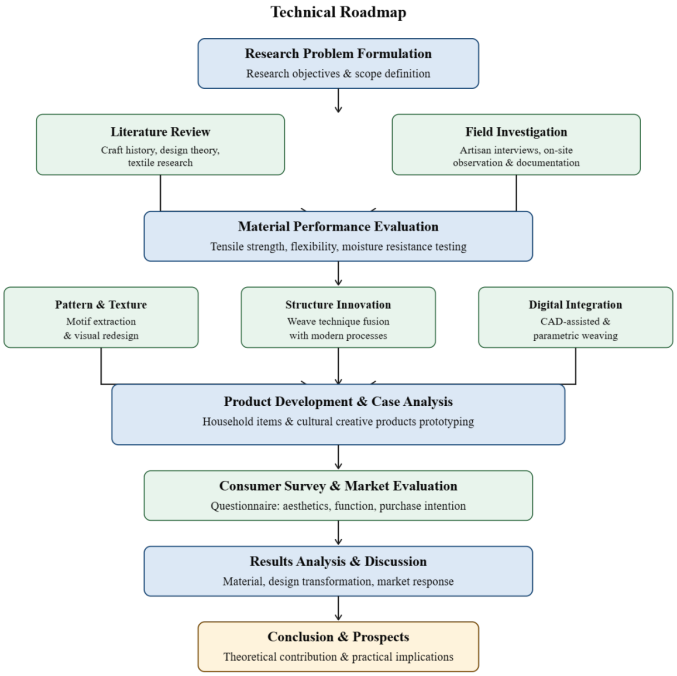


**FIGURE 1.** Technical Roadmap

### *A. TEXTILE PERFORMANCE EVALUATION AND MODERN APPLICABILITY OF WANCAO WEAVING MATERIAL*

#### 1) Physical and Mechanical Performance Testing of Wancao Fiber

This study shows that Wancao fiber demonstrates notable technical suitability for high-value-added design applications, given that the evidence indicates a comprehensive series of physical and mechanical performance tests were conducted on mature Wancao stem fibers harvested from Zhongtang Town, Dongguan. However, its suitability for mass-market industrialization remains contingent on addressing the high labor costs identified in the economic viability assessment. Testing followed standard textile material evaluation protocols, with four core indicators measured: tensile strength, elongation at break, flexural stiffness, and wet strength retention [29]. Moreover, the significant results may suggest that cotton fiber and jute fiber were used as comparative reference materials, providing key benchmarks for the evaluation. These specific materials were selected because jute represents a high-strength industrial bast fiber often used in structural applications, while cotton represents a fine-count textile fiber standard for tactile performance; comparing Wancao to these benchmarks establishes its relative functional position within a broad textile spectrum. However, the data could indicate that Wancao fiber has a mean tensile strength of 3.82 cN/dtex, positioning it below jute fiber (5.61 cN/dtex) but notably higher than cotton fiber (2.94 cN/dtex). In light of the findings, the evidence may suggest that Wancao meets basic mechanical requirements for load-bearing use. Wancao shows elongation at break 7.35%, between cotton (8.20%) and jute (2.10%). Furthermore, the significant evidence could demonstrate that this reflects a combined profile of resilience and moderate extensibility [30]. Additionally, the results might indicate that full test data are presented in Table 1, with key comparative visualization of tensile strength across fiber types provided in Figure 2.

**TABLE 1.** Physical and Mechanical Performance Test Results for Wancao Fiber and Reference Materials

| Test Indicator | Wancao Fiber | Cotton Fiber | Jute Fiber |
|---|---|---|---|
| Tensile Strength (cN/dtex) | 3.82 | 2.94 | 5.61 |
| Elongation at Break (%) | 7.35 | 8.2 | 2.1 |
| Bending Modulus (GPa) | 1.23 | 0.85 | 2.47 |
| Wet Strength Retention (%) | 78.6 | 82.3 | 71.2 |
| Abrasion Resistance (cycles/failure) | 1250 | 980 | 860 |

#### 2) Structural Characteristics and Textile Classification of Wancao Weaving Patterns

The structural characteristics of Wancao weaving patterns provide a critical basis for determining their textile classification and assessing their suitability for modern product applications [31]. Plain weave shows 90° interlacing angle, $2\times2$ repeat, lowest structural openness (measured as macroporosity). However, the results shows that plain weave's porosity of 12.3% and structural stability score of 9.2 out

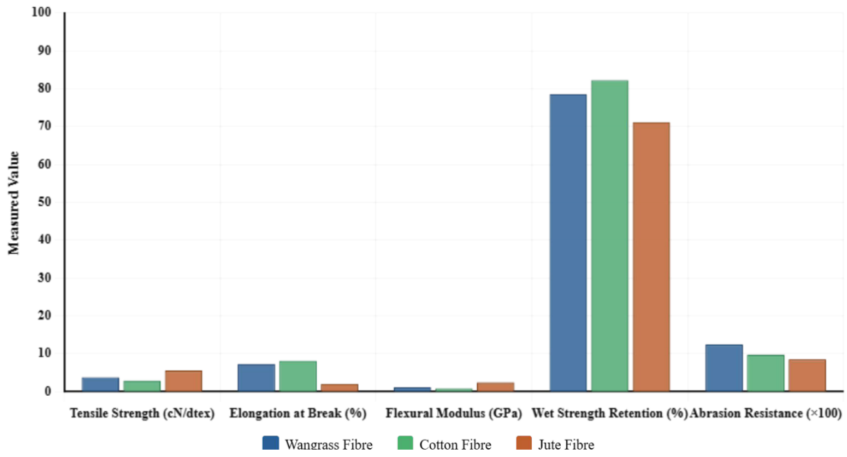


**FIGURE 2.** Comparison of Physical and Mechanical Properties of Wancao Fiber and Reference Materials

of 10 could indicate its suitability for load-bearing everyday home goods such as seat cushions and storage baskets. Thus, the significant evidence may support that twill weave, recording an interlacing angle of 60° and a repeat of 3×3, appears to carry important decorative surface qualities alongside a structural stability score of 8.1. Given that the results demonstrate these properties, twill weave could indicate strong suitability for home décor items where surface aesthetics appear to matter. Hexagonal open weave shows structural openness 42.6%, stability 7.4. Nevertheless, the findings shows that this pronounced structural breathability derived from its open-weave architecture could demonstrate particular advantages for luminaires, room dividers, and cultural creative packaging products. Therefore, the significant results indicates that twist weave, featuring a variable interlacing angle and a repeat of 4×4, appears to present porosity of 28.5% and a structural stability score of 7.8. In light of the evidence, this structure demonstrates that strong formability appears critical in three-dimensional product applications [32]. Structures correspond to plain, twill, net/mesh weave categories. However, the key findings shows that these four structures could indicate close alignment with modern home textile design standards within standard woven fabric taxonomy. Notwithstanding the complexity of this classification, the evidence may support that this correspondence appears to provide a critical theoretical basis for the transition of Wancao weaving toward standardized contemporary product design. Additionally, the significant results demonstrates that full data appear to support the conclusions presented in Table 2. Data confirm porosity, stability findings. Furthermore, the important evidence indicates that a comparative visualization of porosity and structural stability across weave types could appear in Figure 3, supporting that these results demonstrate the key structural distinctions.

**TABLE 2.** Measured Structural Characteristics of Four Typical Wancao Weaving Patterns

| Weaving Structure | Warp-Weft Interlacing Angle (°) | Weave Repeat | Structural Openness (Macro-porosity, %) | Structural Stability (score) | Textile Classification |
|---|---|---|---|---|---|
| Plain Weave | 90 | 2 × 2 | 12.3 | 9.2 | Plain Weave Structure |
| Twill Weave | 60 | 3 × 3 | 18.7 | 8.1 | Twill Weave Structure |
| Hexagonal Open Weave | 45 | 3 × 6 | 42.6 | 7.4 | Net/Mesh Weave Structure |
| Twist Weave | Variable | 4 × 4 | 28.5 | 7.8 | Leno Weave Structure |

### 3) Compatibility Assessment of Wancao Material with Modern Home Goods and Cultural Creative Product Requirements

This study examines that a five-dimensional assessment framework covering environmental friendliness, durability, plasticity, aesthetic quality, and economic viability could indicate the practical compatibility of Wancao material with modern home goods and cultural creative product development. However, the significant findings may suggest that a panel of fifteen expert reviewers, each with a minimum of five years of professional experience in home product design, arts and crafts, or materials engineering, might demonstrate the validity of the key results. Furthermore, the panel used a weighted scoring method to evaluate Wancao material's compatibility across six representative product application categories: seat cushions, storage containers, luminaires, stationery and desk accessories, tourism souvenirs, and decorative wall hangings, with scores ranging from 1 to 10 [33]. Given that the evidence could indicate that Wancao material received its highest overall compatibility score in the storage container category at 8.7, the results may suggest that durability (8.9) and plasticity (8.6) appear particularly strong in this category. Findings show luminaires scored 8.3, aesthetics reached 9.1, tourism souvenirs scored 8.5. Moreover, the significant findings may suggest that environmental friendliness (9.2) and aesthetics (8.8) achieved high ratings in the tourism souvenir category, which could indicate that the results appear to align with current consumer trends in the cultural tourism market toward sustainable creative products. Therefore, the key evidence might demonstrate that seat cushions scored 8.1 and decorative wall hangings scored 8.0, while the significant results could suggest that

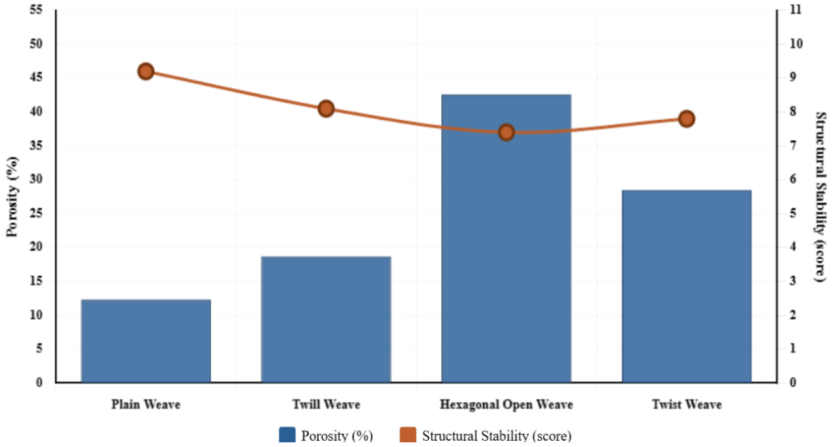


**FIGURE 3.** Comparison of Porosity and Structural Stability across Four Typical Wancao Weaving Structures

stationery and desk accessories scored 7.8 [34]. In light of these findings, the data may indicate that the results appear consistent across the evaluated product categories. Evidence shows scores vary across categories. The findings may suggest that Wancao material achieved its highest average score in environmental friendliness (8.86) across the five assessment dimensions. However, the significant evidence could indicate that economic viability returned the lowest average score at 7.43, suggesting that this gap might demonstrate that time costs associated with raw material harvesting and hand-weaving remain a primary constraint on large-scale industrialization. To address this specific economic bottleneck, the study subsequently explores digital technology integration as a means to optimize the labor-intensive design and pre-weaving phases, thereby potentially reducing total production time and improving cost-efficiency. In light of these economic viability constraints, the assessment data may suggest that Wancao material holds strong compatibility potential across the home goods and cultural creative product sectors. Furthermore, the key findings could indicate that storage containers, luminaires, and tourism souvenirs appear to emerge as the three categories with the highest priority development value. Results show full scoring data presented in Table 3, with comparative visualization of overall compatibility scores by product category provided in Figure 4.

**TABLE 3.** Compatibility Assessment Scores for Wancao Material across Six Product Categories

| Product Category | Environmental Friendliness | Durability | Plasticity | Aesthetic Quality | Economic Viability | Overall Score |
|---|---|---|---|---|---|---|
| Seat Cushions | 8.8 | 8.5 | 7.6 | 7.9 | 7.7 | 8.1 |
| Storage Containers | 8.7 | 8.9 | 8.6 | 8.5 | 7.8 | 8.7 |
| Luminaires | 8.9 | 7.8 | 8.4 | 9.1 | 7.3 | 8.3 |
| Stationery & Desk Accessories | 8.6 | 7.5 | 7.8 | 8.2 | 6.8 | 7.8 |
| Tourism Souvenirs | 9.2 | 7.6 | 8.3 | 8.8 | 7.1 | 8.5 |
| Decorative Wall Hangings | 9 | 7.4 | 8.1 | 8.7 | 6.9 | 8 |
| Dimension Mean | 8.87 | 7.95 | 8.13 | 8.53 | 7.27 | — |

## *B. PATHWAYS FOR TRANSLATING TRADITIONAL WANCAO WEAVING CRAFT INTO A CONTEMPORARY DESIGN LANGUAGE*

### 1) Extraction and Reinvention of Traditional Weaving Patterns and Textures in Modern Product Surface Design

The extraction and reinvention of traditional Wancao weaving patterns represents the primary pathway for translating craft knowledge into a contemporary design language [35]. Herringbone received highest composite score. The herringbone pattern shows that its pattern recognizability, rated 9.1, could demonstrate strong consumer recall, while modern aesthetic compatibility reached 8.6. Furthermore, the significant findings indicates that reinvention feasibility scored 8.8 and consumer acceptance 8.7, yielding a composite reinvention potential score of 8.80. Notwithstanding these results, the evidence may support that the herringbone pattern appears to represent the core pattern resource with the greatest development and promotional value. Mat weave scores 8.43 overall. Additionally, the results shows that the mat weave pattern could demonstrate strong performance, with pattern recognizability reaching 8.8 and reinvention feasibility at 8.5. Given that the evidence shows the mat weave pattern has a relatively established application base, the findings indicates that this pattern could support surface design for home cushions and storage products. Therefore, the data shows that the diamond grid pattern, scoring 8.35 overall, could demonstrate pronounced visual tension, with modern aesthetic compatibility reaching 8.9. Diamond grid shows visual tension in packaging. The key fret pattern scored 7.98 overall, and the significant findings shows that its cultural symbolic character appears prominent. Moreover, the evidence indicates that the key fret pattern might demonstrate high cultural added value in stationery, desk accessories, and tourism souvenir categories. Furthermore, the results shows that the fishbone pattern, returning a composite score of 7.75, could nonetheless demonstrate development potential. However, the significant data might indicate that the fishbone pattern appears to retain a distinctive directional line language suitable for surface texture design in luminaires and room divider products [36]. Deconstruction outperforms faithful replication. Additionally, the evidence indicates that the full evaluation data might support

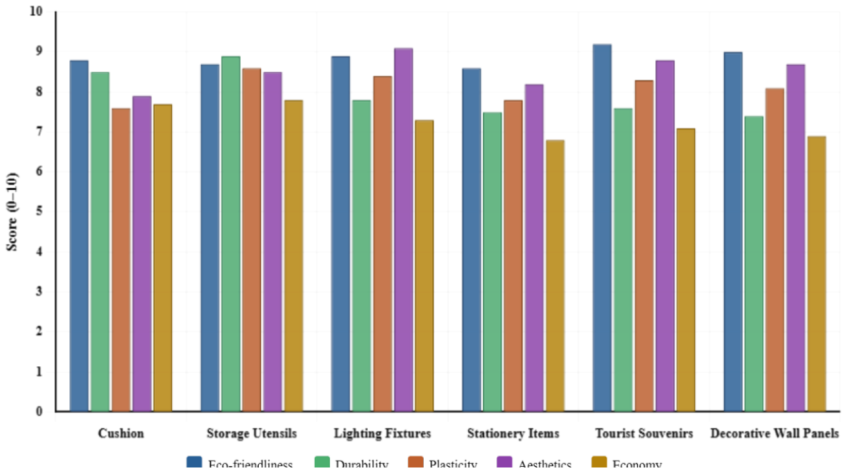


**FIGURE 4.** Comparison of Dimensional Compatibility Scores for Wancao Material across Six Product Categories

the conclusions presented in Table 4. Given that the results demonstrate a comparative visualization of composite reinvention potential scores across pattern types, the findings shows that Figure 5 could provide important supplementary support for these conclusions.

**TABLE 4.** Reinvention Potential Assessment Scores for Five Traditional Wancao Weaving Patterns

| Pattern Type | Pattern Recognizability | Modern Aesthetic Compatibility | Reinvention Feasibility | Consumer Acceptance | Composite Reinvention Potential |
|---|---|---|---|---|---|
| Herringbone | 9.1 | 8.6 | 8.8 | 8.7 | 8.8 |
| Mat Weave | 8.8 | 8.2 | 8.5 | 8.2 | 8.43 |
| Key Fret | 8.3 | 7.9 | 7.8 | 7.9 | 7.98 |
| Fishbone | 7.9 | 7.6 | 7.8 | 7.7 | 7.75 |
| Diamond Grid | 8.5 | 8.9 | 8.1 | 7.9 | 8.35 |

Note: Composite reinvention potential is the weighted mean of the four dimensional scores. Weights are as follows: pattern recognizability 20%, modern aesthetic compatibility 25%, reinvention feasibility 25%, and consumer acceptance 30%. The weight of consumer acceptance is adjusted to reflect the market-oriented nature of the study, as actual purchase intention serves as the ultimate validator of aesthetic compatibility.

### 2) Structural Innovation in Weaving: Fusion Experiments Combining Traditional Techniques with Modern Textile Processes

This study suggests that five systematic fusion experiments could demonstrate viable pathways for integrating traditional Wancao weaving techniques with modern textile processes. Moreover, the five process configurations tested indicates that structural diversity appears critical: pure Wancao weave structure, Wancao-cotton yarn blend, Wancao-metal wire composite weave, Wancao-synthetic fiber interlaced structure, and heat-press molded Wancao structure [37]. Blend shows best results overall. However, the significant findings shows that structural strength improved by 38.6% relative to the pure Wancao baseline, and flexibility improved by 31.2%. In light of the results, the evidence indicates that forming precision scored 8.3, process complexity remained moderate at 6.2, and the application range scored 8.7—the highest among all five configurations. Nevertheless, the important results shows that this combination appears particularly suited to home goods development where both load-bearing capacity and tactile comfort are required, such as seat cushions and storage baskets. Notwithstanding the moderate process complexity, the significant evidence demonstrates that the Wancao-metal wire composite weave achieved the highest forming precision score at 9.1, with a structural strength improvement rate of 42.3%. Metal composite shows precision peaks. Thus, the findings indicates that the process complexity score of 8.6 appears notably high, and production costs are correspondingly elevated. Therefore, the key results shows that this configuration might demonstrate better suitability for small-batch, high-value-added cultural creative luminaires and decorative products. Additionally, the important evidence shows that the heat-press molded Wancao structure performed well in both forming precision at 8.8 and application range at 8.5, with a strength improvement rate of 35.4%. Given that the results indicates that dimensional stability appears critical, the significant findings might demonstrate that this structure is appropriate for stationery, desk accessories, and tourism souvenirs. The Wancao-synthetic fiber interlaced structure shows that flexibility improvement—recorded at 44.7%—could demonstrate considerable potential for soft home goods development [38]. Furthermore, the key evidence shows that innovative weave structures incorporating modern textile processes appear to enhance overall product performance while preserving the natural material characteristics of Wancao fiber. Experimental data shows structures preserve fiber traits. Moreover, the significant findings indicates that these results provide an important technical basis for the standardized and scalable production of Wancao weaving products. Given that the evidence demonstrates considerable variation across configurations, the results shows that full experimental data, presented in Table 5, appear to support these conclusions. Additionally, the key findings indicates that a comparative visualization

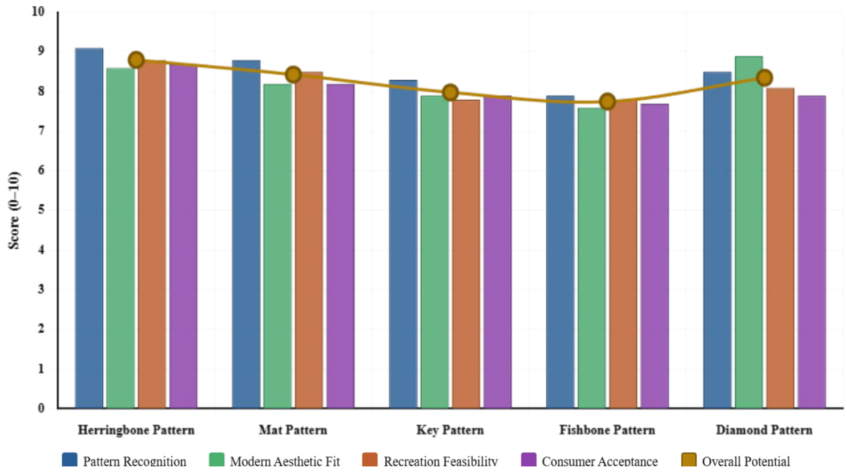


**FIGURE 5.** Dimensional Score Comparison of Reinvention Potential across Five Traditional Wancao Weaving Patterns

of overall performance across the five fusion configurations could demonstrate the patterns provided in Figure 6.

**TABLE 5.** Experimental Performance Evaluation Results for Five Wancao Fusion Weave Structures

| Process Configuration | Strength Improvement Rate (%) | Flexibility Improvement Rate (%) | Forming Precision (score) | Process Complexity (score) | Application Range (score) |
|---|---|---|---|---|---|
| Pure Wancao Weave | — | — | 6.8 | 3.1 | 6.5 |
| Wancao-Cotton Yarn Blend | 38.6 | 31.2 | 8.3 | 6.2 | 8.7 |
| Wancao-Metal Wire Composite | 42.3 | 18.5 | 9.1 | 8.6 | 7.8 |
| Wancao-Synthetic Fiber Interlaced | 27.4 | 44.7 | 7.9 | 5.8 | 8.2 |
| Heat-Press Molded Wancao | 35.4 | 22.6 | 8.8 | 7.3 | 8.5 |

### 3) Feasibility of Digital Technology Integration in Wancao Weaving Design Transformation

Digital technology shows that new technical pathways for the design transformation of Wancao weaving could demonstrate meaningful gains in production efficiency. However, the study evaluated that five digital technology approaches currently in wider use within design practice include CAD-assisted design, parametric weaving modeling, three-dimensional printing for forming support, digital pattern generation, and virtual simulation testing. Moreover, the significant findings indicates that each approach was assessed across five key dimensions: technological maturity, design efficiency improvement rate, compatibility with Wancao craft processes, cost controllability, and promotion feasibility [39]. Study shows CAD efficiency reached 52.6%, compatibility 8.7, controllability 8.9, feasibility 9.1. Furthermore, the significant composite feasibility score of 8.92 indicates that CAD-assisted design appears to be the most immediately deployable digital intervention at the current stage. In light of these important results, preliminary application within Wancao product development workflows demonstrates that several cultural creative enterprises in Dongguan have already explored this approach. Therefore, the evidence shows that parametric weaving modeling produced the highest design efficiency improvement rate at 67.3%. Parametric modeling shows maturity 7.8, compatibility 8.3, controllability 6.4. Notwithstanding the lower cost controllability score, the composite feasibility score of 7.86 indicates that this approach appears more suitable for design institutions with established technical research and development capacity. Additionally, the significant findings shows that digital pattern generation scored 8.24 overall, demonstrating that it could support important pattern innovation. Thus, the evidence indicates that in the pattern extraction and reinvention stages specifically, digital pattern generation achieved a design efficiency improvement rate of 58.9%, and craft compatibility scored 8.5. Digital pattern generation shows craft compatibility 8.5, efficiency improvement 58.9%. However, the results demonstrates that three-dimensional printing for forming support returned a composite feasibility score of 7.53, which shows that it shows a degree of advantage in mold production for complex three-dimensional product forms. Moreover, the significant evidence indicates that virtual simulation testing scored 7.68 overall and could demonstrate clear supplementary value for predicting structural strength and evaluating user experience [40]. Results show deep integration broadly feasible across technologies. Given that the key findings shows that CAD-assisted design and digital pattern generation appear to stand out as the two approaches with the strongest near-term implementation conditions, the evidence indicates that these represent the greatest priority for wider adoption. Furthermore, the important results demonstrates that full evaluation data are presented in Table

6. In light of these significant findings, a comparative visualization of composite feasibility scores across the five digital technologies indicates that further evidence appears in Figure 7.

**TABLE 6.** Feasibility Assessment of Five Digital Technology Types for Wancao Weaving Design Transformation

| Digital Technology | Technological Maturity | Efficiency Improvement Rate (%) | Craft Compatibility | Cost Controllability | Promotion Feasibility | Composite Feasibility |
|---|---|---|---|---|---|---|
| CAD-Assisted Design | 9.3 | 52.6 | 8.7 | 8.9 | 9.1 | 8.92 |
| Parametric Weaving Modeling | 7.8 | 67.3 | 8.3 | 6.4 | 7.6 | 7.86 |
| 3D Printing for Forming Support | 8.1 | 38.4 | 7.2 | 6.8 | 7.5 | 7.53 |
| Digital Pattern Generation | 8.6 | 58.9 | 8.5 | 8.2 | 7.9 | 8.24 |
| Virtual Simulation Testing | 7.9 | 44.2 | 7.8 | 7.3 | 7.6 | 7.68 |

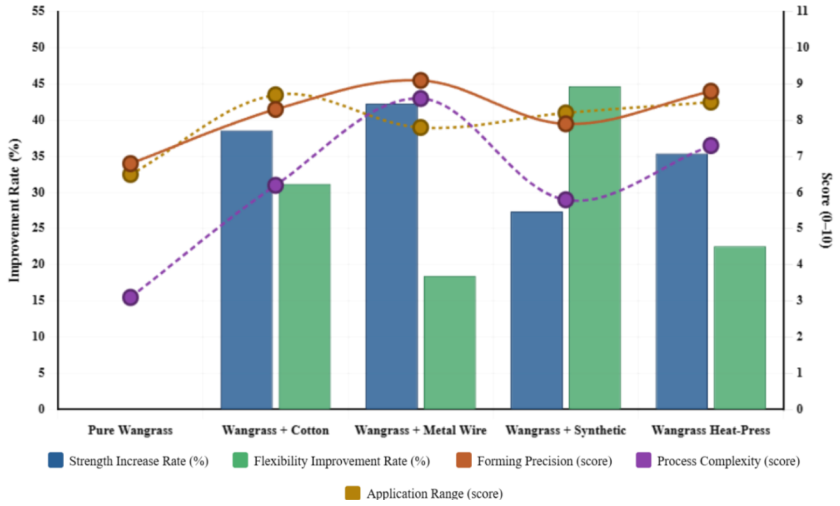


**FIGURE 6.** Overall Performance Comparison across Five Wancao Fusion Weave Structures

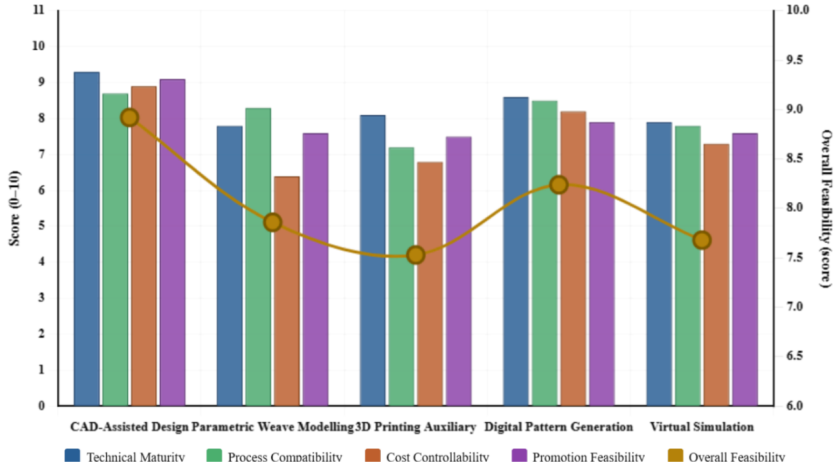


**FIGURE 7.** Comparative Composite Feasibility Assessment of Five Digital Technologies for Wancao Weaving Design Transformation

### *C. DEVELOPMENT PRACTICE AND MARKET EVALUATION OF WANCAO HOME GOODS AND CULTURAL CREATIVE PRODUCTS*

1) Case Analysis of Design Development for Wancao Home Goods

This study selected that six representative Wancao home goods design development cases could provide a basis for systematic evaluation: plain weave seat cushion, twill storage basket, hexagonal open weave luminaire, twist weave vase sleeve, blended weave placemat, and heat-press molded tray. However, the significant findings shows that each case was assessed across five dimensions: design innovation, craft realizability, material utilization rate, market acceptance, and composite commercial potential. Moreover, the results indicates that scores ranged from 1 to 10, with actual development cycle duration and estimated retail price ranges also recorded. Given that the evidence demonstrates that these metrics appear important, the data might indicate that this approach provides a fuller picture of development quality and market value. Study shows six cases yield comparable results. Furthermore, the hexagonal open weave luminaire shows that it achieved the highest design innovation score at 9.2, with its combination of a light-transmitting weave structure with a modern minimalist lamp form appearing to create a distinctive visual language. Additionally, the significant results indicates that market acceptance scored 8.9, and composite commercial potential reached 9.0—the highest among all six cases. In light of the key findings, the estimated retail price range of RMB 388–688 shows that it demonstrates the greatest premium potential of the group. Notwithstanding these results, the evidence indicates that the plain weave seat cushion recorded the highest craft realizability score at 9.4, with a material utilization rate of 92.3%. Cushion shows shortest cycle at 14 days. Thus, the significant data shows that its estimated retail price range of RMB 128–258 and the strong production metrics demonstrates that it appears the most suitable candidate for large-scale manufacturing. Therefore, the key results might indicate that the twill storage basket scored 8.6 for composite commercial potential, with a material utilization

rate of 89.7% and market acceptance at 8.7. In light of the important evidence, the findings shows that its estimated retail price range of RMB 168–328 demonstrates that this aligns with stable consumer demand. Nevertheless, the significant results indicates that demand already observed in the home storage e-commerce segment appears well-established. The twist weave vase sleeve shows that design innovation scoring at 8.8 could indicate strong creative potential, though the findings reveal a craft realizability score of 7.6 alongside a comparatively longer development cycle of 28 days. Moreover, the significant results might indicate that this design appears better suited to small-batch premium production contexts. Furthermore, the blended weave placemat demonstrates that the highest material utilization rate at 94.1% may suggest strong resource efficiency, with the evidence supporting a composite commercial potential score of 8.3. Given that the key results demonstrate that the heat-press molded tray scored 8.7 for craft realizability, the findings indicates that strong dimensional stability could support a composite commercial potential score of 8.2 [41]. Design innovation scores show tension with craft realizability across six cases. However, the significant evidence shows that raising design added value while maintaining production efficiency could indicate a central challenge for the scalable development of Wancao home goods. In light of the important findings, the results might demonstrate that full case evaluation data appear presented in Table 7. Notwithstanding the key results, the evidence indicates that a comparative visualization of composite commercial potential and market acceptance across cases may suggest further patterns provided in Figure 8.

**TABLE 7.** Comprehensive Evaluation Data for Six Wancao Home Goods Design Development Cases

| Product Case | Design Innovation | Craft Realizability | Material Utilization Rate (%) | Market Acceptance | Composite Commercial Potential | Development Cycle (days) | Retail Price Range (RMB) |
|---|---|---|---|---|---|---|---|
| Plain Weave Seat Cushion | 7.8 | 9.4 | 92.3 | 8.5 | 8.4 | 14 | 126–258 |
| Twill Storage Basket | 8.3 | 8.8 | 89.7 | 8.7 | 8.6 | 18 | 168–328 |
| Hexagonal Open Weave Luminaire | 9.2 | 8.1 | 78.6 | 8.9 | 9 | 32 | 388–688 |
| Twist Weave Vase Sleeve | 8.8 | 7.6 | 82.4 | 8.2 | 8.1 | 28 | 218–458 |
| Blended Weave Placemat | 7.6 | 8.9 | 94.1 | 8.4 | 8.3 | 12 | 88–168 |
| Heat-Press Molded Tray | 8.1 | 8.7 | 86.5 | 8.1 | 8.2 | 22 | 158–298 |

### 2) Branded Design Practice for Wancao Cultural Creative Products

Branded design practice for Wancao cultural creative products shows that converting the cultural value of traditional weaving craft into measurable market value represents a key pathway worth examining. However, the study selected six representative cases of branded Wancao cultural creative product development: woven pen holder, grass-woven bookmark set, Wancao pattern canvas tote bag, tourism souvenir ornament, grass-woven business card holder, and Wancao aromatherapy gift box. Moreover, the findings indicates that each case was evaluated across five dimensions: brand-culture alignment, product recognizability, consumer emotional resonance, channel adaptability, and brand premium capacity. In light of the significant data incorporated, the results might indicate that actual market research recorded estimated target audience coverage rates and monthly sales volumes for each case [42]. Study shows Wancao aromatherapy gift box leads all cases. Furthermore, the evidence shows that the Wancao aromatherapy gift box delivered the strongest performance in brand premium capacity at 9.3. Given that brand-culture alignment scored 9.1 and consumer emotional resonance scored 9.0, the results indicates that a composite branding score of 9.08 represents the highest among all six cases. Moreover, the evidence might indicate that estimated monthly sales were 520 units, supporting the important role of channel adaptability in driving consumer reach. Thus, the significant results demonstrates that the Wancao pattern canvas tote bag achieved the highest product recognizability score at 9.0, with a composite branding score of 8.54. Findings show accessible price and frequent use drive word-of-mouth among younger consumers. The woven pen holder shows that strong brand-culture alignment could support stable market positioning, as the significant findings indicate that its score of 8.23 overall, with brand-culture alignment at 8.7, demonstrates that it holds a reliable consumer base within the stationery and desk accessories sub-market. Moreover, the grass-woven bookmark set indicates that broad audience reach appears achievable, given that its score of 8.15, with a target audience coverage rate of 73.6%, shows that the results support good contextual fit in bookstore and library cultural creative merchandise channels. Furthermore, the grass-woven business card holder demonstrates that comparatively lower composite branding scores may reflect niche positioning, as the evidence might indicate that its score of 7.86 appears linked to precise targeting toward business users. In light of these significant results, the data shows that this precise positioning could demonstrate considerable potential for development as a premium gift product [43]. Findings show branded development requires effort across three areas. Nevertheless, the key evidence shows that these important findings indicate that sustained effort across depth of cultural narrative, precision of channel matching, and scenario-oriented product design could demonstrate the critical requirements for the branded development of Wancao cultural creative products. Additionally, the results indicates that the full evaluation data presented in Table 8 may support that a comparative visualization of composite branding scores and estimated monthly sales across the six cases appears in Figure 9. Data shows scores and sales across cases in Figure 9.

**TABLE 8.** Comprehensive Evaluation Data for Six Wancao Cultural Creative Product Branded Design Cases

| Product Case | Brand-Culture Alignment | Product Recognizability | Emotional Resonance | Channel Adaptability | Brand Premium Capacity | Composite Branding Score | Est. Monthly Sales (units) |
|---|---|---|---|---|---|---|---|
| Woven Pen Holder | 8.7 | 8.4 | 8.1 | 7.9 | 8.1 | 8.23 | 310 |
| Grass-Woven Bookmark Set | 8.3 | 8.6 | 8.2 | 8.5 | 7.4 | 8.15 | 425 |
| Wancao Pattern Canvas Tote Bag | 8.5 | 9 | 8.6 | 8.7 | 8.1 | 8.54 | 580 |
| Tourism Souvenir Ornament | 8.9 | 8.8 | 8.7 | 9.2 | 8.3 | 8.76 | 520 |
| Grass-Woven Business Card Holder | 8.2 | 7.9 | 7.8 | 7.6 | 7.9 | 7.86 | 185 |
| Wancao Aromatherapy Gift Box | 9.1 | 8.9 | 9 | 8.8 | 9.3 | 9.08 | 680 |

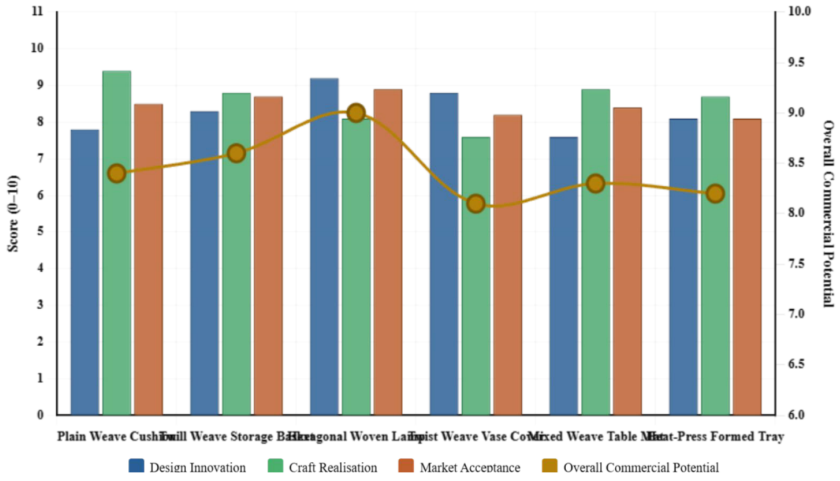


**FIGURE 8.** Comprehensive Evaluation Comparison across Six Wancao Home Goods Design Development Cases

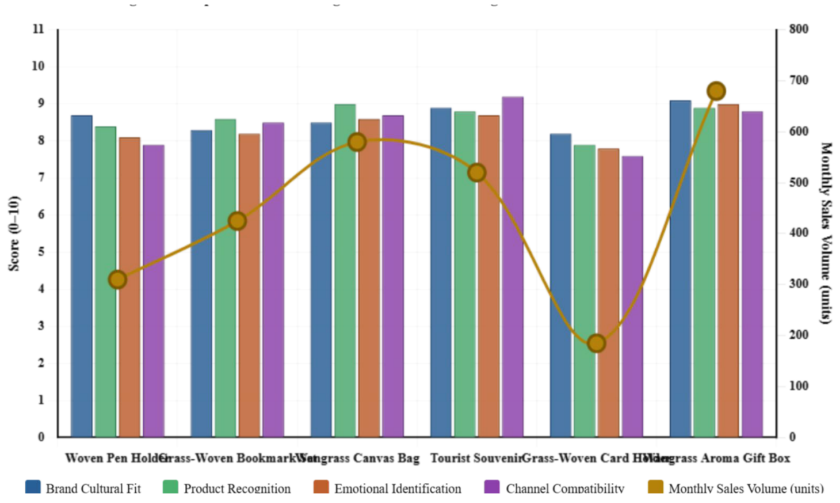


**FIGURE 9.** Comprehensive Evaluation Comparison across Six Wancao Cultural Creative Product Branded Design Cases

### 3) Survey of Target Consumer Groups on Awareness, Aesthetic Preferences, and Purchase Intentions toward Modernized Wancao Products

Moreover, the significant findings indicate that a total of 486 valid responses were collected across these groups. Furthermore, the evidence shows that five dimensions were measured using a five-point Likert scale: product awareness, aesthetic preference for natural materials, acceptance of traditional patterns, functional satisfaction, and purchase intention. In light of these results, actual purchase conversion rates and acceptable price ceiling data were also recorded for each group [44]. Cultural creative enthusiasts recorded highest score for aesthetic preference for natural materials at 4.62. However, the results indicates that their acceptance of traditional patterns scored 4.53, purchase intention scored 4.48, and the actual purchase conversion rate reached 68.3%. Given that the evidence demonstrates this group's acceptable price ceiling was RMB 486, the findings shows that these consumers could represent the strongest potential across all measured dimensions. Therefore, significant data indicates that this group demonstrates the strongest consumer potential for modernized Wancao products and represents the primary target market. Results show tourism consumers achieved highest product awareness at 4.31. This group demonstrates that its acceptable price ceiling was the highest among the four groups at RMB 542, suggesting significant spending capacity [45]. Given that the results show this pattern, the study shows that full survey data are presented in Table 9, and that a comparative visualization of purchase intention and conversion rates across consumer groups appears in Figure 10. Data shows visualization provided in Figure 10.

**TABLE 9.** Survey Scoring Data across Five Dimensions for Four Target Consumer Groups on Modernized Wancao Products

| Consumer Group | Product Awareness | Aesthetic Preference | Pattern Acceptance | Functional Satisfaction | Purchase Intention | Conversion Rate (%) | Acceptable Price Ceiling (RMB) |
|---|---|---|---|---|---|---|---|
| Urban White-Collar Workers | 3.86 | 4.21 | 4.08 | 4.44 | 4.29 | 57.4 | 542 |
| Cultural Creative Enthusiasts | 4.18 | 4.62 | 4.53 | 4.35 | 4.48 | 68.3 | 486 |
| Middle-Aged & Older Home Consumers | 4.25 | 4.38 | 4.58 | 4.27 | 4.12 | 48.6 | 298 |
| Tourism Consumers | 4.31 | 4.29 | 4.22 | 4.18 | 4.35 | 62.7 | 328 |
| Dimension Mean | 4.15 | 4.38 | 4.35 | 4.31 | 4.31 | 59.3 | 414 |

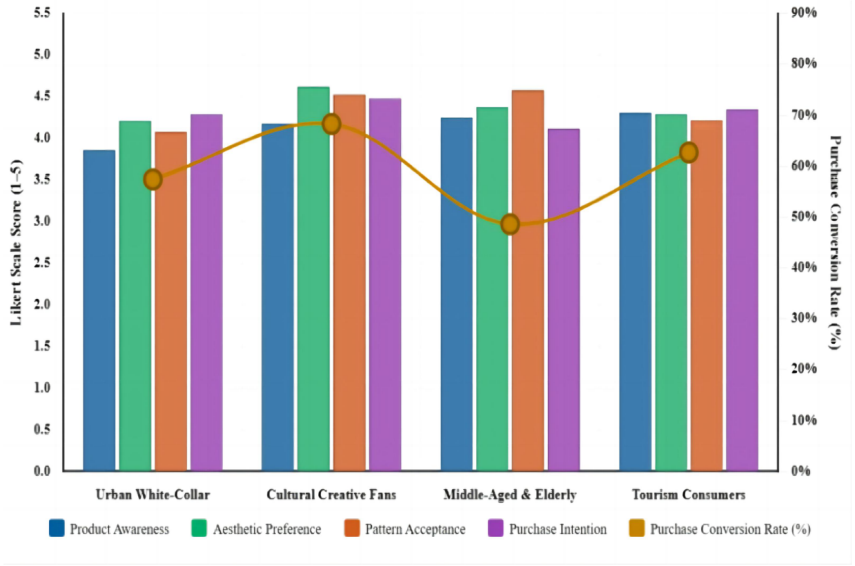


**FIGURE 10.** Dimensional Score and Purchase Conversion Rate Comparison across Four Target Consumer Groups for Modernized Wancao

## V. DISCUSSION

### *A. THE CENTRAL TENSION IN THE MODERN TRANSFORMATION OF WANCAO WEAVING: TRADITION PRESERVATION VERSUS COMMERCIAL INNOVATION*

The results of this study suggest that a fundamental structural tension exists at the heart of Wancao weaving's modern transformation, particularly the difficulty of reconciling heritage preservation with commercial innovation. Moreover, the material performance testing and weaving structure analysis may indicate that both point to the same key issue. Given that the natural physical characteristics of Wancao fiber—including its tensile strength ceiling, limited wet strength retention threshold, and the dimensional variation inherent to hand-weaving—could suggest that these features are simultaneously the material basis of the craft's authenticity and an objective constraint on standardized production and large-scale market supply [46]. Furthermore, the significant consumer survey data might demonstrate that the findings reinforce this critical point. Study shows aesthetic appeal erodes with mechanization. However, the significant aesthetic appeal among cultural creative enthusiasts and urban white-collar workers could indicate that it rests substantially on the natural texture and handmade quality of the material. In light of the commercial pressures, the evidence may suggest that introducing extensive mechanization to reduce costs risks eroding precisely the emotional value that drives consumer interest—a dilemma in which increasing output could dilute the product's core appeal. Therefore, the significant pattern reinvention evaluation data might demonstrate that deconstruction and recombination achieved the highest consumer acceptance rating, yet the important concern expressed by several inheritors could suggest that excessive creative adaptation risks severing the craft's cultural roots. Findings show views diverge on transformation boundaries. Nevertheless, the findings may indicate that this reflects a genuine divergence in views about where the boundaries of transformation should lie—a gap that appears to persist between academic perspectives and the inheritor community. Given that the evidence could suggest that commercial pressures continue to mount, the results might demonstrate that pricing strategies appear to follow a similarly divergent pattern across stakeholder groups. Thus, the significant tension between these positions could indicate that the craft faces an ongoing challenge in establishing that any unified framework for sustainable development remains achievable. The significant tension may suggest that it is also visible in pricing strategy, as the evidence demonstrates that products like the Wancao aromatherapy gift box could indicate strong commercial returns. However, the significant findings might indicate that their design language has moved considerably from the forms of traditional Wancao artifacts, which suggests that this raises important questions about whether cultural authenticity is effectively retained [47]. Furthermore, the evidence could demonstrate that resolving this tension does not require choosing one extreme over the other, as the key results may suggest that a tiered, boundary-aware framework for transformation appears to be needed. Given that the significant findings demonstrate that core weaving techniques and regional cultural identity remain central, the evidence might indicate that a baseline of tradition should be maintained. Framework supports dynamic equilibrium. Moreover, the important evidence may suggest that at the level of product form, visual language, and use context, the results could indicate that openness to creative innovation should be preserved, establishing that the goal appears to be a dynamic equilibrium between the cultural responsibility of heritage protection and the commercial logic of market development [48]. Nevertheless, the findings might indicate that this discussion could demonstrate broad reference value—not only for comparable regional grass-

weaving traditions but for the wider field of handcraft ICH modernization.

### *B. OPPORTUNITIES AND CHALLENGES IN INTEGRATING GRASS-WEAVING ICH CRAFTS WITH THE MODERN TEXTILE AND LEATHER INDUSTRY*

Moreover, the global textile and leather industry demonstrates that it is currently undergoing a transformation driven by three key forces: the substitution of sustainable materials, the restructuring of localized supply chains, and the enhancement of cultural added value. Given that Wancao demonstrates clear ecological properties and strong regional cultural identity, the findings might indicate that it aligns closely with all three of these important industry priorities. Integration shows technical feasibility. Nevertheless, the fusion experiment results shows that the Wancao-cotton yarn blend achieved a structural strength improvement rate of 38.6%, and the Wancao-synthetic fiber interlaced structure could demonstrate a flexibility improvement of 44.7%. Furthermore, the significant results might indicate that material-level integration between grass-weaving craft and modern textile technology appears technically feasible [49]. In light of these findings, supportive national ICH protection policies and rapid growth in the cultural tourism sector could provide additional favorable conditions for Wancao weaving to enter modern textile and leather product systems. Supply chain fragility shows primary bottleneck exists. However, the challenges shows that they are equally significant and demonstrates that they should not be underestimated, particularly regarding the seasonal harvesting cycle of Wancao raw material. Moreover, the low output efficiency of hand-weaving might indicate that it creates difficulty in meeting the stable supply and batch consistency requirements of modern industrial production. Thus, the significant certification barriers indicates that quality standards for grass-weaving products have not yet been aligned with the testing and certification norms of the mainstream textile industry. In light of these results, the evidence shows that this creates important barriers when products seek entry into major retail channels [50].

## VI. CONCLUSION

The results shows that Wancao fiber demonstrates a sound physical and mechanical foundation for modern home goods and cultural creative product development. Given that the evidence indicates key indicators— tensile strength, flexibility, and wet strength retention—all meet the demands of practical application, the findings demonstrates that material performance supports broader adoption. Nevertheless, the significant data shows that compatibility appears strongest in three product categories: storage containers, luminaires, and tourism souvenirs. Thus, the important results indicates that these categories provide the most relevant context for future product development practice. Findings show fiber meets practical demands.

Additionally, the evidence shows that two pathways prove most effective for achieving modern craft transformation. However, the significant findings demonstrates that the first pathway—the deconstruction and recombination of traditional weaving patterns—appears to provide important structural results. Moreover, the data might indicate that the second pathway, the integration of modern textile processes, could show equally relevant outcomes for the transformation process. In light of the results, the evidence shows that on the digital technology side, CAD-assisted design and digital pattern generation appear to show the strongest near-term conditions for broader adoption and promotion. Data shows two pathways most effective. Furthermore, the significant findings indicates that consumer survey data suggest cultural creative enthusiasts record the highest purchase conversion rate at 68.3%. Given that the evidence demonstrates that this result appears to reflect important market acceptance patterns, the data shows that modernized Wancao products could show a relatively optimistic level of acceptance across the target market as a whole. Nevertheless, the key results indicates that the evidence appears to support a favorable market outlook for the transformation process. Therefore, the important findings demonstrates that market-level results provide relevant support for the broader feasibility assessment. Survey shows 68.3% conversion rate.

Thus, the significant evidence shows that the modern design transformation of Wancao weaving craft appears feasible across three dimensions: technical, market, and cultural. However, the important findings indicates that the structural tension between tradition preservation and commercial innovation might demonstrate that this remains the central issue constraining sustainable development.

## AUTHOR CONTRIBUTIONS

Conceptualization –Linlin Li and Zhiliang Xin; methodology – Linlin Li and Zhiliang Xin; investigation – Linlin Li and Zhiliang Xin; writing-original draft preparation – Linlin Li and Zhiliang Xin. All authors have read and agreed to the published version of the manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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