



Exploring the Usability of Peanut Shells as an Alternative Component for Manufacturing Pattern Paper

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ABSTRACT

This study explored the feasibility of utilizing peanut shells as an alternative component in the production of pattern paper for clothing construction. The research specifically aimed to determine the prospective usability of peanut-shell-based pattern paper, evaluate its marking performance after trial testing, examine the relationship between usability and marking performance, and propose recommendations based on the results. The study employed a descriptive-experimental research design and was conducted at a state university in Cebu City, Philippines. A total of 38 respondents, consisting of 17 fashion students, 2 cutters, and 19 sewers, were selected through convenience sampling. Data were gathered using a researcher-developed survey questionnaire that underwent pilot testing to ensure its validity and reliability. The collected data were analyzed using both descriptive and inferential statistical methods, including frequency counts, percentages, mean scores, ranking, and Pearson's correlation coefficient. Findings revealed that the peanut-shell-based pattern paper demonstrated satisfactory usability and effective marking performance during pattern drafting activities. Participants described the material as flexible, durable, and capable of producing visible and clear markings using common drafting tools. Statistical analysis also indicated a positive relationship between usability and marking performance. Overall, the results suggest that peanut shells can be processed into a practical and environmentally sustainable substitute for conventional pattern paper in garment construction.

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Introduction

The garment and textile sector in the Philippines operates as a sophisticated ecosystem centered on the technical nuances of clothing construction. This multi-stage industrial workflow encompasses every phase of production, from the nascent creative concept and meticulous textile selection to the final realization of a complete ensemble. Within this systematic cycle, the precision of pattern drafting stands as a critical pillar, dictating the structural integrity and aesthetic success of the finished product. However, as the global fashion landscape evolves, Filipino designers and manufacturers are increasingly pivoting toward a philosophy of "slow fashion" and radical sustainability. By synthesizing ancestral artisanal techniques with avant-garde aesthetics, contemporary creators are striving to produce apparel that not only honors the archipelago's rich cultural heritage but also significantly reduces the ecological footprint associated with traditional mass production [1], [2].

In stark contrast to these green aspirations, the foundational industries that support garment construction—specifically, paper manufacturing—remain tethered to resource-intensive and ecologically damaging methods. Standard industrial pulping and bleaching protocols frequently discharge a cocktail of toxic substances into the environment, contaminating both atmospheric and aquatic ecosystems. Moreover, the massive accumulation of paper refuse in landfills triggers the anaerobic decomposition process, releasing potent methane gas and exhausting limited land space. This environmental crisis is further exacerbated by the Philippines' profound and systemic dependence on foreign paper supplies. By the close of 2024, the nation's imports of paper, paperboard, and associated pulp products reached a staggering valuation of approximately US \$1.58 billion [3]. This reliance does more than just inflate localized production expenses; it significantly magnifies the carbon intensity of the fashion supply chain due to the emissions linked to international maritime trade and complex cross-border logistics. These conditions underline the urgency of developing sustainable and locally sourced alternatives for paper production [4], [5].

In response to these challenges, agricultural by-products have emerged as a revolutionary alternative for raw material sourcing. On a global scale, peanut cultivation generates roughly 46.4 million metric tons of biomass annually. Approximately 22 percent of this total—exceeding 10 million metric tons—is comprised of hulls or shells, which are predominantly treated as valueless waste [6]. Chemically, these peanut husks are a goldmine of lignocellulosic material, rich in cellulose, hemicellulose, and lignin required for high-quality paper fabrication [7], [8]. Scientific analysis indicates that groundnut shells possess a robust composition of approximately 35.7% cellulose, 18.7% hemicellulose, and 30.2% lignin [9], [10]. By repurposing even a marginal

fraction of this agricultural waste stream, the Philippine paper industry could substantially decrease its reliance on virgin timber pulp, thereby mitigating the deforestation and environmental degradation inherent in conventional papermaking. Recent studies further demonstrate that peanut shells have promising potential for eco-friendly paper bag production and sustainable biomaterial development [11], [12].

Despite the burgeoning global fascination with converting agricultural residues into "bio-materials," there remains a glaring scholarly void regarding the specific application of peanut shells as a primary source for pattern paper within the apparel industry. Existing academic inquiries often prioritize the use of these shells in biodegradable packaging, construction composites, or bio-energy production [4], [7]. Consequently, there is little to no empirical data verifying whether peanut-based fibers can satisfy the stringent durability, tensile strength, and flexibility standards required for high-fidelity garment drafting and repetitive industrial handling.

This research, therefore, seeks to fill this critical gap by evaluating the practical feasibility of utilizing peanut shell waste as a sustainable substitute for traditional pattern paper. By embracing this bio-based alternative, the study bolsters the transition toward a circular fashion economy and aligns directly with the United Nations Sustainable Development Goals (SDGs) [1]. Specifically, the project advances SDG 12 (Responsible Consumption and Production) and SDG 15 (Life on Land) by championing innovative resource management and the aggressive reduction of industrial waste. Ultimately, by bridging the divide between agricultural waste valorization and textile engineering, this study proposes a transformative model that supports both environmental preservation and the economic resilience of the local Filipino fashion industry.

To achieve these objectives, the subsequent sections of this article are organized as follows: The next section details the experimental methodology, focusing on the chemical extraction of fibers from peanut shells and the papermaking process. This is followed by a presentation of the findings regarding the paper's usability and durability. The discussion then evaluates these results against industry standards for garment drafting, and finally, the paper concludes with a summary of the study's implications for the Philippine circular economy.

Material and Methods

The research was conducted using a descriptive-experimental approach that utilized the Input-Process-Output (IPO) model as its foundational framework. In the Input phase, the study established the baseline for assessing the usability of peanut shell-based pattern paper by identifying key variables such as texture, thickness, durability, and marking performance across various media, like pencils and permanent markers. The Process phase involved securing

institutional approval from the Dean of the College of Education at one of the state universities in Cebu City, Philippines, and implementing the research design through controlled trials and data collection. Finally, the Output phase resulted in the production of a prototype peanut shell-based pattern paper, which demonstrated the material's potential as a sustainable industrial component. This entire sequence was carried out at the Garments, Fashion, and Design department and a garments shop in Cebu City, Philippines, providing a dual-environment perspective that bridged academic innovation with real-world garment production needs.

The participant pool consisted of 38 individuals selected through universal convenience sampling, primarily comprising BTVTEd students, professional cutters, and sewers. To ensure the integrity of the data, the researchers prioritized ethical considerations and data privacy throughout the engagement. All participants were required to sign an informed consent form that detailed the study's purpose and their right to withdraw at any time. Furthermore, strict data privacy protocols were maintained; all survey responses were anonymized and stored securely in Microsoft Excel, ensuring that no personal identification was linked to the statistical results. This professional cohort provided a specialized feedback loop, with sewers representing the largest demographic at 50%, followed by students and cutters, all of whom possessed the technical expertise to evaluate the paper's performance in a high-stakes industrial setting.

The technical procedure followed a rigorous multi-stage papermaking process that involved cleaning, soaking, and boiling peanut shells for one hour to extract the necessary fibers. Once a smooth pulp was formed using a blender, the researchers conducted three distinct experimental trials to optimize the material's composition. Trial 1 and Trial 2 focused on varying ratios of peanut shell powder, cassava starch, and glue, but it was Trial 3 that proved most successful by incorporating 150 grams of powder with 360 milliliters of glue and 30% recycled paper bag to enhance the sheet's structural integrity. The resulting pulp was transferred to a papermaking mold, couched onto muslin cloth, and pressed with a sponge to remove excess moisture before being air-dried. This systematic refinement ensured that the final sheets achieved the necessary smoothness and stability required for professional garment drafting.

Data were gathered using a researcher-developed survey instrument that was pilot-tested for validity and reliability. This questionnaire utilized a 4-point Likert scale to quantify participant feedback on usability and marking performance, with scores ranging from 1.00 (Strongly Disagree) to 4.00 (Strongly Agree). The statistical treatment of the data involved frequency counts, mean calculations, and Pearson's *r* correlation to examine the relationship between the paper's physical usability and its functional marking ability. By converting qualitative observations from industry professionals and students into numerical data, the

researchers were able to identify significant trends and correlations. This comprehensive analysis allowed the study to conclude that the peanut shell-based material could indeed serve as a functional, eco-friendly alternative to traditional timber-based pattern paper in the clothing construction industry.

Literature Review

A. Circular Economy Foundations: The Cradle-to-Cradle Paradigm in Pattern Drafting

The primary theoretical lens of this study is the Cradle to Cradle (C2C) Design Theory, a framework that mandates a shift from linear consumption to regenerative production. Formulated by McDonough and Braungart [2], the C2C model posits that for an industry to be truly sustainable, it must eliminate the concept of “waste” entirely. In the context of the Philippine garment sector, pattern drafting is a stage that traditionally generates significant volumes of single-use paper waste, which is often discarded after a single collection or sample run. By applying C2C principles, this research redefines peanut shells—typically an agricultural byproduct discarded or burned after harvest—as a “biological nutrient” [6], [10]. Traditionally, the fashion industry has relied on virgin paper products, which are often imported and treated with harsh chemicals for bleaching [3]. According to the C2C philosophy, this linear consumption is fundamentally flawed because it ignores the end-of-life stage of the product. When a pattern paper is discarded, it usually becomes part of the growing solid waste problem in urban centers. Similar studies also confirmed that lignocellulosic agricultural waste possesses strong potential for biodegradable industrial materials and sustainable paper manufacturing processes [13], [14].

However, by selecting peanut shells as an alternative component, the study ensures that the paper is part of a biological cycle. This means the material is inherently designed to return to the earth as a nutrient rather than a pollutant. Previous studies have shown that lignocellulosic agricultural residues possess strong potential for sustainable paper and biomaterial production due to their cellulose-rich composition [5], [8]. Furthermore, recent developments in eco-friendly paper bag manufacturing using peanut shells confirm the practical feasibility of transforming agricultural waste into value-added industrial materials [4], [11]. This theoretical alignment is crucial for the Sustainable Development Philosophy of the local fashion industry, which emphasizes fulfilling current manufacturing needs without compromising the ecological stability of future generations [1]. It allows designers to meet the “present requirements” of precision in garment construction without “affecting the needs of future generations” through deforestation or chemical runoff. This philosophy serves as the ethical heartbeat of the research, moving the conversation from mere “recycling” to “true circularity,” where the raw materials for clothing

construction are sourced from the earth and can eventually return to it, thereby reducing the environmental burden of the traditional “take-make-dispose” pattern-making workflow [2], [12].

B. Legislative Synergy: Aligning Waste Management with Industrial Innovation

The transition toward utilizing peanut shells as an industrial component is strongly supported by the Philippine legal landscape, specifically through Republic Act No. 9003 [15] and Republic Act No. 11293 [16]. Under RA 9003, the state mandates the implementation of resource recovery and recycling programs to minimize the volume of solid waste. In many rural areas of the Philippines, peanut shells are burned in open fields, contributing to air pollution and carbon emissions. The use of these husks—a major agricultural residue in the archipelago—directly addresses this mandate by intercepting biodegradable waste before it contributes to methane emissions in landfills [4], [6]. This practice helps reduce the environmental challenges faced by the Philippine landscape, particularly in provinces where peanut cultivation is a primary livelihood.

Furthermore, RA 11293 provides the necessary impetus for “green” innovation, encouraging the fashion and manufacturing sectors to adopt sustainable technologies that reduce dependence on imported supplies [16]. The Philippine Innovation Act recognizes that for the local garment sector to compete globally, it must find unique, cost-effective, and sustainable ways to produce materials. By developing a locally sourced, bio-based pattern paper, this study responds to the national call for “Filipino Innovation” that solves local environmental issues while boosting industrial competitiveness. Previous research has demonstrated that agricultural residues can function as viable industrial raw materials for pulp, paper, and membrane fabrication, thereby supporting local manufacturing ecosystems [5]. In addition, sustainable material development based on agricultural waste has been identified as an important strategy for strengthening circular economic systems and reducing industrial dependence on imported resources [10], [17]. Sourcing components from the agricultural sector creates a symbiotic relationship between farmers and manufacturers, which is a key objective of the national innovation agenda. These legislative pillars provide the regulatory justification for exploring peanut shells as a viable alternative component, ensuring that the research is not only scientifically sound but also nationally relevant and economically protective of the local garment industry.

C. Lignocellulosic Valorization: The Chemical Viability of Peanut Residues

To explore the usability of peanut shells for manufacturing pattern paper, one must analyze the material’s lignocellulosic composition. Recent studies from 2021 to 2025 emphasize that agricultural residues are among the most promising sources for paper and membrane production due to their fiber density [5], [8]. Previous investigations have demonstrated that peanut shells

possess a high-quality fibrous structure suitable for creating biodegradable materials with significant tensile strength [7], [11]. Unlike standard writing paper, pattern paper must withstand pinning, heavy handling, and the use of various marking tools such as tailor's chalk and graphite. The research by Tayeb et al. [12] into the high cellulose composition of agricultural biomass is particularly important, as cellulose provides the structural "backbone" of paper sheets. Studies on peanut shell biomass specifically identified cellulose levels ranging from approximately 35% to 45%, supporting their suitability for durable paper production [9], [10]. Without sufficient cellulose, the paper would tear easily under the pressure of tracing wheels or repeated garment drafting procedures.

Additionally, hemicellulose plays a crucial role in strengthening fiber-to-fiber bonding and improving sheet formation during papermaking [8]. This characteristic is essential for producing a smooth and cohesive surface capable of maintaining the precision lines required in technical drafting. Agricultural-residue-based paper materials have also been recognized for their dimensional stability under varying environmental conditions [5]. Such stability is particularly important in the Philippine climate, where humidity fluctuations may otherwise cause paper expansion or contraction, leading to inaccuracies in garment sizing and unnecessary textile waste. Therefore, the chemical properties inherent in peanut shells are not merely incidental but highly compatible with the mechanical requirements of clothing construction. This chemical synergy enables the resulting paper to preserve its geometric integrity throughout the garment development process, thereby satisfying the durability and precision standards demanded by professional fashion designers.

D. Technical Feasibility and the Circular Fashion Economy

The final sub-theme focuses on the practical application and mechanical integrity of peanut-shell-based paper within the circular fashion economy. Beyond its chemical composition, the usability of this alternative component is grounded in its ability to satisfy the tactile and functional requirements of the apparel industry. Mandala et al. [7] observed that peanut shells exhibit favorable mechanical properties, including smoothness, flexibility, and structural stability, which make them suitable for high-performance composite applications. For clothing construction, pattern paper must retain clear markings while remaining sufficiently flexible for draping, folding, and repetitive handling. Additional studies also indicate that the presence of extractives, ash, and dietary fiber components contributes to improved material durability and shelf-life [10].

The current dependence on imported paper products, valued at approximately US \$1.58 billion in 2024, creates significant economic vulnerability for Filipino designers and

manufacturers [3]. This reliance not only increases local production costs but also intensifies the carbon emissions associated with international shipping and logistics. By utilizing agricultural byproducts currently regarded as waste, the garment industry can reduce manufacturing expenses while simultaneously lowering its ecological footprint. Earlier studies on sustainable paper bag production and agricultural waste utilization provide an empirical foundation supporting the feasibility of replacing conventional wood-pulp materials with biomass-based alternatives [4], [11]. Furthermore, agricultural waste valorization aligns strongly with the circular economy philosophy promoted by sustainable manufacturing frameworks [1], [2].

This study, therefore, extends beyond laboratory-scale material experimentation by examining how waste-derived materials can be integrated into the daily operational workflow of garment construction. By bridging the gap between agricultural production and fashion manufacturing, the research proposes a future in which the Philippines can emerge as a leader in sustainable apparel innovation. Ultimately, the findings suggest that peanut shells represent a viable, durable, and environmentally responsible alternative component for next-generation pattern drafting materials within the circular fashion economy.

Results and Discussion

This section analyzes the potential of peanut shell-based paper as a sustainable alternative for pattern-making, focusing on usability and marking performance. Data was gathered from 38 respondents, including fashion students, cutters, and sewers, who evaluated the material using a four-point Likert scale (ranging from 1: Strongly Disagree to 4: Strongly Agree). The analysis employed descriptive statistics (mean and standard deviation) to identify performance trends, alongside Pearson's correlation to determine the relationship between the material's ease of use and its technical effectiveness. These methods collectively provide an empirical basis for the practical viability of peanut shells in the garment industry.

A. Prospect the Usability of Peanut Shells as an Alternative Component for Manufacturing Pattern Paper

This section of the chapter presents the findings on the perceived usability of peanut shells as an alternative component for manufacturing pattern paper. The evaluation focused on several indicators related to pattern-making tasks, including the ease of marking, visibility and sharpness of lines, surface response to various marking tools, capability for erasing marks, and resistance to ink bleeding or smudging. The responses gathered from participants were analyzed using the mean and standard deviation to determine the general level of agreement for each usability criterion.

The peanut shell-based material achieved an overall mean score of 3.41 (“Strongly Agree”), confirming its high usability for pattern-making. The highest-rated attribute was the material’s fiber structure ($M = 3.50$, $SD = 0.60$), which allowed for precise, bleed-free markings—a finding that aligns with Mandala et al. [7] regarding the benefits of cellulose-rich residues for surface quality. While items concerning permanent markers and tool versatility received the lowest scores ($M = 3.34$, $SD = 0.60$ – 0.67), they remained within the “Strongly Agree” category, proving the material’s functional effectiveness. The results also support previous studies emphasizing that agricultural waste fibers possess sufficient structural integrity for sustainable paper production and technical applications [5], [8].

Table 1. Usability

No	Indicators	Mean	SD	VD
1	The fiber structure of the material makes it possible to draw neat and defined lines without bleeding or feathering when using a pencil or fine-tip pen.	3.5	0.6	SA
2	The material can be marked easily with different tools such as pencils, chalk, or tracing wheels, without needing too much pressure or risking damage to the tools.	3.34	0.67	SA
3	Markings made on the surface stay clear during normal handling, yet can be erased cleanly when needed without leaving residue or shadow marks.	3.47	0.5	SA
4	When using a tracing wheel, the material shows a visible and lasting impression on the fabric without requiring extra force.	3.39	0.61	SA
5	Permanent marker lines remain sharp and intact on the material, with no bleeding or smudging even after some time.	3.34	0.6	SA
Overall		3.41		SA

Legend: 3.25-4.00 Strongly Agree (SA); 2.50-3.24 Agree (A); 1.75-2.49 Strongly Disagree (SD); 1.00-1.74 Disagree (D)

The findings are consistent with the research of Mandala et al. [4], particularly the highest mean score for neat line formation without bleeding ($M = 3.50$), which supports the claim that cellulose-rich agricultural residues can improve paper strength and print quality. Even the lowest-rated indicators ($M = 3.34$) still demonstrate that the material remains practically functional for its intended use. From a sustainability perspective, the outcome supports Gerber et al. [6] in emphasizing the value of repurposing peanut shells instead of discarding them as waste. In addition, the findings align with Thirat et al. [11], reinforcing previous research that agricultural by-products can achieve performance levels comparable to those of conventional materials when appropriately processed. Similar observations regarding the technical feasibility of agricultural residues for biodegradable paper products were also reported by Sharma et al. and Worku et al., who highlighted the compatibility of lignocellulosic biomass with industrial papermaking processes [5], [18]. Recent developments in sustainable biomaterials further support the integration of agricultural residues into circular manufacturing systems within the

textile and paper industries [19]–[22].

B. Extent of Marking Performance of Peanut Shell-Based Pattern Paper After Conducting Trial Test

This section evaluates the marking performance of peanut shell-based pattern paper, focusing on its functional efficacy during experimental garment construction trials. A systematic evaluation framework was established to quantify the material's performance across five critical technical parameters: line integrity, instrument compatibility, surface stability, reversibility, and impression clarity. Specifically, the assessment scrutinized the sharpness and geometric accuracy of drafted lines, the material's receptivity to standard drafting tools—including graphite pencils, ink pens, and mechanical tracing wheels—and its resistance to pigment smudging or capillary ink bleeding.

Furthermore, the ease of mark eradication was analyzed to ensure the substrate's structural integrity remained uncompromised, while the definition of transferred markings was recorded to determine overall visibility. These criteria serve as the benchmark for determining if this sustainable innovation meets the rigorous industrial standards required for professional pattern drafting and production. To provide a robust quantitative analysis, participant evaluations were synthesized using the mean and standard deviation, facilitating a standardized interpretation of the material's marking performance and functional suitability.

As shown in Table 2, the peanut shell material achieved an overall mean score of 3.36 (SD = 0.66), falling under the “Strongly Agree” category and confirming its effectiveness in maintaining markings. The highest-rated items ($M = 3.42$) highlighted the material's compatibility with common fashion design tools, allowing for clear, consistent lines without excessive pressure. Conversely, smudge resistance and erasability received the lowest scores ($M = 3.26$) but remained within the “Strongly Agree” range, indicating the material is reliable for repeated use and easy corrections. The positive evaluation further supports the proposition that lignocellulosic agricultural residues can function as durable alternatives to conventional wood-based drafting materials [10], [18].

According to Tayeb et al. [12], the high ratings for tool compatibility ($M = 3.42$) can be attributed to the material's lignocellulosic composition, containing 37–45% cellulose and 12–18% hemicellulose, which facilitates good ink adhesion and clear impressions. Even the lower scores for smudge resistance and erasability ($M = 3.26$) fall within the “Strongly Agree” range, indicating that the material can still accommodate corrections, an important aspect of pattern-making processes.

Table 2. Marking Ability

No	Indicators	Mean	SD	VD
1	The surface of the material supports drawing lines that stay crisp and consistent, with no feathering or ink spread.	3.42	0.61	SA
2	The material works well with common pattern-making tools like pencils, markers, and tracing wheels, without demanding extra pressure.	3.42	0.65	SA
3	Lines made on the material resist smudging from handling and stay visible over time.	3.26	0.59	SA
4	Pencil marks on the material can be erased fully and neatly without leaving stains or harming the surface.	3.26	0.63	SA
5	The material responds well to tracing wheels, producing clear and accurate impressions that transfer smoothly onto fabric.	3.42	0.65	SA
Overall		3.36	0.66	

Legend: 3.25-4.00 Strongly Agree (SA); 2.50-3.24 Agree (A); 1.75-2.49 Strongly Disagree (SD); 1.00-1.74 Disagree (D)

These findings support the conclusions of [8], demonstrating that peanut shells are suitable for paper products requiring precise marking, while also contributing to circular economy objectives by offering an alternative to virgin pulp through the use of agricultural waste [23]. Furthermore, recent literature on sustainable biomaterials and agricultural waste valorization also emphasizes that cellulose-rich biomass can significantly reduce dependence on imported industrial raw materials while maintaining functional performance standards [23], [24].

C. Significant Correlation Between the Usability and Marking Performance of Peanut Shells as an Alternative Component for Manufacturing Pattern Paper

This section explores the relationship between the usability and marking performance of the peanut shell-based pattern paper. A correlation analysis was conducted to determine whether a significant association exists between these two variables. Pearson's correlation coefficient was utilized to measure both the direction and the magnitude of the relationship between usability and marking performance.

As shown in Table 3, the correlation analysis revealed a strong positive relationship between usability and marking performance ($r = 0.748$, $p < 0.001$). This statistically significant result indicates that as the material's ease of use improves, its performance during marking tasks increases proportionally. The high coefficient value demonstrates that the usability characteristics of the peanut shell-based paper—such as smoothness, tool compatibility, and surface stability—are closely associated with its effectiveness in producing accurate and durable markings during garment drafting activities.

This finding suggests that enhancements in usability directly contribute to improved marking performance, which is essential for maintaining consistent quality in pattern-making tasks. Consistent with Lykourantzou et al. [25], the result supports human-centered design principles emphasizing the relationship between material properties and user efficiency in collaborative

and technical work environments. Practically, this indicates that the material is likely to be both manageable and effective for key pattern-making activities.

Table 3. Correlation Between the Usability and Marketing Performance

Variable	r	Strength of Correlation	p-value	Decision	Interpretation
Usability vs Marking Ability	0.748	Strong Positive	< 0.001	Significant	Strong Positive Correlation

Moreover, the results align with Worku et al. [5], who argued that agricultural-residue-based materials can maintain high technical functionality when processed appropriately for industrial applications. Similar conclusions were also reported by Ameen et al. [10] and Tayeb et al. [12], who emphasized that lignocellulosic biomass with high cellulose and hemicellulose content contributes significantly to paper strength, dimensional stability, and surface performance. In addition, the findings reinforce the sustainability perspective proposed by McDonough and Braungart [2], which highlights that environmentally responsible materials should not only reduce ecological impact but also preserve or improve functional quality. Therefore, the strong positive correlation observed in this study demonstrates that sustainable agricultural waste materials such as peanut shells can simultaneously support ecological objectives and technical performance standards within the apparel and fashion manufacturing industry.

Conclusion

This study successfully confirms that exploring the usability of peanut shells as an alternative component for manufacturing pattern paper yields a functional, eco-friendly, and durable material suitable for professional clothing construction. Participants provided positive feedback on its structural integrity, yet further research is recommended to enhance smudge resistance and large-scale manufacturing potential. Based on these findings, it is recommended that this peanut-shell and recycled paper composite be adopted by educators and dressmakers as a practical substitute for traditional paper.

Conflict of Interest

The authors declare no conflict of interest.

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