Textile & Leather Review

ISSN 2623-6281| www.tlr-journal.com | 10.31881/TLR

An Exploratory Analysis of Integrating Digital Printing with Traditional Weaving Patterns for Creative Cultural Tourism Products

Yanqiong WANG

How to cite: Wang Y. An Exploratory Analysis of Integrating Digital Printing with Traditional Weaving Patterns for Creative Cultural Tourism Products. Textile & Leather Review. 2025; 8:782-799. https://doi.org/10.31881/TLR.2025.782

How to link: https://doi.org/10.31881/TLR.2025.782

Published: 29 October 2025

An Exploratory Analysis of Integrating Digital Printing with Traditional Weaving Patterns for Creative Cultural Tourism Products

Yanqiong Wang

School of Fine Arts, Shanxi Application Technology College, Taiyuan City 030062, Shanxi Province, China
18649509608@163.com

Article

https://doi.org/10.31881/TLR.2025.782
Received 3 June 2025; Accepted 17 July 2025; Published 29 October 2025

ABSTRACT

This paper presents a comparative case study focusing on the integration of traditional weaving patterns with digital printing for creative cultural tourism products. This study collected traditional patterns such as Yunjin and Shujin and conducted printing experiments on various fabrics to analyze their respective outcomes across eight indicators. In this case, the application of a digital workflow, compared to a traditional weaving process, was associated with an improved pattern reproduction score (from 5.78 to 6.92) and more accurate color representation, with the color difference ΔEab value decreasing from 4.8 to 2.4. Furthermore, production time for a sample batch of 100 units was reduced from 40 hours to 8 hours. However, the digital process also led to a noticeable decline in fabric feel and wear resistance. The findings from this case study provide a practical foundation for applying digital technology in the development of cultural products, highlighting its significant potential and current limitations and promoting the innovative transformation of traditional culture.

KEYWORDS

traditional weaving pattern, digital printing technology, integration, creative cultural tourism products

INTRODUCTION

As a significant carrier of traditional Chinese culture, traditional brocade patterns have been passed down for thousands of years, carrying deep historical memories and ethnic sentiments. Their historical value can be traced back to various periods and regions, forming unique cultural threads. The Yun Brocade, originating from the Six Dynasties period in Nanjing, became a royal item during the Yuan, Ming, and Qing dynasties, with its production concentrated in the Nanjing area [1]. The Shu Brocade, originating from the ancient Shu Kingdom (now the Chengdu area of Sichuan Province) during the Warring States period, spread to the world through the Silk Road during the Han Dynasty [2]. The Zhuang Brocade, a traditional brocade of the Zhuang ethnic group, originated in the Han Dynasty and is mainly found in the Guangxi Zhuang Autonomous Region [3]. These traditional brocade patterns not only showcase exquisite weaving techniques but also carry rich cultural connotations—such as blessings and human stories—and possess high aesthetic value. From imperial use to everyday life, from Han craftsmanship to the wisdom of ethnic minorities, traditional brocade weaves a vivid history of Chinese cultural development through the language of its unique patterns.

Digital printing technology has evolved through various stages. In its early days, inkjet printing used on-demand inkjet technology to print small batches of colorful patterns on fabric surfaces, though with limited color vibrancy and fastness [4]. Later, thermal sublimation printing emerged, using high temperatures to sublimate dyes into the fabric. This method effectively addressed the color representation issues of synthetic fabrics and expanded its range of applications [5]. Digital direct inkjet printing, which directly applies water-based or pigment inks to natural fiber fabrics (e.g., cotton and linen), combined with pretreatment and posttreatment processes, achieved high color range and fastness, making it the current mainstream technology [6].

Under the vigorous development of modern cultural and creative industries, digital printing technology has become a key tool for developing creative cultural products owing to its high precision, efficiency, and ability to support customization. For example, in Dunhuang cultural creation, mural patterns are digitally printed onto scarves and clothing, making the ancient art glow with new vitality. Similarly, in the Forbidden City, notebooks, canvas bags, and other products with traditional patterns developed by Wenchuang are deeply loved by consumers，Wenchuang, Namely cultural and creative products, which combine cultural elements with creative design and have both cultural connotation and practical value [7]. As a result, the use of digital printing in Wenchuang products is growing in both scope and depth. The combination of traditional weaving patterns and digital printing is crucial for the development of creative cultural tourism products. On the one hand, it can realize the innovative transformation and development of traditional culture and enable traditional patterns to enter public life in a more modern, convenient way. On the other hand, digital printing technology can help improve the design level and production efficiency of creative cultural tourism products, meet the diversified needs of the market, enhance the market competitiveness of products, and promote the prosperity and development of the creative cultural tourism industry.

Against this background, scholars have studied the integration of traditional weaving patterns and digital printing in creative cultural tourism products. Existing research falls into two categories: traditional weaving patterns and digital printing based on these patterns. Some studies analyzed the traditional textile techniques of Li women in Hainan, China, including spinning, dyeing, knitting, and embroidery [8,9]. These textile patterns are believed to be created purely from imagination and an understanding of traditional styles [10]. Fu studied the inheritance and development of traditional handicrafts in intangible cultural heritage [11]. Zhang analyzed folk dyeing and weaving embroidery, highlighting its rich cultural meaning and artistic value. This paper uses Suzhou embroidery to explore the application of folk dyeing embroidery patterns in graphic design, from the aspects of color application, line and composition, and pattern implication [12].

By contrast, only a few scholars have studied digital printing based on traditional weaving patterns. Ding [13] studied Chinese character patterns, designed fabrics inspired by the words “mountain,” “Miao, and “valley,” simulated them with textile CAD software and colored yarn arrangements, and completed trial weaving on a semi-automatic sample loom. These patterns combined traditional culture with modern aesthetics. Other scholars have analyzed digital printing technologies more broadly. Considering the cultural and background color characteristics of silk scroll painting, as well as the customization needs of creative cultural products, Ding explored digital design, painting, and printing in ceramic painting and showed how these technologies help artists achieve more complex and detailed designs while preserving uniqueness and artistic value [14]. For example, Sahil studied the development and importance of 3D printing. Owing to its unique advantages, 3D printing technology has been widely used in the rapid development of digital polymer materials, raising requirements for virtual reality printing technology [15]. Jing studied the application of computer virtual reality technology in a 3D digital polymer material printing system [16]. Zhuang [17] pointed out that intelligent printing technology, as a product of the digital age, can not only improve the efficiency and quality of printing production, but also achieve personalized printing functions. Tan [18] claimed that using digital technology to dye and finish textiles meets actual needs, playing a key role in the development of the textile dyeing industry.

An analysis of existing literature reveals that limited research has been conducted on the combination of traditional weaving patterns and digital printing in creative cultural products [19]. For example, research on the cultural connotation transmission and market acceptance of integrated products is shallow, and comparative analysis on the application effects under different fabric materials and printing parameters is lacking [20]. To address this gap, the present work undertakes a comparative case study to explore the holistic application effect of integrating these two domains. By evaluating the outcomes across a comprehensive set of indices, it aims to provide a practical reference that compensates for the shortcomings in existing literature, thereby demonstrating strong innovation and necessity.

MATERIALS AND METHODS

Materials

Traditional Weaving Patterns

A curated collection of national intangible cultural heritage weaving patterns, including Yunjin, Shujin, Zhuangjin, and Songjin, was sourced from museum archives, works by non-genetic inheritors, and ancient texts. The selection process was guided by the following criteria to ensure sample representativeness and research value:

Artistic Value: Priority was given to patterns with unique weaving techniques (e.g., the floral decoration of Yunjin), complex structures, and distinct aesthetic features.

Historical Value: Patterns with clear historical origins (e.g., Shu brocade from the Han Dynasty) were prioritized, along with those of significant archaeological value or on the verge of being lost.

Cultural Representativeness: A minimum of three to five representative patterns were selected from each key region (e.g., Nanjing, Sichuan, Guangxi). Patterns from ethnic minorities were chosen to reflect their unique beliefs and customs.

Sample Integrity: Physical samples exhibited clear patterns without significant damage or fading. Digital reproductions were required to have a minimum resolution of 600 dpi, accurate color, and no obvious distortion. An industrial-grade scanner was used for flat patterns, while professional photographic equipment (≥45 million pixels) and image mosaic software were used for 3D patterns to create complete digital images.

Digital Printing Materials

Fabrics: Four common fabrics used in cultural tourism products were selected: pure cotton plain cloth (120 g/m²), linen canvas (280 g/m²), silk crepe de chine (16 momme), and polyester taffeta (290T). For each fabric type, three parallel samples (50 cm × 50 cm) were prepared.

Inks: Fabric-specific inks were chosen to ensure optimal performance. This included reactive dye ink (DuPont™ Artistri®) for cotton and linen, acid dye ink (Huntsman LANASOL®) for silk, and disperse dye ink (DyStar Terasil®) for polyester. A 500 ml supply of each ink was prepared.

Experimental Equipment

The primary equipment included a Mimaki TS300-1800 industrial direct-injection digital printer (up to 1200 dpi resolution), Adobe Photoshop 2024, and Illustrator 2024 for image processing; an X-Rite Ci7800 desktop spectrophotometer for color measurement; and a YG026H electronic fabric strength tester.

Methods

Digital Pattern Processing

Digital images of the patterns were first repaired using Photoshop's tools to remove stains and damage. Color correction was performed by adjusting curves and levels. Details were enhanced using an Unsharp Mask filter (120% amount, 1.0-pixel radius, 3-level threshold). Finally, the optimized raster images were vectorized in Illustrator using the "High Fidelity Photo" preset to create scalable graphics suitable for printing at various sizes.

Digital Printing Experiment

Three sets of printing parameters were established to investigate their effects on the final output, with resolution set at 600, 900, and 1200 dpi, and corresponding adjustments to ink volume, temperature, and pressure. Prior to printing, fabrics underwent standard pretreatment (e.g., de-pulping for cotton, de-gumming for silk). After printing, post-treatment processes such as steam setting for reactive dyes (102°C, 15 min) and heat setting for disperse dyes (180°C, 90 s) were applied.

Comparative Evaluation Framework

A framework of eight indices was designed to compare the outcomes of the traditional weaving process (before application) and the digital printing workflow (after application).

Pattern Reproduction Degree

Assessed using a weighted score. A subjective score (40% weight) was obtained from 10 textile experts and 10 heritage researchers on a five-point similarity scale. An objective Structural Similarity Index (SSIM) score

(60% weight) was calculated using ImageJ software. To balance the scales, the SSIM value (0-1) was multiplied by 10 before weighting. The final score was calculated as follows:

$$\text{Score} = (\text{Subjective Score} \times 0.4) + (\text{SSIM} \times 10 \times 0.6)$$

Color Expressive Force

Measured using the CIE Lab color difference formula (ΔE × ab), where a smaller value indicates a more accurate color match.

Fabric Feel

Evaluated by a panel of 5 textile professionals and 15 ordinary consumers on a seven-point scale covering softness, smoothness, and roughness, where a lower value (e.g., 1-2) indicates poor performance (e.g., low softness, lack of smoothness, high roughness) and a higher value (e.g., 6-7) represents excellent quality (e.g., high softness, exceptional smoothness, minimal roughness).

Wear Resistance

A comprehensive score was calculated based on strength loss and surface damage after 500 abrasion cycles. To ensure valid calculation, the five-point surface damage score was first normalized to a 0-1 scale. The final score was calculated as follows:

$$\text{Normalized Damage Score} = (\text{Original Damage Score} - 1) / 4$$

$$\text{Comprehensive Score} = (1 - \text{Strength Loss Rate}) \times 0.6 + (\text{Normalized Damage Score} \times 0.4)$$

Color Fastness to Washing

Assessed according to the GB/T 3921-2008 standard, rated on a five-grade gray scale. The final score is the average of the discoloration and staining grades.

Production Efficiency

Measured by comparing the total time required to produce 100 units using the traditional process versus the digital workflow.

Market Acceptance

Evaluated through a 200-person questionnaire distributed via stratified sampling across eastern (40%), central (30%), and western (30%) regions. The survey measured liking degree, purchasing intention, and price acceptance on five-point scales. The comprehensive score was calculated as the average of three dimensions:

$$\text{Market Acceptance Score} = (\text{Liking Score} + \text{Purchase Intention Score} + \text{Price Acceptance Score}) / 3$$

Qualitative feedback was also gathered from consumer interviews.

Study Design and Data Analysis

This study employs a holistic case study methodology. The “before application” and “after application” comparison is not a controlled experiment isolating a single variable. Rather, it is designed to simulate and evaluate the overall impact of shifting from a traditional craft-based production model to a modern, integrated digital workflow in a real-world context.

Given the exploratory nature of this case study and the sample size, the analysis relies on descriptive statistics (e.g., mean values) to identify key performance trends and areas for further investigation. While no inferential statistical tests are conducted, the observed differences provide practical and valuable insights for the cultural and creative industries.

RESULTS AND DISCUSSION

Pattern Restoration Results

The application of the digital printing workflow resulted in a marked improvement in pattern restoration. As shown in Table 1, the subjective evaluation score from experts and researchers increased from 3.2 to 4.1. Concurrently, the objective SSIM value, which measures structural similarity at a pixel level, rose from 0.75

to 0.88, leading to an increase in the final weighted score from 5.78 to 6.92. This improvement is attributed to the high-resolution capabilities of the digital printer, which can faithfully replicate intricate details and smooth curves [21,22]. Such feature overcomes the physical limitations of traditional weaving, where thread thickness and loom mechanics can restrict pattern precision.

Table 1. Pattern restoration degree before and after the use of the digital printing workflow

Experimental stage	Subjective evaluation score	SSIM price	Final score
Before application	3.2	0.75	5.78
After application	4.1	0.88	6.92

Color Expression Results

Figure 1 illustrates the comparison of color expression. The digitally printed fabrics exhibited significantly lower ΔL*, Δa*, and Δb* values, indicating less deviation from the original digital pattern's lightness, red-green, and yellow-blue values, respectively. Consequently, the total color difference (ΔEab) decreased from 4.8 to 2.4. Notably, since ΔEab values below 2.0 are generally imperceptible to the human eye, this reduction represents a meaningful improvement in color consistency that approaches the threshold of visual detectability. A lower ΔEab value signifies a more accurate color reproduction. The enhanced color accuracy stems from the precise color management system inherent in the digital workflow. This system converts pattern colors to a specific CMYK profile calibrated for the printer, ink, and fabric combination, thereby minimizing the color variability often present in traditional batch dyeing processes [23,24].

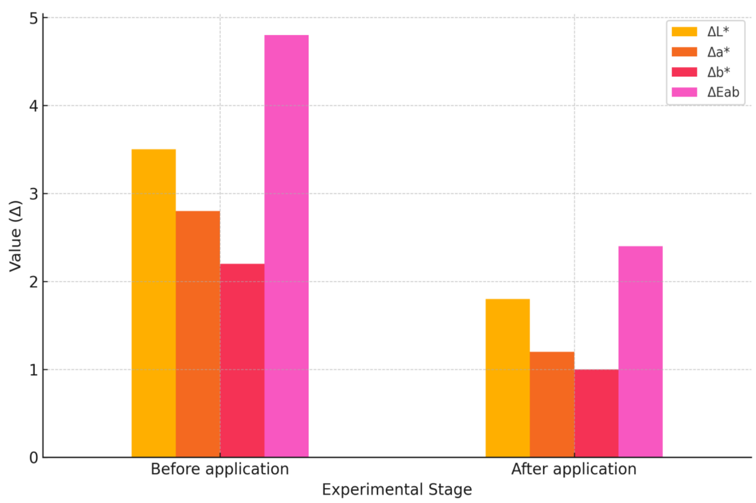

Figure 1. Comparison of color expression

Fabric Feel Results

Digital printing had a negative impact on the tactile properties of the fabric. As detailed in Figure 2, the average fabric feel score, which combines expert and consumer ratings, declined from 5.68 to 4.13. This trend was consistent across both evaluator groups. The degradation in fabric feel was likely due to two primary factors. First, the ink layer—especially pigment ink—forms a palpable film on the fabric surface, which can increase stiffness and reduce natural softness [25]. Second, essential high-temperature post-treatment processes (e.g., curing or heat setting) can alter the inherent handle of natural fibers like cotton and silk, making them feel harsher.

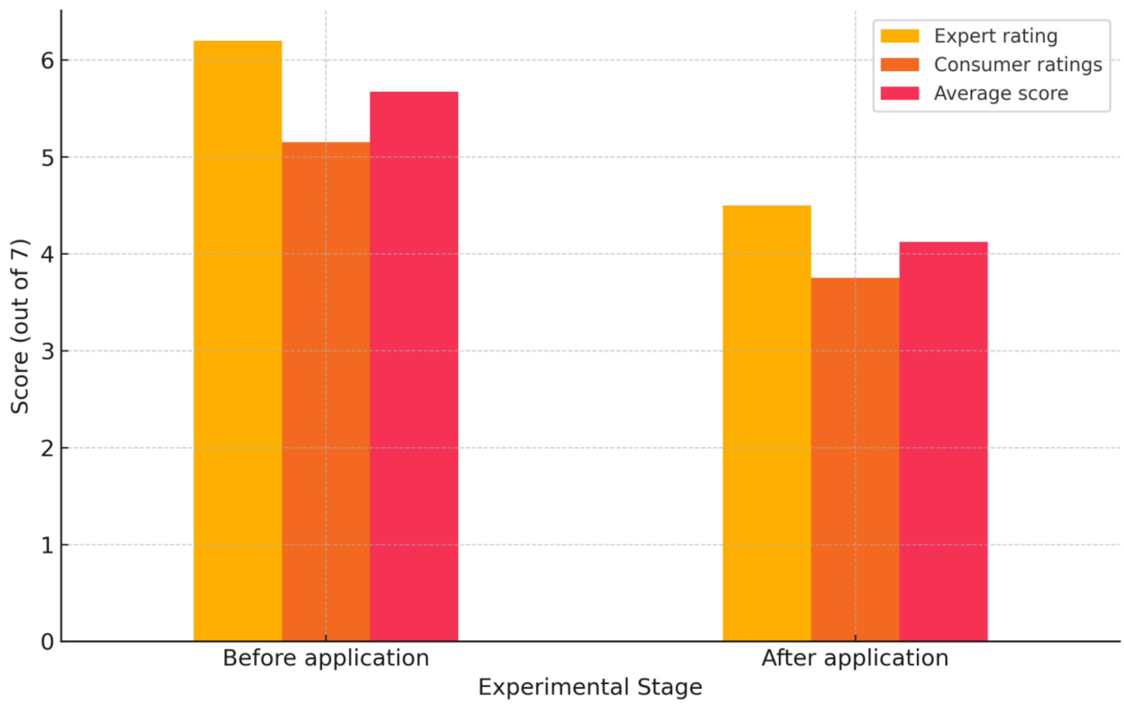

Figure 2. Comparison of fabric feel

Wear Resistance Results

The digital printing process reduced the wear resistance of the fabric. Figure 3 shows that the strength loss rate after the abrasion test increased from 12% to 20%. While the surface damage score also decreased, the overall comprehensive score, calculated using the normalized formula, fell from 0.83 to 0.70. The reduced wear resistance can be attributed to the chemical and thermal stresses imposed on the fabric during the printing workflow. Pretreatment chemicals and high-temperature dye fixation can cause minor degradation to the polymer structure of the fiber, slightly reducing its tensile strength and resilience to abrasion [26].

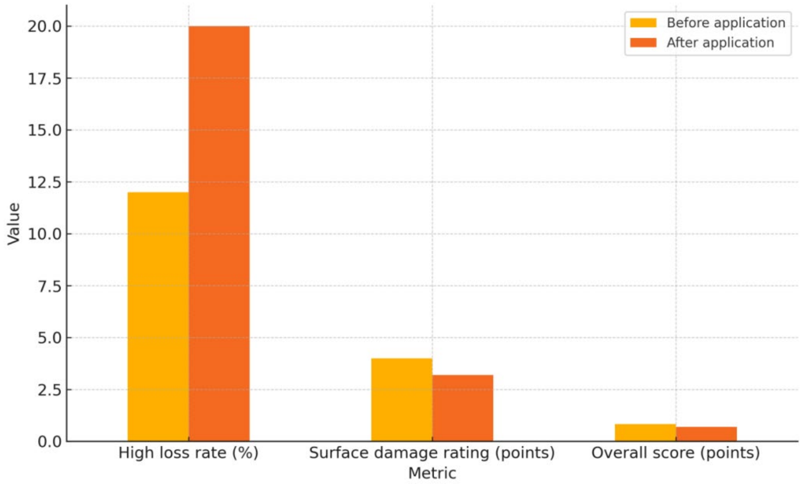

Figure 3. Comparison of wear resistance

Wash Colorfastness Results

Unlike wear resistance, colorfastness to washing showed significant improvement. As shown in Figure 4, the ratings for color change and staining on adjacent white cloth increased from Grade 3 to Grade 4, resulting in a higher overall score. The superior colorfastness is a direct benefit of modern dye chemistry and proper post-treatment. Processes like steam and heat setting create strong covalent bonds (reactive dyes) or trap dyes within the fiber matrix (disperse dyes), making them highly resistant to removal during laundering [27].

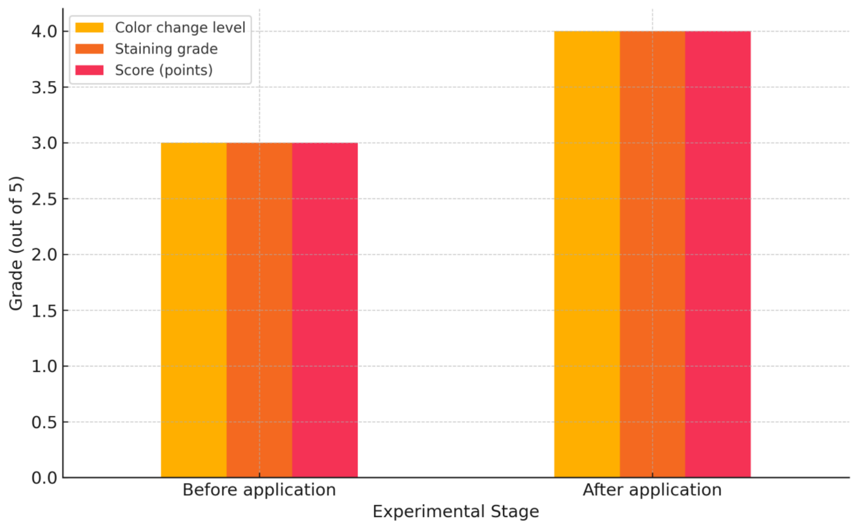

Figure 4. Comparison of wash fastness

Production Efficiency Results

A major advantage of the digital workflow is the dramatic increase in production efficiency. As shown in Figure 5, the time required to produce a sample batch of 100 cultural product units decreased from 40 hours for the traditional weaving process to just 8 hours for the digital printing process. This fivefold increase in efficiency stems from eliminating the time-consuming manual setup of looms and thread preparation and the inherently slower pace of mechanical weaving. While the core processes of digital printing, including pattern rendering, color calibration and material feed, are fully automated, certain pre-production steps, such as initial design file optimization and post-production quality checks, still require human supervision to ensure accuracy and cultural authenticity. The digital process allows for rapid file preparation and continuous, automated printing.

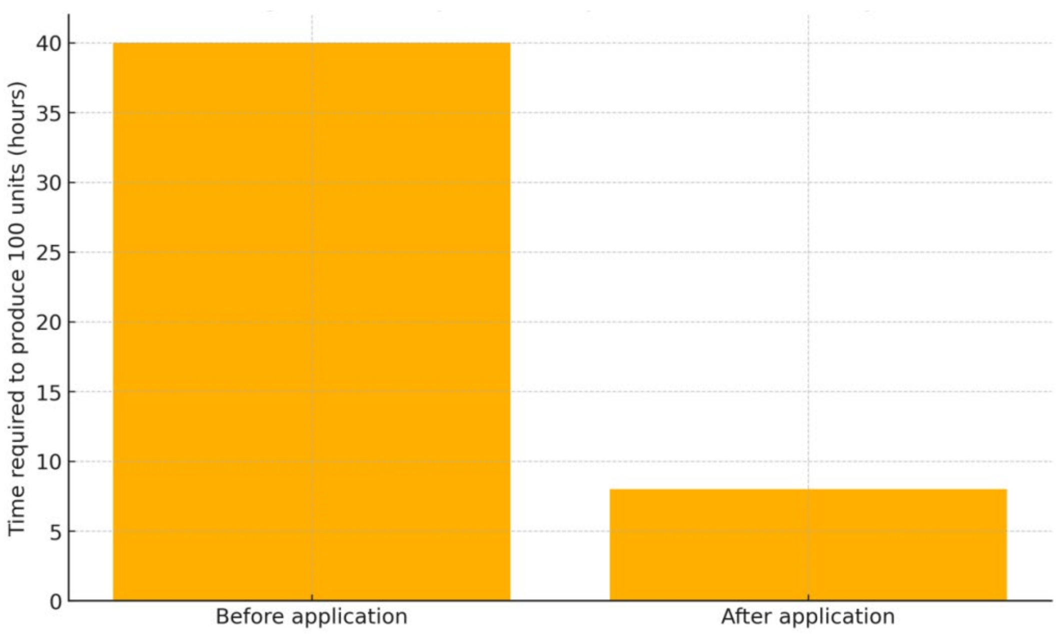

Figure 5. Comparison of production efficiency

Market Acceptance Results

The market acceptance survey focused on gauging consumer perception of the products created through the two methods. The results, shown in Figure 6, indicate a favorable response to the products from the digital workflow. The average scores for liking degree, purchase intention, and price acceptance all increased. The overall average acceptance score, calculated on a five-point scale, rose from 3.23 to 4.03. The improved market acceptance is likely driven by the enhanced visual appeal of the digitally printed products, specifically the higher pattern accuracy and more vibrant colors. This suggests that consumers may prioritize aesthetic fidelity in creative cultural products, even at the cost of a slight reduction in fabric feel. The data reflect the positive consumer perception to specific case study items, not a shift in the overall market.

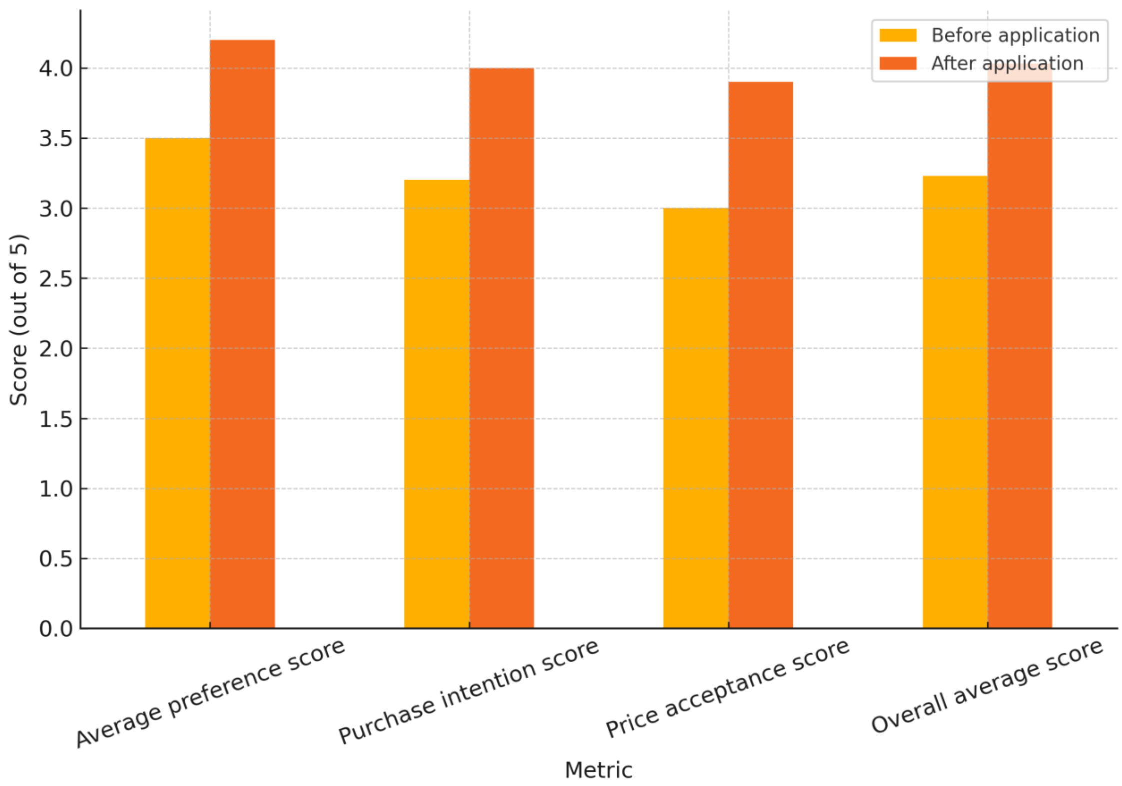

Figure 6. Comparison of market acceptance

Analysis of Product Sales Performance by Category

To further understand the impact of digital workflow, we compared sales data by product category six months before and six months after its adoption. Figure 7 reveals that the introduction of digitally printed products corresponded with increases in sales volume and repurchase rates across all three categories: clothing, home goods, and stationery. To support this claim, take apparel categories as an example: Sales grew most significantly in the six months after the adoption of digital workflow applications, thanks to the ability of the process to rapidly produce diverse and complex patterns that better meet the needs of fast fashion markets. Stationery maintained the highest sales volume due to its lower price and high-frequency purchase cycle. However, its repurchase rate also rose, suggesting that customers appreciated the new designs. The steady growth in home goods indicates that even enhanced aesthetics can drive purchasing decisions ever for more durable items.

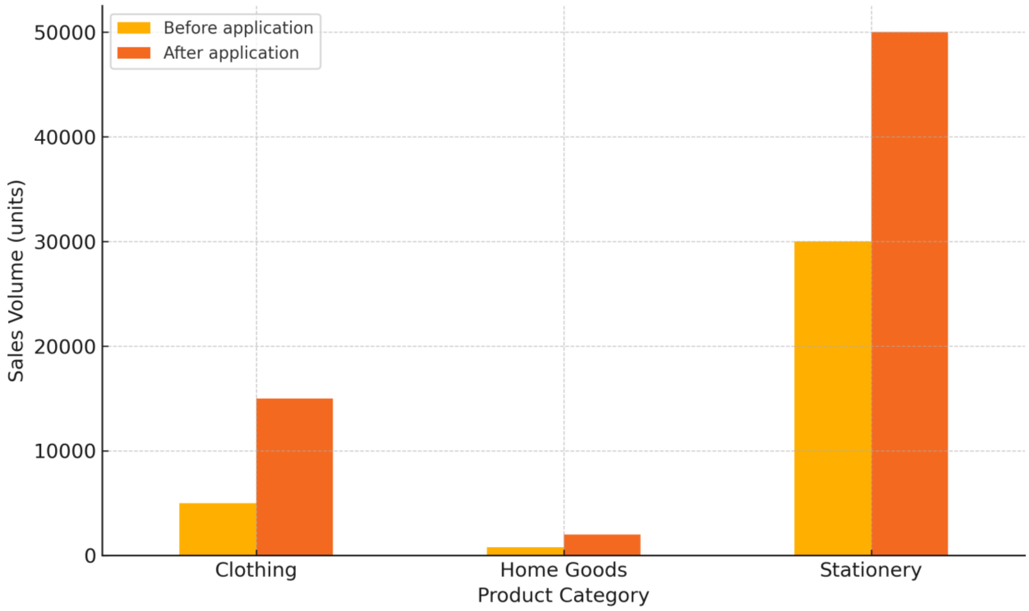

Figure 7A. Comparison of sales volume

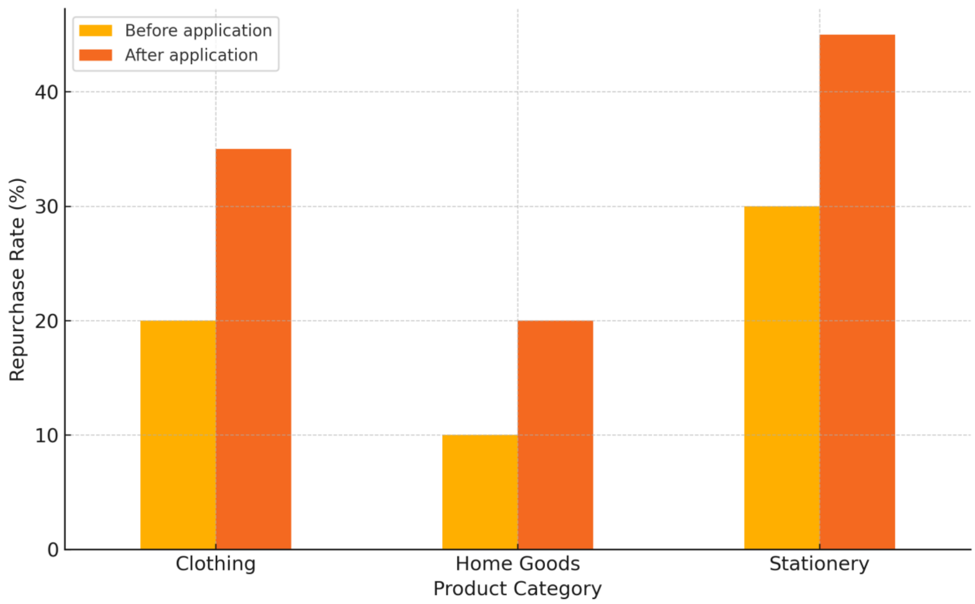

Figure 7B. Comparison of repurchase rate

CONCLUSION

This comparative case study demonstrates that integrating digital printing into the production of creative cultural tourism products offers significant advantages and distinct challenges. The digital workflow is highly effective at enhancing the visual fidelity of traditional weaving patterns, delivering improved pattern reproduction scores and superior color accuracy versus traditional weaving. Furthermore, the production efficiency is substantially enhanced, demonstrating the technology's capacity to meet batch production demands for the market. Consumer surveys also reflect a positive reception, with products from the digital workflow achieving higher average scores in liking degree, purchase intention, and price acceptance. However, this study also identifies key areas requiring further optimization. The digital process resulted in noticeable declines in fabric feel (~27.3% in the average score) and comprehensive wear resistance score (~15.7%). These trade-offs between aesthetic quality and tactile/physical performance are critical considerations for product development.

The primary limitation of this research is its holistic, real-world case design, which does not permit the isolation of individual variables. The observed effects cannot be attributed to a single factor, such as ink type or print resolution, as multiple factors are changed simultaneously. Therefore, future research is strongly recommended to adopt controlled, single-factor experimental designs to precisely quantify the specific contributions of each variable. Larger sample sizes and inferential statistical analysis can help to validate the trends identified in this exploratory work.

Based on the findings, the following optimization strategies are proposed to maximize the benefits and mitigate the drawbacks of this technology in cultural product development.

Partner with equipment manufacturers to develop higher-resolution nozzles (≥1800 dpi) and advanced ink jet control algorithms to better render fine pattern details and reduce fabric hardening.

Develop fabric-specific inks, such as inks with softeners for cotton and linen, to improve hand feel without compromising color fastness.

Standardize pretreatment protocols, such as applying low-temperature plasma treatment to silk, to enhance ink adsorption and vibrancy.

Innovate post-treatment processes (e.g., ultrasonic fixation) to ensure color fastness while minimizing damage to fabric strength.

Utilize big data analytics to understand consumer preferences and create a modular design system for customizing pattern and color combinations.TikTok Data shows that in the past year, the annual sales volume of intangible cultural heritage products exceeded 6.5 billion units, among which TikTok search drove a 51% year-on-year increase in the transaction volume of intangible cultural heritage products; at the same time, the group purchase orders of offline merchants of intangible cultural heritage increased by 173%, and Quanzhou, Shantou and Jieyang became the favorite small cities of consumers for intangible cultural heritage.

Partner with cultural tourism destinations to offer "on-site customized experiences" using instant printing technology to enhance product appeal.

Integrate digital watermarking technology into the design process to embed unique identifiers in each product. This strengthens intellectual property protection by creating a traceable record of copyright and preventing infringement.

Develop interdisciplinary courses in partnership with universities that combine traditional craft expertise with digital design and printing technology, cultivating versatile talent who can master both traditional crafts and digital design skills while sparking innovative ideas for cultural products.

Organize regular seminars and workshops that bring together intangible cultural heritage inheritors, designers, and technicians to deepen the integration of culture and technology.

Availability of Data and Materials

The datasets used and/or analysed during the current study were available from the corresponding author on reasonable request.

Author Contributions

Yanqiong Wang designed, collected and analyzed the data, and drafted the manuscript. Yanqiong Wang conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Yanqiong Wang participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Acknowledgments

Not applicable.

Funding

Not applicable.

Conflict of Interest

The author declares no conflict of interest.

REFERENCES

[1] Gao J, Noknoi K, Sirisuk M. Nanjing Yun Brocade of China: Cultural Inheritance and Social Education in the Context of Modern Society. International Journal of Education and Literacy Studies. 2025; 13(1):197-204.

[2] Zou J, Sirisuk M. Shu brocade at Sichuan: Reinvention of tradition and commoditization in the context of Chinese modern society. Maha Sarakham City, Thailand: Mahasarakham University, 2023.

[3] Yan J, Mayusoh C, Inkuer A, Puntien P. Comparative study on pattern characteristics and cultural connotation of Zhuang, Miao, and Dong Ethnic Brocade in Guangxi, China. Proceedings of the International Academic Multidisciplinary Research Conference in Paris; 2–5 December 2024; Vienna, Austria. 2024. pp. 296-306.

[4] Wang M. Development and evaluation of digital denim technology. Raleigh, NC, USA: North Carolina State University, 2020.

[5] Adel AM, Ahmed NM, Diab MA, El-Shall FN, El-Shinnawy N. Exploration on ability of printable modified papers for the application in heat sublimation transfer printing of polyester fabric. Scientific Reports 2023; 13(1):6536.

[6] Repon MR, Islam T, Paul TK, Jurkonienė S, Haji A, Shukhratov S, et al. Natural dyes in textile printing: Parameters, methods, and performance. Environmental Science and Pollution Research. 2024; 31(35):47552-47583.

[7] Sun Z, Zhao D, Zhang H. The innovative application of Dunhuang murals patterns in cultural creation design. Journal of Education, Humanities and Social Sciences. 2022; 5:149-162.

[8] Kong X, Liao Q, Yang C. Comprehensive Analysis of Li Ethnic Clothing Based on Five Major Dialects and Its Application in Modern Fashion Design. Fibres & Textiles in Eastern Europe. 2024, 32(2):17-32.

[9] Yan Y. Aesthetic flowing between islands: Migrating loom, traded cotton, mountain of dye. Journal of marine and island cultures. 2024, 13(2). https://doi.org/10.21463/jmic.2024.13.2.02.

[10] Traditional Li Textile Techniques: Spinning, Dyeing, Weaving and Embroidering. China and Africa. 2019; 11(6):60.

[11] Fu Y. Analysis of the transmission and development of traditional handicrafts in intangible cultural heritage. Frontiers in Art Research. 2023; 5(5):23-29.

[12] Zhang Y. Analysis of the Application of Folk Dyeing, Weaving, and Embroidery Patterns in Graphic Design—A Case Study of Suzhou Embroidery. Textile Report. 2023; 42(12):54-56. https://doi.org/10.3969/j.issn.1005-6289.2023.12.015.

[13] Ding Y, Kolosnichenko OV. Chinese ancient folk traditional auspicious patterns in modern clothing design: An example of Su embroidery. Art and Design, 2024. https://doi.org/10.30857/2617-0272.2024.3.2.

[14] Ding J. The Application and Influence of Digital Technology in Modern Ceramic Painting Creation. Ceramics Research. 2024; 39(06):71-74.

[15] Shah SS, Pirayesh A, Valilai OF. Using Blockchain Technology for 3D Printing in Manufacturing of Dental Implants in Digital Dentistry. Flexible Automation and Intelligent Manufacturing: The Human-Data-Technology Nexus: Proceedings of the FAIM 2022; 19-23 June 2022; Detroit, Michigan. New York, NY, USA: Springer; 2023. pp. 565-572.

[16] Liu J, Xie B, Dong J, Xue F, Liu Y. Computer Virtual Reality Technology in 3D Digital Polymer Material Printing System. Proceedings of the 2024 IEEE 3rd International Conference on Electrical Engineering, Big Data and Algorithms: EEBDA 2024; 27-29 February 2024; Changchun, China. 2024. pp. 842-847.

[17] Zhuang X. Analysis of intelligent printing ability and future printing trends. Dyeing and Finishing Technology. 2023; 45(09):84-86.

[18] Tan F. Application of Digital Printing Technology in the Dyeing and Finishing Industry under the Intelligent Background. Science Consulting. 2023; (01):90-92.

[19] Pagán EA, Salvatella MMG, Pitarch MD, Muñoz AL, Toledo MMM, Ruiz JM, et al. From silk to digital technologies: A gateway to new opportunities for creative industries, Traditional crafts and designers. The SILKNOW case. Sustainability. 2020; 12(19):8279.

[20] Pardie SP, Asinyo BK, Howard EK, Acquaye R. Analysis of design concepts: A comparative study of pre-and post-2000 printed fabrics of textile printing companies in Ghana. African Journal of Applied Research. 2023; 9(1):257-272.

[21] Niezrecki C, Baqersad J, Sabato A. Digital image correlation techniques for NDE and SHM. Handbook of Advanced Nondestructive Evaluation. Cham, Switzerland: Springer; 2019. pp. 1545-1590.

[22] Huang X, Luo J, Wang X, Cheng X, Hou X. Preparation of Purpurin–Fe^{2+} Complex Natural Dye and Its Printing Performance on Silk Fabrics. Materials. 2024; 17:5367. https://doi.org/10.3390/ma17215367

[23] Repon MR, Islam T, Islam T, Ghorab AE, Rahman MM. Cleaner pathway for developing bioactive textile materials using natural dyes: A Review. Environmental Science and Pollution Research. 2023; 30(17):48793-48823.

[24] Javoršek D, Weingerl P, Starešinič M. Digital textile printing using color management. History, Properties and Performance and Applications. 2014; 53.

[25] Boumegnane A, Nadi A, Cochrane C, Boussu F, Cherkaoui O, Tahiri M. Formulation of conductive inks printable on textiles for electronic applications: A Review. Textile Progress. 2022; 54(2):103-200.

[26] Sardag S, Ozdemir O, Kara I. The effects of heat-setting on the properties of polyester/viscose blended yarns. Fibres and Textiles in Eastern Europe. 2007; 15(4):50.

[27] Pizzicato B, Pacifico S, Cayuela D, Mijas G, Riba-Moliner M. Advancements in sustainable natural dyes for textile applications: A Review. Molecules. 2023; 28(16):5954.