

# FROM TRADITION TO INNOVATION: DESIGN STRATEGIES FOR CONTEMPORARY HANGZHOU SILK ART

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## ABSTRACT

Hangzhou is renowned as the "Home of Silk". Its silk culture runs through the thousand-year-old history of Chinese civilization. It is not only an important node on the ancient Silk Road but also a bond for the exchange of Chinese culture with the outside world. This study employs a four-dimensional analysis framework of policy, technology, design paradigm and market to systematically deconstruct the historical evolution laws of modern and contemporary Hangzhou silk patterns and reveal the cultural development context of each period. By analyzing and developing innovative design strategies that integrate cultural regeneration, market stratification, user co-creation, and technology empowerment, traditional silk art is combined with contemporary fashion and the textile market to ensure its commercial feasibility. The research adopted data collection methods such as literature review, field investigation, and in-depth interviews, combined with qualitative and quantitative analysis, to clarify the evolution laws and cultural inheritance and development context of modern and contemporary Hangzhou silk patterns within a four-dimensional framework. It also proposed innovative design strategies with practical significance, providing theoretical and practical references for the inheritance and innovation of Hangzhou silk art.

**Keywords:** Hangzhou silk patterns, Cultural inheritance, Innovative design

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## INTRODUCTION

Hangzhou, renowned as the "Silk Capital", boasts a long history of silk production and splendid silk art. Silk patterns, as a concentrated embodiment of the cultural connotation of Hangzhou's silk, have undergone profound changes in modern times. In 2011, "Hangzhou Silk" was certified as a national Geographical indication product, marking the official recognition of its unique craftsmanship and cultural value (Bian, Cao, & Ren, 2017). In 2013, China proposed the strategic concept of building the "Belt and Road Initiative", which once again brought the concepts of silk and the "Silk Road" into people's view (Chan, 2018). In 2015, the International Silk Alliance was established in Hangzhou, Zhejiang Province, further consolidating Hangzhou's position in the international silk industry. However, in the context of globalization and digitalization, traditional silk art is confronted with dual challenges: on the one hand, although mechanized production has enhanced efficiency, it has weakened the uniqueness of traditional handcraft skills; On the other hand, international market competition has intensified, and Western fast fashion brands are squeezing the domestic market. Meanwhile, there is a significant imbalance in academic research. Although the analysis of patterns from the Tang, Song, Ming and Qing Dynasties is relatively mature, there is a lack of systematic review of the evolution of modern and contemporary patterns. Regarding the modernization of Hangzhou silk patterns, especially in the context of contemporary design, gender influence and market adaptation, there is still a gap in academic literature. This gap not only restricts the competitiveness of Hangzhou silk in the modern market, but also affects the inheritance and innovation of its cultural value.

## RESEARCH OBJECTIVES

This study aims to systematically sort out the historical evolution laws of modern and contemporary Hangzhou silk patterns by using a four-dimensional analysis framework of policy, technology, design and market. Further, an innovative design strategy integrating "cultural regeneration, market stratification, user co-creation, and technological empowerment" is proposed to systematically activate the genes of traditional silk art, precisely connect with the diverse markets of contemporary fashion and textiles, and achieve sustainable transformation of commercial value.

## LITERATURE REVIEWS

### **The historical evolution of silk patterns in Modern and contemporary Hangzhou The Republic of China Period (1912-1949): Democratic Transformation and Integration of Chinese and Western Cultures**

In terms of policy orientation, after the Xinhai Revolution, the promulgation of the "Republic of China Clothing System" in 1912 broke the feudal hierarchical clothing system for the first time, promoting the consumption of silk from a court privilege to the mass market. Meanwhile, the wave of "Western wind spreading eastward" permeated inland through coastal cities, creating institutional space for the localization of foreign patterns (Zhao, & Xiao, 2024).

In terms of technological innovation, Hangzhou Zhenxin Silk Factory was the first to use hand-pulled looms in 1911 and introduced electric looms in 1915. Its production efficiency was more than double that of traditional wooden looms, with a speed of 110 to 160 weavers per minute. The application of rayon instead of traditional silk has further promoted the birth of new varieties such as brocade and ancient fragrant brocade. The popularization of mechanical printing and dyeing and machine embroidery techniques has significantly reduced production costs, enabling the mass production of geometric patterns, scattered dot patterns and other designs (Naik, 2006).

In terms of design style, against this background, there is a remarkable feature of the integration of Chinese and Western elements: traditional landscape patterns are often collage with the

geometric lines of the Art Deco style; Western floral elements such as roses and clustered leaves are integrated into the Chinese composition of wrapped and folded branches. In terms of color, the introduction of Western chemical dyes (such as indigo blue) has broken the constraints of the traditional empirical color system. In addition, traditional patterns such as round flowers and broken branches have gradually shifted from their narrative nature of "meaning in every picture" to a more decorative development path.

In terms of market performance, the rise of the middle class has given rise to a popular demand for patterns. Correspondingly, silk and satin fabric stores (such as Hangzhou Hengfeng Silk Store) have launched a "seasonal customization" service. It is worth noting that courtesans and female students became an important group leading the fashion trend during this period, and calendar advertisements became a key medium for spreading popular patterns (Yeh, 2006).

#### **The New China Period (1949-1979): Dominated by the planning system and ideology**

In terms of policy orientation, the planned economy system established the core principle that "domestic sales should be subordinate to foreign sales". After the "First Five-Year Plan" in 1953, public-private partnerships were implemented, and the foreign trade department uniformly controlled the production and sales chain, which led to designers being isolated from the market. Under this framework, during the Cultural Revolution (1966-1976), the theme of "revolutionary realism" was forcibly promoted, and traditional patterns were denounced as "feudal remnants".

In terms of technological development, the standardization of jacquard equipment has enhanced mass production efficiency. The number of electric looms increased from 45,000 in 1953 to 354,000 in 1975 (Zhou et al., 2018). However, standardized production also suppressed individual creativity. Please verify the original data. However, standardized production has also suppressed individual creativity. Meanwhile, the application fields of silk have expanded to industrial uses, such as insulating silk, textured silk and other functional products (Zhou, Zhang, Cao, Marelli, Xia, & Tao, 2018).

In terms of design style, it shows a feature of differentiation in line with policies and market demands. Specifically, the designs of the 1950s, while inheriting traditional patterns such as plum blossoms, orchids, bamboo and chrysanthemums, incorporated themes of workers and peasants (such as "Picking water chestnuts in the Water Town"). After the focus of foreign trade shifted to Europe and America in the 1960s, it differentiated into the "capital sales" style (abstract geometry, elegant color schemes) targeting the capitalist market and the "social sales" style (flowers all over the ground, rich colors) targeting the socialist camp. During the Cultural Revolution, political symbols (such as sunflowers and steel flowers) became the dominant elements in design.

In terms of market performance, the domestic sales market shrank severely. From 1950 to 1979, the per capita consumption of silk was only 0.09 to 0.68 meters (Démurger, Sachs, Woo, Bao, Chang, & Mellinger, 2002). In contrast, under the pattern dominated by exports, the patterns that were mainly sold to the Soviet Union in the 1950s focused on national styles. However, after shifting to Western Europe in the 1960s, the patterns' styles clearly became more in line with international aesthetics.

#### **The period of Reform and Opening up (1979-2000): Market-oriented transformation and internationalization**

In terms of policy orientation, the China National Silk Corporation was established in 1981, and the autonomy of foreign trade was gradually decentralized. In 1992, the market economy system was established and private enterprises rose, completely breaking the planned control (Pearson, 1997).

In terms of technological breakthroughs, the popularization of rotary screen printing machines and CAD systems has effectively solved the problem of linear patterns being prone to skewing, while digital scanning technology has achieved high-precision restoration of famous painting

patterns. Meanwhile, the automation level of the jacquard machine has been enhanced, significantly shortening the production cycle and supporting the rapid iteration of complex patterns.

In terms of design style, it presents a two-way interaction between globalization and localization: the proportion of abstract patterns is on the rise, and floral patterns are shifting from realistic to freehand. This directly promoted the design's emphasis on wearing functionality, such as the preference for straight stripes on shirts and the dense pattern design on the hem of skirt materials.

In terms of market response, Hong Kong garment factories have driven the export of silk garments, and the domestic market has gradually recovered: the consumption of silk increased from 268 million meters in 1978 to 903 million meters in 1986 (Yanagishima, 1991). Furthermore, the market shows a trend of stratification, with traditional brocade and modern printed silk each having a clear positioning. The personalized demands of women's consumption have returned, and the mixed style of suits, denim and silk has become popular.

### **Postmodern Tendencies (2000 - Present): Cultural Revival and Digital Ecology**

In terms of policy support, in 2010, "Chinese Sericulture and Silk Weaving Skills" was inscribed on the United Nations Intangible Cultural Heritage List. In 2013, the International Silk Union was established in Hangzhou, which effectively promoted the international export of local culture and industrial upgrading (Li, Jiang, & Nam, 2020).

In terms of technology-driven development, digital empowerment has become the core: AI generation technology has significantly shortened the design cycle, and blockchain technology has enabled the traceability of silk raw materials. Meanwhile, intangible cultural heritage skills such as Hangluo weaving and Zhenxingxiang Chinese clothing making have been rejuvenated by integrating with digital technology.

In terms of design style, it presents a trend of diverse integration: traditional dragon and phoenix, landscape patterns are mixed and matched with heterogeneous elements such as punk and ukiyo-e. The concept of "gender-neutral design" dissolves the traditional gender symbols. Petersson McIntyre (2018) The aesthetic of leaving blank space is more in line with the modern minimalist aesthetic.

In terms of market segmentation, the characteristics are becoming increasingly prominent: the high-end market mainly focuses on intangible cultural heritage co-branded products; The mid-range market is represented by domestic trend cultural and creative products. The mass consumer market focuses on functional silk products. Ultimately, Gen Z consumers actively participated in the co-creation of patterns through platforms such as Xiaohongshu and Douyin. The rise of domestic trend consumption has effectively promoted the younger transformation of traditional symbols.

## **RESEARCH METHODOLOGY**

The research purpose of this article is to explore the historical characteristics of the development of Hangzhou silk patterns in modern times. Understand the cultural value of Hangzhou silk, the market demand and design value of consumers for the innovative design of Hangzhou silk products. The main method adopted is qualitative research.

### **Data collection**

Literature Review: In order to enrich the research content, enhance the breadth and depth of the research, and provide data support for the research, various literature materials related to silk patterns from the period of the Republic of China, the People's Republic of China, the reform and opening up, and the postmodern tendency in Hangzhou are collected, and the data most relevant to the research topic are screened out.

Field investigation: On-site observations were conducted at the China National Silk Museum, Hangzhou Silk Enterprise Museum, Huzhou Silk Town and Shaoxing Keqiao Fabric Market.

Use electronic devices to take photos and record the weaving equipment, weaving techniques and pattern features of the silk patterns related to the research.

In-depth interview: To provide contemporary empirical evidence for the proposed strategies, a questionnaire survey was conducted among 385 consumers (aged 25–45) in Hangzhou between October and December 2025. The survey assessed preferences for silk pattern styles, willingness to participate in co-creation, and brand engagement on digital platforms. Additionally, semi-structured interviews were held with marketing managers from three leading silk enterprises (Wanshili Group, Hangzhou Zhenxingxiang, and China National Silk Corporation) to obtain real-world data on user co-creation participation rates and AI-driven customization metrics.

### **Data analysis**

Qualitative analysis: Collect and organize data from literature research, in-depth interviews, on-site observations, etc., and conduct an in-depth analysis of the historical evolution laws and cultural inheritance and development of modern and contemporary Hangzhou silk patterns under the four-dimensional framework logic of "policy, technology, design, and market".

### **Research Instrument**

Historical document classification method: This study examines the nearly modern Hangzhou silk patterns within a four-dimensional framework of "policy, technology, market, and design" for analysis. It uses literature research and online research to collect, organize, and analyze relevant policy documents, technological innovations, design cases, market archives, and other materials to reveal the evolution laws of Hangzhou silk patterns.

Observation form: Researchers will enter the China National Silk Museum, Hangzhou Silk Enterprise Museum, Huzhou Silk Town, and Shaoxing Keqiao Fabric Market for on-site observation, to understand the modern and contemporary development history and characteristics of Hangzhou silk patterns. The collected observation data will be sorted out and presented in a descriptive analysis format.

In-depth interviews: Based on the pre-prepared interview outline, researchers record and summarize the interview information of relevant personnel such as inheritors of Hangzhou silk intangible cultural heritage, research experts, enterprise leaders, and university researchers, revealing the historical interactive relationship among the four-dimensional framework of "policy, technology, design, and market".





## **RESEARCH RESULTS**

### **The evolution characteristics of modern and contemporary Hangzhou silk patterns under the four-dimensional framework logic of "policy, technology, design and market"**



The modern and contemporary evolution of Hangzhou silk patterns will revolve around the four-dimensional dynamic interaction of "policy, technology, design and market". The core contradictions and collaborative logics of different historical periods have shaped the transformation trajectory of the patterns from traditional to modern. The following is an analysis of its evolution characteristics in four stages: the Republic of China (1912-1949), the People's Republic of China (1949-1979), the Reform and Opening Up (1979-2000), and the postmodern tendency (2000 - present).





**Table 1** The Republic of China Period (1912-1949)

Policy characteristics	In 1912, the "Regulations on Clothing of the Republic of China" was promulgated, breaking the feudal hierarchical system of clothing. Silk consumption shifted from the privilege of the imperial court to the mass market, embodying the idea of democracy and equality. Government supports national industries and encourages the development of mechanical textiles, providing policy space for technological innovation.
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Technical characteristics	<p>In 1911, Hangzhou Zhenxin Silk Factory was the first to use hand-pulled looms. In 1915, it introduced electric looms, which increased production efficiency by more than double compared to traditional wooden looms. This promoted the replacement of "earth silk" with "factory silk", making the patterns more delicate and exquisite.</p> <p>After the introduction of rayon, the complexity of jacquard fabrics increased. In 1926, the rayon sizing method gave rise to new varieties such as brocade satin and ancient scented satin. The popularization of mechanical printing and dyeing and chemical dyes (such as indigo) made it possible to mass-produce Western patterns.</p>	
Market characteristics	<p>Emerging citizens, female students, and courtesans have become fashion leaders, driving patterns to shift from the auspicious meaning of "every picture has a meaning" to decorative ones (such as the cheongsam patterns in calendar plate advertisements).</p> <p>Newspapers, periodicals and advertisements (such as the "THE YOUNG COMPANION" magazine) have become popular channels for the dissemination of patterns, promoting the market adaptation of traditional themes to Western styles(Liu, Liu, &amp; Cunningham, 2023).</p>	
Design characteristics	<p>The westward spread promotes the combination of traditional landscape patterns and Art Deco geometric lines. For instance, in the fabric of cheongsams, there are not only Chinese broken-branch flowers but also Western free-form flowers and Pezzley scroll patterns.</p> <p>Women's clothing in the Republic of China era became carrier of pattern transformation. Patterns on cheongsams shifted from elaborate embroidery to simple prints, reflecting women's pursuit of physical (Han, 2019).</p>	
Pattern characteristics		
	<p>Blue indigo cotton long-sleeved cheongsam (Collected by Zhang Shuanglian)</p>	<p>The fabric patterns were influenced by the "Art Deco" movement in modern times</p>
		
	<p>Fashionable woman in a cheongsam featured on the cover of the "THE YOUNG COMPANION" magazine</p>	<p>Socialites in cheongsams in (LinLoon Magazine)</p>

**Table 2** The Period of New China (1949-1979)

Policy characteristics	<p>1. After the "First Five-Year Plan" in 1953, the state implemented a planned economy system. The silk industry was a public-private partnership, with production, supply and marketing being allocated by the state in a coordinated manner. A combination of design, production and trade was adopted. The patterns of this period served political and diplomatic purposes (Mu, De Jong, &amp; Koppenjan, 2011).</p> <p>2. During the "Cultural Revolution" from 1966 to 1972, traditional patterns were dismissed as "feudal remnants" and replaced by revolutionary symbols for development. At this time, patterns became tools for the dissemination of ideology.</p>	
Technical characteristics	<p>1. Promoting the standardization of jacquard machines to ensure batch production for export has restricted designers' creativity, and the patterns tend to be stylized.</p> <p>2. In the 1950s, industrial silk such as sieve silk and insulating silk were successfully trial-produced, which expanded their non-wearing functions and weakened the development of decorative patterns.</p>	
Market characteristics	<p>1. Export was dominant, with domestic sales accounting for only 2.68% of the total consumption (in 1950). The pattern design was completely in line with the demands of foreign trade (such as catering to Soviet aesthetics).</p> <p>2. Silk was regarded as a "luxury item of the bourgeoisie", and the common people mainly used cotton cloth. The commercial nature of the patterns gave way to their political nature.</p>	
Design characteristics	<p>1. In the 1950s, exports to the Soviet Union focused on ethnic styles. After shifting to Western Europe in the 1960s, abstract geometric patterns and deformed floral designs increased.</p> <p>2. Under collectivist culture, the gender characteristics of patterns are weakened, and neutral patterns of workers and peasants, such as ears of wheat and gears, are predominant.</p>	
Pattern characteristics		
Capital sales patterns		
	<p>"Paisley" of gold and silver Dragon satin Produced by Hangzhou Shengli Silk Weaving Factory, 1968</p>	<p>Colorful silk "roses" Produced by Hangzhou Shengli Silk Weaving Factory, 1964</p>

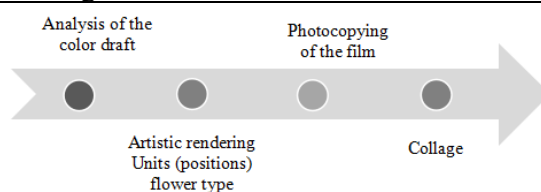
Socialist sales patterns		
	Printed double crepe "cluster flower" Pattern by Wu Jinliang, black-and-white draft by Liu Jiying, color matching by Wu Jinliang, 1960s and 1970s	Printed double crepe "flower" Pattern by Pang Zuhua, black-and-white draft by Liu Jiying, color scheme by Lou Zilang, 1960s and 1970s
Patterns from the Cultural Revolution period		
	Weaving brocade "Heavy ears of wheat" Produced by Hangzhou Shengli Silk Weaving Factory in the 1970s	Ancient brocade "Gears and Ears of Wheat" Produced by Hangzhou Shengli Silk Weaving Factory, 1968

**Table 3** The period of reform and opening up (1979-2000)

Policy characteristics	<p>In 1981, the China National Silk Company was established, and local enterprises were granted the right to export independently. In 1981, the export volume of Zhejiang Silk Company exceeded 100 million US dollars, promoting the pattern design to be more in line with the international market.</p> <p>2. Since the 1990s, the development of traditional craftsmanship has been emphasized. Techniques such as Hangluo and brocade weaving have been included in the protection list, providing cultural resources for the innovative development of patterns (Zou, J., &amp; Sirisuk, M., 2023).</p>
Technical characteristics	<p>In the 1980s, the introduction of rotary screen printing machines and wide-format printing machines led to an increase in the proportion of linear patterns (stripes, grids, and geometry), and design broke free from technological limitations.</p> <p>2. In the 1990s, CAD systems became widespread, capable of scanning famous Western paintings and reassembling them into silk patterns, significantly shortening the design cycle.</p>
Market characteristics	<p>1) The domestic market expanded. In 1986, the consumption of silk reached 903 million meters. The demand for quilt covers and clothing rose, and the patterns showed a stratified expression of "traditional auspicious patterns (quilt covers) + abstract patterns (fabric)".</p> <p>2) With female consumption taking the lead, the resurgence of cheongsam</p>

	clothing has led to the revival of elements such as buttons and stand-up collars. The patterns have returned from being "political symbols" to "aesthetic expressions"(Germanà, M. ,2019).
Design characteristics	1) Under the influence of international trends, realistic floral patterns have given way to abstract lines (such as the Matisse paper-cutting style), while also taking into account the requirements of clothing cutting (such as dense patterns on the hem of dresses). 2) Traditional cloud patterns and meansives have been simplified into geometric units and applied to everyday clothing such as shirts and ties, achieving a "modern translation of traditional elements".

Pattern characteristics



Photocopier pattern conversion process



Patterns of silk quilt covers for domestic sales, Zhejiang Silk Clothing in the 1990s



Hangzhou Silk United Dyeing and Printing Factory (New Color), China National Silk Company, 1983

**Table 4** The postmodern Tendency period (2000 - present)

Policy characteristics	1) In 2010, "Chinese Sericulture and Silk Weaving Techniques" were inscribed on the World Heritage List, and Hangzhou's Hangluo and brocade weaving techniques received special support, promoting the integration of "intangible cultural heritage + design" . 2) The government encourages digital transformation. Enterprises such as Wanshili Group have received policy support and are conducting large-scale research and development of AI pattern generation technology.
Technical characteristics	1) AI (such as StyleGAN) deeply learns traditional pattern libraries and automatically generates "new Chinese style" designs; Blockchain has enabled the traceability of silk and met the EU green standards. 2) The promotion of natural dyes (such as sophora flower bud extract) and

supercritical CO<sub>2</sub> anhydrous dyeing technology can better meet the development needs of both ecological and aesthetic aspects in pattern colors (Che & Yang, 2022)

**Market characteristics**  
 1) The market conducts stratified consumption. The high-end market (Hermes co-branded Song brocade bag) emphasizes cultural scarcity, while the mass market (digital printed silk scarves) highlights cost-effectiveness. Generation Z has driven the recognition of the "New Chinese style" pattern community (Yang, 2024).  
 2) Social media platforms such as Xiaohongshu and Douyin have launched "Pattern Mass Creation Competitions", enabling consumers to participate in design and enhancing brand stickiness (such as Wanshili's "AI + User" customization model).

**Design characteristics**  
 1) Deconstruct traditional landscapes, flowers and birds, such as transforming the small scenes of Northern Song Dynasty into minimalist lines and color schemes, which are suitable for modern clothing design.  
 2) "Genderless landscape paintings" have dissolved the traditional female symbol, and the cold-toned metallic luster has broken the "soft and seductive" label of silk.

**Pattern characteristics**



The awarding ceremony dress made by Zhenxingxiang for the Beijing Olympics



The Hangzhou embroidery technique and splendid costumes blend to create the "Nangong Show"



Marco, WUYONG/the Earth, Paris, 2007



Uma Wang Ink-wash landscape



### **Innovative Design strategies for Hangzhou Silk Patterns**

The innovative development of silk-patterned clothing products is achieved through the synergy of four major strategies: cultural regeneration, market stratification, user co-creation, and technological empowerment. This enables silk-patterned clothing to not only carry Eastern aesthetics but also meet contemporary demands, striving to achieve a deep integration of traditional craftsmanship and contemporary needs.

#### **1) Cultural Regeneration**

The core of cultural regeneration lies in breaking the predicament of "specimenization of intangible cultural heritage", and through symbolic deconstruction and aesthetic reconstruction, transforming silk patterns from historical heritage into carriers of contemporary life aesthetics. For instance, the solitary boat and water ripples in "Fishing Alone on the Cold River" can be abstracted into minimalist lines, which are suitable for modern clothing fabrics. At the same time, it breaks through the boundaries of craftsmanship application, integrating brocade, Hangzhou embroidery and other techniques with the functions of modern clothing, allowing the craftsmanship genes to be integrated into contemporary life scenarios. This not only retains the memory of craftsmanship but also conforms to the aesthetic standards of the younger generation.

#### **2) Market Stratification**

Market segmentation is based on the needs of different consumer groups, constructing a three-tiered market system: the high-end market targets high-net-worth individuals, creating a luxury attribute through "intangible cultural heritage craftsmanship + limited production," and strengthening scarcity through channels such as art exhibitions; the mid-range market focuses on urban white-collar workers and Generation Z, balancing cultural connotation and practicality with "traditional elements + trendy design," and spreading cultural stories through social media. Our survey data shows that 64.7% of respondents prefer the "New Chinese Style" that blends traditional patterns with minimalist modern aesthetics, confirming the product positioning of the mid-range market; the mass market targets the low-end market, lowering the consumption threshold with "basic styles + cultural symbol embellishments," emphasizing a balance between practicality and cultural value.

#### **3) User Co-creation**

User co-creation can break the "design-centeredness," allowing users to participate in creativity through online mass innovation platforms and generating personalized patterns in combination with AI tools. For instance, Wanshili Group's AI customization platform reported that user-generated patterns accounted for 38.2% of its total silk scarf sales in 2025, with an average engagement rate of 4.6 co-creation attempts per registered user (internal company data, 2026). Hold workshops offline and build communities to enhance users' sense of cultural participation, making designs more in line with market demands and increasing brand stickiness.

#### **4) Technology Empowerment**

Technology empowerment runs through the entire process of design, production and marketing, providing support for cultural regeneration, market stratification and user co-creation through efficiency improvement and possibility expansion. For instance, on the design side, by leveraging AI generation technology and big data to predict trends, creativity can be liberated and the development cycle shortened. The production end utilizes digital printing to achieve flexible manufacturing and adopts environmentally friendly technologies to meet the

standards of the high-end market. The marketing end can enhance the experience and communication effect through AR fitting and digital collectibles.

However, the integration of these advanced technologies also introduces significant strategic challenges. First, intellectual property (IP) risks arise when AI generates patterns based on existing traditional designs, potentially infringing on collective cultural heritage rights or individual copyrights. The current legal framework in China does not yet provide clear guidelines on AI-generated pattern ownership, which may deter enterprises from fully embracing AI co-creation. Second, blockchain-based traceability, while enhancing transparency and meeting EU green standards, requires substantial upfront investment in infrastructure and staff training. For small and medium-sized silk enterprises—which form the backbone of Hangzhou’s silk industry—these costs can be prohibitive without government subsidies or industry consortia. Third, the rapid evolution of digital design tools demands continuous upskilling of both designers and traditional craftsmen, creating a human resource gap that may slow adoption. Addressing these challenges requires a multi-stakeholder approach involving policy support, cross-industry collaboration, and educational programs to ensure that technological empowerment does not exacerbate inequality or dilute cultural authenticity.

## DISCUSSION & CONCLUSION

This study, through a four-dimensional analysis framework of policy, technology, design and market, systematically sorts out the historical evolution laws of modern and contemporary Hangzhou silk patterns, reveals the internal logic of pattern changes in different periods, and proposes an innovative design strategy integrating "cultural regeneration, market stratification, user co-creation and technology empowerment". It provides theoretical and practical references for the contemporary transformation of traditional silk art.

Nonetheless, the successful implementation of these strategies must confront the socio-economic and managerial challenges highlighted earlier. IP uncertainties, digital investment barriers, and skill gaps require proactive policy interventions and collaborative industry initiatives. Future research should empirically examine the cost-effectiveness of blockchain adoption for SMEs, explore legal frameworks for AI-generated cultural products, and develop training models that integrate digital literacy with traditional craftsmanship. By addressing these challenges, Hangzhou silk can truly transition from tradition to innovation in a sustainable and inclusive manner.

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