

Preserving The Cultural Heritage of Kanyakumari Through Digitally Printed Handloom Textiles

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Abstract—Kanyakumari district possesses a distinctive cultural heritage reflected through its historical dynasties, religious architecture, traditional jewellery, landscapes, and coastal identity. However, the visual representation of such regional heritage in contemporary textile design remains limited. The present study aimed to develop culturally inspired textile motifs representing selected heritage elements of Kanyakumari and integrate them into handloom veshti using Direct-to-Film (DTF) transfer printing. Five handloom veshtis were developed based on five thematic categories: historical dynasties of the Chera, Chola, and Pandya periods; geographical and iconic landmarks including the Thiruvalluvar Statue, Kanyakumari Amman Temple, and coastal elements; the five Tamil *Thinai* landscapes; traditional temple jewellery; and regional architectural heritage represented by Padmanabhapuram Palace and Suchindram Thanumalayan Temple. Cultural elements were documented, interpreted, stylised, and digitally developed into textile motifs before application onto the handloom substrate using DTF transfer printing. A symbolic design scale of 133 cm was incorporated into the Thiruvalluvar-inspired motif in relation to the 133 chapters of the *Thirukkural* and the 133-foot height of the Thiruvalluvar Statue. The developed textiles were evaluated for aesthetic appeal, cultural representation, colour harmony, motif suitability, and overall acceptability.

The study demonstrates the potential of combining regional cultural heritage, handloom textiles, and digital printing technology to develop contemporary textile products while visually communicating and preserving the cultural identity of Kanyakumari. The proposed design framework may support further applications of regional heritage elements in contemporary textile and fashion design.

Index Terms—Kanyakumari Heritage, Cultural Motifs, Handloom Veshti, DTF Transfer Printing, Textile Design, *Thinai*, Tamil Heritage, Cultural Representation.

I. INTRODUCTION

Textiles serve as an enduring repository of Indian cultural heritage, encapsulating the history, traditions, and artistic expressions of diverse geographical regions. Within Tamil Nadu, the handloom *veshti* remains a quintessential symbol of cultural identity, traditionally woven from cotton yarns and worn during religious, social, and ceremonial occasions. However, evolving contemporary fashion paradigms necessitate innovative design methodologies to ensure the continued relevance and preservation of traditional handloom textiles without diminishing their intrinsic cultural value.

Kanyakumari district, situated at the southernmost tip of mainland India, possesses a distinct cultural landscape shaped by a legacy of imperial dynasties, monumental architecture, coastal geography, and traditional craftsmanship. The historical dominance of the Chera, Chola, and Pandya dynasties, alongside iconic landmarks, classical literature, and temple art, provides an exceptional foundation for textile design inspiration. The project titled "Preserving the Cultural Heritage of Kanyakumari Through Digitally Printed Handloom Textiles" translates these multifaceted heritage elements into contemporary textile surface designs integrated directly onto traditional handloom *veshtis*.

The research is structured around five thematic handloom *veshti* designs:

- **Dynastic Heritage:** Incorporates calligraphic Tamil letterforms representing the Chera, Chola, and Pandya dynasties along with their respective heraldic emblems.

- **Geographical and Coastal Identity:** Highlights the Kanyakumari coastline, coastal shrines, and astronomical visual phenomena (sunrise and sunset), featuring the Thiruvalluvar Statue proportionately scaled to 133 cm to symbolize the 133 chapters of the *Thirukkural* and the height of the statue.
- **Classical Landscape Classification (*Thinai*):** Reinterprets the traditional Tamil eco-literary concepts of *Kurinji*, *Mullai*, *Marutham*, *Neithal*, and *Palai*.
- **Ornamental Heritage:** Adapts traditional temple jewellery motifs into continuous textile borders and patterns.
- **Architectural and Musical Legacy:** Transforms the floral woodwork of Padmanabhapuram Palace and the architectural-musical elements of Suchindram Thanumalayan Temple into modern surface motifs.

To execute these intricate and color-rich designs, Direct-to-Film (DTF) transfer printing was employed. DTF technology enables the precise application of detailed lettering, complex gradients, and fine motifs onto handloom substrates, overcoming traditional printing limitations while preserving the tactile character of the fabric. Ultimately, this research bridges regional cultural iconography, handloom craftsmanship, and digital print technology, offering a scalable framework for cultural sustainability in contemporary textile design.

II. REVIEW OF LITERATURE

2.1. Handloom Textiles and Traditional Veshti

Handloom textiles embody generational knowledge, artisanal craft, and regional cultural identity (Ramaswamy, 2006). The handloom sector of Tamil Nadu is globally recognized for its diverse cotton and silk weaving traditions, regional design vocabularies, and unique surface structures (Chandru & Kavya, 2025). Among traditional garments, the *veshti* holds a central place in Tamil heritage, symbolizing modesty, dignity, and cultural continuity (John, 2017). Its unstitched rectangular geometry offers remarkable versatility for both traditional drape and contemporary design interventions. To sustain the relevance of traditional handloom products among modern consumers, integrating innovative surface ornamentation while preserving structural and cultural

integrity is increasingly essential (Kumar & Gopal, 2018).

2.2. Cultural Heritage of Kanyakumari

Kanyakumari, located at the southernmost tip of Tamil Nadu, is a region with a rich cultural heritage shaped by its history, traditions, religious practices, natural landscapes, handloom heritage, architecture, festivals, and jewellery. Its unique geographical position, where the Arabian Sea, Bay of Bengal, and Indian Ocean meet, gives it a distinctive cultural identity. Kanyakumari is renowned for its spectacular sunrise and sunset over the sea, which can be experienced from the same coastal region. The region is also known for important heritage landmarks such as the Kumari Amman Temple, Thiruvalluvar Statue, Vivekananda Rock Memorial, and traditional temples. Its coastal lifestyle, traditional arts, crafts, and historical association with the Chera, Chola, and Pandya dynasties further enrich its cultural significance.

2.3. Dynastic Emblems and Tamil Calligraphy in Surface Design

Emblems and heraldic symbols have historically been employed to communicate authority, lineage, and territorial identity. The Chera, Chola, and Pandya dynasties developed distinct visual symbols—the bow and arrow, tiger, and twin fish, respectively (Ziegenbalg & Subramanian, 2021). Integrating these historical heraldic emblems alongside traditional Tamil calligraphic letterforms into textile layouts presents a novel opportunity to connect historical narratives with modern surface ornamentation, transforming a functional garment into a communicative medium.

2.4. Literary and Monumental Heritage: The Thiruvalluvar Iconography

Thiruvalluvar represents a cornerstone of Tamil literary history, with the iconic 133-foot Thiruvalluvar Statue in Kanyakumari serving as a prominent cultural landmark (Devi, 2018). The monument's physical dimensions directly reflect the structure of the *Thirukkural*, which comprises 133 chapters (*Athigarams*). Translating this monumental scale into a proportionally conceptualized textile motif (such as a 133 cm motif layout) establishes a direct, symbolic connection between literary heritage and visual design.

2.5. Eco-Literary Classifications: The Five Landscapes (*Thinai*)

Classical *Sangam* literature categorizes ecological and cultural landscapes into the *Thinai* system: *Kurinji* (mountainous), *Mullai* (forest), *Marutham* (agricultural), *Neithal* (coastal), and *Palai* (arid) (Devi, 2018). Each landscape possesses distinct ecological features, flora, fauna, and societal associations. Translating these five eco-literary zones into visual textile compositions bridges ancient ecological philosophy with contemporary surface art.

2.6. Temple Jewellery and Ornamental Motifs

South Indian temple jewellery is characterized by intricate geometric symmetry, divine iconographies, and repetitive ornamental patterns (John, 2017). Translating three-dimensional jewelry forms into two-dimensional textile surfaces requires simplified vectorization, rhythm, and repeating motif arrangements. This stylized adaptation allows traditional metalwork and gemstone settings to be reinterpreted as fluid surface patterns for woven fabrics.

2.7. Architectural Heritage as a Surface Design Resource

Architectural monuments offer extensive design inspiration through structural silhouetting, decorative wooden carvings, stone reliefs, and floral motifs. The intricate woodwork and floral motifs of *Padmanabhapuram Palace* (Padmanabhapuram Palace Heritage Trust, 2020), alongside the artistic and musical stone pillars of *Suchindram Thanumalayan Temple*, provide rich structural and symbolic references.

Converting architectural details into stylized textile motifs allows built heritage to be visually extended beyond static physical monuments.

2.8. Coastal Landscapes and Visual Aesthetics

The geographical identity of Kanyakumari is deeply tied to its marine environment. The interplay of crashing waves, sand topographies, sunrise, and sunset generate unique color gradients and linear movements (Devi, 2018).

Interpreting these natural phenomena through abstract lines, spatial forms, and color palettes embeds regional geography directly into the textile's aesthetic fabric.

2.9. Digital Surface Design Techniques in Textiles

Digital printing techniques have expanded the possibilities for complex, high-resolution surface design (Textile Learner, 2012). Unlike conventional screen printing, which involves lengthy setup times and color-layer limitations, digital workflows allow multi-color gradients, intricate calligraphic details, and variable scaling to be developed digitally and applied directly without sacrificing line precision (Kornit Digital, 2024).

2.10. Direct-to-Film (DTF) Transfer Printing

Direct-to-Film (DTF) transfer printing is an emerging digital technique where designs are printed onto a specialized PET film using water-based pigment inks, backed with a hot-melt adhesive powder, and heat-transferred onto the textile substrate (Must Technologie, 2023). DTF printing excels at reproducing intricate typography, multi-colored gradients, and fine-line illustrations on diverse fabric compositions without demanding the flat surface constraints of traditional direct-to-garment (DTG) systems. Furthermore, DTF transfer enables precise, modular placement of thematic motifs across distinct zones of a garment (such as the *karai* border or *mundhi* end-piece of a *veshti*).

2.11. Synthesis of Heritage and Modern Surface Interventions

Contemporary textile design increasingly focuses on hybridizing cultural heritage with advanced manufacturing technologies (Kumar & Gopal, 2018). Combining traditional handloom weaving—valued for its rich texture and breathability—with digital surface printing creates a product that respects artisan heritage while aligning with contemporary visual aesthetics.

2.12. Research Gap

While Kanyakumari possesses extensive historical, architectural, and literary heritage, these elements have rarely been synthesized into a unified, thematic textile collection. Furthermore, the traditional handloom *veshti* remains predominantly confined to plain or simple geometric border variations. There is a distinct lack of empirical work exploring the integration of multi-thematic regional iconography onto handloom *veshtis* utilizing contemporary Direct-to-Film (DTF) transfer technology.

This research directly addresses this gap by conceptualizing, digitizing, and executing five distinct cultural themes across handloom *veshtis*, establishing a systematic framework for cultural sustainability, visual storytelling, and modern textile innovation.

III. METHODOLOGY

Selection of Heritage Topic
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Study of Cultural & Heritage Designs
↓
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↓
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↓
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↓
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↓
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3.1. Selection of Heritage Topic

The present research work entitled "Preserving the Cultural Heritage of Kanyakumari Through Digitally Printed Handloom Textiles" was selected because Kanyakumari district possesses a unique and distinctive cultural identity compared to other regions of Tamil Nadu.

Kanyakumari is enriched with ancient temples, historical monuments, prestigious architecture, literary heritage, and natural greenery. However, this uniqueness is not fully known to the younger generation and tourists. Therefore, the concept of printing Kanyakumari's heritage on traditional attire was conceptualized.

This approach aims to document and preserve the historical, architectural, literary, and ecological identity of Kanyakumari district in an innovative and

wearable form. The heritage-printed handloom textiles will help tourists to easily understand, appreciate, and get familiarized with the heritage, history, and culture of Kanyakumari. It will also serve as a tool for cultural promotion, promote cultural tourism, and create awareness among youth about local heritage through traditional attire like veshti.

3.2 Study of Cultural & Heritage Designs

Kanyakumari district is bestowed with a beautiful atmosphere, glorious history, remarkable architecture, cultural heritage, and deep-rooted traditions.

Hence, for the present study, heritage designs were sourced and classified under the following categories:

1. Dynastic Influence: Motifs inspired by the Chera, Chola, and Pandya dynasties who ruled Kanyakumari.
2. Geographical Identity (Ainthinai): Concepts based on the five landscapes of Tamil literature – Kurinji, Mullai, Marutham, Neithal, and Palai – representing the diverse terrain of Kanyakumari.
3. Temple Architecture and Art: Architectural elements, gopuram designs, wood carvings, and sculptures observed during field visits.
4. Temple Jewellery and Symbolism: Traditional jewellery patterns and auspicious symbols of Kanyakumari Amman Temple

3.3 Development of Heritage Designs & Motifs

Heritage motifs and designs were developed from primary sources collected during an extensive field visit to significant heritage sites of Kanyakumari District, including Kanyakumari Bhagavathy Amman Temple, Thiruvalluvar Statue, Vivekananda Rock Memorial, Padmanabhapuram Palace, and Suchindram Thanumalayan Temple.

Photographs were captured, and sketches were made on-site. The collected sources were further refined by referring to Tamil literature, historical records, and temple inscriptions. The raw photographs were then converted into simplified, printable motifs suitable for textile printing while retaining their original heritage essence.

Table 1.1: Development of Heritage Designs & Motifs

Veshti Code	Heritage Theme	Primary Visual Motifs	Structural Placement
Veshti 1	Dynastic Kingdoms	Chera, Chola, and Pandya heraldic emblems (bow/arrow, tiger, twin fish) with classical Tamil typography	Along main border (<i>karai</i>) and lower hemline
Veshti 2	Regional Identity & Coastal Heritage	Thiruvalluvar Statue, Kanyakumari Amman Temple silhouette, sea waves, and horizon sunrise/sunset gradients	Scaled central motif with extended coastal borders
Veshti 3	Classical Eco-Landscapes (<i>Thinai</i>)	Representative flora, fauna, and environmental elements of <i>Kurinji</i> , <i>Mullai</i> , <i>Marutham</i> , <i>Neithal</i> , and <i>Palai</i>	Sequential panel arrangement along length
Veshti 4	Temple Jewellery Heritage	Traditional <i>Kanti</i> , <i>Manga Malai</i> , and gemstone encrusted repeating geometric motifs	Continuous border ornament (<i>karai</i>) layout
Veshti 5	Architectural & Musical Arts	Floral woodcarving motifs from Padmanabhapuram Palace and musical pillar relief motifs from Suchindram Temple	End-piece (<i>mundhi</i>) composition and corner accents

3.4 Selection of Garment

Veshti is the traditional and cultural attire of Tamil Nadu, especially worn during temple festivals, Pongal, and cultural events in Kanyakumari district. Tourists visiting Suchindram Temple and Padmanabhapuram Palace are required to wear veshti to enter the temple premises. Therefore, a heritage-designed veshti will serve as a direct cultural product and souvenir for tourists.

Veshti provides a large, uninterrupted surface area, which is highly suitable for printing large-scale heritage motifs like the 133-feet Thiruvalluvar Statue and temple gopurams through DTF printing. Unlike shirts, it has no cuts, seams, or stitches that would disturb the design.

The selection of 100% cotton handloom veshti from the Kanyakumari Weavers' Cooperative Society will help promote local weavers and sustainable traditional textiles. At present, veshtis are available only in plain white or with simple zari borders. The incorporation of heritage designs through DTF technology will create innovation and add value to the traditional garment, making it more attractive to the youth.

Hence, veshti was purposively selected as the base garment because it best represents the cultural identity of Kanyakumari and serves as an effective medium to educate tourists about its history and culture.

3.4.1 Specification of Garment Selected

Table 2.1 Specification of Garment Selected

Particulars	Specification
Type of Garment	100% Cotton Handloom Veshti
Yarn Count	100s Count
GSM	120 GSM
Size	Double Veshti - 4 meters length x 1.32 meters (52 inches) height
Colour	Off-white / Cream White - selected to highlight DTF print colours
Source	Kanyakumari District Handloom Weavers' Society

3.5 Study of Printing Methods

Various printing methods were studied and reviewed to select the most suitable method for printing heritage motifs on handloom cotton veshti.

The methods studied were:

1. Block Printing
2. Screen Printing
3. Digital Printing / Sublimation Printing
4. DTG (Direct to Garment) Printing
5. DTF (Direct to Film) Printing

Each method was analyzed based on its suitability for cotton fabric, cost-effectiveness, ease of design development, colour vibrancy, and ability to print large and intricate heritage designs.

3.6 Selection of Suitable Printing Method

DTF (Direct to Film) printing method was selected as the most appropriate method for this research.

DTF was selected because it is highly suitable for 100% cotton handloom veshti, can print large-size designs (up to 50 inches height) with high resolution of 1440 dpi, which is essential for preserving intricate heritage details. It also offers high colour fastness, excellent wash durability, is cost-effective for single-piece customized production, and has no colour limitations.

Other methods were not found suitable: Block printing is time-consuming and not suitable for large motifs; Screen printing requires separate screens for each colour and loses fine details; Digital / Sublimation printing is suitable only for polyester fabrics; and DTG printing requires extensive pre-treatment and has poor wash fastness for large prints.

Therefore, DTF printing was finalized as it preserves the intricate details of Kanyakumari heritage motifs and ensures the final veshti is attractive to tourists as a cultural souvenir.

3.7 Creation of Digital Designs

Canva software was used as a tool for developing and visualizing the heritage motifs of Kanyakumari before final DTF printing, as it is user-friendly, cost-effective, and provides high-resolution output.

The collected heritage photographs were uploaded to Canva. Using the background remover tool, the existing background was removed and only the main statues and architectural elements were retained. Brightness, contrast, and sharpness were adjusted to enhance clarity. The motifs were then developed with antique effects and stone textures to impart a heritage look. Traditional Tamil Brahmi letters and temple border patterns were incorporated. The colour palette was selected by drawing inspiration from the original heritage sources and was chosen to create a strong contrast against the cream-coloured veshti. Finally, five different designs were developed and finalized. The files were exported as PNG format, 300 DPI, with a transparent background, suitable for DTF printing.

3.8 Printing on PET Film

For DTF printing, PET (Polyethylene Terephthalate) film was selected. The specifications of the film used were: 75 microns thickness, double-sided matte coated, cold peel type, 24-inch width roll, which was

cut according to the design size. The digitized heritage motifs were placed in Photoshop, and the print resolution was set to 1440 dpi for high clarity. During printing, the colour layer (CMYK) was first printed on the PET sheet, followed by a white ink layer printed over the colour layer to provide opacity. Pigmented textile inks were used.

Immediately after printing, hot melt adhesive powder (TPU powder) was applied uniformly over the wet ink and the excess powder was removed by shaking. The printed PET sheet with powder was then cured in a curing oven at 160°C for 2-3 minutes. During this process, the powder melted and formed a uniform adhesive layer.

The printed sheet was checked for any ink spread, colour mismatch with the original heritage source, and sharpness of the motif. Finally, the printed PET sheets were stored in a dust-free environment and used for heat press transfer onto the veshti.

3.9 Transfer of Print onto Garment

The heritage design printed on the PET film was transferred onto the handloom cotton veshti using a heat press machine. The handloom veshti was pre-washed and ironed to remove moisture and wrinkles. It was then laid flat on the lower platen of the heat press machine. The cured PET sheet with the heritage design was placed over the veshti with the printed side facing down, and a Teflon sheet was placed over the PET film to protect both the design and the machine.

The machine parameters were set as follows:

Table 3.1: machine parameters

Parameter	Setting
Temperature	165°
Time	15 Seconds
Pressure	Medium-High Pressure
Peel Type	Cold Peel

The machine was locked and pressed for 15 seconds at 165°C. The high temperature caused the hot melt powder to melt and strongly bond with the cotton fibres. After pressing, the veshti was allowed to cool for 1-2 minutes. The PET film was then slowly peeled off at a 180-degree angle, and the heritage design was perfectly transferred onto the veshti. To ensure better wash fastness and softness, a second pressing was done with a Teflon sheet for 5 seconds. Final ironing was then completed.

3.10 Quality Checking and Evaluation of Developed Veshti

The quality of the developed digitally printed handloom veshtis was assessed based on the following parameters: design clarity, colour appearance, dimensional accuracy, motif placement, wash performance, rubbing resistance, cracking resistance, and fabric handle.

3.10.1. Dimensional Accuracy and Motif Placement

The dimensions of the printed heritage motifs were verified using a measuring scale to ensure consistency with the planned design specifications (50 inches height). The placement and alignment of the motifs on the veshti were visually examined for accuracy, centering, and uniformity. All five veshtis showed accurate placement with 8 inches above the bottom border.

3.10.2. Visual Appearance and Colour Evaluation

The developed veshtis were evaluated for visual appearance, including sharpness of the heritage details (e.g., facial features of Thiruvalluvar statue, carvings of Suchindram gopuram), colour vibrancy, and colour matching with the original heritage source. The DTF prints exhibited high resolution and excellent colour reproduction.

3.10.3. Wash Fastness Assessment (Preliminary Test)

A preliminary washing assessment was carried out as per standard procedure. The printed veshti was hand-washed using a mild detergent (Ezee) in water maintained at approximately 30°C for 15 minutes. After washing, the fabric was visually examined for colour fading, colour bleeding, and distortion of the printed motifs. No visible colour fading or bleeding was observed during the assessment, indicating good wash fastness. The assessment was rated as 4/5 (Good).

3.10.4 Rubbing Fastness Assessment

Rubbing resistance was checked manually using a white cotton test cloth in both dry and wet conditions (Crocking Test - Manual Method). The white cloth was rubbed over the printed area 10 times. No visible colour transfer or staining was observed on the test cloth, indicating good rubbing fastness. Rating: 4/5 (Good).

3.10.5 Cracking and Stretch Resistance

The printed surface was examined after slightly stretching the fabric to identify any visible cracking or distortion of the printed motifs. No visible cracking or distortion was observed, which confirms the flexibility and durability of the DTF transfer and hot melt adhesive bonding.

3.10.6 Fabric Handle and Feel

The fabric handle was assessed by touch method. The finished veshti was found to have a soft handle despite the printing. The second pressing (post-pressing for 5 seconds with Teflon sheet) contributed to the smooth and soft surface appearance of the developed textile.

3.10.7 Overall Quality Evaluation Summary

Table:4.1: Overall Quality Evaluation Summary

S. No	Quality Parameter	Test Method	Result / Rating
1	Dimensional Accuracy	Measuring Scale	Accurate
2	Visual Appearance	Visual Examination	Excellent
3	Wash Fastness	Hand Wash (30°C)	4/5 - Good
4	Rubbing Fastness	Manual Crocking	4/5 - Good, No Transfer
5	Cracking Resistance	Stretch Test	No Cracking
6	Fabric Handle	Touch and feel	Soft Handle

Overall, the preliminary quality assessment indicated that the DTF-printed handloom veshtis maintained satisfactory design clarity, colour appearance, motif placement, and surface handle after the basic washing and physical assessments. Thus, the developed veshtis were found to be suitable for commercialization as a cultural promotional product for tourists.

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