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Research Article

"Sustainable Strategies For Supply Chain Optimization: Insights From Telangana's Cotton Textile Cottage Industry"

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ABSTRACT

This paper delves into the supply chain practices within the cotton textile export cottage industry of Telangana India with a primary focus on optimizing efficiency by addressing non-value-added activities. Through extensive data collection via deep observation and in-depth interviews with all entities involved in the supply chain, the study employs Value Stream Mapping (VSM) techniques to map value-added activities, identify key performance Factors, and conduct root-cause analysis. The research offers an overview of the cottage industry in Telangana, underscoring its economic significance and the challenges it confronts. Specifically, the study centers on the Pochampally Ikat cotton textile cottage industry. Detailed analysis is conducted on key supply chain practices, including raw material sourcing, production processes, quality control, logistics, and market distribution. Findings reveal significant delays and inefficiencies across various stages of the supply chain, highlighting the imperative for sustainable practices. Factors contributing to non-value-added activities are meticulously identified, analyzed, and accompanied by proposed suggestions and sustainable solutions for improvement.

Key words: cottage industry, cotton textile, supply chain, practices, VSM, factors.

1. Introduction:

The Indian textile industry has historically been a significant global player, with cotton textiles holding a pivotal role in exports (Zala, 2010; Choudhary, 2001). Within this landscape, the cotton textile export cottage industry stands out as a significant sector, despite its existence within the unorganized realm (Gera, 2012). Comprising small-scale, decentralized units, the cottage industry is a major contributor to India's economy, providing employment to millions (Bedi, 2008). Recognizing cotton textiles contribution to India's agricultural GDP and export earnings, highlights its importance (Chinchane, 2020; Sarkar, 2019). However, it faces numerous challenges, particularly in supply chain practices, including financial constraints, poor management, and reliance on traditional, labour-intensive techniques (Gupta, 2006; Joy, 2013). Supply chain highlights the intricate relationship between supply chain practices and production performance (Anumala, 2021). Moreover, balancing sustainability with market access for small-scale cotton farmers poses additional complexities. External factors such as price fluctuations further impact the industry's competitiveness (Joy, 2013).

This study focuses on the export cotton textile cottage industry in Telangana, specifically the Pochampally Ikat cotton textile, renowned for its historical significance and socio-economic importance (Berkley, 1954; Durai, 2005). The primary objective of this study is to assess supply chain performance, identify key challenges, and propose sustainable practices to enhance overall efficiency within the cotton textile export cottage industry of Telangana, India.

2. Literature Survey:

Literature on Supply chain in cotton textile cottage Industry is shown in table no1.

Table 1: Literature on Supply chain in cotton textile.

Author & Year	Description
Beatrice Kogg, 2003	Discussion focus of exclusively on trading type I eco-labelled products made from certified organic cotton in Peru.
Maria Jesus Munoz- Torres, et al., 2022	Author attempted to determine whether companies belonging to textile product lifecycle identify and manage social impacts in keeping with most relevant social hotspots in supply chain of the textile industry. A consistency analysis was conducted.
Ville Hinkka, et al. 2023	The focus is on how the recycling could be arranged in such a way that the value of the recycled material exceeds the costs of recycling. The approach is via an embedded case study examining the end-of-life (EoL) textile recycling supply chain in Finland.
Shahbaz Abbas, et al. 2021	Study focus on the cotton crop waste can supplement the energy system of industry as well as the sustainable utilization of the agricultural waste.
Jacob Korenblum, 2009	Cotton textile supply chain project aims to increase the income, bargaining power, and control over market for both men and women works engaged in cotton farming, in AP and Karnataka, India.
Md.Jahid Hasan Akash	The textile industry is a complex supply chain that manufactures garments, complements, raw materials, and other items.
R. Vanathi, 2014	Sustainability needs to be propagated to upstream partners in the supply chain
Matt Berdine, et al. 2010	Transforming crop in to textile and then into final item of clothing involves many stages of processing
Zoe Mellick, et al. 2021	Sustainable value propositions specific different actors in the chain can be identified.
Ping wang, et al. 2019	Increases in industry market power have the same effect on the supply chain as increases in labor costs.

Literature on Supply chain management practices and the tools used to analyse is shown in table no.2.

Table no.2: Supply chain management practices and tools used for the analysis

Author & Year	Description
K. Tan, 2002	Supply chain management is significant strategic tool for firm striving to achieve competitive success.
T. Scahill, 2012	Customer satisfaction is a crucial part of any best practice strategy for supply chain.
Rajwinder singh, et al. 2010	Indian retailers know that competitive advantage has high impact on SCP
D. Gebisa, 2019	Supply chain management is a systematic coordination and management from upstream to downstream paths of an organization.
Hassan Barau Singhry, 2015	Sustainable practices include sustainable sourcing, sustainable design, sustainable production, sustainable packaging, sustainable transportation, sustainable consumption, and sustainable reverse logistics could be used to improve the theory of sustainable supply chain management
Ferdoush Saleheen, et al. 2018	The performance measurement used through different supply chain models is a literature review.
Anna Surowiec, 2013	Key resources are a source of competitive advantage for today's organizations.
James C. Chen, et al. 2013	The study focus on the total operation time can be saved by 81% from current stage of future stage with the integration of RFID and lean
Y Quin & H. Liu, 2021	The value stream mapping together with five-ways analysis helps to improve customer's satisfaction effectively.
Boonsthonsatis & Jungthawan , 2015	Application of value stream mapping is capable of shortening production lead time by 80%
Suarez- Barraza, et al., 2016	Supply chain value stream mapping is a new tool of operation management
Oberhausen & Plapper, 2016	A common value stream management method with integrated feature according to the specific needs of the applying organization will help to optimize the value creation in cross-enterprise supply chains.

3. Research Objective:

- Assess Supply Chain Performance
- Identify Key challenges
- Propose Sustainable Practices

4. Research methodology:

4.1: Data collection:

A Comprehensive data is collected from all entities involved in the supply chain of cotton textile export cottage industry, in Telangana. An in-depth interviews were conducted to collect the data.

4.2: Data Analysis Techniques:

Based on the literature review, Value Stream Mapping (VSM) technique is applied for the study, VSM is used for mapping of value-added and non-value added activities. Key performance indicators are identified and root-cause analysis is conducted to propose sustainable practices. VSM of the supply chain is shown in the fig.1.

5. Supply Chain practices in cotton textile Export Cottage Industry of Telangana:

5.1: Overview of the industry in Telangana:

Telangana, a state located in southern India, has emerged as a significant player in the cotton textile export cottage industry. The sector comprises small-scale, decentralized units engaged in the production and export of cotton-based textiles. Telangana is deeply rooted in the state's agricultural legacy. Cotton cultivation has been a traditional practice, providing a raw material base for the thriving textile sector. Over the years, the industry has evolved, and the cottage sector has gained prominence due to its role in decentralized production and export activities. The cotton textile export cottage industry in Telangana holds significant economic importance.

5.2: Supply Chain Practices:

Supply chain practices in the cotton textile export cottage industry of Telangana play a crucial role in determining the industry's efficiency, competitiveness, and overall success in global market. The key aspects of the supply chain practices in this study are listed:

1. Raw Material Sourcing or Cotton Procurement: The industry heavily relies on cotton as a raw material. In Telangana cotton farming is seen in the village Jogulamba around 187Km from Hyderabad capital of Telangana, with a processing time of 300 days for harvesting cotton crop and price of INR. 6000/- per quintal.
2. Production Processes: Production in small scale cottage manufacturing units are decentralized in nature. It includes Spinning, design, dyeing, and weaving as per customization, finishing and packaging, all the activities in this production process happen at different destinations. Which are shown in table no.3.

- **Spinning:**

Place: Suryavanshi spinning mill, Secunderabad, Telangana
Distance: from Jogulamba to Suryavanshi spinning mills is 266 KM
Processing time: 25 days, Man power: 75 labour. Price: INR. 2500-3000/- quintal.

- Design & Customization: is a third party (Handloom Corporation, or designers or private organisation) processing time of 25 days and man power depending on agency
- Dying and Weaving: Pochampally Village at a distance of 65 KM from Secunderabad with around 60 weavers involved charging Rs. INR.1500/- per saree.

3. Quality and compliance: Implementing rigorous quality control measures and certifying to meet international standards and customer expectations. In the study it is observed that quality inspection and assurance is maintained by 3rd party usually development commissioner of handlooms corporation, Telangana, charging fixed INR. 75,000/- per year. (Shown in value stream mapping diagram fig no.1).
4. Logistics and Transportation or Timely Delivery: as it is a decentralised sector. Logistics and timely transportation plays a major role. Ensuring timely delivery of finished goods to ports or export hubs, considering the challenges of transportation infrastructure in the region.
5. Finishing & Packaging: Finishing and packaging in the study takes place in KL cotton Industries where the finished textile products are packed for exports. The industry has 30 man power with processing time of 10 days and charges INR.720/- per KG
6. Export Documentation or compliance and documentation: Adhering to international trade regulations, completing export documentation accurately and ensuring compliance with destination country standards. For the study Kaveri Exports, Hyderabad, with a processing time of 10 days and charges of INR. 9000/- is considered.
7. Market Access and distribution or global market penetration: Developing effective strategies for market access and distribution to reach international buyers and expand market share. Processing time of 45 to 60 days.

5.3: Value stream mapping (VSM): VSM of the cotton textile export cottage industry is shown in the fig.1. Few constrains which were to be considered are:

- In this study, Pochampally handloom cotton IKAT textiles cottage industry, with reference to export is considered, it is a highly un-organised handloom sector. The textile is produced in Pochampally village, of Telangana.
- The industry works with 60 handloom wavers who can produce around 6 meters of fabric per day with 48inches width.
- Cotton crop farming from Jogulamba village, Telangana was considered. And the farming time of cotton crop was also included in the supply

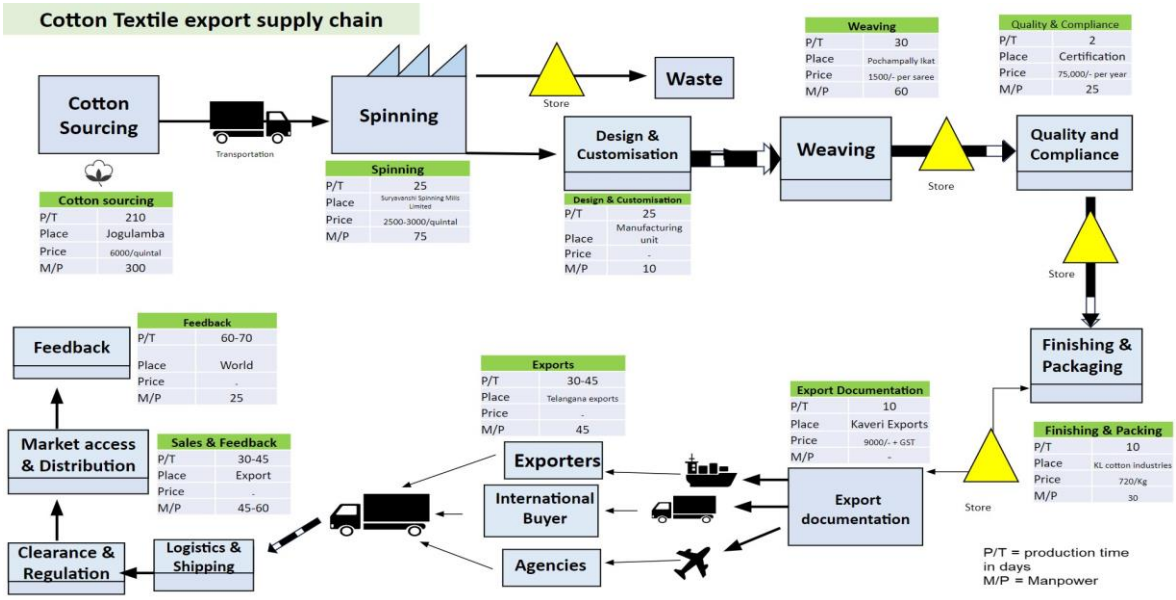

Fig 1 value stream of the supply chain in export cottage Industry of cotton.

5.4: Observations and Analysis of VSM from the above fig no 1.
This value stream analysis provides insights into the various entities involved in the cotton textile export process, their respective roles, and process time and value-added/non-value-added activities. Few observations are listed and the analysis of the VSM is shown in the table 3.
In Addition to the above entities. It is observed that there is a temporary storage and delay of 75 days at weaving stage, quality assurance stage and finishing & packaging.

Table. 3 analysis of value added and non-value added activities in the supply chain:

Sl. No.	Entities	Value added activities	Value in days	Value in cost INR	Non-value-added activities	Value in days	Value in cost INR
1	Cotton Sourcing	Raw-material procurement	210	6000/- per quintal	Transportation delays	30	500/- to 3000
2	Spinning	Conversion of Raw material to yarn	25	2500-3000/- per quintal	Waste unavoidable	2 to 3	200/- to 300/-
3	Design & Customisation	Process time depends on the customisation	25		Un known	3	
4	Weaving	Conversion of yarn to fabric	30	1500/- per saree.	Loom setup, downtime due to weaving defects or machine breakdowns.	15	500/- to 1000/- depends on the design
5	Quality and compliance	Inspection and certification	2 to 5	75000/- per year	Administrative delays in compliance documentation, time spent on non-critical quality checks.	2 to 5	No change in the charges
6	Finishing & Packaging	Enhance product presentation and protect the product during transportation	10	800/- per KG	packaging materials, inefficiencies in packaging process	10	No change in the charges
7	Export House & Documentation	Facilitating the export process and ensuring compliance with international trade regulations.	10	9000/- + 18% GST	Un known	Nil	
8	Logistics, Clearance & Regulation	Facilitating smooth movement of goods from production to export destinations, ensuring compliance with transportation and regulatory requirement.	30 - 45	unknown	Not under control	Nil	
9	Market & Distribution	Establishing market presence and distribution channels to reach target customers	30-45	unknown	Not under control	15	Depends on the market scenario
10	Customer Feedback	Gathering feedback from customer to improve product quality and customer satisfaction.	60-70	Not under control	Not under control	30-40 (by digital transformation)	No direct cost required
		Total time taken for Value added activities	432 days	20,200/- + 75,000/- (fixed quality charges by govt.)	Total time taken for non-Value added activities	75	1200/- to 4,600/-

Note: The cost for quality and assurance is an amount of I**NR. 75,000/- per year, fixed by the government under hand-loom and textile commission.**

6. Findings and Proposing sustainable practices for a supply chain:

It is observed that **432** days of lead time is need to complete whole supply chain cotton textile cottage industry including unavoidable farming time of 210 days. The lead time taken in cottage industry is longer than needed with a noticeable delay of **75 days** at different entities.
It is also observed that few stages in supply chain in cotton **textile export cottage industry could not be quantified as this industry is unorganised in nature**. The list of challenges /factors effecting the non-

value added activities at every entity in supply chain, and proposing solutions for sustainable practices in supply chain are listed in the table no.4.

Table no 4: factors/challenges for non-value added activities and suggestions to have a sustainable supply chain practices.

The results state that there is lead time reduction from 432 days to **355** days with a difference of **110 to 130**

Sl. No.	Entities	Factors/ challenges for Non-Value added activities	solutions to have a sustainable supply chain practices	Value in days	Value in cost INR.
1	Cotton Sourcing	Delay in transportation. Inefficiencies in procurement process	Implement advanced forecasting and procurement technologies to streamline raw material procurement process and reduce the lead time. Establish strategic partnerships with reliable suppliers to ensure timely delivery of high-quality raw materials.	180	3000/- to 5500/-
2	Spinning	Waiting time for machine setup, loading time and down time due to maintenance or breakdowns.	Implement preventive maintenance schedules to reduce downtime due to machine breakdowns.	23	2100/- to 2800/-
3	Design & Customisation	Waiting time for design approval, delays in communication with the third party.	Utilizing digital design tools and software to facilitate rapid customization.	7 – 12	(As per the design complexity)
4	Weaving	Waiting time for loom setup, downtime due to weaving defects or machine breakdowns.	Conduct regular maintenance and calibration of looms to minimize setup time and reduce downtime due to breakdowns. By implementing quality control measures during the weaving process to detect and address defects early, minimizing rework and delays.	15	1000/- (based on the design)
5	Quality and compliance	Administrative delays in compliance documentation, time spent on non-critical quality checks.	Digitize compliance documentation processes to streamline administrative tasks and reduce processing time. Utilize automated quality control systems to accelerate quality checks and ensure compliance with regulatory standards.	2 to 5	75,000/- per year (no change)
6	Finishing & Packaging	Waiting time for packaging materials, inefficiencies in packaging process.	Optimize packaging processes by standardizing packaging materials and procedures to reduce setup time and minimize inefficiencies. Implement lean principles to eliminate waste and streamline the finishing and packaging process.	10	800/-
7	Export House & Documentation	Administrative delays in documentation processing, inefficiencies in customs clearance.	Develop clear documentation guidelines and provide training to staff to ensure efficient handling of export processes. Digital documentation system may be used to automate the processes and reduce manual errors and processing time.	10	9000/- + GST (no change Fixed)
8	Logistics, Clearance & Regulation	Delays in customs clearance, inefficiencies in transportation logistics.	Using real time tracking system and visibility tools to monitor shipment movements and proactively address delays	30	
9	Market & Distribution	Delays in identifying market opportunities, inefficiencies in distribution logistics.	Market research and data analytics to identify new market opportunities and optimize distribution channels. Strategic partnership with distributors and retailers to improve market reach.	30 to 40	
10	Customer Feedback	Delays in the receiving and analysing feedback, inefficiencies in addressing customer concerns	Implementation of automated feedback collection mechanisms, such as online surveys and feedback forms to gather real time customers input. May utilize customer relationship management (CRM) systems for analysing the feedback.	30	
			Total: Note: I**NR. 75,000/-** (fixed quality charges by govt.)	337 to 355 Days	15,900/- to 19,000/- + **75,000/-**

days and a cost saving of around INR. 1,000/- to INR. **4,800**/- per quintal after the application of proposed sustainable practices. Comparative analysis and the saved difference in man days and cost is shown in table 5 and value stream mapping of cotton textile supply chain after the application of proposed sustainable practices are shown in the fig. 2.

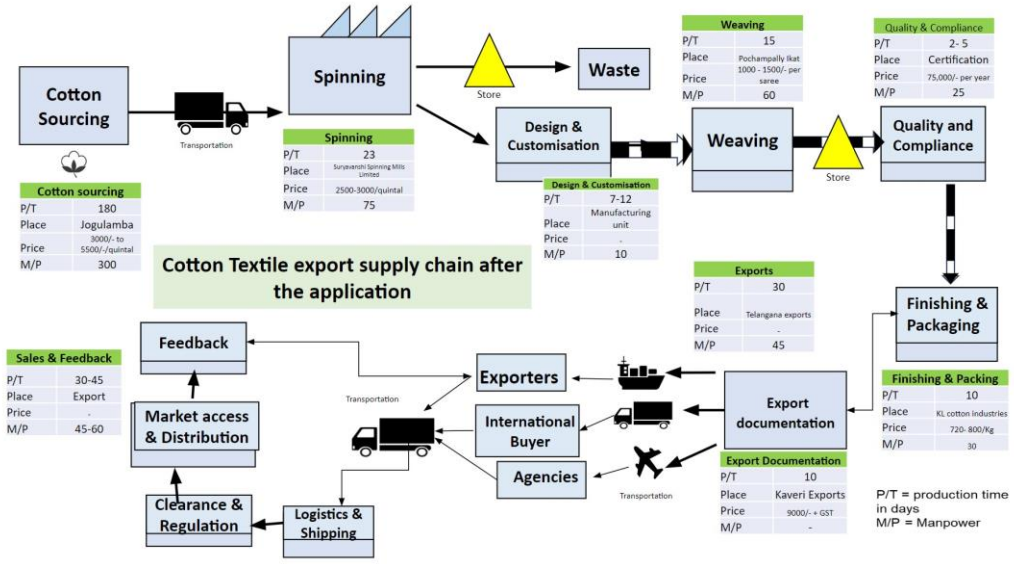

Fig. 2: value stream of the supply chain in export cottage Industry of cotton after application.

Table 5: Comparative analysis and difference in savings

Sl. No.	Entities	Observed non value added		After application of sustainable solution		Difference in savings	
		Value in Days	Value in /INR	Value in days	Value in INR	Days	INR
1	Cotton Sourcing	210	6000/- per quintal	180	3000/- to 5500/-	30	5,00/- to 3,000/-
2	Spinning	25	2500-3000/- per quintal	23	2100/- to 2800/-	2	200/- to 300/-
3	Design & Customisation	25		7 – 12	(As per the design complexity)	13	As per the design
4	Weaving	30	1500/- per saree.	15	1000/- (based on the design)	15	500/- to 1,500/-
5	Quality and compliance	2 to 5	75000/- per year	2 to 5	75,000/- per year	no change Fixed	no change Fixed
6	Finishing & Packaging	10	800/- per KG	10	800/- per KG	no change	no change
7	Export House & Documentation	10	9000/- + 18% GST	10	9000/- + GST	no change	no change
8	Logistics, Clearance & Regulation	30 - 45	Not under control	30	Not under control	15	Not under control
9	Market & Distribution	30-45	Not under control	30 to 40	Not under control	5 - 10	Not under control
10	Customer Feedback	60-70	Not under control	30	Not under control	30 to 40	Not under control
Savings in days and cost						110 to 130	4,800/- per quintal

Conclusion:

In conclusion, addressing non-value-added activities is crucial for optimizing the efficiency and effectiveness of the supply chain in cotton textile cottage industry. Each entity involved in supply chain in cottage industry faced specific challenges that contribute to delays and inefficiencies. The suggestions provided offer practical solutions to mitigate the factors contributing to non-value-added activities. Over all by implementing these suggestions, the cottage industry of cotton textiles can establish a more efficient and responsive supply chain, thereby enhancing competitiveness and customer satisfaction in the global market.

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