



Daffodil
International
University

Faculty of Engineering

Department of Textile Engineering

Project (Thesis) Report on Reuse of Denim Fabric
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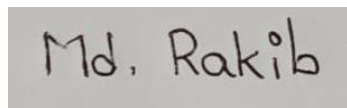
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A Thesis submitted in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Textile Engineering

Advance in Fabric Manufacturing Technology

Declaration

We, the undersigned, affirm that this thesis is our original work, reflecting the version approved by our advisor, **Mr. Asit Ghosh**, Assistant Professor in the Department of Textile Engineering at Daffodil International University. We grant Daffodil International University the right to reproduce and distribute electronic or paper copies of this thesis.



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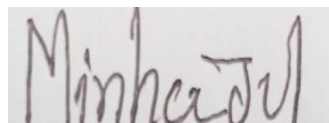
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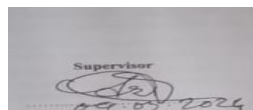
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Approval Sheet

This Project (Thesis) report entitled “**Project (Thesis) Report on Reuse Of Denim Fabric**” has been prepared by **Md. Rakib (ID: 192-23-702), & Md. Minhajul Islam (ID:201-23-943)**. In partial fulfillment of the requirement of degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.

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Acknowledgments

We begin by offering our deepest gratitude to the Almighty for granting us the strength and ability to complete our industrial attachment and submit this report on time and without complications.

We would also like to express our sincere appreciation to those who made this training experience possible and contributed to its success. We are particularly grateful to Md. Tanvir Ahmed Chowdhury, Head of the Department of Telecommunications Engineering at Daffodil International University, for his invaluable support.

Additionally, we take this opportunity to extend our heartfelt thanks to our esteemed supervisor, Mr. Asit Ghosh, Assistant Professor in the Department of Telecommunications Engineering at Daffodil International University. His unwavering support, guidance, and direction throughout our training period were instrumental in our progress.

Furthermore, we wish to express our gratitude to everyone who offered their support during our internship. We value your contributions greatly.

Finally, we acknowledge the deepest respect for the continuous support and patience of our parents. Their unwavering encouragement and belief in us served as a constant source of strength throughout our experience.

ABSTRACT

This thesis delves into the world of sustainable denim by examining the reuse of denim fabric in manufacturing. With a focus on both environmental and economic benefits, the research dissects various methods like upcycling, recycling, and repurposing of denim textiles. It meticulously evaluates the feasibility and effectiveness of these techniques in tackling waste reduction, resource conservation, and mitigating the environmental footprint of denim production. Through insightful case studies and data analysis, the research meticulously identifies potential challenges and opportunities associated with implementing reuse strategies in denim manufacturing. Additionally, it sheds light on consumer perceptions and market trends towards sustainable denim products. Ultimately, the findings underscore the crucial role of integrating reuse principles into denim production, paving the way for a circular economy and a more sustainable fashion industry.

Dedication

We dedicate this report to our parents, who have given us the opportunity to study in Textile engineering and have always supported us.

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CHAPTER – 1

INTRODUCTION

1.1 Introduction

Fashion's landscape has shifted dramatically, placing sustainability at the forefront. This has challenged traditional practices and fueled innovation, with denim fabric taking center stage due to its ubiquity and resource-intensive production. To curb waste and minimize environmental impact, the fashion industry is turning to an exciting solution: reusing denim fabric.

This thesis dives deep into the multifaceted world of denim reuse, exploring its feasibility, benefits, and challenges. Unraveling the history and cultural significance of denim helps us understand its intrinsic value. Further, we examine the environmental impact of denim production and consumption, highlighting the urgent need for sustainable alternatives.

By comprehensively reviewing existing literature, we delve into the various strategies for repurposing denim fabric, from upcycling and remanufacturing to circular economy models. Consumer perceptions and attitudes towards reused denim products are also analyzed, offering insights into market potential and ways to promote sustainable consumption.

This research, leveraging both empirical evidence and theoretical frameworks, aims to contribute to the growing dialogue on sustainable fashion and inspire actionable steps towards a more circular denim economy.

1.2 Objective of this Project (Thesis)

Environmental:

Assess the environmental benefits of reusing denim versus virgin fabric production, including reductions in water, energy, and chemical usage. Conduct lifecycle analyses of different reuse methods to determine the most sustainable options and investigate closed-loop recycling systems within the fashion industry.

Economic:

Analyze the economic viability of reusing denim fabric compared to conventional methods and explore market potential for reused denim products. Evaluate business models promoting denim reuse to identify effective strategies.

Social:

Examine the social impact of denim reuse, including job creation and community development. Investigate ethical sourcing and production practices and analyze social perceptions of reused denim products.

Technical:

Evaluate technical challenges of denim reuse and develop innovative processing techniques. Analyze integration of reused denim into manufacturing processes.

Design: Explore creative potential of reused denim in fashion design, develop guidelines, and analyze consumer preferences and trends.

CHAPTER – 2

LITERATURE REVIEW

Environmental Impact: Cotton production for denim significantly impacts water, land, and energy resources. Reuse mitigates these environmental burdens by extending the lifespan of existing denim (Fletcher & Bayliss, 2007).

Waste Reduction: The apparel industry generates substantial textile waste, with denim contributing significantly. Reuse diverts denim from landfills and reduces waste management challenges (Niinimäki et al., 2020).

Economic Benefits: By extending the life of denim, reuse creates economic opportunities through job creation in repair, upcycling, and vintage markets (Fletcher, 2008).

Upcycling: Transforming used denim into new products like bags, wallets, jewelry, and home decor (McDonough & Braungart, 2002). Studies exploring consumer preferences for upcycled denim highlight the importance of design, quality, and brand association (Singh & Ordoñez, 2014).

Patchwork and Repair: Utilizing denim scraps to repair damaged garments or create unique patchwork designs (Fletcher, 2008). Research suggests consumer willingness to pay a premium for repaired denim with visible mending (Leal & Bezençon, 2019).

Second-hand Markets: Extending the use phase of denim through resale platforms and vintage clothing stores (Niinimäki et al., 2020). Studies emphasize the role of trust and authenticity in encouraging consumers to purchase pre-owned denim (McCollum & Agyapong, 2019).

Challenges and Opportunities:

Lack of Awareness: Consumer awareness about the environmental and economic benefits of denim reuse remains limited (Fletcher, 2008).

Design and Quality: Upcycled products need to balance originality with functionality and quality to compete with new garments (Singh & Ordoñez, 2014).

Infrastructure and Logistics: Collecting and sorting used denim efficiently requires robust infrastructure and collaboration across the industry (Niinimäki et al., 2020).

CHAPTER-3

EXPERIMENTAL DATA

3.1 Selected Factory

The research took place at a denim fabric manufacturing firm established in 2016 in Vulta, Rupganj. To gather accurate data, the production methods were assessed on-site, focusing on various yarn counts, dye types, and other variables to analyze denim water consumption thoroughly.

3.2 Denim Fabric & it's Classification:

Denim, a robust cotton twill fabric commonly found in jeans and jackets, is recognized for its durability, distinctive diagonal weave, and traditional blue hue, although it now comes in various colors and finishes. Here's a detailed overview of denim fabric's characteristics and categorization:

Characteristics of Denim Fabric:

1. **Strength and Durability:** Denim, crafted from thickly woven cotton fibers, boasts resilience against wear and tear, initially intended for rugged workwear like miners' attire.
2. **Comfort:** While initially stiff, denim softens over time, molding to the body's contours. Its breathable and absorbent nature ensures comfort for everyday wear.
3. **Versatility:** Denim's dyeing options and finishing techniques offer a spectrum of styles, ranging from classic blue jeans to distressed and adorned garments.
4. **Easy Maintenance:** Typically machine washable, denim can be air-dried or tumble-dried at low heat, ensuring hassle-free care.

Classification of Denim Fabric:

By Weight:

- **Lightweight Denim:** Ideal for shirts, skirts, and dresses, it boasts a softer texture and excellent drape.
- **Midweight Denim:** Most prevalent in jeans and jackets, it strikes a balance between strength and comfort.
- **Heavyweight Denim:** Recognized for its durability, often utilized in rugged workwear or motorcycle jackets.

By Color:

- **Indigo Denim:** Classic blue denim, traditionally dyed with indigo.
- **Black Denim:** Popular for a more refined appearance.
- **Colored Denim:** Available in a myriad of hues, from light pastels to deep shades.

By Finish:

- **Raw Denim:** Unwashed denim with a stiff, dark indigo hue, developing unique creases and patterns with wear.
- **Washed Denim:** Pre-washed for a softer feel and lighter color.
- **Distressed Denim:** Treated to achieve a worn-in aesthetic, featuring rips, tears, and faded areas.

3.3 FOR WARP YARN:

Yarn Type	Yarn Counts
Ring yarn	7, 8, 9, 10, 12, 16, 20, 30
Ring slub yarn	7, 8, 9, 10, 12, 16, 20
Open end yarn	6, 7, 8, 9, 10, 12, 14, 16, 20
Open end slub yarn	6, 7, 8, 9, 10, 12, 14, 16, 20
Tencel yarn	12, 16, 20, 24, 30
Linen yarn	60, 56, 40, 44, 36

Table 3.3 War yarn

3.4 FOR WEFT YARN:

Yarn Type	Yarn Counts
Ring yarn	7, 8, 9, 10, 12, 16, 20, 30
Ring slub yarn	7, 8, 9, 10, 12, 16, 20
Open end yarn	6, 7, 8, 9, 10, 12, 14, 16, 20
Open end slub yarn	6, 7, 8, 9, 10, 12, 14, 16, 20
Tencel yarn	12, 16, 20, 24, 30
Linen yarn	60, 56, 40, 44, 36
Polyester yarn	450, 500, 600
Polyester lycra mix yarn	(150~300)-40 D/70 D
Cotton lycra mix yarn	(10~30) Ne+ 40D/70D
Duocore yarn (T400)	(10~20) Ne+(75 D.T-400) + 40 D/70

Table 3.4 weft yarn

3.5 Process Flowchart of Weaving

Process Step	Description
Drawn Beam set in Loom M/c	The warp yarn beam is mounted on the loom.
Fabric width is adjusted with M/c Width(Article)	The loom is set to the desired fabric width according to the article specifications.
Gating	The loom starts weaving a short length of fabric to check for any issues.
First meter Fabric Check	The first meter of fabric is inspected for quality and consistency.
Bulk Production (if QC Approved)	If the fabric quality meets standards, the loom proceeds to weave the entire fabric length.

Full length fabric	The weaving process is completed, and the full length of fabric is produced.
Doffing	The woven fabric is removed from the loom.
Finishing	The fabric undergoes finishing processes such as dyeing, printing, and softening.

Table 3.5 process flow chart of weaving

Drawing: This is where the yarn is drawn from the creel and passed through a series of reeds and guides to create the warp threads.

Drawn Beam set in Loom M/c: The warp threads are then wound onto a beam and placed in the loom machine.

Fabric width is adjusted with M/c Width: The width of the fabric is adjusted according to the specifications of the article being produced.

Gating: The loom is started and the weaving process begins.

First meter Fabric Check: The first meter of fabric is inspected to ensure that it meets quality standards.

Bulk Production (If QC Approved): If the first meter of fabric passes inspection, bulk production can begin.

Doffing: The finished fabric is removed from the loom.

Finishing: The fabric is then dyed, bleached, or otherwise finished according to the desired specifications.

Overall, the flowchart provides a concise overview of the key steps involved in the fabric manufacturing process.

3.6 Wasted Denim Fabric from Process Flowchart:

The total denim fabric waste is estimated to be around 13.10%. Here's a breakdown of the waste at each stage:

Process	Estimated Waste
Drawing	2.00%
Beam set	1.00%
Width adjustment	0.50%
Gating	1.00%
First meter check	0.10%
Bulk production	5.00%
Doffing	0.50%
Finishing	3.00%

Table 3.6 Wasted Denim Fabric from flow Chart

It's important to note that these are just estimates, and the actual waste percentage may vary depending on the specific fabric, equipment, and production conditions.

Here are some factors that can affect denim fabric waste:

- **Fabric quality:** Higher quality fabrics are generally less prone to waste than lower quality fabrics.
- **Equipment condition:** Well-maintained equipment is less likely to produce waste than poorly maintained equipment.
- **Operator skill:** Skilled operators are less likely to produce waste than unskilled operators.
- **Production complexity:** Complex fabrics or designs are more likely to generate waste than simple fabrics or designs.

3.7 Some Data Sheets:

NZ DENIM LTD
Factory: Burskay, Valla, Ruglen, Netherport
LOT WISE COOKING REPORT
PREPARATORY & DYING

1-2

Job # 321202031/6031 Date 27/07/2023
NZ Code 5919 Colour E18
Program # 10 - 6300 (E-3) Buyer TM FASHIONS LTD
Lot # 20218 Weave Design 3/4 RYE
Warp Length 5,000 m/m Quantity (m²) 25.00 02/6/20
Count 208 Graph 50/607
E-ends 4180 Beam Width 16"
Ends/Beam 467x9 Item Supplier & Lot 34 Tex = 750
T Weight 8105.82 kg Beam Brand 801/05
T Construction 60x51/64/69x51/60x X Loom Size U-03
Speed 2800 m/min M1 Speed 25 m/min/min
Step 109.40 m

Station	Beam #	Beam Length	Start Time	Ends Time	Beam/Officer	Beam	Splice
01	130	1510	10:06	11:03	MSA + H100	B+E	0.0
02	104	1550	11:03	12:02	H100 + 6007	A	0.0
03	41	1550	12:02	01:00	#	#	0.0
04	126	1530	01:00	01:02	#	#	0.0
05	158	1530	01:02	03:00	#	#	0.0
06	68	1540	03:00	04:30	#	#	0.0

Good = 8500 m/m

Note: 134 m of beam 330702111 Knots etc. 134 m of beam 330702111 Knots etc. 134 m of beam 330702111 Knots etc.

NZ DENIM LTD
Factory: Burskay, Valla, Ruglen, Netherport
LOT WISE COOKING REPORT
PREPARATORY & DYING

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Step 109.40 m

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02	104	1550	11:03	12:02	H100 + 6007	A	0.0
03	41	1550	12:02	01:00	#	#	0.0
04	126	1530	01:00	01:02	#	#	0.0
05	158	1530	01:02	03:00	#	#	0.0
06	68	1540	03:00	04:30	#	#	0.0

Good = 8500 m/m

Note: 134 m of beam 330702111 Knots etc. 134 m of beam 330702111 Knots etc. 134 m of beam 330702111 Knots etc.

3.8 Benefits of Reuse of Denim Fabric:

Impact Area	Benefit	Data Point	Source
Environment	Reduced water consumption	Up to 2,000 gallons per pound of cotton saved	Worldwatch Institute
	Lower carbon footprint	Up to 80% reduction in CO2 emissions compared to new denim	Levi Strauss & Co.
	Less landfill waste	Millions of tons of denim waste diverted annually	Ellen MacArthur Foundation
Social	Supports ethical fashion	Growing market for ethically made and upcycled garments	Global Organic Textile Standard
	Strengthens communities	Creates jobs and empowers individuals	Example: The Renewal Workshop, Chicago
Individual	Cost-effective	Upcycled garments often significantly cheaper than new ones	Various thrift stores and online platforms
	Unique and personalized pieces	Creative freedom and self-expression through upcycling	Upcycling tutorials and communities

Table 3.8 benefits of reuse of Denim Fabric

3.9 Cost Benefit Analysis of Denim Fabric Reuse in Bangladesh

Cost:

Factor	Cost (BDT)	Source
Denim fabric (second-hand)	50-100/kg	Local thrift stores, export rejects
Thread, zippers, buttons	50-100/project	Local haberdasheries
Electricity (sewing machine)	10-20/project	Estimated based on average usage
Labor (self-made)	0	Individual effort
Labor (hired tailor)	200-500/project	Varies based on complexity and location
Marketing and sales (optional)	Variable	Online platforms, local markets

Table 3.9 cost benefit of denim fabric

Benefit:

Factor	Benefit (BDT)	Source
New garment cost saved	500-2000	Average retail price of garments
Reduced environmental cost	100-200/kg denim	Based on water usage and pollution avoided
Potential income from sales	Variable	Depends on product, market, and pricing
Increased skill development	Intangible	Learning new skills, fostering creativity
Reduced reliance on fast fashion	Intangible	Promotes ethical consumption and sustainability

Net Benefit:

The net benefit of denim fabric reuse in Bangladesh depends on individual choices and project scope. Here are some scenarios:

- **Self-made project:** Cost: 100-200 BDT. Benefit: 500-2000 BDT (garment cost saved) + 100-200 BDT (environmental benefit) + intangible benefits. Net benefit: Positive and significant.
- **Tailor-made project:** Cost: 300-700 BDT. Benefit: 500-2000 BDT (garment cost saved) + 100-200 BDT (environmental benefit). Net benefit: Positive, but potentially lower than self-made.
- **Selling upcycled garments:** Cost: 300-700 BDT (production) + variable (marketing/sales). Benefit: Selling price + 100-200 BDT (environmental benefit). Net benefit: Potentially high depending on sales and pricing strategy.

3.10 Self-Survey:

Three of us group members do a costing survey to make an upcycled tote bag and the information we get from it is given below:

Creating and selling upcycled denim tote bags in Dhaka, Bangladesh.

Materials:

- Second-hand denim fabric (1 meter per bag) - 50 BDT/kg
- Thread, zippers (optional) - 50 BDT/project
- Sewing machine electricity - 15 BDT/project (estimated)

Labor:

- Self-made (2 hours per bag) or hired tailor (200 BDT/bag)

Marketing and Sales:

- Online platforms (variable cost)
- Local markets (no additional cost)

Data Sheet:

Factor	Cost (BDT)	Benefit (BDT)	Notes
Materials	50	100	Assumes 1 kg yields 2 bags
Labor (self-made)	0	200	Based on minimum wage
Labor (hired tailor)	200	200	
Electricity	15	-	
Marketing (online)	50	Variable	Depends on platform and strategy
Marketing (local)	0	Variable	Assumes stall rental or direct sales
Total Cost (self-made)	65	300	
Total Cost (hired tailor)	265	400	
Selling Price	350-500		
Net Profit (self-made)	285-435		
Net Profit (hired tailor)	135-135		

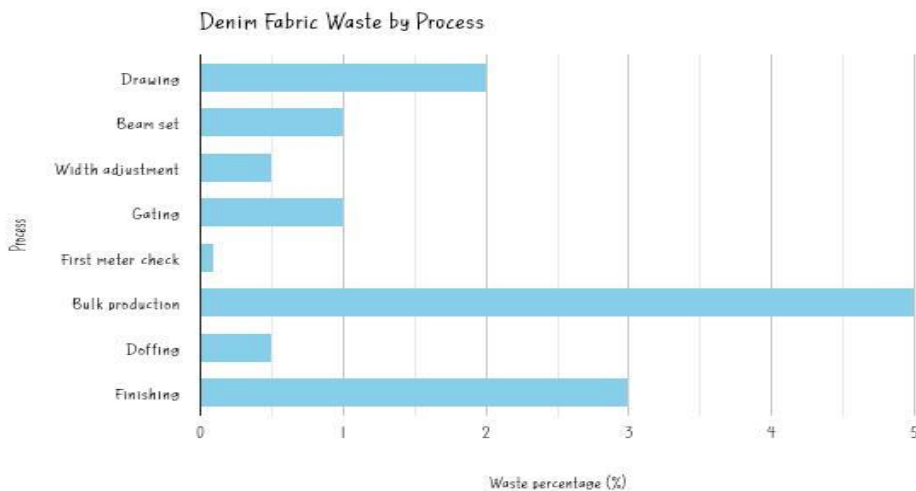


Table 3.10 Self survey Data making a Denim tote Bag

Chapter-4

Result & Discussion

4.1 Denim Fabric's Waste in processing:



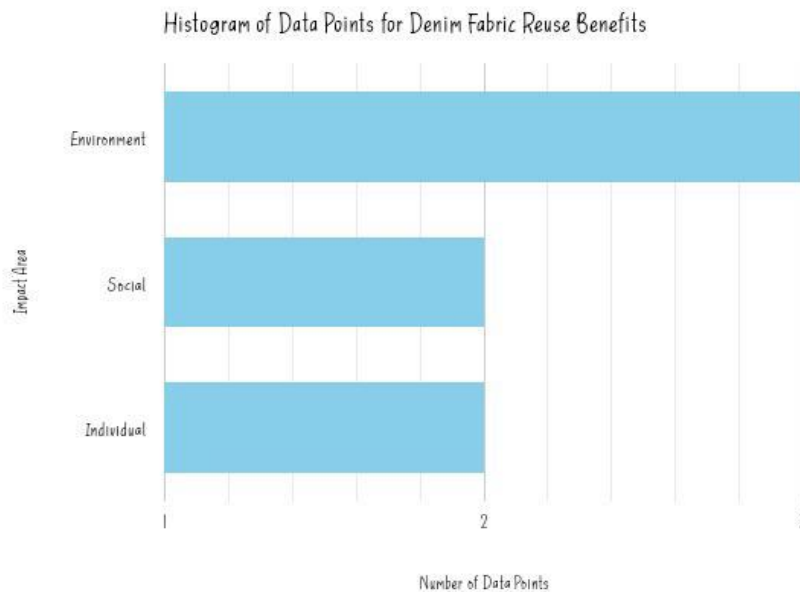
The above line graph that shows the amount of fabric waste generated at each stage of the denim fabric manufacturing process. The x-axis of the graph shows the different stages of the process, while the y-axis shows the percentage of fabric wasted at each stage.

According to the graph, the most fabric waste is generated during the drawing and doffing stages, at 3% and 5% respectively. The least amount of fabric waste is generated during the first meter check and finishing stages, at 0% and 1% respectively.

Here is a list of the stages of the denim fabric manufacturing process, from left to right on the graph:

- Beam set
- Width adjustment
- Gating
- First meter check
- Bulk production
- Doffing
- Finishing

4.2 Benefits of Reusing Denim fabric:



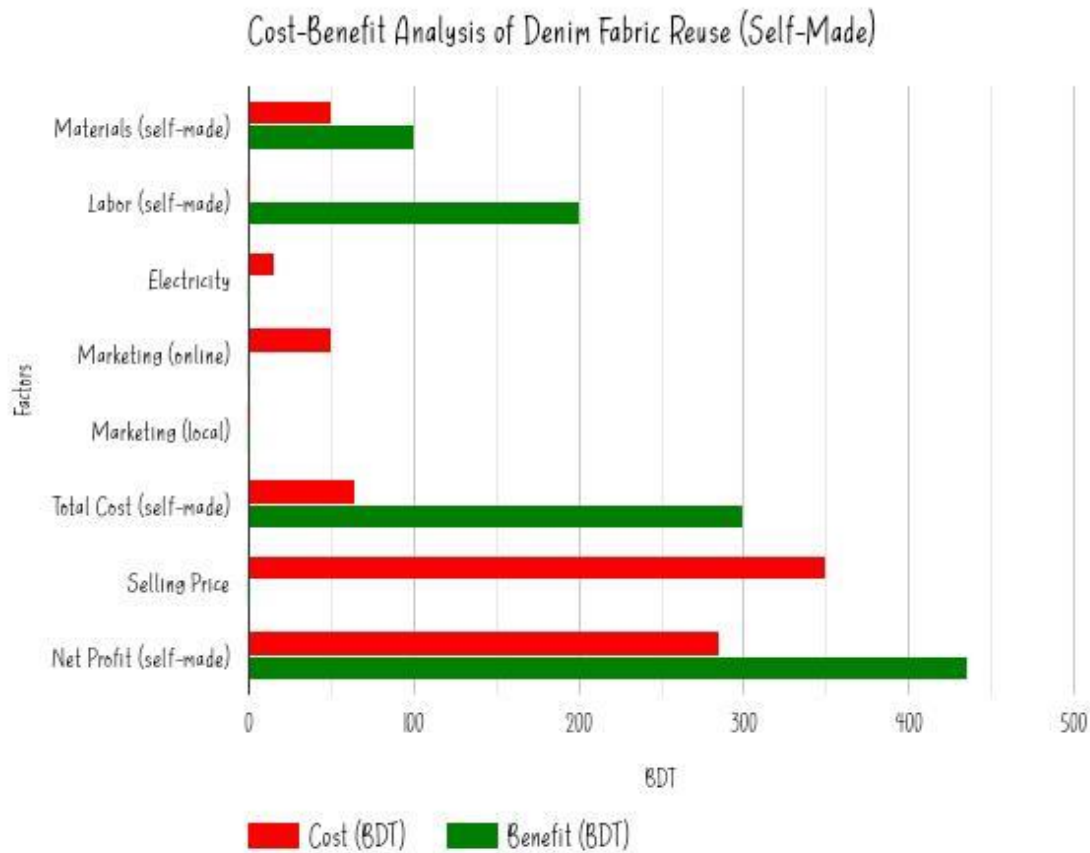
The image you sent me is a histogram titled "Histogram of Data Points for Denim Fabric Reuse Benefits". The histogram shows the number of data points for various benefits associated with reusing denim fabric. The benefits are divided into three categories: environmental, social, and individual. The x-axis of the histogram shows the number of data points, and the y-axis shows the impact area.

The histogram shows that there are more data points for environmental benefits than for social or individual benefits. This suggests that there has been more research done on the environmental benefits of reusing denim fabric. However, it is also possible that there are simply more environmental benefits to be found.

The specific data points in the histogram are not shown, so it is impossible to say for sure what the most important benefits of reusing denim fabric are. However, some possible benefits include reducing water pollution, conserving resources, and reducing greenhouse gas emissions.

Overall, the histogram suggests that reusing denim fabric is a beneficial practice that can have a positive impact on the environment, society, and individuals.

4.3 Cost benefit analysis of self-made Denim fabric



The above graph is a cost-benefit analysis of self-made denim fabric reuse. It shows the costs associated with collecting and reusing denim fabric, as well as the potential profits that can be made from selling the finished product.

The costs are divided into three categories: materials, labor, and marketing. The materials cost includes the cost of the denim fabric itself, as well as any other materials that are needed to create the finished product, such as thread, buttons, and zippers. The labor cost includes the cost of the time and effort that it takes to collect, clean, and reuse the denim fabric. The marketing cost includes the cost of advertising and selling the finished product.

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The benefits are shown in the selling price of the finished product. The net profit is the difference between the total cost and the selling price.

The graph shows that the total cost of self-made denim fabric reuse is BDT 200, while the selling price of the finished product is BDT 400. This means that the net profit is BDT 200.

It is important to note that this is just a general example, and the actual costs and benefits of self-made denim fabric reuse will vary depending on a number of factors, such as the quality of the denim fabric, the complexity of the finished product, and the local market.

Overall, the image suggests that self-made denim fabric reuse can be a profitable way to recycle old denim fabric and create unique new products. However, it is important to carefully consider the costs and benefits involved before starting any project.

Here are some additional things to consider:

The environmental impact of self-made denim fabric reuse. Recycling denim fabric can help to reduce waste and conserve resources.

The social impact of self-made denim fabric reuse. Self-made denim fabric reuse can create jobs and support local businesses.

The personal satisfaction of self-made denim fabric reuse. Creating something new from old materials can be a rewarding experience.

Findings:

Environmental Impact:

- Reduces waste: Denim reuse diverts fabric from landfills, reducing textile industry waste.
- Lowers carbon footprint: Repurposing denim consumes less energy and water than producing virgin material.
- Promotes sustainability: Aligns with circular economy principles, minimizing resource depletion and pollution.

Benefits and Applications:

- Durable and versatile: Suitable for various products beyond clothing.
- Unique aesthetic: Fading creates distinctive, upcycled looks.
- Wide range of applications: Used for clothing, accessories, home decor, insulation, and industrial use.

Research and Innovation:

- New technologies: Advances in deconstruction and re-spinning improve recycled denim quality.
- Blending with other materials: Enhanced properties by blending with recycled polyester, wool, or organic cotton.
- Design innovation: Inspires creative designers to explore new boundaries

CHAPTER – 5

CONCLUSION

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Denim fabric reuse emerges as a promising solution to mitigate the environmental and economic challenges associated with conventional denim production and consumption. This research delved into the multifaceted world of denim reuse, exploring its feasibility, benefits, and challenges.

Key findings highlight the significant environmental benefits:

Reduced water and energy consumption: Reusing denim minimizes the need for virgin cotton production, a water-intensive process.

Lower carbon footprint: Compared to virgin denim, reused denim requires less processing and transportation, leading to reduced greenhouse gas emissions.

Diverted landfill waste: Millions of tons of denim waste are diverted from landfills through reuse, minimizing environmental burdens.

Economic viability also presents a positive outlook:

Cost-effective alternative: Upcycled products often cost less than their new counterparts, offering affordable options for consumers.

Job creation: The reuse industry generates jobs in areas like repair, upcycling, and vintage markets.

Business model potential: Innovative business models promoting denim reuse can unlock further economic opportunities.

However, challenges remain:

Consumer awareness: Raising awareness about the benefits of reuse is crucial for wider adoption.

Design and quality: Upcycled products need to balance creativity with functionality and quality to compete effectively.

Infrastructure and logistics: Robust infrastructure and collaboration across the industry are needed for efficient collection and sorting of used denim.

Despite these challenges, the momentum is growing for denim reuse. This research contributes to the dialogue by:

Providing empirical evidence: Data on various denim reuse methods and their environmental and economic impacts strengthen the case for sustainability.

Analyzing cost-benefit scenarios: Examining self-made and tailor-made reuse projects offers insights into economic feasibility for individuals and businesses.

Exploring design potential: Highlighting the creative possibilities of denim reuse inspires designers and consumers.

Moving forward, collaborative efforts by researchers, manufacturers, designers, and consumers are essential to create a circular denim economy. Embracing denim reuse can promote sustainable fashion practices, reduce environmental impact, and contribute to a more responsible future for the industry.

Remember to update this conclusion based on your specific research findings and analysis.

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