

A STUDY ON UNDERSTANDING THE VARIOUS WASTE REDUCTION AND OPTIMIZATIONAL TECHNIQUES FOLLOWED BY TEXTILE INDUSTRIES

Submitted in partial fulfillment of the requirements for the award of

MASTER OF BUSINESS ADMINISTRATION

BY

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**DEPARTMENT OF BUSINESS ADMINISTRATION
SCHOOL OF MANAGEMENT STUDIES**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

CATEGORY – 1 UNIVERSITY BY UGC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **CHRIS AROCKIA RHOSWEN ROCHE R (42410084)** who carried out the Project Training “**A STUDY ON UNDERSTANDING THE VARIOUS WASTE REDUCTION AND OPTIMIZATIONAL TECHNIQUES FOLLOWED BY TEXTILE INDUSTRIES**” under my supervision from September 2023 to November 2023.

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ABSTRACT

The textile industry is known for its significant environmental impact, primarily due to high resource consumption and waste generation. This study aims to explore and analyze the waste reduction and optimization techniques employed by textile industries to mitigate their environmental footprint. The research encompasses a comprehensive review of current practices, technological advancements, and sustainable approaches within the textile sector. The investigation involves a multi-faceted research methodology, including in-depth interviews with industry experts, surveys of textile manufacturers, and an extensive literature review. By examining various aspects such as raw material selection, manufacturing processes, recycling strategies, and waste management systems, this research identifies the most effective techniques for waste reduction and optimization. The findings of this study reveal a range of strategies used by textile industries to minimize waste generation, increase resource efficiency, and adopt more sustainable practices. These strategies include the adoption of eco-friendly materials, innovative dyeing and finishing methods, lean manufacturing principles, and the implementation of circular economy principles. Furthermore, this study also investigates the economic and environmental benefits of these techniques. The study's results provide valuable insights for textile industry stakeholders, policymakers, and environmental advocates, offering guidance on how to align business operations with sustainability goals. By understanding and implementing these waste reduction and optimization techniques, textile companies can reduce their ecological impact while potentially improving their economic sustainability, ultimately contributing to a more environmentally responsible and economically viable textile industry.

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CHAPTER 1

INTRODUCTION

1.1. INTRODUCTION

Waste management is the systematic and organized process of collecting, transporting, processing, recycling, and disposing of waste materials in a way that minimizes environmental, health, and economic impacts. It encompasses a range of activities aimed at effectively and responsibly handling different types of waste, including municipal solid waste, industrial waste, hazardous waste, and more. The primary goals of waste management are to reduce the generation of waste, promote recycling and reuse, and ensure that waste is safely and environmentally soundly managed, reducing its potential harm to the environment and human health. Efficient waste management is essential for conserving resources, preventing pollution, and fostering a sustainable and healthy living environment.

The textile industry, a cornerstone of our global economy, fulfills an essential role by providing us with a diverse array of textiles and clothing. Yet, the very processes that enable this industry to flourish have given rise to complex waste management challenges that demand our immediate attention. As sustainability and environmental responsibility assume a more central role in our world, the textile industry finds itself at a crossroads, compelled to adopt innovative waste management practices.

This report is a comprehensive investigation into the domain of waste management within the textile industry. It seeks to unravel the intricacies, dilemmas, and viable solutions tied to the efficient, responsible, and sustainable management of waste within textile production and manufacturing processes.

Categories of waste generated in textile industry

The textile industry generates various types of waste during its production processes. These wastes can have environmental, economic, and health implications if not managed properly. Some of the key waste generated in the textile industry include:

- **Fabric Scraps:** Textile manufacturing often results in significant amounts of fabric scraps or cuttings. These are the leftover pieces of fabric from the cutting and sewing processes. They can be substantial, and their management is an essential aspect of waste reduction.
- **Dyeing and Chemical Waste:** The use of dyes, chemicals, and finishes in textile processes generates wastewater and chemical waste. These substances can be hazardous and must be managed in compliance with environmental regulations.
- **Spinning and Weaving Waste:** Spinning and weaving processes may produce waste materials, including broken or damaged threads, which can contribute to waste in textile mills.
- **Yarn Waste:** Yarn production generates waste in the form of ends, knots, and cones that are no longer usable in the manufacturing process.
- **Packaging Waste:** Textile products are often packaged for shipping and retail. This can lead to waste in the form of cardboard boxes, plastic packaging materials, and hangers.
- **Garment Cutting Waste:** In the garment manufacturing phase, cutting fabric into patterns generates waste in the form of smaller fabric pieces and irregularly shaped scraps.

- **Used and Defective Products:** Textile products that are considered defective or unsellable may be disposed of as waste. This can include garments with defects, rejected batches, or returned items.
- **Excess Inventory:** Overproduction and excess inventory in the textile industry can lead to the disposal of unsold goods, which become waste.
- **Maintenance Waste:** Maintenance activities in textile mills can generate waste, such as used lubricants, worn-out machine parts, and cleaning materials.
- **Non-Recyclable Materials:** Some materials used in textile production, such as certain types of plastics and composites, may be difficult to recycle and may contribute to waste generation.

Various waste management techniques followed by textile industry

The textile industry generates a significant amount of waste during its various processes, from raw material production to fabric manufacturing and garment production. To mitigate the environmental impact of this waste, the industry employs several waste management techniques. Here are various waste management techniques followed by the textile industry:

1. **Source Reduction:** The textile industry works to reduce waste at the source by implementing sustainable design and production practices. This includes using patterns that minimize fabric waste during cutting and optimizing the use of raw materials.
2. **Recycling and Reusing Textile Waste:** Textile manufacturers recycle and reuse textile waste, such as fabric scraps, to create new products. Recycled materials can be used for various purposes, including manufacturing new textiles, insulation, and even eco-friendly fashion items.

3. Effluent Treatment Plants (ETPs): Textile companies often use effluent treatment plants to treat and purify the wastewater generated during dyeing and finishing processes. This helps reduce the environmental impact of chemicals and dyes in the wastewater.
4. Dyeing Process Optimization: More efficient dyeing processes and techniques are implemented to reduce the amount of water and chemicals used, as well as to minimize dye run-off and waste.
5. Zero-Liquid Discharge (ZLD) Systems: Some textile facilities employ ZLD systems, which aim to recover and reuse all the water and chemicals used in the dyeing process, leaving zero liquid discharge as waste.
6. Upcycling: In addition to recycling, the textile industry is exploring upcycling, where waste materials are transformed into higher-value products. For example, old textiles can be upcycled into new clothing items or home furnishings.
7. Circular Fashion: Circular fashion initiatives promote the concept of designing clothing and textiles to be easily recycled, repaired, or repurposed. This reduces the waste generated by the disposal of old clothing.
8. Waste-to-Energy: Some textile waste, such as non-recyclable materials, can be converted into energy through waste-to-energy (WtE) facilities, which help reduce landfill waste and generate power.
9. Landfill Diversion: Textile companies work to minimize waste sent to landfills by separating waste streams and diverting materials for recycling, reusing, or repurposing.
10. Textile Collection and Recycling Programs: Some textile brands and organizations establish programs for collecting and recycling old clothing and textiles. These programs encourage consumers to return old garments and textiles for recycling.

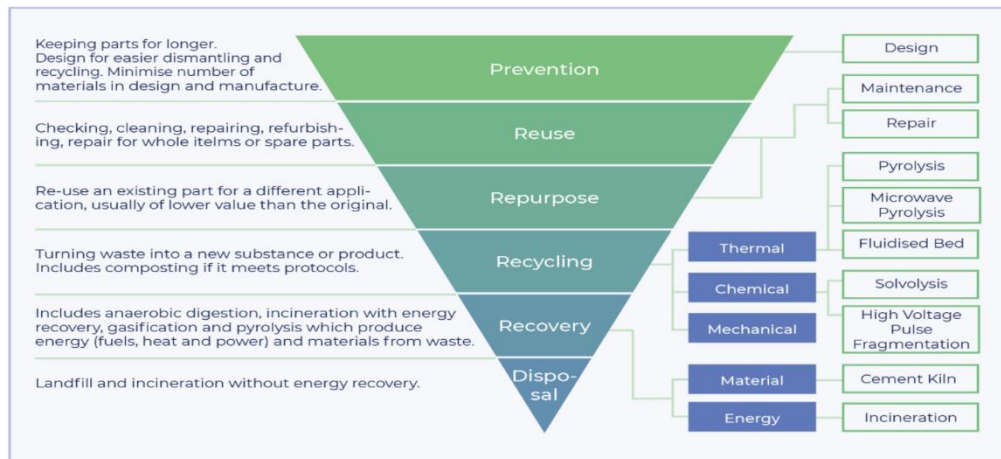
11. **Eco-Friendly Materials:** Textile manufacturers are increasingly using eco-friendly and sustainable materials, such as organic cotton and recycled fibres, to reduce the environmental impact of textile production.
12. **Sustainable Supply Chain Practices:** Implementing sustainable supply chain practices can minimize waste generation and improve resource efficiency from the raw material stage to the finished product.
13. **Educational Initiatives:** Textile companies often invest in employee training and educational initiatives to raise awareness about waste management and the importance of reducing waste at every stage of production.

Waste management in Textile Industry

Waste management includes the processes and actions required to manage waste from its inception to its final disposal. When practicing waste management, most textile industries use a basic concept of waste management to implement a proper waste management system. Most textile industries use a waste management hierarchy, zero waste concepts, and 3R waste hierarchy to implement their waste management system.

1. Waste Management Hierarchy

It represents the waste management hierarchy and its basic steps. Also it includes some basic information about this waste management concept. In this concept, the most favourable option is 'REDUCE.' Simply, it minimizes the amount of waste produced from each production process. Disposal is the least promising option in this hierarchy. From top to bottom mainly there are five options here. Reuse, Recycle and Recover are the other three options. According to the industry and its facilities, we can apply this waste management concept to implement a proper waste management system.



2. Zero Waste Management

In the industrial sector, the zero waste concepts are a successful concept for solving waste problems. Rather than managing waste inside the industry, this aims to eliminate waste. Also, the zero-waste concept can be defined as a systematic process of eliminating waste at the source. A closed-loop circular system is modeled in zero waste, and one-way linear resource use and disposal culture is rejected. Zero waste creates more job opportunities compared to waste incineration.

3. 3R Waste Hierarchy

It shows the basic steps of the 3R waste hierarchy. The 3R waste hierarchy can be identified as a management tool to guide the allocation of resources and policy formation. The 3R waste hierarchy extracts the maximum value from already produced products and minimizes the amount of waste disposed of. This waste hierarchy grew in popularity during the early 21st century due to global environmental issues and the depletion of natural resources. 3R waste strategy generates both economic and ecological benefits.



Reduce

When upcoming fast fashion models and trendy products supply to the retail stores as quickly as possible, the traditional fashion retail methods are moving away. So seasonal fashion trends, fast fashion retailers constantly introduce new fashion of textile throughout the year. So social media display new styles of fast fashion Textile. As a result, customers are buying new fast fashion Textiles at a lower price. So, to reduce strategies, these textile wastes introduce education and awareness campaigns. These campaigns should be to educate customers about sustainable purchasing and use decisions. So, they can adjust their purchasing and consumption to cultivate environmental concern and encourage by recognizing the impact of environmental degradation. So, this campaign helps to remove the connotation of consumers these textiles are disposable. It can reduce the demand for textile and reduce textile waste.

Reuse

Reuse waste focuses on reusing and used items prolonging their life. So, this extends the life of textile and its reduced water, carbon, resource, and waste footprints. The most common example for this can be described as second-hand reuse market. But the problem is there are a lot of textiles in the bales that are unsellable. So, they end up thrown out. Most countries have textile donation centers, but people through away items because they think donation center doesn't accept them. Most people appear to be lack understanding about the donation and reuse process. So, the industry focuses on two components for reuse strategy, information campaign, and collaboration.

People have too low knowledge about this recycling strategy. So, the industry should expand the awareness campaign to include information on reusing textiles.

Recycle

This involves recovering valuable raw materials from products by using chemical or mechanical recovery processes and use to make a new product. This process keeps unnecessary textile waste from landfills. The industry should develop a comprehensive collection and handling system with demand for recycled products and technologies, and second, the industry increases the investment for recycling process and support initiatives or that and doing awareness programs and discuss how the products containing recycled materials are benefited and how these products help to reduce raw materials, save energy and reduce CO2 emissions.

4. Zero waste management in the textile industry

This process has more employment opportunities when compared to waste incineration by; increasing recycling and reuse will reduce the production of air pollutants compared to incineration and landfilling. Industries selected a few strategies to prevent the Generation of waste. This research study was developed by addressing existing waste management strategies and issues and suggestions to achieve zero waste management goals. This Framework was developed under 3 headings as planning and design Production and sales stages. These zero waste goals mean avoiding waste before its Generation and environmental sustainability, eliminating landfilling and resource efficiency.

Planning and design stage

In this stage, there were several Organizational Strategies to prevent or minimize generation waste. So, Industries following things identified as inspecting the raw materials before sending in the production stage, preventing damage by the proper ranking system, checking goods when buying from suppliers.

Production stage

In this stage use new technological machines, giving training to employers to improve awareness. Reuse of materials, given responsible for workers and keep well-trained staff and good quality control team.

Sales stage

In this stage prevent waste generation can be summarized as increasing the utilization of cardboard, reuse and recycle of package materials. There are some issues in this stage, difficulty to increase the efficiency because of customer constraint, order issues in planning effect to the generated waste. To overcome this issue can change the opinion on customers to increase the efficiency, send back remaining packages for suppliers, check carton quality, use reusable packages and recycle materials can minimize generation textile waste.

5. Upcycling off-cuts into valuable products

The procedure of cutting and separating some raw fabric materials for quality and quantitative verification of the raw fabric materials resulted in the first fabric waste generation, which began in the store. After that, the fabric inspection process was followed before production began. A random selection of 10% of raw fabric materials from each allocation is cut and segregated for color shading and shrinkage testing purposes [15]. Upcycling is a recycling technique in which a waste product is recycled into a raw material with a higher value than the original. To put it another way, upcycling is the process of changing waste material into a new product of the same or better quality than the old one. William McDonough and Michael Braungart were the first to introduce the concept of upcycling items. They proposed that, unlike recycling, there should be a procedure in which the finished product has a value that is at least equal to that of the original product. Textile off-cuts can be reused for pillow stuffing, shredding, felting purposes. Nonwoven sound and thermal insulation mats can be produced from waste wool, recycled polyester. High value added upcycled luxury handbags could be designed for fashion markets by using textiles offcuts. Insulated building

material can be produced by using cotton waste and fly ash together with cement and water

6. Demand for recycled textiles in world market

Numerous Technologies can streamline the textile Recycling Process, but they are commercially viable. One major thing is the investment and demand needed for recycling Textile waste. So, it can ensure a stable market for final recycling products. In the UK, there are two recycling applications. They were wiping cloths and non-woven products. These wiping cloths have a declining market. Non-woven products are mainly used for car manufacturing, mattress spring coverings that are mature markets. Textile recycling plays a significant economic role in the global marketplace while having many positive entities and significantly contributing to social responsibility. However, the textile industry can work to achieve economies of scale, reduce their overall production cost. There is a barrier to this because cheap fabric available to the textile markets. Production cost, uncertain supply chain, lower-quality fiber are additional challenges for textile recyclers in the market. However, some large retailers introduced recycled fiber into their products to ensure a stable end market that needs more demand by manufacturers.

7. Negative impact of waste on the industry and environment

The generation of waste in the textile manufacturing process is a significant challenge facing the industry. Dispose of some of the valuable raw materials used in textiles as waste also contributes to the increased production costs. Reworking, replacement production, and inspection occur wasteful handling time and effort. Increasing the percentage of waste generated also increases energy loss. It requires extra effort, energy, and cost to transport, dispose and adequately manage the generated waste. If an institute or a factory is not able to properly work this waste, it will face many legal, environmental, and social problems. It can directly affect the existence, image, and profitability of the organization.

8. Environmental and economic benefits of managing textile waste

As a benefit of maximizing fiber reuse reduces the cost of purchasing the material and the use of the generated solid waste for by-products such as paper production increases additional revenue and reduces the amount of waste added to the environment. The textile industry collects a large amount of wastewater compared to other industries. Therefore, improving the quality of wastewater contributes to reducing water pollution. Methane emission from landfills to generate electricity and co2 emitted by combustion can be used as a source of heating. Therefore, the effect on the environment from these emissions can be reduced and a significant amount of energy can be saved. 90% of discarded fiber by the consumers can be recycled. Achieving sustainable fashion can be economically viable and greatly contributes to reducing greenhouse gas emissions and has enormous environmental benefits.

1.2. Problem statement

The textile industry, while essential for the global economy, is known for its significant waste generation and inefficient resource usage. In light of increasing environmental concerns and resource scarcity, there is an urgent need to address sustainability challenges in the textile sector. This study aims to investigate waste reduction and optimization techniques used by textile industries to tackle environmental and economic sustainability issues.

1.3. Scope of the study

- It comprehensively examine waste reduction and optimization techniques within the textile industry.
- It will encompass areas such as water and energy conservation, sustainable materials, process improvements, recycling, and the use of eco-friendly chemicals. The research will also explore case studies, industry practices, and regulatory considerations.
- The goal is to offer insights for enhancing environmental and economic sustainability in the textile industry.

1.4. Objective of the study

- Primary objective focuses on understanding the various waste reduction and optimizational techniques followed by textile industries.
- To analyze the existing waste management and reduction practices in the textile industry, including the methods used, technologies employed, and their effectiveness.
- To find the different sources of waste in the textile manufacturing process, which can include raw materials, energy, water, and byproducts.
- To identify and document industry-specific best practices and case studies that demonstrate successful waste reduction and optimization techniques.

1.5. Need of the study

- The textile industry's environmental impact is a pressing concern. The study is needed to identify effective waste reduction techniques to mitigate environmental harm.
- As global resources become scarcer, there is a need to optimize resource usage in the textile industry to ensure long-term viability.
- Discovering techniques to minimize waste and resource consumption can lead to cost savings for textile companies.
- Implementing sustainable practices can enhance a company's competitiveness in the growing market for eco-friendly products.
- By promoting sustainable textile practices, the study contributes to global sustainability and responsible consumption and production.

1.6. Limitations of the study

- The study may not capture region-specific variations in waste reduction techniques due to its broader focus.
- Limited access to industry data and proprietary information may constrain the study's depth and accuracy.
- Sustainability is a multifaceted concept, and the study might not address all dimensions comprehensively.
- Constraints in terms of time and funding may impact the study's breadth and depth.

CHAPTER 2

REVIEW OF LITERATURE

2.1. REVIEW OF LITERATURE

In this Chapter, the researcher has made an attempt in understanding the basic concepts of on these topics will provide a strong foundation for your study on waste reduction and optimization techniques in the textile industry, offering a comprehensive understanding of the current state of the industry and its environmental challenges and opportunities made by earlier researchers in respect of strategies that are used by company to make employee get engaged, for this, the researcher has used various books, research Journals and websites. The detailed list is further elaborated in the Bibliography. Through this Literature Survey researcher wants to find out which are the important parameters of employee engagement.

Significance of bioadsorption process on textile industry wastewater - Omprakash Sahu , Nagender Singh (2019)

In this research paper, the textile industry's environmental impact, especially concerning the use of dyes and pollutants, necessitates effective methods for dye removal from wastewater. Adsorption, particularly through bioadsorbents, is presented as a promising and sustainable approach to address this issue. The study aims to contribute to alternative and eco-friendly solutions for treating dye-containing wastewater from the textile industry.

A Technical Review of Emerging Technologies for Energy and Water Efficiency and Pollution Reduction in the Textile Industry - Ali Hasanbeigi, Lynn Price (2017)

The value of this research is textile industry faces pressing challenges related to energy consumption, greenhouse gas emissions, and environmental pollution. To address these issues and support the industry's sustainable growth, the paper focuses on emerging technologies that have the potential to reduce energy use and

mitigate environmental impacts. This resource aims to bridge the information gap and facilitate the adoption of these technologies in the textile sector.

Identifying the potential for circularity of industrial textile waste generated within Swiss companies - M'elanie Schmutz , Claudia Som (2022)

The objective is to analyse the importance of addressing industrial waste in the textile industry to support a circular economy. By quantifying waste generation and examining potential end-of-life treatments, the study emphasizes the need to develop recycling technologies and create markets for recycled textile materials to harness the value of textile waste as a resource.

Modern enabling techniques and adsorbents based dye removal with sustainability concerns in textile industrial sector -A comprehensive review - N. Rajesh Jesudoss Hynes , J. Senthil Kumar , Hesam Kamyab , J. Angela Jennifa Sujana , Omar Ali Al-Khashman , Yasemin Kuslu , Antoaneta Ene , B. Suresh Kumar (2020)

The objective is to analyse the need for comprehensive solutions to address the environmental and health impacts of textile industry wastewater. It emphasizes the importance of integrating traditional treatment methods with modern technologies like IoT for effective and sustainable manufacturing. The proposed strategies seek to enhance the overall management and treatment of textile industry wastewaters, offering potential benefits for both the industry and the environment.

Mapping environmental sustainability of knitted textile production facilities - Md. Shamsuzzaman , Md Mazedul Islam , H M Rakib Ul Hasan , Adnan Maroof Khan , Abu Sadat Muhammad Sayem (2023)

The value of this research recognizes the need for evaluating the environmental sustainability of fashion production facilities and highlights the challenges faced by knit-dyeing facilities in Bangladesh. The study's results call for collaborative efforts to address these challenges and work toward more sustainable practices in the fashion industry.

An Evaluation on Lifecycle of Products in Textile Industry of Turkey through Quality Function Deployment and Pareto Analysis - Ayşenur Erdil (2019)

This research paper emphasizes the use of QFD methodology as a strategic tool in the textile production industry to bridge the gap between customer expectations and technical characteristics. The application of QFD and Pareto Analysis in assessing sustainability highlights the industry's commitment to quality, robustness, and environmentally-conscious production, setting the stage for further research and development in this area.

Textile-apparel manufacturing and material waste management in the circular economy: A conceptual model to achieve sustainable development goal (SDG) 12 for Bangladesh - Maeen Md. Khairul Akter , Upama Nasrin Haq , Md. Mazedul Islam b , Mohammad Abbas Uddin (2022)

The value of this research recognizes the pressing need for efficient materials waste management in the textiles and apparel manufacturing industry. It highlights the economic losses associated with waste and the informal trading of waste materials. The development of a conceptual waste management model aims to facilitate a shift toward a circular economy and contribute to the achievement of SDG 12 in Bangladesh.

Sustainable applications of textile waste fiber in the construction and geotechnical industries: A retrospect - Saadman Sakib Rahman, Sumi Siddiqua , Chinchu Cherian (2022)

The objective is to emphasize the pressing need to address textile waste and promote sustainable waste management practices within the textile and fashion industries. The concept of a circular textile economy is introduced as a solution to make the best use of textile waste, and the review paper discussed in the passage explores the potential applications of textile waste fibers in construction and geotechnical engineering, with a focus on cleaner and more environmentally friendly practices.

Ecolabelling in textile industry: A review - L. Ranasinghe, V.M. Jayasooriya (2021)

The value of this research recognizes the need for informed decision-making in the context of sustainable production and consumption. The review of textile ecolabels is intended to provide insights into the attributes and trends of such labels while promoting regional or localized ecolabelling frameworks to address the complex and diverse nature of the textile industry's manufacturing processes. This review aims to contribute to more effective ecolabelling practices and recommendations for future research.

Textile waste management in Australia: A review - Mahbuba Imroz Khan, Lijing Wang , Rajiv Padhye (2023)

In this research paper, the global textile industry contributes significantly to CO2 emissions, with around 10% of worldwide emissions attributed to this sector. Textile waste is a pressing global issue, and in Australia, it's a particularly concerning problem, as it has the lowest recovery rate among all waste types. The understanding of textile waste management is incomplete. This study examines textile waste management in Australia, considering factors like textile consumption, waste generation, the roles of social entrepreneurs and charities, government and organizational initiatives, as well as relevant laws and regulations.

Municipal Textile Waste and Its Management - Rinku Agrawal, Madhu Sharan (2017)

This paper sheds light on the management of textile waste within the context of municipal waste and its environmental implications. By advocating for the reprocessing of textile waste, the utilization of waste materials, and the development of innovative products from these materials, this paper aims to drive a campaign toward sustainable textile waste management. The implementation of these methods can help reduce the overall textile waste present in municipal waste, contributing to a cleaner and more sustainable environment.

A review on the sustainability of textile industries wastewater with and without treatment methodologies - Punyasloka Pattnaik, G.S. Dangayach , Awadhesh Kumar Bhardwaj (2018)

This paper emphasizes the importance of sustainable textile wastewater management, explores alternative methods for reducing textile waste, and suggests innovative ways to utilize treated wastewater by incorporating it into other industries, thereby contributing to both environmental preservation and resource optimization.

Lean Manufacturing Application in Textile Industry - Leandro L. Lorente Leyva, Edwin P. Curillo Perugachi, Ramiro V. Saraguro Piarpuezan, Carlos A. Machado Orges , Edwin P. Ortega Montenegro (2018)

This research advocates the application of Lean Manufacturing principles, specifically the 5S methodology and Manufacturing Cells, to address waste and improve production efficiency in a textile company. The results demonstrate a significant reduction in order failure, ensuring customer satisfaction and enhancing the company's overall competitiveness.

An Investigation of Lean Manufacturing Implementation in Textile Sector of Pakistan - Zahid Abbass Shah, Hadia Hussain (2017)

The objective is to indicate that the textile sector in Pakistan is at a relatively early stage of implementing lean manufacturing practices. While there is growing interest and recognition of the benefits of lean, companies face challenges related to awareness, organizational culture, communication, and employee engagement. To successfully implement lean, these barriers need to be addressed, and a deeper understanding of lean principles should be fostered within the sector.

A Sustainability Overview of the Supply Chain Management in Textile Industry - Juan David Cruz Negrete, Valentina Navarro López (2020)

This paper underlines the pressing need for sustainability in the textile industry due to its significant environmental impact. It highlights the importance of technology adoption and shifts in business models to promote sustainability. Moreover, it advocates for the development of a shared sustainability assessment framework to facilitate transparent and consistent reporting on sustainability efforts in the sector.

Textile waste in the concept of circularity - Iliana Papamichael , Georgia Chatziparaskeva , Irene Voukkali , Pantelitsa Loizia , Antonis A. Zorpas (2022)

This paper emphasizes the fashion and textile industry faces substantial environmental challenges, but there is a growing recognition of the need for sustainability and circularity. The industry is exploring innovative approaches, such as using waste as raw materials, adopting circular business models, and addressing consumer preferences and WTP. These efforts aim to reduce the environmental impact of the fashion sector and promote a more sustainable and responsible industry.

Introductory Chapter: Textile Manufacturing Processes - Faheem Uddin (2022)

This paper highlights the significance of textile fibers in modern society, their application in fashion, and the increasing focus on sustainability and environmental responsibility in the textile industry. The environmental impact of textile manufacturing processes is a key concern, prompting efforts to regulate and reduce environmental degradation in the industry.

Towards Understanding Sustainable Textile Waste Management: Environmental impacts and social indicators - Bahareh Zamani (2018)

This thesis addresses the complex issue of textile waste management, encompassing both environmental and social aspects. It provides insights into the environmental impact of different waste treatment methods and explores social concerns and priorities, offering recommendations for the development of labels and standards in the textile industry to promote sustainable practices.

Assessing data-driven sustainable supply chain management indicators for the textile industry under industrial disruption and ambidexterity - Ming-Lang Tseng , Tat-Dat Bui , Ming K. Lim , Minoru Fujii , Umakanta Mishra (2022)

Overall the study contributes to the understanding of data-driven SSCM indicators and their application in the textile industry, particularly in the face of industrial disruption and the need for ambidextrous strategies. It provides a foundation for improving sustainability and resilience in supply chain management.

Reuse Feasibility of Electrocoagulated Metal Hydroxide Sludge of Textile Industry in the Manufacturing of Building Blocks - Tanveer Mehedi Adyel, Syed Hafizur Rahman, Mohammad Moniruz Zaman, Hossain Md. Sayem, Mala Khan, Md. Abdul Gafur, S. M. Nazrul Islam (2017)

The research explores a sustainable approach to managing textile industry sludge by incorporating EMHS into the manufacturing of building blocks. The study identifies the optimal proportions and firing temperatures to produce BBs suitable for non-loading applications, contributing to both waste reduction and the creation of construction materials.

Textile Industry Effluent Treatment Techniques - Teshale Adane , Amare Tiruneh Adugna , Esayas Alemayehu (2021)

This objective reviews recommends various alternative wastewater treatment systems to be implemented at different stages of the effluent generated from textile operational units. These systems aim to reduce the environmental impact of textile industry wastewater and protect both aquatic ecosystems and human health.

A sustainable development framework for a cleaner multi-item multi-stage textile production system with process improvement initiative - Muhammad Tayyab, Jihed Jemai, Han Lim, Biswajit Sarkar (2019)

This research provides a comprehensive framework for achieving cleaner textile production by balancing efficiency, economic growth, and environmental protection. It highlights the importance of discrete investments and process improvements as strategies to meet sustainability goals while sustaining economic growth within the textile industry.

An Investigation of Lean Manufacturing Implementation in Textile Industries of Pakistan - Zahid Abbass Shah, Hadia Hussain (2017)

This study provides insights into the status of lean implementation in Pakistan's textile industry. It highlights the drivers, benefits, tools, and challenges associated with adopting lean manufacturing practices. The findings can guide textile companies in Pakistan and similar industries in their efforts to improve efficiency and competitiveness through lean principles.

An Overview of Wastes Produced During Cotton Textile Processing and Effluent Treatment Methods - B. Ramesh Babu, A.K. Parande, S. Raghu, T. Prem Kumar (2017)

This review focuses on the cotton textile processing industry and methods for treating effluent in this sector. The textile industry, including countries like India, has faced stricter ecological standards, and more stringent controls are expected in the future. Therefore, it is essential to implement effective measures to minimize effluent-related problems in textile processing.

Potential applications of silk sericin, a natural protein from textile industry by-products - Pornanong Aramwit, Tippawan Siritientong ,Teerapol Srichana (2018)

This objective reviews while fibroin has traditionally been the more recognized and utilized protein in silk, sericin's newfound properties and biocompatibility have opened up exciting possibilities for its use in various biological and industrial applications, particularly in the fields of medicine, cosmetics, and pharmaceuticals.

Low - cost multilayered green fiber for the treatment of textile industry waste water - Mary Lidiya Mathew , Akhil Gopalakrishnan , Charuvila T. Aravindakumar , Usha K. Aravind (2018)

Overall, this study presents an innovative and sustainable approach to water treatment, specifically in the context of the textile industry, by using LbL assembly to create an efficient adsorbent from natural coir fiber for the removal of dyes and other pollutants from water.

Sustainable management of textile and clothing - Chukwuebuka C. Okafor, Christian N. Madu, Charles C. Ajaero , Juliet C. Ibekwe, Chinelo A. Nzekwe (2021)

It underscores the need to transition from a linear model to a more sustainable and circular model for the textile and clothing industry. This transition is essential to mitigate environmental challenges and promote sustainable practices in the sector, with a focus on eco-design and waste management.

Cleaner Production in the textile industry and its relationship to sustainable development goals - Geraldo Cardoso de Oliveira Neto , Jose Manoel Ferreira Correia, Paulo Cesar Silva, Ariane Gaiola de Oliveira Sanches, Wagner Cezar Lucato (2019)

This study underscores the importance of understanding how Cleaner Production practices in the textile industry can contribute to broader sustainability objectives, specifically the United Nations Sustainable Development Goals. The results indicate that Cleaner Production practices not only lead to economic and environmental improvements but also align with specific SDGs related to industry, responsible consumption, and land ecosystems.

Textile Industry 4.0: A Review of Sustainability in Manufacturing - Dr. Bharati Rathore (2023)

The study findings were discussed critically, weighing the advantages and disadvantages of various sustainability initiatives within the textile industry. Additionally, the research emphasized the need for further investigation to better understand best practices in the product life cycle of textiles and to improve production and consumption patterns. The importance of sustainability in the textile industry, highlighting the potential for positive impacts on the environment, economy, and society, while also emphasizing the necessity for continued research and improvement in this area.

Potential Applications of Textile Wastes and By-products in Preparation of Textile Auxiliaries - H. El-Sayed, M. Abou Taleb, S. Mowafi (2021)

The article focuses on the retrieval of waste or by-products during the wet processing of proteinic fibers, such as wool and silk, and proposes different ways to effectively utilize these materials. Three main by-products are examined: keratinous materials, wool wax, and sericin. The review explores the state of the art and future prospects for using these materials in the production of textile auxiliaries, including softeners, binders, and flame-retardants.

Sustainability of the use of natural dyes in the textile industry - K Elshahida , AM Fauzi , I Sailah , I Z Siregar (2019)

This study focus on waste of synthetic dyes from the textile industry causes environmental problems, and it is categorized as hazardous wastes. In contrast, the use of natural dyes is reported to produce fewer pollutants. However, the use of mordant for improving the quality of the dyeing process may release hazardous pollutants because mordant that is commonly used contains heavy metals. In order to claim that the use of natural dyes promotes the sustainable textile industry, it is challenging to find alternative sources of mordant-like materials that are environmental-friendly. It has been reported that tannins could replace mordant for dyeing process using natural dyes. This paper discussed the sustainability of the use of natural dyes in the textile industry based on economic, environmental and social aspects.

Drivers and Barriers to Industrial Energy Efficiency in Textile Industries of Bangladesh - A S M Monjurul Hasan , Mohammad Rokonzaman , Rashedul Amin Tuhin , Shah Md. Salimullah , Mahfuz Ullah , Taiyeb Hasan Sakib , Patrik Thollander (2019)

The study focuses on the textile industry in Bangladesh faces challenges in managing its energy demands efficiently, but there is potential for improvement through the adoption of energy management practices and the involvement of energy professionals. Additionally, the study suggests that better awareness and understanding of energy service companies could be beneficial for the industry.

Exploitation results of seven RO plants for recovery and resume of treated effluents in textile industries - Rita S. Dhodapkar, Girish R. Pophali, Tapas Nandy, Sukumar Devotta (2017)

The case study demonstrates the successful implementation of advanced treatment processes in small-scale textile industries to comply with regulations and reduce environmental impact. The recycling and reuse of treated effluents and the use of purified water for boiler makeup have resulted in substantial water savings for these industries.

Towards sustainable textile sector: Fractionation and separation of cotton/polyester fibers from blended textile waste - May Kahoush , Nawar Kadi (2022)

This article highlights the importance of finding effective ways to separate and recycle cotton/polyester blended textile waste to reduce environmental impacts and promote sustainability in the textile industry. It discusses various separation methods and the challenges involved in implementing these processes at a larger scale.

Implementing circular economy concepts for sustainable urban freight transport: case of textile manufacturing supply chain - Bhavesh Dhonde , Chetan R. Patel (2020)

The article underscores the potential of the circular economy to address the challenges arising from urbanization and industrial growth, with a case study in the textile industry. It demonstrates how circular economy principles, especially when integrated with supply chain processes, can have positive impacts on sustainability, emissions reduction, and traffic management.

Strategies of Recovery and Organic Recycling Used in Textile Waste Management - Irena Wojnowska-Baryła, Katarzyna Bernat , Magdalena Zaborowska (2022)

The article highlights the complexity of managing post-consumer bio-based textile waste and the need for effective sorting and recycling processes. It also underscores the potential for recovering valuable materials and emphasizes the importance of biodegradability, compostability, and innovative recycling techniques to reduce the environmental impact of textile waste.

Indian textile industry-Environmental issues - RB Chavan (2021)

This article provides an overview of the Indian textile industry, highlighting its importance in the Indian economy, its structure, and its environmental impact. It also mentions the response to specific regulations, such as the German ban on azo dyes, and emphasizes other environmental issues that the industry is addressing.

Global trends of textile waste research from 2005 to 2020 using bibliometric analysis - Saraswathy Kasavan, Sumiani Yusoff, Ng Chee Guan, Nur Shakirah Kamarul Zaman, Mohd Fadhli Rahmat Fakri (2021)

This study's bibliometric analysis provides insights into the research trends and developments in textile waste over the specified period. The analysis identified the main research directions by analyzing frequently used keywords in the research papers. "Textile wastewater" and "adsorption" were highlighted as the most commonly used keywords in recent years, indicating their importance and the attention they have received in the field. It highlights the global nature of research, the contributions of various institutions and authors, and the key research directions within the field.

Pilot scale nanofiltration membrane separation for waste management in textile industry - I. Koyuncu, E. Kural , D. Topacik (2021)

This study demonstrates the effectiveness of nanofiltration membranes in treating textile industry dyehouse effluents, with high removal efficiencies for COD and color. The results suggest that this technology could enable the recycling of permeate in the dyehouse, potentially reducing environmental impact and water consumption in the textile industry. Additionally, the economic analysis provides valuable insights into the cost-effectiveness of this approach.

Textile supply chain waste management in China - Xin Li, Laili Wang, Xuemei Ding (2020)

This study provides insights into the challenges and opportunities in waste management within the Chinese textile supply chain, with a focus on pre-consumer waste. That waste management in China is more efficient compared to Cambodia, Vietnam, South Korea, and Myanmar. However, it also highlights that there is significant potential for improvement in waste management in China and these other countries. It highlights the importance of collaboration and investment in improving waste management practices in the industry.

Managing post-industrial textile waste: current status and prospects for Sri Lanka - D. G. K. Dissanayake , Dakshitha Weerasinghe (2020)

It underscores the pressing need for Sri Lanka's apparel manufacturing industry to address post-industrial textile waste issues and move towards more sustainable waste management practices. It also highlights the potential role of global fashion retailers in supporting and incentivizing these changes, both through regulations and financial support. This would not only benefit the environment but also enhance the sustainability and reputation of the industry.

Nanoscience and Biotechnology for Environmental Applications - K M Gothandam , Shivendu Ranjan , Nandita Dasgupta , Eric Lichtfouse (2022)

The study appears to offer insights into innovative approaches and technologies within the field of environmental biotechnology, emphasizing solutions to pressing environmental issues associated with industrial and urban development. The chapters cover a range of topics, from water pollution and waste management to biodegradable materials and enzyme-based applications. It's a valuable resource for researchers, professionals, and students interested in environmental sustainability and biotechnological solutions to environmental challenges.

Opportunities and Conditions for the Development of Green Entrepreneurship in the Polish Textile Sector - Dorota Burzyńska , Małgorzata Jabłońska , Radosław D (2018)

The paper appears to be structured into three main parts: characterizing the concept of green entrepreneurship, presenting the methodology of the survey, and providing the results of the survey conducted among Polish textile industry enterprises. This research can contribute to a better understanding of how green entrepreneurship can be integrated into the textile sector and the potential benefits it may bring in terms of environmental sustainability and economic growth.

A new approach to accomplish wastewater regulation in textile sector: an egyptian case study - F. El-gohary, n. A. Ibrahim, f. Nasr, m. H. Abo-shosha, h. Ali (2022)

The objective discusses the challenges related to water consumption and wastewater in the textile industry and emphasizes the importance of cleaner

production as an alternative to end-of-pipe treatment methods. It presents specific cleaner production opportunities and mentions potential wastewater treatment technologies that can help meet regulatory standards for wastewater discharge. Cleaner production aims to reduce the environmental impact of industrial processes by addressing pollution and resource consumption at the source, which is a more sustainable approach.

The Case of Fabric and Textile Industry: The Emerging Role of Digitalization, Internet-of-Things and Industry 4.0 for Circularity - Malahat Ghoreishi , Ari Happonen (2021)

The focus of the paper is on how the utilization of IoT technology can increase the opportunities for textile circulation within a more effective ecosystem. The primary goal is to maximize the value of products through enhanced data collection, sharing, and awareness. The importance of design, digitalization, and collaboration in transitioning to a circular economy, particularly in the context of the textile industry. It highlights how Industry 4.0 technologies, IoT, and the exchange of real-time data are instrumental in promoting the efficient and sustainable use of resources while increasing product value and extending their lifecycle.

Contribution of traceability towards attaining sustainability in the textile sector - Vijay Kumar , Tarun Kumar Agrawal , Lichuan Wang , Yan Chen (2017)

This paper highlights the importance of sustainability in the textile industry and underscores the need for an efficient traceability system to monitor and enhance sustainability efforts. It acknowledges the complexity of supply chains and the interdependence of ecological, societal, and economic aspects in achieving sustainability goals. It also identifies challenges that need to be addressed for the successful implementation of traceability systems in the industry.

Integrating Product Stewardship into the Clothing and Textile Industry: Perspectives of New Zealand Stakeholders - Lauren M. Degenstein , Rachel H. McQueen , Naomi T. Krogman , Lisa S. McNeill (2023)

It highlights the environmental challenges in the textile industry and the need for a shift towards circularity. It suggests that product stewardship, involving all stakeholders and potential government interventions, is essential for driving this

transformation and reducing the industry's environmental impact. Furthermore, it highlights the importance of customizing product stewardship approaches to regional and local contexts.

Textile industry's environmental effects and approaching cleaner production and sustainability, an overview - Tuba Toprak, Pervin Anis (2017)

The paper highlights the influence of public awareness and societal consciousness on the textile industry, pushing for more environmentally friendly production practices. It emphasizes key factors for creating sustainable textiles and the need to address environmental effects in detail. Furthermore, it suggests that discussions on opportunities for change, in accordance with environmental laws, are essential for promoting cleaner production and sustainability within the textile industry.

An overview on corporate response towards sustainability issues in textile industry - Anupriya Desore , Sapna A. Narula (2019)

The study focus the importance of incorporating sustainability into the textile industry due to its significant environmental impact. It reviews the existing literature, discusses key aspects related to drivers and barriers, and points out areas where further research is needed, particularly in understanding managerial perspectives on sustainability and new technologies. This research is crucial for addressing the ecological challenges associated with textile production.

Decoupling Water Consumption and Environmental Impact on Textile Industry by Using Water Footprint Method: A Case Study in China - Yi Li , Linyi Lu , Yingxi Tan , Laili Wang , Manhong Shen (2017)

It discusses factors influencing the water footprint and suggests that the total water footprint increased with the scale of production. However, the technical level in the industry played a critical role in inhibiting the water footprint. Adjustments in the industrial structure had a relatively weaker effect. It highlights China's efforts to address water consumption and pollution challenges in the textile industry through sustainable development initiatives. It discusses the calculation of water footprints, the relationship between water use and economic growth, and the factors influencing water footprints. The goal is to achieve sustainable economic growth with a reduced environmental impact related to water usage and pollution.

Identifying potential environmental impacts of waste handling strategies in textile industry - Dalia M. M. Yacout , M. S. Hassouna (2018)

The objective of the study highlights the importance of waste management in the textile industry and the need to assess its environmental impacts. It concludes that shifting from landfill to incineration could reduce environmental impacts and allow for energy recovery, while emphasizing the need for further research in this area, especially in developing countries.

Emerging trends to Approaching Zero Waste - Chaudhery Mustansar, Sunpreet Singh, Lalit Goswami (2022)

This paper highlights the shift towards net zero waste buildings in the construction sector. The adoption of the 3Rs approach, along with other emerging trends and practices, is helping to reduce waste, minimize environmental impact, and promote sustainability in building construction. The transition from a linear model of waste disposal to more circular and sustainable models is a significant step in achieving these goals.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 METHODOLOGY:

Research methodology is mainly needed for the purpose of framing the research process and the designs and tools that are to be used for the project purpose. Designing a methodology for a study on understanding waste reduction and optimization techniques followed by textile industries involves several key steps. Provide an overview of the textile industry and its environmental impact. Understanding waste reduction and optimization techniques. Clearly state the objectives of the study. It aims to provide a holistic understanding of waste reduction and optimization techniques in the textile industry, incorporating a mix of quantitative and qualitative data to ensure a comprehensive analysis.

3.2 RESEARCH DESIGN:

QUALITATIVE RESEARCH DESIGN

Qualitative research involves gathering and examining non-numerical data, which includes observational data, focus group transcripts, and interview transcripts. These types of data are frequently utilized to investigate detailed subjects or gain perspective on the experiences of individuals or groups.

3.3 SAMPLING TECHNIQUE:

PROBABILITY SAMPLING

Every person in the population has an equal chance of getting chosen when using probability sampling. Since it yields the most representative samples, this kind of sampling is frequently employed in research investigations. Cluster sampling is selected under probability sampling.

Cluster sampling is a method, in which the participant groups are chosen from the population.

3.4 SOURCES OF DATA:

A place where data is generated or stored is called a data source. There are two categories of data sources, primary and secondary data. A combination of primary and secondary data is used for research purposes.

- **PRIMARY DATA SOURCES**

Primary data are those from which fresh information is initially gathered. A variety of methods, including surveys, interviews, focus groups, experiments, and observations, can be used to gather primary data. A questionnaire is being used to collect primary data for the research purposes.

- **SECONDARY DATA SOURCES**

Secondary data are those that include information that has previously been gathered by another party. A range of sources, including government data, industry reports, scholarly publications, news articles, and online articles, can be used to gather secondary data.

3.5. STRUCTURE OF QUESTIONNAIRE:

Questionnaire was divided into two sections. First part was designed to know the general information about various waste reduction and optimizational techniques and the second part contained the respondent's opinions about various waste reduction and optimizational techniques followed by textile industries

- Basic Introduction
- Personal Details
- Research related Questions
- Perception Questions
- Likert Scaling Questions
- Suggestion Question

3.6. SAMPLE SIZE:

The sample size for this research project is 131

3.7. SAMPLE DESIGN:

The process of choosing a subset of a population to represent the entire population is known as sample design. It is an essential stage in any research project since it can greatly affect the validity and dependability of the findings. Probability sampling and non-probability sampling are the two categories of sample design. Cluster sampling under probability sampling is being utilized in the study.

SAMPLING

- Sampling Design : Probability Sampling
- Sampling Techniques : Cluster Sampling
- Sample Unit : Employees
- Sample Size : 131 Respondents

3.8. PERIOD OF STUDY:

The period of the study is to determine the research process is carried out for 3 months.

3.9. AREA OF THE STUDY:

The targeted people are the employees under textile industries.

3.10. HYPOTHESIS:

HYPOTHESIS 1

- **H0:** There is no significant association between gender and the preferred methods or principles employed for waste management.

- **H1:** There is a significant association between gender and the preferred methods or principles employed for waste management.

HYPOTHESIS 2

- **H0:** The average monthly waste generated by projects is within the range of 1000 to 1500 tons.
- **H1:** The average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

3.11. TOOLS FOR ANALYSIS:

A questionnaire was created to get the response from the sample required to achieve the research objective. Following are the tools used for data analysis.

3.12. PERCENTAGE ANALYSIS:

Analyzing data by representing it as a percentage of a total is known as percentage analysis. It is an effective tool for comparing many data points and discovering similarities. When it is essential to know how many of the participants gave a specific answer, percentage analysis is appropriate.

3.13. ANALYTICAL TOOLS:

SPSS tool is used to test hypothesis.

CORRELATION

Correlation is a statistical technique that shows how strongly two variables are related to each other or the degree of association between the two. For example, if we have the weight and height data of taller and shorter people, with the correlation between them, we can find out how these two variables are related.

CHI-SQUARE

The chi-square test is a statistical analysis tool used to determine whether there is a significant relationship between two categorical variables. It is a non-parametric test, meaning it does not make any assumptions about the underlying distribution of the data. The chi-square test is based on the comparison of observed frequencies to expected frequencies. The observed frequencies are the actual counts of the data, while the expected frequencies are the counts we would expect to see if there were no relationship between the two variables.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1. PERCENTAGE ANALYSIS

4.1.1. GENDER OF RESPONDENTS

S.NO	GENDER	NO.OF.RESPONDENTS	PERCENTAGE ANALYSIS
1	MALE	119	91%
2	FEMALE	12	9%
TOTAL		131	100%

CHART

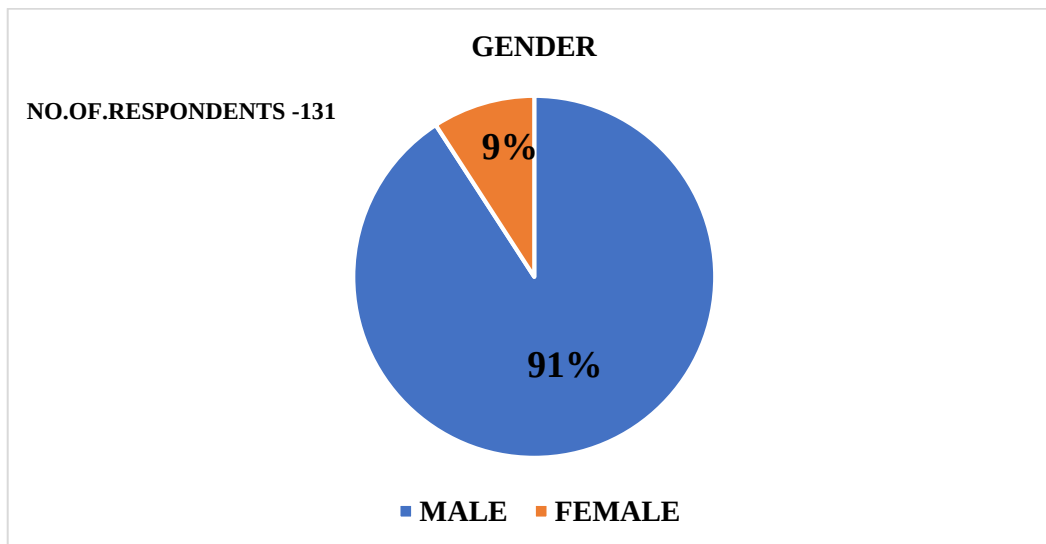


FIG.4.1.1. Gender of respondents

INTERPRETATION

91% of respondents were given by male employees and 9% were given by female Employees.

INFERENCE

Majority i.e., 91% of the response were given by male employees.

4.1.2. AGE GROUP YOU BELONG TO

S.NO	AGE GROUP YOU BELONG TO	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Below 20	3	2%
2	20 to 35	70	53%
3	35 to 45	27	21%
4	Above 45	31	24%
TOTAL		131	100%

CHART

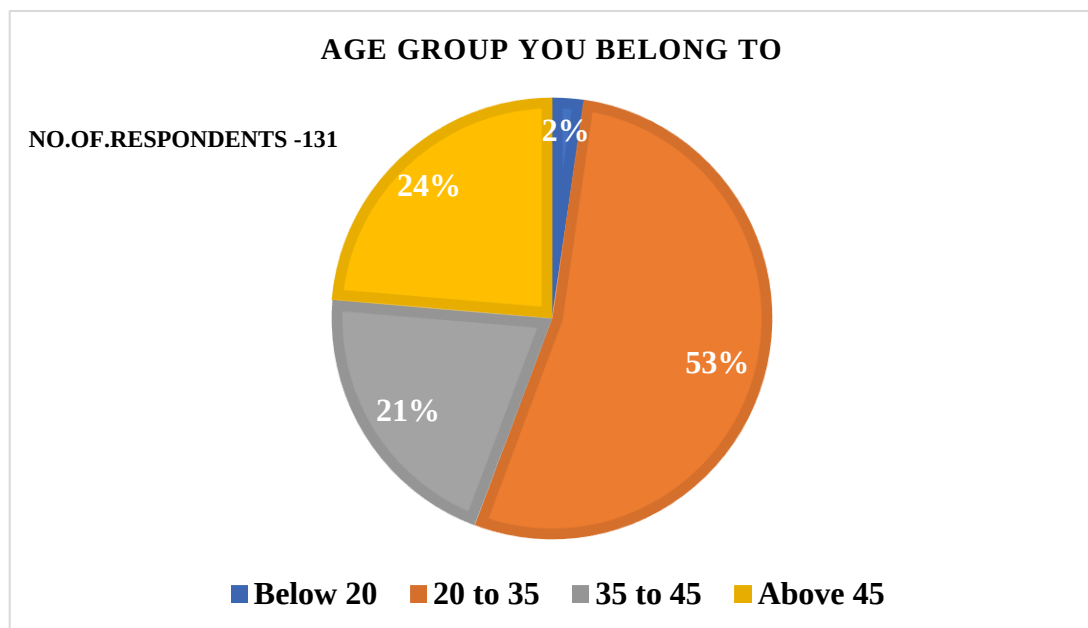


FIG.4.1.2. Age group you belong to

INTERPRETATION

The respondents., 2% of employees were between the age group of Below 20, 53% of the employees were between the age group of 20 to 35, 21% of the employees

were between the age group of 35 to 45, and 24% of the employees were above 45 years.

INFERENCE

Most responses, i.e., 53%, were given by employees in the age group of 20 to 35.

4.1.3. HOW MUCH YEARS OF EXPERIENCE DO YOU HAVE IN THIS FIELD

S.NO	HOW MUCH YEARS OF EXPERIENCE DO YOU HAVE IN THIS FIELD	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	0 to 5	53	40%
2	5 to 10	19	15%
3	10 to 15	35	27%
4	More than 15	24	18%
TOTAL		131	100%

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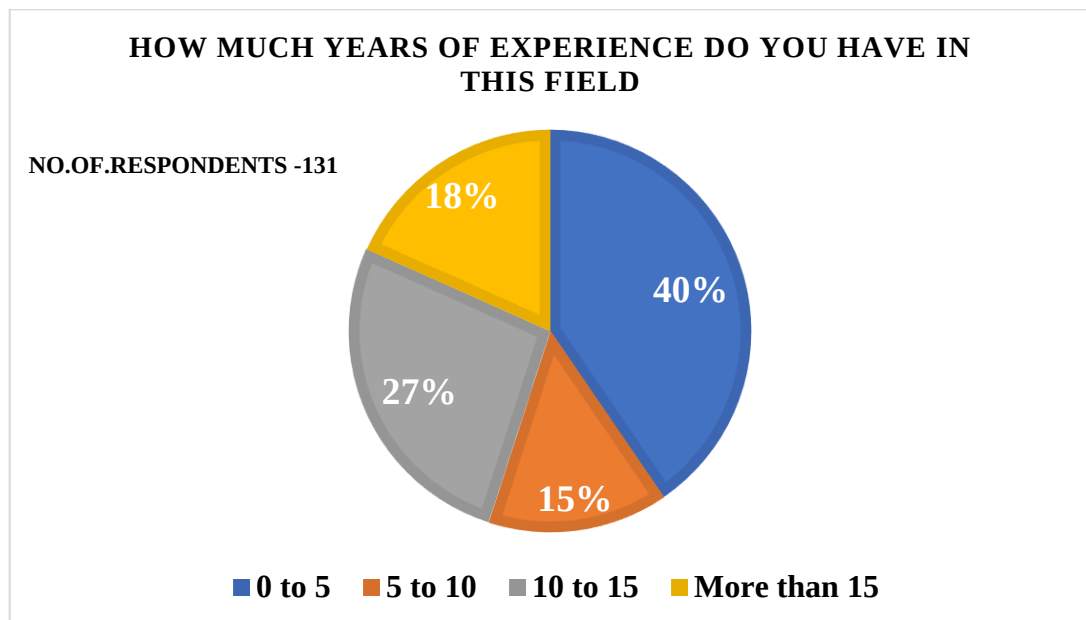


FIG.4.1.3. How much years of experience do you have in this field

INTERPRETATION

The respondents., 40% of employees with years of experience between 0 to 5, 15% of the employees with years of experience between 5 to 10, 27% employees with years of experience between 10 to 15, and 18% of the employees with years of experience above 15 years.

INFERENCE

Most responses, i.e., 40%, were given by employees with years of experience between 0 to 5.

4.1.4. COMPANY LOCATION

S.NO	COMPANY LOCATION	NO.OF.RESPONDENTS	PERCENTAGE ANALYSIS
1	Urban	47	35.9
2	Rural	38	28.2
3	Semi Urban	43	32.8
4	Others	3	
TOTAL		131	100%

CHART

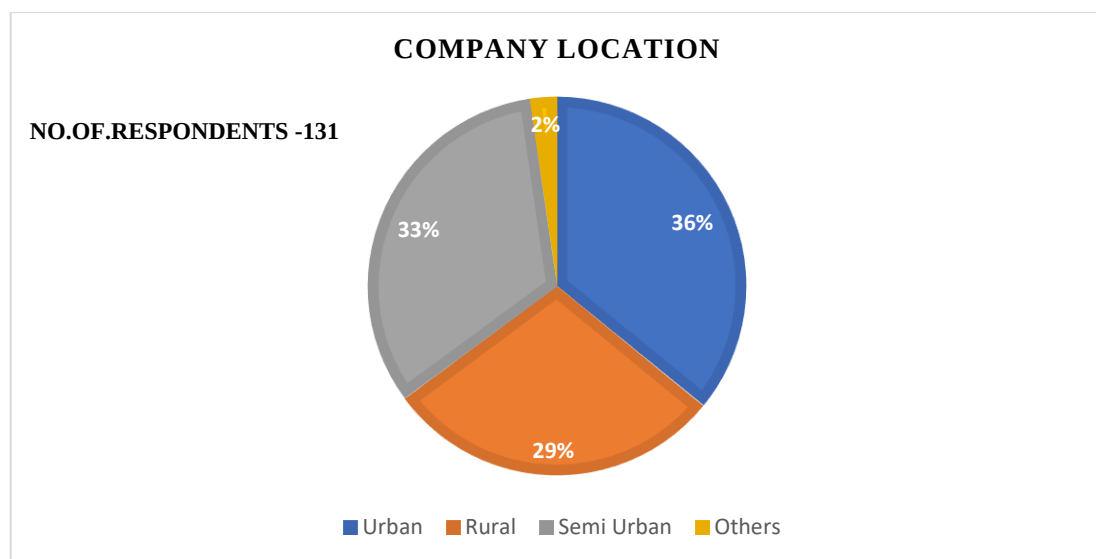


FIG.4.1.4. Company location

INTERPRETATION

The respondents, 35.9% of employees Company location is urban, 28.2% of the employees Company location is rural, 32.8% of employees Company location is Semi Urban, and 2% of the employees Company location is others.

INFERENCE

Most responses, i.e., 35.9%, were given by employees Company location is Urban.

4.1.5. TYPES OF WASTE GENERATED

S.NO	TYPES OF WASTE GENERATED	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Plastic	79	21%
2	Metal	31	9%
3	Paper	64	17%
4	Medical	8	2%
5	Organics	50	14%
6	Glass	26	7%
7	Batteries	12	3%
8	Water	71	19%
9	Cotton	31	8%
TOTAL		131	100%

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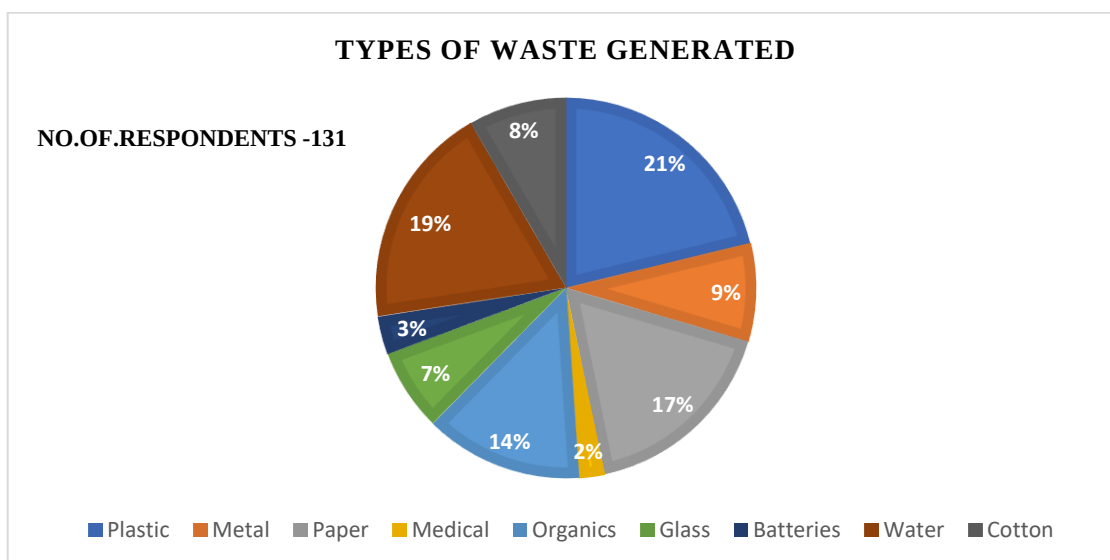


FIG.4.1.5. Types of waste generated

INTERPRETATION

The respondents, response for types of waste generated are 21% of plastic, 9% of metal, 17% of paper, 2% of medical, 14% of organic, 7% of glass, 3% of batteries, 19% of water and 8% of cotton.

INFERENCE

Most responses, i.e., 21% of plastic waste.

4.1.6. DOES YOUR COMPANY FOLLOW ANY WASTE MANAGEMENT PROCEDURE

S.NO	DOES YOUR COMPANY FOLLOW ANY WASTE MANAGEMENT PROCEDURE	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Yes	119	90.8
2	No	12	9.2
TOTAL		131	100%

CHART

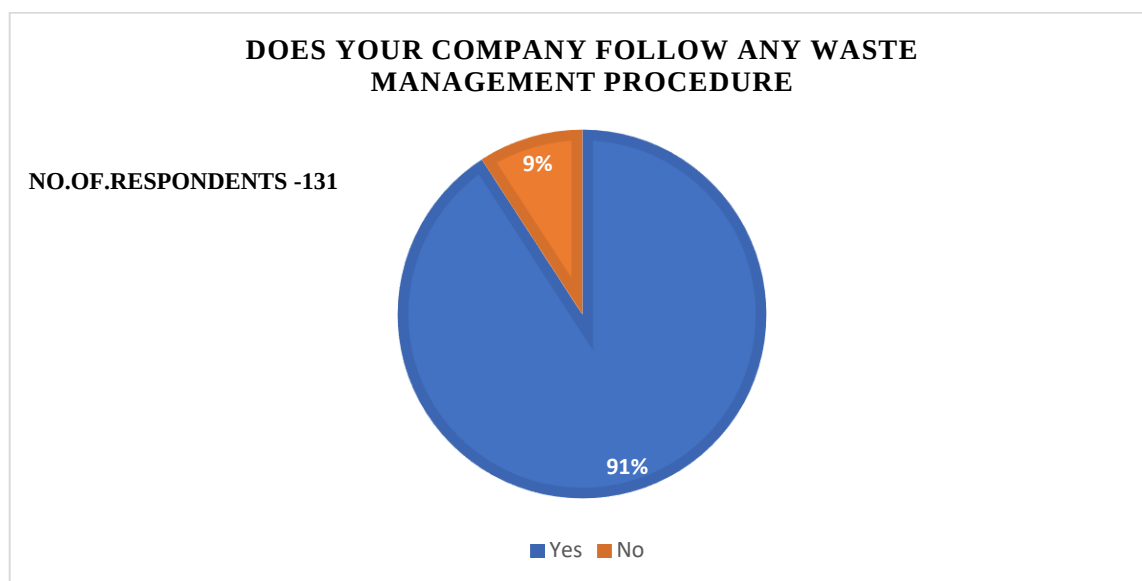


FIG.4.1.6. Does your company follow any waste management procedure

INTERPRETATION

The respondents, response for waste management procedure followed 91% for yes and 9% for no.

INFERENCE

Most response, for waste management procedure followed is 91% for yes.

4.1.7. WHAT METHODS OR PRINCIPLES DO YOU FOLLOW FOR WASTE MANAGEMENT

S.NO	WHAT METHODS OR PRINCIPLES DO YOU FOLLOW FOR WASTE MANAGEMENT	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Regeneration	35	27%
2	Composting	12	9%
3	Textile with technical application	58	44%

4	Source Reduction	11	9%
5	Dumping ground	11	8%
6	Others	4	3%
TOTAL		131	100%

CHART

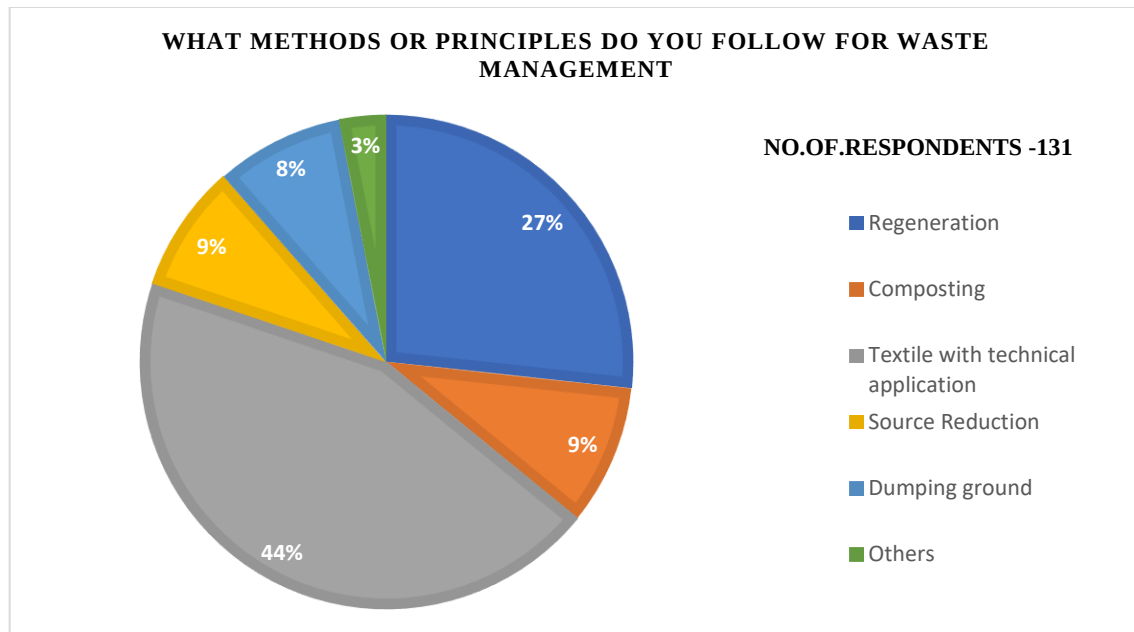


FIG.4.1.7. What methods or principles do you follow for waste management

INTERPRETATION

The respondents, for Methods or Principles do you follow for waste management 27% of regeneration, 9% of composting, 44% of textile with technical application, 9% of source reduction, 8% of dumping ground and 3% of others.

INFERENCE

Most response, for Methods or Principles do you follow for waste management is 44% for textile with technical application.

4.1.8. WHAT MEASURES DO YOU TAKE TO PROMOTE SUSTAINABILITY AND ENVIRONMENTAL RESPONSIBILITY IN YOUR TEXTILE PRODUCTION PROCESSES

S.NO	WHAT MEASURES DO YOU TAKE TO PROMOTE SUSTAINABILITY AND ENVIRONMENTAL RESPONSIBILITY IN YOUR TEXTILE PRODUCTION PROCESSES	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Use of eco-friendly dyes and chemicals	66	50%
2	Water and energy conservation	51	39%
3	Carbon footprint reduction initiatives	6	5%
4	Others	8	6%
TOTAL		131	100%

CHART

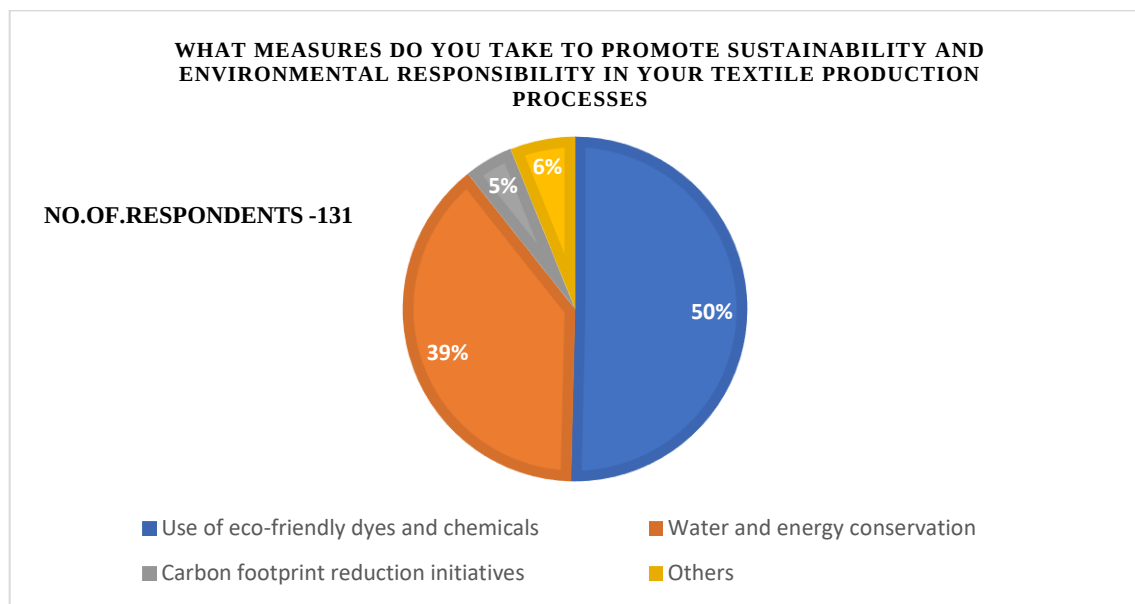


FIG.4.1.8. What measures do you take to promote sustainability and environmental responsibility in your textile production processes

INTERPRETATION

The respondents, for measures do you take to promote sustainability and environmental responsibility in your textile production processes 50% of Use of eco-friendly dyes and chemicals, 39% of Water and energy conservation, 5% of Carbon footprint reduction initiatives, 6% of others.

INFERENCE

Most response, for measures do you take to promote sustainability and environmental responsibility in your textile production processes is 50% of Use of eco-friendly dyes and chemicals.

4.1.9. HOW MUCH AMOUNT DOES YOUR ORGANIZATION INVEST ON IMPLEMENTING WASTE MANAGEMENT PROCEDURE IN ESTIMATE

S.NO	HOW MUCH AMOUNT DOES YOUR ORGANIZATION INVEST ON IMPLEMENTING WASTE MANAGEMENT PROCEDURE IN ESTIMATE	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	10 to 25 lakhs	38	29%
2	25 to 50 lakhs	21	16%
3	50 to 75 lakhs	14	11%
4	75 to 100 lakhs	42	32%
5	More than 1 Crore	16	12%
TOTAL		131	100%

CHART

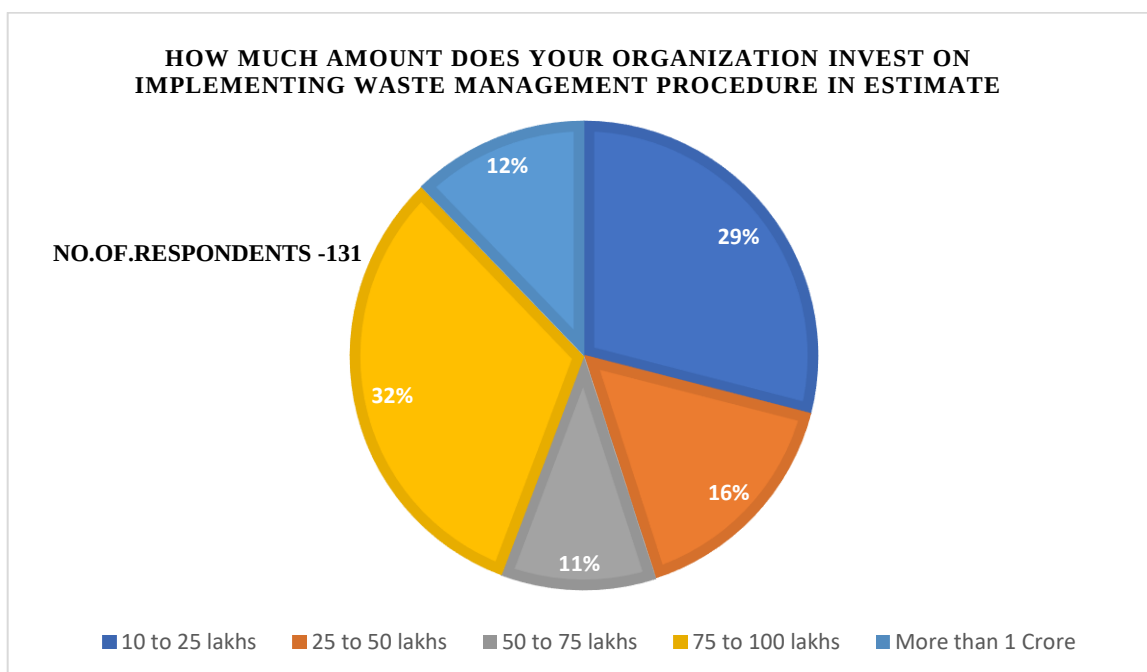


FIG.4.1.9. How much amount does your organization invest on implementing waste management procedure in estimate

INTERPRETATION

The respondents, for how much amount does your organization invest on implementing waste management procedure in estimate 29% of 10 to 25 lakhs, 16% of 25 to 50 lakhs, 11% of 50 to 75 lakhs, 32% of 75 to 100 lakhs, 12% of More than 1 Crore.

INFERENCE

Most response, for how much amount does your organization invest on implementing waste management procedure in estimate 32% of 75 to 100 lakhs.

4.1.10. ON AVERAGE HOW MUCH WASTE DOES YOUR PROJECT GENERATE ON A MONTHLY BASIS

S.NO	ON AVERAGE HOW MUCH WASTE DOES YOUR PROJECT GENERATE ON A MONTHLY BASIS	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Less than 500 tones	47	36%
2	500 to 1000 tones	20	15%
3	1000 to 1500 tones	54	41%
4	1500 to 2000 tones	7	6%
5	More than 2000 tones	3	2%
TOTAL		131	100%

CHART

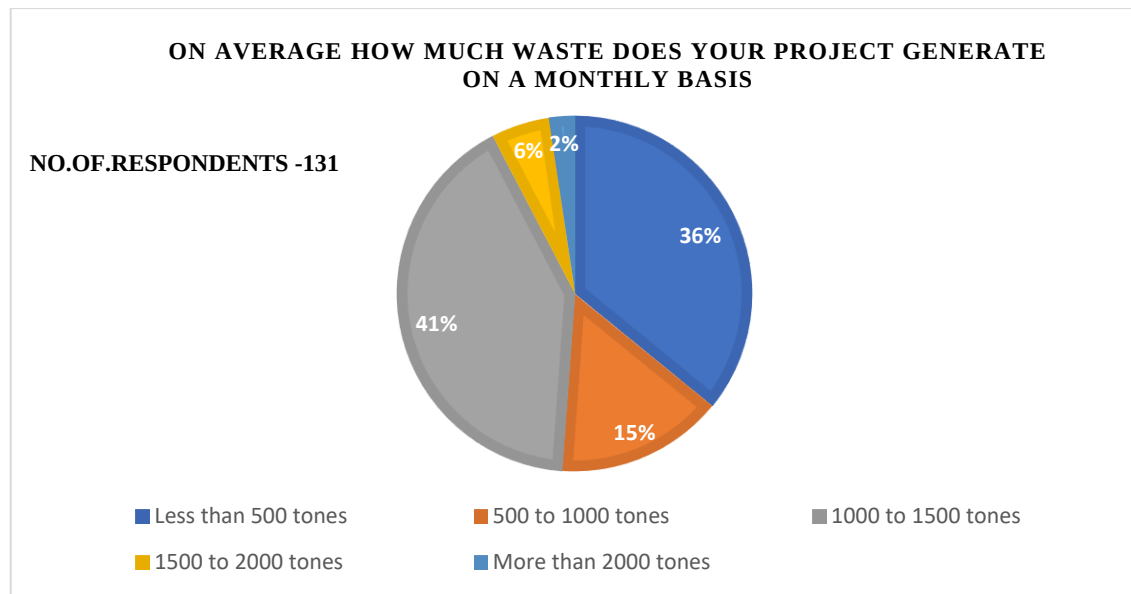


FIG.4.1.10. On average how much waste does your project generate on a monthly basis

INTERPRETATION

The respondents On average how much waste does your project generate on a monthly basis 36% of Less than 500 tones, 15% of 500 to 1000 tones, 41% of 1000 to 1500 tones, 2% of 1500 to 2000 tones, 2% of More than 2000 tones.

INFERENCE

Most response, on average how much waste does your project generate on a monthly basis 41% of 1000 to 1500 tones.

4.1.11. HOW IS WASTE COLLECTED AND MANAGED IN YOUR ORGANIZATION

S.NO	HOW IS WASTE COLLECTED AND MANAGED IN YOUR ORGANIZATION	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	On-site waste treatment and recycling	76	58%
2	Off-site waste collection and disposal	19	14%
3	Combination of on-site and off-site	35	27%
4	Others	1	1%
TOTAL		131	100%

CHART

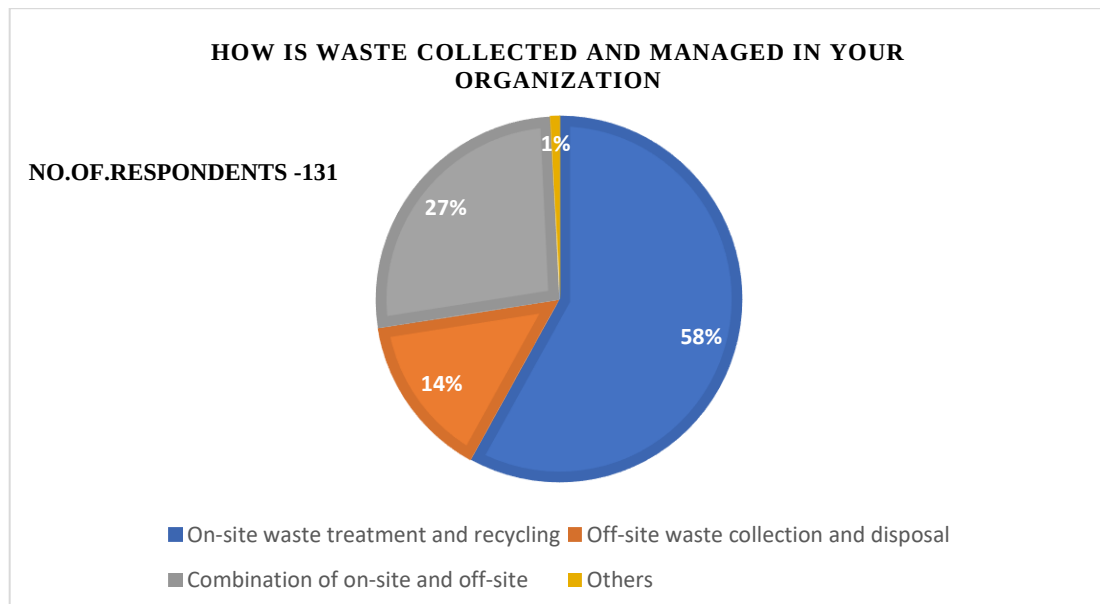


FIG.4.1.11. How is waste collected and managed in your organization

INTERPRETATION

The respondents on how is waste collected and managed in your Organization 58% of On-site waste treatment and recycling, 14% of Off-site waste collection and disposal, 27% of Combination of on-site and off-site, 1% of others.

INFERENCE

Most response, on how is waste collected and managed in your Organization 58% of On-site waste treatment and recycling.

4.1.12. ARE YOU SATISFIED WITH YOUR CURRENT WASTE MANAGEMENT PROCESS

S.NO	ARE YOU SATISFIED WITH YOUR CURRENT WASTE MANAGEMENT PROCESS	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Satisfied	119	91%
2	Not Satisfied	12	9%
TOTAL		131	100%

CHART

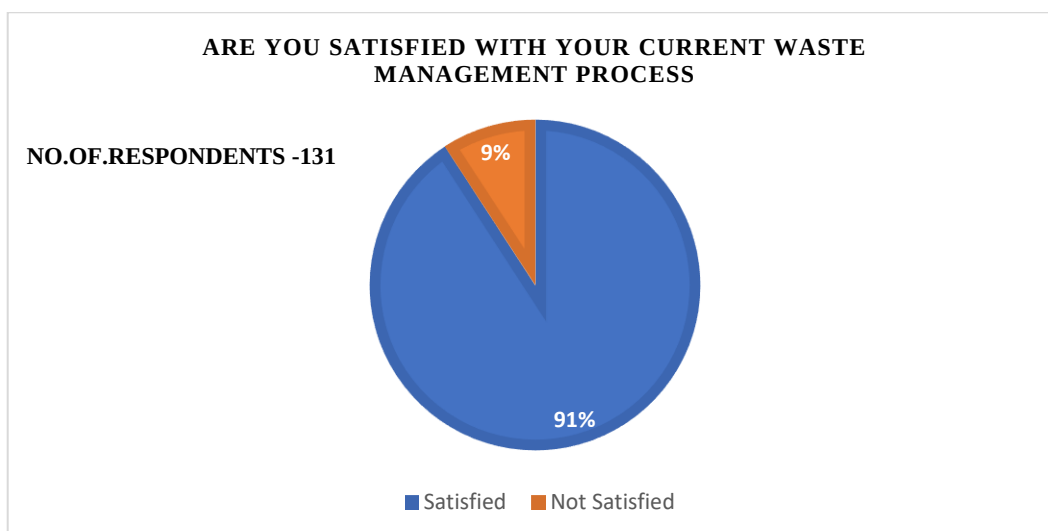


FIG.4.1.12. Are you satisfied with your current waste management process

INTERPRETATION

The respondents on are you satisfied with your current waste management Process 91% of satisfied and 9% of not satisfied.

INFERENCE

Most response, on are you satisfied with your current waste management Process 91% of satisfied.

4.1.13. WHAT EFFORTS HAVE YOU MADE IN WASTE MANAGEMENT TO CONTROL THE OFFENSIVE

S.NO	WHAT EFFORTS HAVE YOU MADE IN WASTE MANAGEMENT TO CONTROL THE OFFENSIVE	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Recycling	84	64%
2	Provide waste Disposal	21	16%
3	Biological Treatment	24	18%
4	Others	2	2%
TOTAL		131	100%

CHART

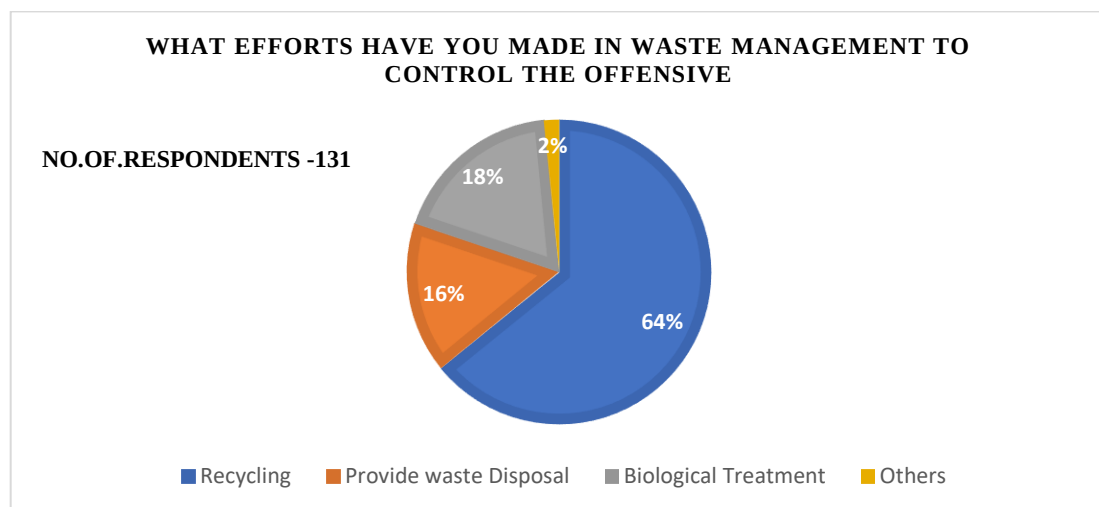


FIG.4.1.13. What efforts have you made in waste management to control the offensive

INTERPRETATION

The respondents on what efforts have you made in waste management to control the offensive 64% of Recycling, 16% of Provide waste Disposal, 18% of Biological Treatment and 2% of others.

INFERENCE

Most response, on what efforts have you made in waste management to control the offensive 64% of recycling.

4.1.14. HOW MANY WASTE COLLECTION POINTS DO YOU HAVE IN YOUR LOCALITY

S.NO	HOW MANY WASTE COLLECTION POINTS DO YOU HAVE IN YOUR LOCALITY	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	1 to 2	49	37%
2	3 to 4	27	21%
3	5 to 6	31	24%
4	more than 6	24	18%
TOTAL		131	100%

CHART

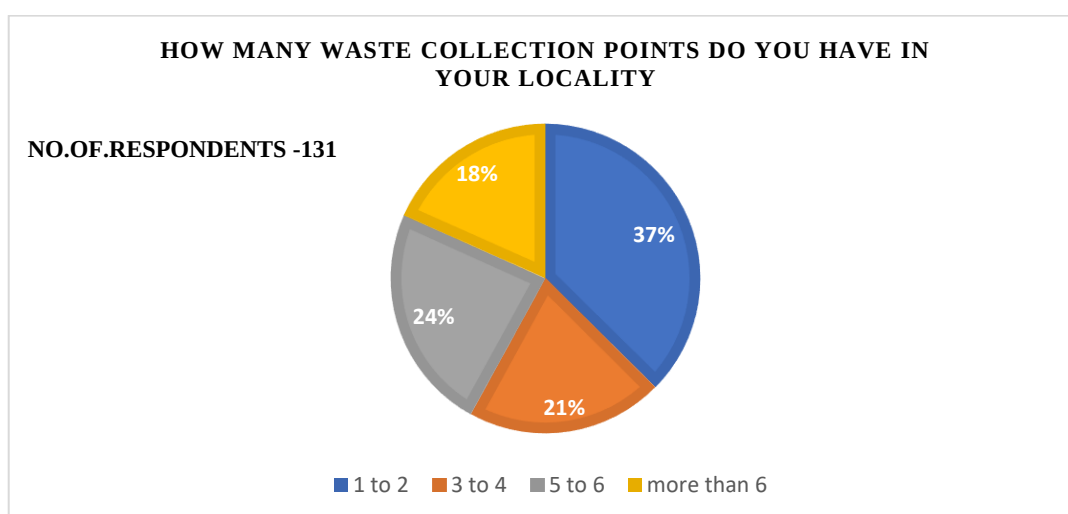


FIG.4.1.14. How many waste collection points do you have in your locality

INTERPRETATION

The respondents on how many waste collection points do you have in your locality 37% of 1 to 2, 21% of 3 to 4, 24% of 5 to 6 and 18% of more than 6.

INFERENCE

Most response, on how many waste collection points do you have in your locality 37% of 1 to 2.

4.1.15. HOW OFTEN DOES ENVIRONMENT SANITATION TAKES PLACE IN YOUR LOCALITY

S.NO	HOW OFTEN DOES ENVIRONMENT SANITATION TAKES PLACE IN YOUR LOCALITY	NO.OF. RESPONDENTS	PERCENTAGE ANALYSIS
1	Once per week	65	50%
2	Once in 2 weeks	43	33%
3	Once in 3 weeks	20	15%
4	Never	3	2%
TOTAL		131	100%

CHART

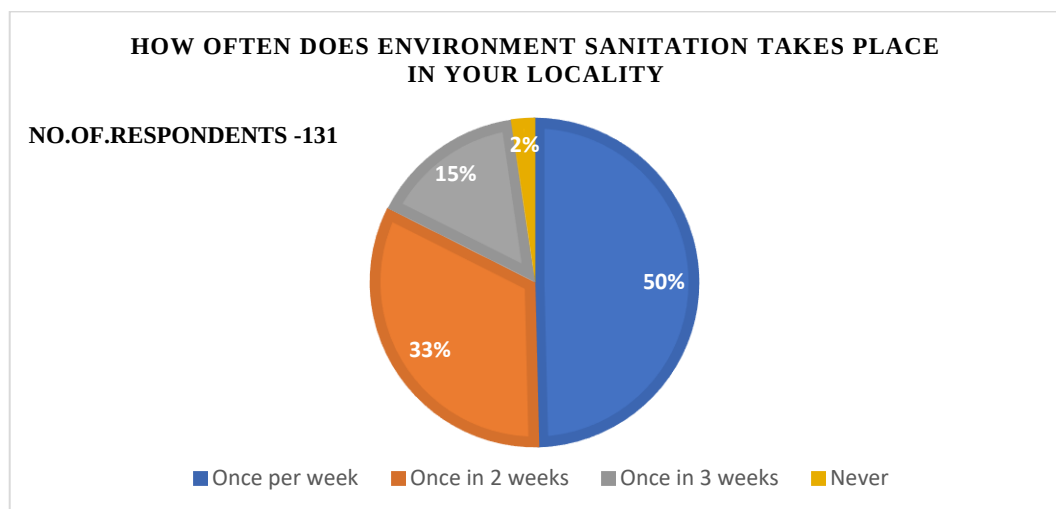


FIG.4.1.15. How often does environment sanitation takes place in your locality

INTERPRETATION

The respondents on how often does environment sanitation takes place in your locality 50% of Once per week, 33% of Once in 2 weeks, 15% of Once in 3 weeks and 2% of never.

INFERENCE

Most response, on how often does environment sanitation takes place in your locality 50% of Once per week.

4.2. CHI SQUARE

HYPOTHESIS 1

- **H0:** There is no significant association between gender and the preferred methods or principles employed for waste management.
- **H1:** There is a significant association between gender and the preferred methods or principles employed for waste management.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * WhatMethodsorPrinciples doyoufollowforwaste management	131	100.0%	0	0.0%	131	100.0%

Gender * WhatMethodsorPrinciplesdoyoufollowforwastemanagement
Crosstabulation

			WhatMethodsorPrinciplesdoyoufollowforwastemanagement									Total
			Composting	Dumping grounds	Except dumping ground we are using/applying all the above techniques	Recycling of all the wastes.	Regeneration	Segregation of wet& dry waste& dispose	Source Reduction	Textiles with technical applications	Waste Recycling and reuse them in production	
Gender	Female	Count	2	0	0	0	6	0	1	3	0	12
		Expected Count	1.1	1.0	.1	.1	3.2	.1	1.0	5.3	.1	12.0
	Male	Count	10	11	1	1	29	1	10	55	1	119
		Expected Count	10.9	10.0	.9	.9	31.8	.9	10.0	52.7	.9	119.0
Total		Count	12	11	1	1	35	1	11	58	1	131
		Expected Count	12.0	11.0	1.0	1.0	35.0	1.0	11.0	58.0	1.0	131.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.114 ^a	8	.634
Likelihood Ratio	7.034	8	.533
N of Valid Cases	131		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is .09.

INTERPRETATION

The p value is 0.634 which is greater than the significance value (0.05) hence null hypothesis H₀ is accepted. And H₁ is rejected

INFERENCE

There is no significant association between gender and the preferred methods or principles employed for waste management.

4.3. CORRELATION

HYPOTHESIS 2

- **H0:** The average monthly waste generated by projects is within the range of 1000 to 1500 tons.
- **H1:** The average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

Correlations

		How much amount does your organization invest on implementing waste management procedure in estimate	On average how much waste does your project generate on a monthly basis
How much amount does your organization invest on implementing waste management procedure in estimate	Pearson Correlation Sig. (2-tailed) N	1 131	-.333** .000 131
On average how much waste does your project generate on a monthly basis	Pearson Correlation Sig. (2-tailed) N	-.333** .000 131	1 131

** . Correlation is significant at the 0.01 level (2-tailed).

INTERPRETATION

The p value is -0.333 which is less than the significance value (0.05) hence alternative hypothesis H1 is accepted. Therefore the average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

INFERENCE

The average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

CHAPTER 5

FINDINGS, SUGGESTIONS AND CONCLUSION

5.1. FINDINGS

- Majority i.e., 91% of the response were given by male employees.
- Most responses, i.e., 53%, were given by employees in the age group of 20 to 35.
- Most responses, i.e., 40%, were given by employees with years of experience between 0 to 5.
- Most responses, i.e., 35.9%, were given by employees Company location is Urban.
- Most responses, i.e., 21% of plastic waste.
- Most response, for waste management procedure followed is 91% for yes.
- Most response, for Methods or Principles do you follow for waste management is 44% for textile with technical application.
- Most response, for measures do you take to promote sustainability and environmental responsibility in your textile production processes is 50% of Use of eco-friendly dyes and chemicals.
- Most response, for how much amount does your organization invest on implementing waste management procedure in estimate 32% of 75 to 100 lakhs.
- Most response, on average how much waste does your project generate on a monthly basis 41% of 1000 to 1500 tones.
- Most response, on how is waste collected and managed in your Organization 58% of On-site waste treatment and recycling.
- Most response, on are you satisfied with your current waste management Process 91% of satisfied.
- Most response, on what efforts have you made in waste management to control the offensive 64% of recycling.
- Most response, on how many waste collection points do you have in your locality 37% of 1 to 2.

- Most response, on how often does environment sanitation takes place in your locality 50% of Once per week.
- By using chi square for finding the relation between gender and what Methods or Principles do you follow for waste management The p value is 0.634 which is greater than the significance value (0.05) hence null hypothesis H_0 is accepted and H_1 is rejected. There is no significant association between gender and the preferred methods or principles employed for waste management.
- By using correlation for finding the relation between how much amount does your organization invest on implementing waste management procedure in estimate and On average how much waste does your project generate on a monthly basis. The p value is -0.333 which is less than the significance value (0.05) hence alternative hypothesis H_1 is accepted. Therefore the average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

5.2. SUGGESTIONS

- Conduct surveys and interviews with professionals in the textile industry to gather first-hand information. Insights from industry experts, managers, and employees can provide valuable perspectives on the challenges and opportunities associated with waste reduction and optimization.
- Begin with an extensive literature review to understand the existing knowledge and research gaps in waste reduction and optimization within the textile industry. This will provide a solid foundation for your study and help you identify areas that require further exploration.
- Include case studies of specific textile companies that have successfully implemented waste reduction and optimization techniques. These real-world examples can offer practical insights, challenges faced, and lessons learned, providing a richer context for your research.
- Explore emerging technologies and innovations that have the potential to revolutionize waste reduction and optimization in the textile industry. This

could include advancements in recycling, material efficiency, and sustainable manufacturing processes.

- Conclude your study with a forward-looking section that outlines potential future trends, challenges, and recommendations for the textile industry to further enhance waste reduction and optimization practices.

5.3. CONCLUSION

In conclusion, the study on understanding the various waste reduction and optimization techniques followed by textile industries provides valuable insights into the sustainable practices within this sector. The research delved into the methods employed by textile companies to minimize waste generation and optimize their processes. Here are some key conclusions drawn from the study

- The textile industry employs a diverse range of waste reduction techniques, including regeneration, composting, utilization of textiles with technical applications, source reduction, and potentially other innovative methods.
- A significant finding is the identification of whether companies have established waste management procedures. This highlights the importance of organizational strategies in fostering sustainable practices within the textile industry.
- The research may identify areas where textile industries can further enhance their waste reduction and optimization practices. This could involve recommending the adoption of specific techniques that have proven to be effective or suggesting improvements to existing procedures.
- Assessing the various techniques employed by textile industries contributes to understanding their environmental impact. Sustainable practices not only benefit companies by reducing costs but also contribute positively to the overall ecological footprint of the industry.

The study adds valuable knowledge to the field of sustainable practices in the textile industry, offering a foundation for further research and potentially influencing industry practices and policies towards a more environmentally friendly and efficient future.

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ANNEXURE I – QUESTIONNAIRE

A study on understanding the various waste reduction and optimizational techniques followed by textile industries

- 1) Name of the candidate
- 2) Gender
 - Male
 - Female
- 3) Age group you belong to
 - Below 20
 - 20 to 35
 - 35 to 45
 - Above 45
- 4) How much years of experience do you have in this field
 - 0 to 5
 - 5 to 10
 - 10 to 15
 - More than 15
- 5) Company location
 - Urban
 - Rural
 - Semi Urban
 - Other....

6) Types of waste generated

- Plastic
- Metal
- Paper
- Medical
- Organics
- Glass
- Batteries
- Water
- Other...

7) Does your company have any waste management procedure

- Yes
- No

8) What Methods or Principles do you follow for waste management

- Regeneration
- Composting
- Textiles with technical applications
- Source Reduction
- Dumping grounds
- Other....

9) What measures do you take to promote sustainability and environmental responsibility in your textile production processes

- Use of eco-friendly dyes and chemicals
- Water and energy conservation
- Carbon footprint reduction initiatives
- Others

10)How much amount does your organization invest on implementing waste management procedure in estimate

- 10 to 25 lakhs
- 25 to 50 lakhs
- 50 to 75 lakhs
- 75 to 100 lakhs
- More than 1 Crore

11)On average how much waste does your project generate on a monthly basis

- Less than 500 tones
- 500 to 1000 tones
- 1000 to 1500 tones
- 1500 to 2000 tones
- More than 2000 tones

12)How is waste collected and managed in your Organization

- On-site waste treatment and recycling
- Off-site waste collection and disposal
- Combination of on-site and off-site
- Other....

13)Are you satisfied with your current waste management Process

- Satisfied
- Not satisfied

14)What efforts have you made in waste management to control the offensive

- Recycling
- Provide waste Disposal
- Biological Treatment
- Other...

15)How many waste collection points do you have in your locality

- 1 to 2
- 3 to 4
- 5 to 6
- more than 6

16)How often does environment sanitation takes place in your locality

- Once per week
- Once in 2 weeks
- Once in 3 weeks
- Never

ANNEXURE II - RESEARCH ARTICLE

A STUDY ON UNDERSTANDING THE VARIOUS WASTE REDUCTION AND OPTIMIZATIONAL TECHNIQUES FOLLOWED BY TEXTILE INDUSTRIES

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ABSTRACT

The textile industry is known for its significant environmental impact, primarily due to high resource consumption and waste generation. This study aims to explore and analyze the waste reduction and optimization techniques employed by textile industries to mitigate their environmental footprint. The research encompasses a comprehensive review of current practices, technological advancements, and sustainable approaches within the textile sector. The investigation involves a multi-faceted research methodology, including in-depth interviews with industry experts, surveys of textile manufacturers, and an extensive literature review. By examining various aspects such as raw material selection, manufacturing processes, recycling strategies, and waste management systems, this research identifies the most effective techniques for waste reduction and optimization. The findings of this study reveal a range of strategies used by textile industries to minimize waste generation, increase resource efficiency, and adopt more sustainable practices. These strategies include the adoption of eco-friendly materials, innovative dyeing and finishing methods, lean manufacturing principles, and the implementation of circular economy principles. Furthermore, this study also investigates the economic and environmental benefits of these techniques. The study's results provide valuable insights for textile industry stakeholders, policymakers, and environmental advocates, offering guidance on how to align business operations with sustainability.

goals. By understanding and implementing these waste reduction and optimization techniques, textile companies can reduce their ecological impact while potentially improving their economic sustainability, ultimately contributing to a more environmentally responsible and economically viable textile industry.

INTRODUCTION

Waste management is the systematic and organized process of collecting, transporting, processing, recycling, and disposing of waste materials in a way that minimizes environmental, health, and economic impacts. It encompasses a range of activities aimed at effectively and responsibly handling different types of waste, including municipal solid waste, industrial waste, hazardous waste, and more. The primary goals of waste management are to reduce the generation of waste, promote recycling and reuse, and ensure that waste is safely and environmentally soundly managed, reducing its potential harm to the environment and human health. Efficient waste management is essential for conserving resources, preventing pollution, and fostering a sustainable and healthy living environment.

The textile industry, a cornerstone of our global economy, fulfills an essential role by providing us with a diverse array of textiles and clothing. Yet, the very processes that enable this industry to flourish have given rise to complex waste management challenges that demand our immediate attention. As sustainability and environmental responsibility assume a more central role in our world, the textile industry finds itself at a crossroads, compelled to adopt innovative waste management practices.

This report is a comprehensive investigation into the domain of waste management within the textile industry. It seeks to unravel the intricacies, dilemmas, and viable solutions tied to the efficient, responsible, and sustainable management of waste within textile production and manufacturing processes.

OBJECTIVES

- Primary objective focuses on understanding the various waste reduction and optimizational techniques followed by textile industries.
- To analyze the existing waste management and reduction practices in the textile industry, including the methods used, technologies employed, and their effectiveness.
- To find the different sources of waste in the textile manufacturing process, which can include raw materials, energy, water, and byproducts.
- To identify and document industry-specific best practices and case studies that demonstrate successful waste reduction and optimization techniques.

SCOPE OF THE STUDY

- It comprehensively examine waste reduction and optimization techniques within the textile industry.
- It will encompass areas such as water and energy conservation, sustainable materials, process improvements, recycling, and the use of eco-friendly chemicals. The research will also explore case studies, industry practices, and regulatory considerations.
- The goal is to offer insights for enhancing environmental and economic sustainability in the textile industry.

NEED OF THE STUDY

- The textile industry's environmental impact is a pressing concern. The study is needed to identify effective waste reduction techniques to mitigate environmental harm.
- As global resources become scarcer, there is a need to optimize resource usage in the textile industry to ensure long-term viability.
- Discovering techniques to minimize waste and resource consumption can lead to cost savings for textile companies.
- Implementing sustainable practices can enhance a company's competitiveness in the growing market for eco-friendly products.

REVIEW OF LITERATURE

In this Chapter, the researcher has made an attempt in understanding the basic concepts of on these topics will provide a strong foundation for your study on waste reduction and optimization techniques in the textile industry, offering a comprehensive understanding of the current state of the industry and its environmental challenges and opportunities made by earlier researchers in respect of strategies that are used by company to make employee get engaged, for this, the researcher has used various books, research Journals and websites. The detailed list is further elaborated in the Bibliography. Through this Literature Survey researcher wants to find out which are the important parameters of employee engagement.

Significance of bioadsorption process on textile industry wastewater - Omprakash Sahu , Nagender Singh (2019)

In this research paper, the textile industry's environmental impact, especially concerning the use of dyes and pollutants, necessitates effective methods for dye removal from wastewater. Adsorption, particularly through bioadsorbents, is presented as a promising and sustainable approach to address this issue. The study aims to contribute to alternative and eco-friendly solutions for treating dye-containing wastewater from the textile industry.

A Technical Review of Emerging Technologies for Energy and Water Efficiency and Pollution Reduction in the Textile Industry - Ali Hasanbeigi, Lynn Price (2017)

The value of this research is textile industry faces pressing challenges related to energy consumption, greenhouse gas emissions, and environmental pollution. To address these issues and support the industry's sustainable growth, the paper focuses on emerging technologies that have the potential to reduce energy use and mitigate environmental impacts. This resource aims to bridge the information gap and facilitate the adoption of these technologies in the textile sector.

Identifying the potential for circularity of industrial textile waste generated within Swiss companies - M'elanie Schmutz , Claudia Som (2022)

The objective is to analyse the importance of addressing industrial waste in the textile industry to support a circular economy. By quantifying waste generation and examining potential end-of-life treatments, the study emphasizes the need to develop recycling technologies and create markets for recycled textile materials to harness the value of textile waste as a resource.

Modern enabling techniques and adsorbents based dye removal with sustainability concerns in textile industrial sector -A comprehensive review - N. Rajesh Jesudoss Hynes , J. Senthil Kumar , Hesam Kamyab , J. Angela Jennifa Sujana , Omar Ali Al-Khashman , Yasemin Kuslu , Antoaneta Ene , B. Suresh Kumar (2020)

The objective is to analyse the need for comprehensive solutions to address the environmental and health impacts of textile industry wastewater. It emphasizes the importance of integrating traditional treatment methods with modern technologies like IoT for effective and sustainable manufacturing. The proposed strategies seek to enhance the overall management and treatment of textile industry wastewaters, offering potential benefits for both the industry and the environment.

Mapping environmental sustainability of knitted textile production facilities - Md. Shamsuzzaman , Md Mazedul Islam , H M Rakib Ul Hasan , Adnan Maroof Khan , Abu Sadat Muhammad Sayem (2023)

The value of this research recognizes the need for evaluating the environmental sustainability of fashion production facilities and highlights the challenges faced by knit-dyeing facilities in Bangladesh. The study's results call for collaborative efforts to address these challenges and work toward more sustainable practices in the fashion industry.

An Evaluation on Lifecycle of Products in Textile Industry of Turkey through Quality Function Deployment and Pareto Analysis - Ayşenur Erdil (2019)

This research paper emphasizes the use of QFD methodology as a strategic tool in the textile production industry to bridge the gap between customer expectations and technical characteristics. The application of QFD and Pareto Analysis in assessing sustainability highlights the industry's commitment to quality, robustness, and

environmentally-conscious production, setting the stage for further research and development in this area.

Emerging trends to Approaching Zero Waste - Chaudhery Mustansar, Sunpreet Singh, Lalit Goswami (2022)

This paper highlights the shift towards net zero waste buildings in the construction sector. The adoption of the 3Rs approach, along with other emerging trends and practices, is helping to reduce waste, minimize environmental impact, and promote sustainability in building construction. The transition from a linear model of waste disposal to more circular and sustainable models is a significant step in achieving these goals.

RESEARCH DESIGN

Qualitative research design

Qualitative research involves gathering and examining non-numerical data, which includes observational data, focus group transcripts, and interview transcripts. These types of data are frequently utilized to investigate detailed subjects or gain perspective on the experiences of individuals or groups.

HYPOTHESIS 1

- **H0:** There is no significant association between gender and the preferred methods or principles employed for waste management.
- **H1:** There is a significant association between gender and the preferred methods or principles employed for waste management.

HYPOTHESIS 2

- **H0:** The average monthly waste generated by projects is within the range of 1000 to 1500 tons.
- **H1:** The average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

CORRELATION

		How much amount does your organization invest on implementing waste management procedure in estimate	On average how much waste does your project generate on a monthly basis
How much amount does your organization invest on implementing waste management procedure in estimate	Pearson Correlation Sig. (2-tailed) N	1 131	-.333** .000 131
On average how much waste does your project generate on a monthly basis	Pearson Correlation Sig. (2-tailed) N	-.333** .000 131	1 131

INTERPRETATION

The p value is -0.333 which is less than the significance value (0.05) hence alternative hypothesis H1 is accepted. Therefore the average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

INFERENCE

The average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

CHI SQUARE

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.114 ^a	8	.634
Likelihood Ratio	7.034	8	.533
N of Valid Cases	131		

INTERPRETATION

The p value is 0.634 which is greater than the significance value (0.05) hence null hypothesis H0 is accepted. And H1 is rejected

INFERENCE

There is no significant association between gender and the preferred methods or principles employed for waste management.

FINDINGS

- Majority i.e., 91% of the response were given by male employees.
- Most responses, i.e., 53%, were given by employees in the age group of 20 to 35.
- Most responses, i.e., 40%, were given by employees with years of experience between 0 to 5.
- Most responses, i.e., 35.9%, were given by employees Company location is Urban.
- Most responses, i.e., 21% of plastic waste.
- Most response, for waste management procedure followed is 91% for yes.
- Most response, for Methods or Principles do you follow for waste management is 44% for textile with technical application.
- Most response, for measures do you take to promote sustainability and environmental responsibility in your textile production processes is 50% of Use of eco-friendly dyes and chemicals.
- Most response, for how much amount does your organization invest on implementing waste management procedure in estimate 32% of 75 to 100 lakhs.
- Most response, on average how much waste does your project generate on a monthly basis 41% of 1000 to 1500 tones.
- Most response, on how is waste collected and managed in your Organization 58% of On-site waste treatment and recycling.

- Most response, on are you satisfied with your current waste management Process 91% of satisfied.
- Most response, on what efforts have you made in waste management to control the offensive 64% of recycling.
- Most response, on how many waste collection points do you have in your locality 37% of 1 to 2.
- Most response, on how often does environment sanitation takes place in your locality 50% of Once per week.
- By using chi square for finding the relation between gender and what Methods or Principles do you follow for waste management The p value is 0.634 which is greater than the significance value (0.05) hence null hypothesis H_0 is accepted and H_1 is rejected. There is no significant association between gender and the preferred methods or principles employed for waste management.
- By using correlation for finding the relation between how much amount does your organization invest on implementing waste management procedure in estimate and On average how much waste does your project generate on a monthly basis. The p value is -0.333 which is less than the significance value (0.05) hence alternative hypothesis H_1 is accepted. Therefore the average monthly waste generated by projects is not within the range of 1000 to 1500 tons.

SUGGESTIONS

- Conduct surveys and interviews with professionals in the textile industry to gather first-hand information. Insights from industry experts, managers, and employees can provide valuable perspectives on the challenges and opportunities associated with waste reduction and optimization.
- Begin with an extensive literature review to understand the existing knowledge and research gaps in waste reduction and optimization within the textile industry. This will provide a solid foundation for your study and help you identify areas that require further exploration.

- Include case studies of specific textile companies that have successfully implemented waste reduction and optimization techniques. These real-world examples can offer practical insights, challenges faced, and lessons learned, providing a richer context for your research.
- Explore emerging technologies and innovations that have the potential to revolutionize waste reduction and optimization in the textile industry. This could include advancements in recycling, material efficiency, and sustainable manufacturing processes.
- Conclude your study with a forward-looking section that outlines potential future trends, challenges, and recommendations for the textile industry to further enhance waste reduction and optimization practices.

LIMITATIONS OF THE STUDY

- The study may not capture region-specific variations in waste reduction techniques due to its broader focus.
- Limited access to industry data and proprietary information may constrain the study's depth and accuracy.
- Sustainability is a multifaceted concept, and the study might not address all dimensions comprehensively.
- Constraints in terms of time and funding may impact the study's breadth and depth.

CONCLUSION

In conclusion, the study on understanding the various waste reduction and optimization techniques followed by textile industries provides valuable insights into the sustainable practices within this sector. The research delved into the methods employed by textile companies to minimize waste generation and optimize their processes. Here are some key conclusions drawn from the study

- The textile industry employs a diverse range of waste reduction techniques, including regeneration, composting, utilization of textiles with technical applications, source reduction, and potentially other innovative methods.
- A significant finding is the identification of whether companies have established waste management procedures. This highlights the importance of organizational strategies in fostering sustainable practices within the textile industry.
- The research may identify areas where textile industries can further enhance their waste reduction and optimization practices. This could involve recommending the adoption of specific techniques that have proven to be effective or suggesting improvements to existing procedures.
- Assessing the various techniques employed by textile industries contributes to understanding their environmental impact. Sustainable practices not only benefit companies by reducing costs but also contribute positively to the overall ecological footprint of the industry.

The study adds valuable knowledge to the field of sustainable practices in the textile industry, offering a foundation for further research and potentially influencing industry practices and policies towards a more environmentally friendly and efficient future.

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