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Article

A STUDY ON SMART FABRIC SCRAP REUSE: TURNING WASTE INTO SMALL-SCALE ACCESSORIES.

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Abstract: The increasing generation of scrap materials in textile and garment industries has created significant challenges in effective waste management and resource utilization. In the context of scrap reuse, many organizations face issues such as inadequate availability of usable materials, lack of proper segregation, and limited adoption of efficient recycling and upcycling techniques. Inefficient handling of scrap leads to higher waste accumulation, increased disposal costs, and underutilization of valuable resources. This inefficiency negatively impacts organizational performance by increasing operational expenses and reducing overall productivity. In addition, the absence of innovative practices in converting waste into small-scale accessories limits opportunities for additional revenue generation. Poor waste management practices also affect environmental sustainability and corporate image. The lack of awareness and structured processes further restricts the effective implementation of scrap reuse initiatives. The objective of the study is to analyse the smart fabric scrap reuse: turning waste into small-scale accessories. The descriptive research is utilized to explain the current situation and practices in the organization. The sampling method that will be used in this research is convenience sampling. Data were collected from both primary and secondary sources. The sample size for the study includes 120 employees working in the organization. The collected data were classified, tabulated, and analyzed using statistical tools such as: Simple Percentage Analysis, Chi-Square Test and Correlation Analysis. It is found that there is significant difference between availability of materials and reduction in waste volume. It is suggested that the company should also have the capacity to acquire other types of new scraps of textiles to promote the use of smart textile scraps. , it is concluded that the concept of active recycling and upcycling strategies (appropriate cutting, sewing and craft techniques, etc.) contributes to the better utilization of materials, not to mention the aesthetic quality of accessories.

Keywords: Smart Fabric, Scrap Reuse, Waste, Small-Scale Accessories.

INTRODUCTION

Scrap materials are the other materials which are left behind, used, or unused after a production, manufacturing or consumption process is finished. These materials do not become the finished product but have some functionality or economic use and may be reused, recycled or put to some other use. The scrap materials can consist of fabric and metal scraps,

plastic scraps, paper scraps or any other by-products created during industrial or home processes. Scrap materials should not be considered as waste since they can be used as useful raw materials to make other products, particularly in small and green production.

Reuse is described as the utilization of a product or a material again in its original state or with little or no alteration rather than discarding the product after first use. It entails prolonging the life of materials by using them in a similar or a distinct purpose thus minimizing waste production and usage of resources. Recycling is the act of gathering, reprocessing and reusing waste products into other products. It entails de-manufacturing of used materials and converting them to raw materials which could be re-used in the manufacturing process to help reduce the use of fresh materials and environmental degradation.

Objectives of the study

- To examine the availability of materials for smart fabric scrap reuse in the company.
- To analyze the level of technological integration in scrap used for small-scale accessories.
- To study the recycling and upcycling techniques used in converting smart fabric scrap into accessories.
- To evaluate the reduction in waste volume through smart fabric scrap reuse practices.

Review Of Literature

Worku (2025) organised existing knowledge concerning textile waste streams and emerging technologies in recycling with a focus on environmental issues and sustainable solutions required in circular textile systems. The research purpose was to review and critically evaluate the mechanical, chemical, and biological recycling processes with secondary data collected in peer-reviewed materials and did not presuppose the primary collection of samples. Qualitative literature review method was used to provide comparison of efficiency, scalability and environmental effects of various waste processing technologies. Results indicated that the development of efficient recycling systems and environmental design are the major elements in the realization of a resource-efficient textile industry. The author recommended the implementation of circular economy models, policy intervention and cross-stakeholder cooperation as solutions to improve the results of waste management. The authors concluded that innovative and sustainable methods of recycling can be at the center of minimizing the effects of textile waste.

Shamsuzzaman et al. (2025) carried out a systematic review of waste management in the textile and fashion industries through the circular economy, focusing on the trends, barriers, and opportunities of the industry using 243 research papers condensed to 104 core studies. It aimed to evaluate the amount of waste, waste management, and the circularity of fashion and textile by analyzing thematic literature. The study design was a systematic review, which utilized the knowledge of various fields without defining a respondent sample. Results indicated that the bulk of the research is centered on waste management interventions, reuse and recycling are the key aspects in minimizing environmental effects. The authors proposed the encouragement of the involvement of stakeholders, supportive policies, and innovative methods of waste reduction. The conclusion highlighted that there are significant opportunities of sustainable practices even with the continued implementation challenges.

Parnell et al. (2025) assessed circular economy policies in the textile sector, including the investments into the recycling technology, product design, and system aspects that may contribute to increasing the efficiency of the resources and prevent waste in the context of modern economic requirements. The aim was to determine strategic areas of enhancing the textile circularity by secondary data collected using pertinent literature without specifying a sample size. The method of the qualitative review was used to map the circular strategies and develop the areas of opportunity. The results indicated the significance of incorporating the design, technology, and systemic innovation in order to minimize waste and enhance material lifecycle management. The authors recommended specific investment in recycling and product design to provide more successful circular implementations. The conclusion reiterated that system-level strategies are required to shift to the linear to the circular textile operations.

Research methodology

The descriptive research is utilized to explain the current situation and practices in the organization. The sampling method that will be used in this research is convenience sampling. Data were collected from both primary and secondary sources. The sample size for the study includes 120 employees working in the organization. The collected data were classified, tabulated, and analyzed using statistical tools such as: Simple Percentage Analysis, Chi-Square Test and Correlation Analysis.

RESEARCH METHODOLOGY

The descriptive research is utilized to explain the current situation and practices in the organization. The sampling

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DATA ANALYSIS AND INTERPRETATION

Table No. 1: Availability of Materials

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Different types of smart textile scraps are accessible for reuse purposes	40 (33.3%)	38 (31.7%)	18 (15.0%)	14 (11.7%)	10 (8.3%)	120 (100%)
Availability of scrap materials reduces the need for new raw materials	45 (37.5%)	35 (29.2%)	16 (13.3%)	14 (11.7%)	10 (8.3%)	120 (100%)
Collection systems for smart fabric waste are well-organized	32 (26.7%)	36 (30.0%)	22 (18.3%)	18 (15.0%)	12 (10.0%)	120 (100%)
Sorting and segregation of smart fabric scrap are properly maintained	34 (28.3%)	33 (27.5%)	20 (16.7%)	19 (15.8%)	14 (11.7%)	120 (100%)
Storage facilities for scrap materials ensure material preservation	36 (30.0%)	34 (28.3%)	18 (15.0%)	17 (14.2%)	15 (12.5%)	120 (100%)

Source: Primary data

INTERPRETATION:

The above table indicates the respondents' opinion on the availability of materials for smart textile scrap reuse. It is observed that 33.3% strongly agree and 31.7% agree that different types of smart textile scraps are accessible for reuse purposes, while 15.0% are neutral, 11.7% disagree, and 8.3% strongly disagree. Regarding the statement that availability of scrap materials reduces the need for new raw materials, 37.5% strongly agree and 29.2% agree, whereas 13.3% are neutral, 11.7% disagree, and 8.3% strongly disagree. For collection systems being well-organized, 26.7% strongly agree and 30.0% agree, while 18.3% remain neutral, 15.0% disagree, and 10.0% strongly disagree. Similarly, 28.3% strongly agree and 27.5% agree that sorting and segregation are properly maintained, with 16.7% neutral, 15.8% disagree, and 11.7% strongly disagree. In terms of storage facilities, 30.0% strongly agree and 28.3% agree, while 15.0% are neutral, 14.2% disagree, and 12.5% strongly disagree. Overall, it is inferred that a majority of respondents have expressed positive opinions towards the availability of materials, indicating that it supports effective reuse of smart textile scraps, although a moderate proportion of neutral and negative responses suggests scope for improvement.

Table No. 2: Reduction in Waste Volume

Statements	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total**
Reuse of smart fabric scrap significantly decreases textile waste	42 (35.0%)	36 (30.0%)	16 (13.3%)	14 (11.7%)	12 (10.0%)	120 (100%)
Upcycling practices contribute to landfill waste reduction	44 (36.7%)	34 (28.3%)	18 (15.0%)	13 (10.8%)	11 (9.2%)	120 (100%)
Efficient scrap utilization	40 (33.3%)	35 (29.2%)	17 (14.2%)	15 (12.5%)	13 (10.8%)	120 (100%)

minimizes disposal requirements						
Waste reduction enhances resource conservation	46 (38.3%)	32 (26.7%)	15 (12.5%)	14 (11.7%)	13 (10.8%)	120 (100%)
Continuous recycling efforts lower overall waste generation	43 (35.8%)	33 (27.5%)	16 (13.3%)	15 (12.5%)	13 (10.8%)	120 (100%)

Source: Primary data

INTERPRETATION:

The above table shows the respondents' opinion on reduction in waste volume through smart textile scrap reuse practices. It is observed that 35.0% strongly agree and 30.0% agree that reuse of smart fabric scrap significantly decreases textile waste, while 13.3% are neutral, 11.7% disagree, and 10.0% strongly disagree. Regarding upcycling practices contributing to landfill waste reduction, 36.7% strongly agree and 28.3% agree, whereas 15.0% are neutral, 10.8% disagree, and 9.2% strongly disagree. For efficient scrap utilization minimizing disposal requirements, 33.3% strongly agree and 29.2% agree, while 14.2% remain neutral, 12.5% disagree, and 10.8% strongly disagree. Similarly, 38.3% strongly agree and 26.7% agree that waste reduction enhances resource conservation, with 12.5% neutral, 11.7% disagree, and 10.8% strongly disagree. In the case of continuous recycling efforts, 35.8% strongly agree and 27.5% agree, while 13.3% are neutral, 12.5% disagree, and 10.8% strongly disagree. Overall, it is inferred that a majority of respondents have expressed positive opinions towards waste reduction practices, indicating that reuse, upcycling, and recycling of smart textile scraps play a significant role in reducing waste volume, although a moderate level of neutral and negative responses suggests scope for improvement.

Table No. 3: Level of Technological Integration in Scrap

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Sensors integrated into discarded smart textiles are reusable	38 (31.7%)	34 (28.3%)	18 (15.0%)	16 (13.3%)	14 (11.7%)	120 (100%)
LED elements in scrap materials can be repurposed effectively	40 (33.3%)	32 (26.7%)	20 (16.7%)	15 (12.5%)	13 (10.8%)	120 (100%)
Embedded circuits in fabric scraps retain durability after disposal	36 (30.0%)	33 (27.5%)	19 (15.8%)	17 (14.2%)	15 (12.5%)	120 (100%)
The level of technological features influences accessory functionality	42 (35.0%)	30 (25.0%)	18 (15.0%)	16 (13.3%)	14 (11.7%)	120 (100%)
Smart components in scrap enhance product innovation	44 (36.7%)	29 (24.2%)	17 (14.2%)	15 (12.5%)	15 (12.5%)	120 (100%)

Source: Primary data

INTERPRETATION:

The above table shows the respondents' opinion on the level of technological integration in smart textile scrap. It is observed that 31.7% strongly agree and 28.3% agree that sensors integrated into discarded smart textiles are reusable, while 15.0% are neutral, 13.3% disagree, and 11.7% strongly disagree. Regarding LED elements being repurposed effectively, 33.3% strongly agree and 26.7% agree, whereas 16.7% are neutral, 12.5% disagree, and

10.8% strongly disagree. For embedded circuits retaining durability after disposal, 30.0% strongly agree and 27.5% agree, while 15.8% remain neutral, 14.2% disagree, and 12.5% strongly disagree. Similarly, 35.0% strongly agree and 25.0% agree that technological features influence accessory functionality, with 15.0% neutral, 13.3% disagree, and 11.7% strongly disagree. In the case of smart components enhancing product innovation, 36.7% strongly agree and 24.2% agree, while 14.2% are neutral, 12.5% disagree, and 12.5% strongly disagree. Overall, it is inferred that a majority of respondents have expressed positive opinions towards technological integration in scrap materials, indicating that reusable smart components contribute to functionality and innovation, although a moderate proportion of neutral and negative responses suggests the need for improvement in technology efficiency and awareness.

CHI-SQUARE ANALYSIS: RELATIONSHIP BETWEEN AVAILABILITY OF MATERIALS AND REDUCTION IN WASTE VOLUME

HYPOTHESIS TESTING

Null hypothesis (Ho): There is no significant relationship between availability of materials and reduction in waste volume.

Alternative hypothesis (H1): There is some significant relationship between availability of materials and reduction in waste volume.

INTERPRETATION

As per the above table, it is inferred that the P value is 0.000; it is not significant to 5% (0.05) significant level. The minimum expected count is 0.01. Thus null hypothesis is rejected and it is finding that there is significant difference between availability of materials and reduction in waste volume.

CORRELATION ANALYSIS: RELATIONSHIP BETWEEN LEVEL OF TECHNOLOGICAL INTEGRATION IN SCRAP AND REDUCTION IN WASTE VOLUME

Correlations			
		LEVEL OF TECHNOLOGICAL INTEGRATION	**REDUCTION IN WASTE VOLUME**
LEVEL OF TECHNOLOGICAL INTEGRATION	Pearson Correlation	1	.767**
	Sig. (2-tailed)		.000
	N	120	120
REDUCTION IN WASTE VOLUME	Pearson Correlation	.767**	1
	Sig. (2-tailed)	.000	
	N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).			

INTERPRETATION:

The above table indicates that out of 120 respondents, co-efficient of correlation between level of technological integration in scrap and reduction in waste volume is .767. It is below 1. So there is positive relationship between level of technological integration in scrap and reduction in waste volume.

Suggestions

- The company should also have the capacity to acquire other types of new scraps of textiles to promote the use of smart textile scraps.
- The company is advised to empty as much scrap as it can in a bid to reduce once more the consumption of new raw materials.
- The company would also need to enhance the collecting mechanisms in order to be more successful in the collection of scrap.
- The company should sort and separate the scrap to ensure that it is in good conditions.
- The company should have a warehouse where the material will not degrade with time.
- The company should also think about what can be done to recycle sensors on used smart textile in a manner that is safe.

CONCLUSION

To conclude that the smart fabric scrap reuse has incredible potential in the transformation of waste textile into helpful small scale accessories. The study demonstrates that the fact of having a great range of smart textile scraps as they will be gathered, sorted,

and stored in the appropriate way, can help to reach the stage of sustainable production practices and reduce the use of new raw materials. Moreover, the use of technological characteristics, such as sensors, LEDs and embedded circuit in worn-out clothes will enhance the functionality and uniqueness of the accessory developed, which, once again, will be used to justify the usefulness of the smart waste of a smart textile.

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