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Sustainable Innovation: Refund Based Cloth Recycling System Using Plastic Waste

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Abstract- Sustainability has become a central focus in contemporary research, policy, and industrial practices due to growing environmental challenges. Among these, plastic waste management has emerged as a global concern because of its non-biodegradable nature and harmful impact on ecosystems. This article proposes a theoretical framework for a refund-based cloth recycling system utilizing plastic waste. The returned cloth is then broken down into small particles then mixed with the cements and bricks. Hence it is more than recycling. The system combines the principles of circular economy, waste-to-wealth innovation, and consumer participation mechanisms to address environmental degradation while promoting social and economic sustainability. Through a theoretical exploration, this paper emphasizes how plastic waste can be converted into textile products and reintegrated into the economy via a structured refund-return system.

Keywords: Sustainability, Innovation, Circular Economy, Cloth Recycling, Plastic Waste, Refund System, Waste-to-Wealth.

I. INTRODUCTION

The topic of this paper is the innovative use of Plastic cloth, a recycled fabric material. which after its useful life can be broken down to tiny particles and combined with bricks and cements to produce eco cement and eco bricks with low cost. This approach integrates waste management of plastic waste with sustainable Construction practices, and offering a dual purpose of recycling of plastic. Plastic pollution is one of the most pressing concerns in the world with India only producing around 9.4 million tonnes of plastic waste annually out of which only 40% remains unchanged. At the same time, the manufacturing industry faces the problem of rising material cost and environmental restrictions on mining of soil to make bricks. Studying the conversion of plastic waste into plastic cloth to eco bricks worthwhile because: Control of plastic waste, provides an alternative raw material for cloth ,provides an alternative for industries, Support the circular economy, Open New Avenues for sustainable business practices, Cheap and durable cloth available at low price. India is the third largest country producer of plastic and its rivers are among the leading carries of plastic into the oceans. Government regulation and the ban in 2022 of single use plastic have attempted to control the problem but the gaps remain. Meanwhile the need for affordable and durable cloth as well as the demand for eco-friendly construction material is rising due to rapid customer change and urbanization. In this stage the innovation of plastic waste into useful materials for industries and cloth are being explored globally the present study builds on this momentum by proposing a dual use product plastic cloth that later can be transformed into input for eco bricks and cement production. Previous studies related to these articles are The Ellen MacArthur Foundation (2017) emphasized circular economy models as critical for reducing waste and maximizing resource efficiency. UNEP (2020) reported that only 9% of global plastic waste is

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recycled, underscoring the need for innovative, scalable approaches. Research by Sharma & Bansal (2021) highlighted that incorporating plastic waste into construction materials improves durability and reduces environmental costs. Previous textile innovations have focused on PET bottles-to-fabric models, but very few initiatives integrate refund-based collection with downstream construction reuse. The key research problem addressed in this paper is Can the plastic cloth after use, broken down into small particles into bricks and cement that could maintain acceptable strength, durability for construction purposes, also can plastic cloth become soft?

Sustainability

Sustainability refers to the ability to meet present needs without compromising the ability of future generations to meet their own needs. It involves balancing environmental protection, economic development, and social well-being. In practice, sustainability means using natural resources wisely, reducing waste and pollution, promoting renewable energy, and encouraging responsible consumption and production.

Theories Related to Sustainable Innovation

- **Circular Economy Theory:** resources are used as long as possible, their maximum value is extracted whilst in use, then recovered or regenerated as different products at the end of each life cycle. (Ellen MacArthur Foundation, 2013).
- **Sustainability Theory (Triple Bottom Line):** a sustainability framework that revolves around the three P's: people, planet and profit.(Elkington, 1997).
- **Extended Producer Responsibility (EPR):** policy approach where producers are held responsible for the environmental impact of their products throughout their entire lifecycle, including collection, recycling, and disposal (Lindhqvist, 2000).
- **Refund-Deposit System Theory :** a surcharge on a product when purchased and a rebate when it is returned (Lehmann et al., 2019).
- **Innovation diffusion theory (Rogers 2003):** This theory explains how the new innovations spread in society.The plastic cloth,bricks and cements Shows many advantages to the society like low cost, affordability,efficiency, reliability and observability.This kind of factors increases the chances of adoption of innovation in the society making it common for the consumers to select
- **Resource Based view(RBV) of the firm (Barney 1991):** Firms gain competitive advantage by using unique, valuable and sustainability enhancing ideas and making the resource full utilized
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Stages of Refund Based Cloth Recycling

a)Collection of Plastic Waste– Involving households, industries, and municipalities and other government initiatives

b) Conversion into Textile Materials – Using advanced recycling technologies to convert PET plastics into filament which feel like premium polyester but it is purely made from recycled waste

c)Consumer Engagement through Refund System – Consumers pay the whole amount after the cloth is used and resent 50% of refund will be given

d)Reintegration into Production – Returned cloths are recycled into cements or bricks for construction materials again. This cycle creates a closed-loop system that minimizes waste and maximizes resource efficient.

Benefits of Refund Based Cloth Recycling

- **Environmental Sustainability –** Reduction of plastic pollution and textile waste.

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- **Economic Viability –** New market opportunities in recycled textiles and secondary industries.
- **Consumer Responsibility –** Refund incentives encourage sustainable consumer behavior.
- **Social Impact** – Employment opportunities in waste collection, recycling, and textile production sectors

Challenges of Refund Based Cloth Recycling

- High initial investment costs for recycling technologies.
- Ensuring quality and durability of recycled fabrics.
- Consumer awareness and participation, which are critical for system success.
- Policy and regulatory frameworks to support large-scale adoption.

Future Scope

- Integration with block chain for transparent tracking of recycled products.
- Collaboration with fashion industries to promote sustainable branding.
- Expansion of refund mechanisms using digital wallets or green credits.
- Cross-sectoral applications of recycled cloth in construction, packaging, and industrial uses.

Findings

- **Flexibility of plastic in construction:** In this research found that about 5%-10% of plastic powder instead of sand can be used for making bricks as well as cements which provides an acceptable Strength for the bricks and cements. Beyond 15-20% may cause lack of bonding and may lead to weak strength in both cement and bricks
- **Dual use of plastic:** The plastic cloth plays two roles first as a cloth to use then as a raw material in constructions bricks and cements. This idea increases resources utility and efficiency reduces wastage.
- **Environmental Impact:** The model reduces plastic waste entering into water bodies as well as landfills. By replacing 5% of sand in making raw materials for construction by broken plastic reduces environmental degradation caused by excess sand mining.
- **Economic potential :**The bricks and cements produced are lighter in weight reducing transportation cost. Plastic cloth production and recycling it into bricks or cements can be a new opportunity in waste management and green construction sectors.
- **Alignment with sustainable development goals:** The idea supports sustainable cities and communities(SDG 11),Responsible consumption and production (SDG 12),Climate action (SDG 13)

CONCLUSION

This study revealed the making of plastic waste into valuable things in the future from cloth to raw materials in construction offering a practical solution for two pressing global challenges: the plastic waste management and the rising demand for sustainable construction inputs. By reimagining plastic waste First serving as a cloth, later as a raw material for bricks the idea demonstrate how circular economy principles can be applied to generate social, economic and environmental values the findings reinforce that adding a small amount of plastic in bricks and cement increase strength as well as reduce the cost while reducing the chance of soil degradation by mining. Beyond environmental benefits, it present opportunity to green entrepreneurship and affordable housing initiatives and alignment with Swachh hart mission and housing for all However for successful large scale production further research and policy support are essential, Laboratory testing standardization of work, various effective production techniques and awareness campaign are needed to ensure survival in market and durability of product In conclusion, plastic cloth to bricks or cements, the model not only addresses the urgent issue of plastic globally but also contributes to building a sustainable future by making waste into a

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valuable resource in two different cycles. It proves how a sustainable idea can transform an environmental liability into a powerful economic opportunity.

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