Sustainable E-Waste Recycling and Precious Metal Recovery: A Research on DIGIMINE

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Abstract

The rapid increase in electronic waste (e-waste) due to technological advancements poses significant environmental and economic challenges. [Your Company Name] focuses on sustainable e-waste recycling by recovering valuable metals such as gold, silver, and palladium using advanced and eco-friendly methodologies. This research explores our innovative recycling techniques, business model, financial strategy, and market potential while assessing environmental impacts.

Through **hydrometallurgical leaching and froth flotation**, our process ensures efficient metal recovery while adhering to stringent government regulations. We analyze revenue generation, cost structures, return on investment (ROI), and long-term business sustainability. Findings highlight the economic benefits of structured e-waste recycling and its role in reducing pollution and resource depletion.

1. Introduction

E-waste is one of the **fastest-growing waste streams globally**, with India producing over **3.2 million metric tons annually**. The improper disposal of electronic waste leads to severe environmental hazards, contaminating soil and water with toxic materials. However, e-waste also contains **valuable metals** such as gold, silver, and palladium, which are lost due to inefficient recycling methods.

Digimine. is dedicated to transforming e-waste management through **sustainable extraction techniques**, optimizing resource efficiency while minimizing environmental impact. This research outlines our business model, financial strategies, and marketing approach for a scalable and profitable e-waste recycling enterprise.

2. Literature Review

Research on e-waste recycling highlights key challenges, including toxic waste disposal, lack of awareness, and low metal recovery efficiency. Conventional recycling methods, such as pyrometallurgical smelting, release harmful emissions, making them unsustainable.

Studies suggest that **hydrometallurgical leaching** and **froth flotation** offer **environmentally friendly alternatives**, significantly improving metal recovery rates. Key findings include:

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- Hydrometallurgical leaching dissolves precious metals selectively, increasing efficiency.
- Froth flotation enhances metal separation, reducing material loss.
- Structured recycling programs create economic benefits while ensuring safer waste disposal.

Our research integrates these advanced recovery methods to maximize revenue potential while ensuring compliance with e-waste management policies.

3. Methodology

The **e-waste recycling process** at Digimine follows four key stages:

Collection & Procurement

We establish agreements with IT companies, electronics manufacturers, and recyclers to source e-waste in bulk.

Metal Extraction ii.

We utilize:

- **Hydrometallurgical leaching** Using eco-friendly solvents to dissolve metals.
- **Froth flotation** Separating valuable metals from non-metallic components.
- **Electrolysis** Refining and purifying recovered metals.
- **Refinement & Processing** iii.

Extracted metals undergo **chemical precipitation** and **electrolytic plating** to achieve high purity.

Financial & Sustainability Analysis iv.

We assess cost structures, revenue models, and environmental impact to ensure long-term business sustainability.

4. Business Model

Our business model is designed for cost efficiency, scalability, and environmental sustainability.

- E-Waste Collection: Partnerships with corporate IT parks, manufacturers, and recyclers to collect high-value e-waste.
- Processing & Extraction: Chemical-based metal recovery with minimal toxic waste production.

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- Revenue Generation: Selling recovered metals to industrial buyers, refineries, and jewelry manufacturers.
- Regulatory Compliance: Adhering to the E-Waste (Management) Rules (2024) and environmental guidelines.

5. Financial Strategy

Funding & Investment

The initial investment for [Your Company Name] is ₹11 Lakhs, sourced through:

- **PMMY Loan (₹6 Lakhs)** Covers machinery and chemical procurement.
- **Personal Investment (₹2 Lakhs)** Licensing, office setup, and legal registration.
- Friends & Family Loan (₹3 Lakhs) Provides liquidity for operational expenses.

Break-Even & ROI Analysis

- Break-even occurs within 3-6 months after scaling operations from 2T to 5T per month.
- **Projected ROI: 372.41% within the first year** after break-even.
- **Payback period: 3.22 months** post-break-even.

6. Market Strategy

Target Market

- **Primary Clients:** IT companies, electronics manufacturers, and refineries needing bulk e-waste disposal.
- **Secondary Clients:** Electronics repair shops, sustainability-conscious businesses, and environmental agencies.

Marketing Approach

- **SEO & LinkedIn Ads** Targeting corporate e-waste suppliers.
- **Cold Outreach & Networking** Engaging businesses generating bulk e-waste.
- Government Tenders Acquiring contracts for municipal e-waste management.
- Corporate Sustainability Partnerships Encouraging businesses to adopt green recycling programs.

7. Sustainability & Compliance

- Regulatory Compliance: Adhering to the E-Waste (Management) Rules (2024) and securing necessary environmental licenses.
- Green Processing: Chemical recovery methods minimize emissions and prevent

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hazardous waste disposal.

Circular Economy Model: Extracted metals are reintroduced into industrial supply **chains**, reducing dependency on virgin mining.

8. Challenges & Risk Analysis

- **Market Risks:** Fluctuations in gold & silver prices impact revenue stability.
- Regulatory Risks: Adapting to evolving environmental policies and compliance requirements.
- Operational Risks: Ensuring a consistent e-waste supply chain to maintain steady processing output.
- Technological Challenges: Optimizing chemical use to enhance metal extraction efficiency.

9. Findings & Discussion

- Gold recovery efficiency: 85%
- Silver recovery efficiency: 78%
- **Projected revenue: ₹10.50 Lakhs/month** at break-even (5T processing capacity).
- **Environmental Benefits:** Reduction in **landfill waste and carbon footprint**.

10. Conclusion & Future Scope

Digimine provides a scalable and profitable e-waste recycling solution while ensuring environmental responsibility. Our research demonstrates:

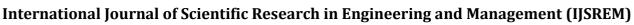
- Financial viability with strong ROI.
- A scalable business model, ready for international expansion.
- Future potential in AI-driven automation for improved efficiency.

With continued technological advancements and regulatory support, Digimine aims to revolutionize e-waste recycling in India and beyond.

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