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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/21466

DOI URL: <http://dx.doi.org/10.21474/IJAR01/21466>



RESEARCH ARTICLE

ECONOMIC PERFORMANCE OF THE SCRAP INDUSTRY AND ITS ROLE IN WASTE MANAGEMENT AND POLLUTION CONTROL IN INDIA

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Manuscript Info

Manuscript History

Received: 23 May 2025

Final Accepted: 25 June 2025

Published: July 2025

Key words:-

Waste recycling, Scrap industry, entrepreneurship, circular economy, waste management, pollution control, Kabadiwalas

Abstract

Fast industrialization and increasing economic operations of India resulted in exceptional growth in creation and accumulation of wastes. These wastes include solid wastes, plastics, metals, bio-medical wastes etc. Increased accumulation of wastes has led to severe ecological and health issues in the country. In this context, the role of scrap industry, which is generally informal, but extensive in its operations plays a significant role. This paper attempts to study the economic performance of scrap industry in India by focusing on its significant contribution to the GDP of the nation, job creation and efficiency in utilisation of resources. Predominantly, the paper evaluates the vital role of the industry in managing the wastes of the nation by collecting several types of waste materials from landfills thereby strengthening the base of a 'circular economy'. Moreover, the study highlights the contributions of scrap industry in controlling pollution through reduced extraction of fresh materials, lower consumption of energy and reduced rate of greenhouse gas emissions. The paper argues for giving due importance to the scrap industry by way of technological integration, professionalised approaches and extending policy support to the industry from the side of Government in order to improve its potential ensuring sustainable development of the country.

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Introduction:-

The increased tensions over exhaustions of natural resources, changes in climatic conditions and adverse impact on the environment led to the emergence of the concept of circular economy in support of the sustainable development initiatives. The problem of waste management is highly crucial for a nation like India which is presently considered as a fast-growing economy, highest population and high per capita consumption. As per several study reports on waste management, the country generates around 15,000 tonnes of solid wastes in a single day. But only a small percentage of the same being processed in a scientific manner. This is considered as a massive problem as well as a great opportunity for the country. Scrap Industry is placed at the top of the emerging circular economy of India. Millions of 'khabadiwalas' (waste pickers), scrap dealers and small to large scale recycling centres constitute the

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scrap industry in the country. The industry is a complex system which deals with numerous materials, plastics, different types of metals, e-wastes and ravages from construction and demolition. The industry offers tremendous contributions to the ecology and economy of the nation by actively participating in waste management initiatives of the nation.

This paper throws light on the economic stature and functions of the scrap industry in India. It highlights the role of the industry in the context of employment generation and resource management. Moreover, it precisely evaluates the lead role of the industry in efficient management of wastes by blocking the burial of materials in land and thereby reducing pollution and ecological issues. It also reviews the intrinsic impediments within the industry and suggests major strategic approaches for its reinforcement and sustainable development.

Understanding India's Scrap Industry:

The scrap industry in India is a massive and dispersed network mostly controlled by an informal segment recognised as an efficient system for collection, sorting and disposal of wastes. It can be broadly categorised as follows;

- **Collection (Kabadiwalas/Waste Pickers):** At the base are millions of informal waste pickers who collect scrap directly from households, businesses, and dumpsites. They are the primary agents of source segregation, albeit often driven by economic value.
 - **Aggregators/Middlemen:** These individuals or small businesses purchase scrap from waste pickers and smaller collectors, further segregating, cleaning, and sometimes pre-processing the materials before selling them to larger dealers or recyclers.
 - **Recycling Units:** These range from small, often polluting, unregistered units (especially for plastics and e-waste) to medium and large-scale, more formally structured recycling facilities for metals, paper, and larger plastic volumes.
 - **End-Users:** Industries that utilize recycled content as raw material, such as steel mills (Electric Arc Furnaces), aluminium foundries, plastic re-processors, paper mills, and construction material manufacturers.
- The dual nature of the industry – a highly efficient informal network compared with an emerging formal sector defines its unique characteristics, challenges, and potential in India.

Economic Performance of the Scrap Industry:

The economic footprint of India's scrap industry is significant, despite its largely unorganized nature and the difficulty in obtaining precise statistical data.

Contribution to GDP and Resource Efficiency:

The scrap industry contributes directly to the GDP through value addition in sorting, processing, and recycling activities. Moreover, it indirectly increases the GDP by supplying raw materials at lower rates to the manufacturing industries. For example, using steel scrap in Electric Arc Furnaces considerably decreases the requirement for fresh iron ore, coking coal, and limestone, thereby reducing cost of production for the steel industry and adds to its international competitiveness. Related gains occur in the case of paper industries, aluminium, and plastic. This efficiency in the utilisation of resources transforms into extensive economic benefits for industries, ultimately resulting in overall economic growth.

Employment Generation:

Possibly the most important economic effect is its enormous input to job creation. The segment provides job and income to millions of people including waste pickers, scrap dealers, and recycling centres. Though accurate statistics of employment are not available, it is assumed that millions of people are directly or indirectly involved in the scrap economy. This large-scale employment, mainly for marginalized people in the country, acts as a vital financial security.

Entrepreneurship and Livelihoods:

Lack of entry barrier into the scrap collection and trading raises a passion for entrepreneurship, predominantly at the grassroots level. Numerous individuals or families operate as small traders, exhibiting outstanding skills in identifying, classifying, and creating values to waste materials. This decentralized model gives financial backup to local economies and generates better income opportunities.

Cost Savings for Manufacturing Sectors:

Recycled materials are generally cheaper than virgin raw materials. For example, producing aluminium from scrap requires only about 5% of the energy needed to produce it from bauxite ore. This massive energy saving translates directly into cost savings for manufacturers, making their products more competitive and contributing to industrial growth. Similar cost advantages are observed in the production of steel, paper, and plastics.

Trade and Investment Potential:

India is a major importer of various types of scrap (e.g., metal scrap) to meet its industrial demands. Simultaneously, with increasing formalization and infrastructure development, there is growing potential for domestic value addition and even export of high-quality recycled products. The formal segment of the industry is attracting significant domestic and international investment, driven by the increasing awareness of circular economy principles and supportive government policies like the Extended Producer Responsibility (EPR) framework.

Role in Waste Management:

The scrap industry is the de facto backbone of India's waste management system, particularly in the absence of robust municipal collection and segregation infrastructure.

Diversion from Landfills:

The primary and most tangible role of the scrap industry in waste management is the massive diversion of recyclable materials from landfills. Waste pickers and informal aggregators actively scavenge for valuable materials, preventing them from being mixed with organic waste, which would render them unrecyclable and contribute to landfill burden. This considerably expands the lifetime of prevailing landfills and bring down the demand for new ones, which is highly intricate to identify because of shortage of land.

Promoting Source Segregation (Informal)

Even though not directly, the scrap industry and market give the economic instinct for households and businesses to classify their waste into metals, paper, and plastics. This casual source segregation is highly significant in effective recycling, as assorted waste is often contaminated and tough to process.

Facilitating Circular Economy:

The scrap industry acts as a prominent player in circular economy by collecting, sorting, and routing waste materials back into the production cycle, it is a crucial facilitator of the circular economy. It converts "waste" into "resources," thereby locking material loops and dissociating economic growth from further depletion of resources. This systemic change keeps away from the general "take-make-dispose" model towards a more sustainable resource management paradigm.

Decentralized Collection Network:

The informal system of kabadiwalas delivers a substantially decentralized and effective collection network that spread nearly every nook and corner of India. This makes sure that even trivial volumes of waste, which would otherwise be left over, are collected and routed for recycling.

Role in Pollution Control:

Beyond waste diversion, the scrap industry plays a crucial, though sometimes paradoxically challenging, role in mitigating various forms of pollution.

Reduced Virgin Resource Extraction:

By providing secondary raw materials, the scrap industry directly reduces the demand for virgin resources. This translates into:

- **Reduced Mining:** Less need for mining iron ore, bauxite, copper, etc., which are highly destructive processes causing land degradation, deforestation, water pollution, and dust emissions.
- **Reduced Deforestation:** Less demand for virgin timber for paper production.
- **Reduced Oil Extraction:** Less reliance on crude oil for new plastic production.

Lower Energy Consumption and Greenhouse Gas (GHG) Emissions:

Producing materials from scrap consumes significantly less energy compared to producing them from virgin raw materials, leading to a substantial reduction in GHG emissions.

- **Steel:** Recycling steel reduces energy consumption by 60-70% and GHG emissions by 58%.
- **Aluminium:** Recycling aluminium saves up to 95% of the energy and reduces GHG emissions by 95% compared to primary production.
- **Plastics:** Recycling plastics can save 50-80% of energy.
- **Paper:** Recycling paper saves 60-70% of energy and reduces air pollution by 74% and water pollution by 35%. This direct reduction in energy consumption is a major contribution to combating climate change and reducing air pollution from utility power generation.

Water Conservation:

Many recycling processes require significantly less water than primary production. For example, recycled paper production uses substantially less water than pulp production from virgin timber, contributing to water conservation, a critical issue in water-stressed India.

Mitigating Land and Water Pollution from Landfills:

By diverting waste, the scrap industry reduces the volume of waste going into landfills and dumpsites. This minimizes:

- **Leachate Formation:** Reduces the generation of toxic liquid (leachate) that contaminates soil and groundwater.
- **Methane Emissions:** Organic waste in landfills decomposes anaerobically, producing methane, a potent greenhouse gas. By removing recyclables, the informal sector indirectly aids in better landfill management, though the primary focus is on value recovery.
- **Open Burning:** Reduces the incentive for open burning of waste at dumpsites, which releases toxic fumes and particulate matter into the air.

Hazardous Waste Management (Emerging Stage):

For specific waste streams like e-waste and batteries, the scrap industry (particularly the emerging formal sector) plays a vital role in ensuring these hazardous materials are collected and processed in facilities equipped to handle toxic components safely, preventing their haphazard disposal in landfills or incineration, which would release heavy metals and other pollutants.

Challenges and Bottlenecks:

Despite its immense contributions, the Indian scrap industry faces significant challenges, primarily stemming from its predominantly informal nature:

- **Informal Sector's Health, Safety, and Environmental Risks:** While efficient, many informal recycling units operate without proper environmental controls or safety measures. Workers, including children, are exposed to hazardous materials, fumes, and unsafe working conditions. Rudimentary processing methods (e.g., acid leaching for e-waste, open burning of cables) cause severe localized air, water, and soil pollution.
- **Lack of Formalization and Regulation Enforcement:** A significant portion of the industry operates outside formal regulatory frameworks, making it difficult to monitor, control, or ensure compliance with environmental and labour laws. Incongruous implementation of prevalent rules make issue more complicated.
- **Data Shortage and Chaotic Character:** The deficiency of broader information on waste generation, collection, processing quantities, and economic inputs hinders efficient formulation of policies and allocation of resource for the sector.
- **Shortcomings of Technology and Lack of Investment:** Several informal scrap units use outmoded and ineffective technologies, resulting in low recovery of materials and high rate of pollution. Lack of finance hampers investment in the state-of-the-art and ecofriendly recycling technologies.
- **Perception of the Society and Disgrace:** The job of waste pickers and recyclers is often degraded, leading to disregard and lack of encouragement from conventional society and insufficient infrastructure.
- **Breakdown of Supply Chain:** The uneven nature of the informal supply chain poses difficulty for the larger, formal recyclers to obtain materials on a regular basis. This hinders the efficiency of the supply chain.

Policy and Future Directions:-

To unleash the full capability of the scrap industry of India for sustainable development, a multi-dimensional approach is essential:

- **Standardization and Collaboration:** Formulate appropriate policies to combine and co-ordinate informal waste pickers and recyclers into the formal economy, extending them with identity cards, proper training,

financial assistance, social security benefits, and safe working conditions. It is highly essential to collaborate the efforts of the scrap people with the local self-government systems of the country.

- **Establishment of Strong Regulatory Mechanisms:** Devise adequate regulatory systems for the scrap industry and strict enforcement of the existing waste management rules and environmental standards for recycling units. Adopt strong rules for different types of scrap processing.
- **Modernisation of Systems:** Extend adequate support for the scrap industry to modernise their operational systems in order to facilitate effective and economical recycling by way of subsidies, tax breaks, and access to green finance. Setting up of research and development in waste processing and material recovery is also essential.
- **Training and Development of Skills:** Delivering suitable training programs for the scrap labourers in the industry on safe handling of materials, efficient sorting, and operating modern machineries would help to enhance the quality of their services.
- **Financial Support:** Establish credit and microfinance schemes for informal waste collectors and small-scale recyclers would help to upgrade their operations and enhance working conditions.
- **Social Awareness and Education:** Public campaigns on the importance of waste segregation at source and the economic and environmental importance of the scrap industry would help to develop positive sentiments and attitude towards scrap workers.
- **Gathering of Data and Monitoring:** Strong systems need to be introduced for gathering relevant information on waste generation, collection, recycling and economic contributions of the scrap industry. This would give valuable inputs for policy decisions and performance evaluation of the industry.
- **Foster the Principles of Circular Economy:** Raise the spirit of manufacturers to make products by giving more emphasis on endurance, restorability, and recyclability. Encourage increased use of recycled materials in the manufacturing of new products.

Conclusion:-

The Indian scrap industry is a vibrant, multifaceted, and largely an informal segment that operates as a significant, but often unnoticed, system of economic activity and environmental management. Its economic role is apparent in its critical contributions to job creation, livelihoods, and the delivery of cheap raw materials for major industries, thereby improving the utilisation of resources. Moreover, its active involvement in waste management by routing millions of tonnes of materials from landfills and in preventing contamination by lowering the extent of fresh resource mining, energy utilisation, and greenhouse gas emissions is imperative for the sustainable development goals of India.

Even though the impediments of its informal nature, mainly affecting health, safety, and local effluence, are irrefutable, they emphasise the need for revival, not rejection. Standardising, monitoring, and regulating this key industrial segment, linked with technological integration and favourable policy contexts, delivers India a strong trajectory in achieving its waste management mission, reducing pollution, promoting a vigorous circular economy, and generating green jobs. The scrap industry is not just a division of the economy; it is a strategic mechanism that embraces the lever to a purer, greener, and highly resource-efficient prospect for India.

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