

A Study on Non Ferrous Metal: Copper in Circular Economy

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Abstract: This study has been undertaken to analyze the Circular Economy of Material Recycling Policy. Thus the study aimed at analyzing the market trends in Production, Consumption & Trade of Copper and examining the impact of these factors on Copper (Cu) Scrap generation using Regression Model & Forecasting & Trend Analysis. The study also investigated the international best practices. To analyze how much scrap is generated by 2025 in future, forecasting has been used. For the very purpose yearly time series data has been arranged. It is observed that Cu Scrap Generation is positively affected by Production and Imports of Cu and Negatively affected by Exports of Copper. The results have overall and individual significance which has been tested through F value, P value and t test.

Keywords: Circular Economy, Combisense, Autosort, Scrap

I. INTRODUCTION

Circular economy(CE) aims to redefine growth. It builds economic, natural, and social capital. It regenerates natural systems. It generates business and economic opportunities. Circular economy (CE) has 3R principles: reducing, recycling and reusing. (Heshmati,2015) It explains about the technical and biological cycles. They regenerate living systems, which provide renewable resources for the economy. It recovers and restore products through repair, reuse, remanufacture, recycling. It may lead to job creation, innovation and economic growth. Developing CE with the objective of promoting Eco Industrial Development (EID) and to meet growing demands and high rate of economic growth. It is a pathway to sustainable development.

Macroeconomic Impacts of Circular Economy

Netherlands: Incremental annual value addition of EUR 7.3 billion, creating 54,000 more jobs

Sweden: Increase in employment of 100,000 (2-3% of labor force), rise in net exports by >3% and reduction in CO₂ emissions of 70%

EU: USD 630 Bn annual cost savings from material efficiency, 2 Mn additional job creation

UK: Creation of 200,000–500,000 gross jobs

1.1 Benefits of Circular Economy

- **Reduced pressures on the environment:**
It reduces greenhouse gas (GHG) emissions, with positive impacts on the climate & better waste management. It helps to limit biodiversity loss.
- **Growth and jobs:**
It could create new jobs & strengthen growth. It may lead to the positive impact on employment.
- **Innovation:**
It could trigger innovation because of redesigning materials and products for circular use.
- **Increased competitiveness:**
It could bring savings to businesses and consumers.

1.2 Challenges of Circular Economy

- **Finance:**
Transition towards a circular economy would involve transition costs, such as asset investments, Research & Development (R&D). (Bourguignon,2016)
- **Skills:**
Skills enable businesses to design products with circularity and to engage in reuse and recycling.
- **Multi-level governance:**
It would require action at many levels and in many policy areas.

1.3 Circular Economy linking with sustainability

It contributes in **Goal 12 on sustainable consumption and production**. Broad areas for waste management:

- **Regarding production,** intends to improve product design by promoting the reparability, durability and recycling of products through producer responsibility schemes. It intends to foster resource efficiency in production processes in order to create business opportunities,
- **Regarding consumption,** It encourages innovative forms of consumption (e.g. sharing products or consuming services rather than products).

1.4 Why India needs a Material Recycling Policy?

- **A challenge that needs addressing:** India generates a mammoth 52 million tons of solid waste each year, expected to reach 137 million tons by 2025 – with waste management infrastructure being inadequate, scrap material recycling offers an alternative solution to India's waste challenge
- **India's resource burden:** Annual material consumption in India to triple by 2030 compared to 4.83 billion tons in 2009 – recycling offers a sustainable domestic supply option for India's material demand
- **Economic imperative of material recycling:**
 - Value creation potential from cost savings due to material recycling pegged at INR 14 Lac Cr. by 2030 or 11% of India's annual Gross Domestic Product (GDP)
 - Waste material recycling, instead of just collection and disposal, potentially creates six times as many jobs – includes both skilled and unskilled jobs
 - Job creation from material recycling more inclusive than conventional manufacturing sectors – has potential to organize and formalize large swathes of the poorer segment of India's population
- **Environmental imperative of material recycling:** Recycled materials have lower environmental footprint, with potential for reduction in GHG emissions due to material recycling pegged at 23% by 2030
 - recycled paper uses 60-70% less energy and 55% less water than virgin pulp;
 - every ton of recycled glass saves 322 KWh of energy and 246 kg of CO₂
 - every ton of recycled steel scrap consumes 40% less water and emits 58% less GHG

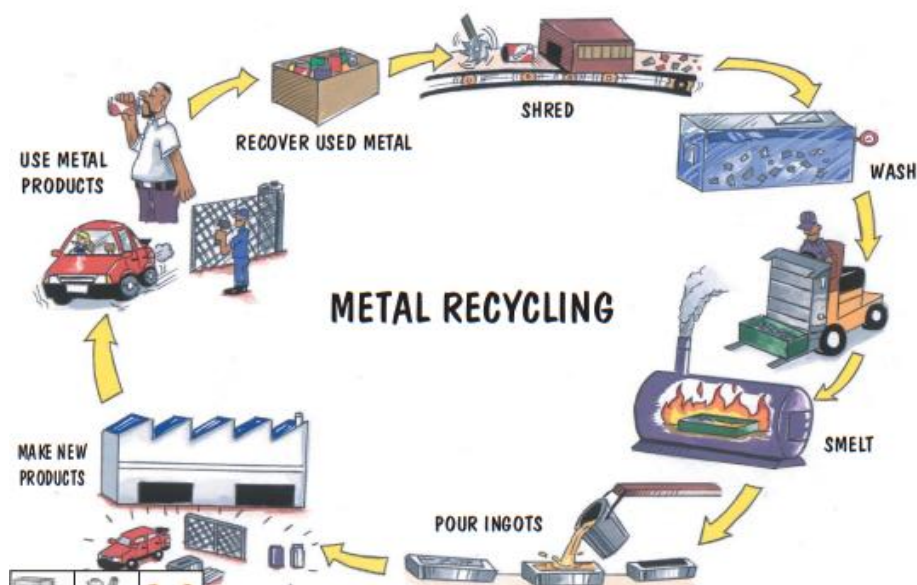
1.5 Recycling of Copper (Background Scenario)

The recycling of copper helps to satisfy the demand and to build a sustainable future. Recycling copper is a highly eco-efficient way. Copper Recycling requires 85% less energy than primary production.

Recycling Value Chain

Waste Generation by household consumers and Industrial producers then waste collection and segregation by rag pickers, scrap importers and scrap collector then processing by small scale players & organized sector players and finally production by manufacturers and shipbuilders in the form of consumer goods, capital goods, automobiles etc.

Figure 1: Recycling Process



Source: Department of Environmental Affairs & Tourism (Working with waste, n.d.)

The process is 5 stage process, the collector collects the scrap from the houses then give it to the segregator who segregates the items like paper, plastics, copper, aluminium, glass so that they can sell to the recycler at different prices according to the product so that they can earn money like copper at Rs.400/kg which is most highly paid, aluminium at Rs.100/kg, steel at 40/kg, brass at 200/kg, white plastic at 15/kg etc. who recycles & made a raw material of the product then it goes to 4th stage (manufacturers) where the products have been made from that raw material then finally it is supplied to the market to the wholesalers & retailers & finally it to consumers as it is observed through primary survey.

Figure2: Segregation can be done of various products which is represented below through diagrams:

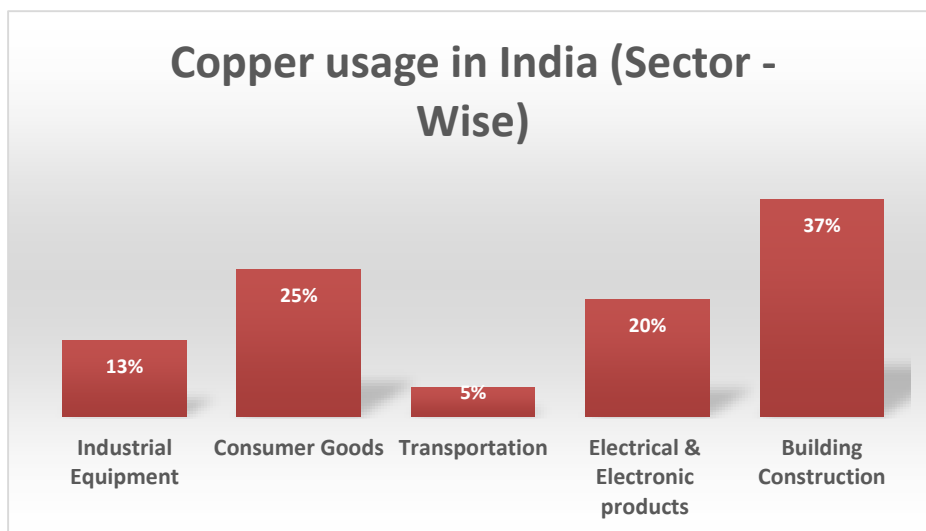


Source: Field Work

Copper Uses

Copper scrap is mostly extracted from: (a) Industrial motors (b) household/domestic wiring (c) copper power cables. The per capita consumption of copper in India during the year 2016 is at 0.6 kg which is very low. Electrical Industry is the largest consumer of copper, where it is used in the form of cables. By using copper in silicon chips. Copper is used in Construction Industry.

Figure3: Copper Usage in India (Sector Wise)



Source: Metal Minder: Freedonia Group

1.6 Global Scenario of Copper

Copper (Cu) is the best non-precious metal conductor of electricity. U.S. provides more than 20 percent of world supply of recovered copper. Copper holds 90 percent of new copper value. Some facts about copper and copper recycling: Copper was used by Neolithic man as a substitute for stone. The Egyptians heated and mold copper into shapes. The processing of recycled copper requires much less energy, provides a savings of 85–90 percent of energy requirements. The U.S. produces 8 percent of the world’s copper supply. Copper was one of the first metals indicating its use more than 10,000 years ago. In 2016, ISRI estimates that copper scrap usage in the United States is 33 percent of total U.S. apparent consumption of refined copper.

Copper scrap Exports

U.S. copper scrap export sales also to India (\$66 million), Belgium (\$57 million), Canada (\$192 million), Germany (\$121 million), South Korea (\$109 million), Japan (\$65 million).

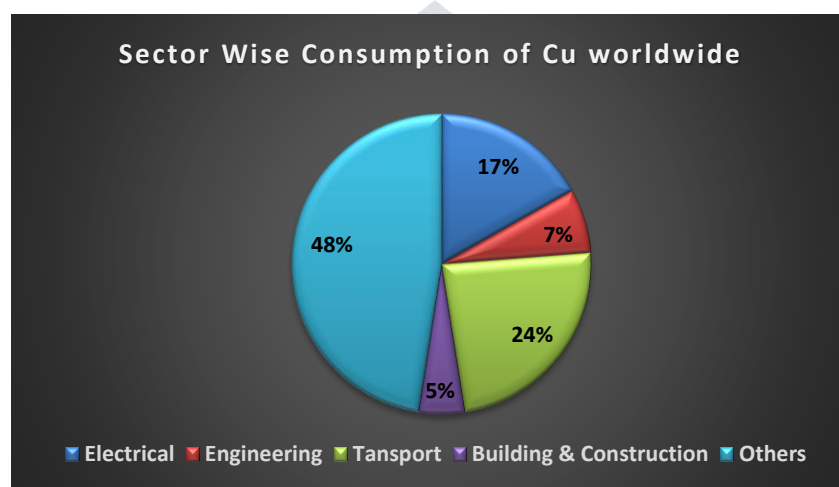
Figure 4: Global Trade Copper Scrap Exports & Copper Scrap Imports Graph is represented below:



Source: Author's own calculations/compilation using data from Institute of Scrap Recycling Industries, Inc. (ISRI, n.d.)

It has been analysed from these tables that in Global Trade Copper Scrap Exports (Tables represented in Appendices) is maximum in USA & minimum in Indonesia & India is not in top 20 exporters copper scrap, whereas in Global Trade Copper Scrap Imports is maximum in China and minimum in UK in 2015 & India is in 5th position who is great importer of copper scrap. China, the world's largest importer of copper scrap, can import all grades (including low yield / breakage material) High grade copper Insulated Copper Wire Brass Motors, Transformers (**Analyzing Copper scrap,2011**). The world mine production of copper increased by 3.34% in 2015. Chile continued to be the largest single producer of copper in 2015 with 30.1% share. Brazil Copper mine production in Brazil increased significantly to 1,55,000 in 2014. China Mined copper output decreased by 4% in 2015.

Figure 5: Sector Wise Consumption of Copper



Source: Ministry of mines

1.7 OBJECTIVES

The main focus/objective of my project was on Material Recycling Policy by exploring the possibility of adapting Circular Economy Mechanism for Non Ferrous Metal (Copper) in India.

- To analyse the Market Trend - Production & Trade and the impact of factors on Copper scrap generation.
- To analyse the International Best Practices of Metal Recycling which includes Copper recycling or Copper Scrap Recycling.

1.8 METHODOLOGY

Paper is based on Secondary Data. So far as 1st Objective is concerned, the Quantitative Research Methodology has been used, for this the study analyzed Trends of Production and Trade using Forecasting analysis from 2012-13 to 2024-25 and also examined the impact of these factors on Copper Scrap Generation. For this Multivariate Regression Analysis has been performed.

As far as concerned the 2nd Objective, the study used the Qualitative Research Methodology, where through in-depth review of literature, international practices of copper recycling has been analyzed.

1.9 DATA AND SOURCES OF DATA

For this study secondary data has been collected & some field work was done to gain the better understanding of how the recycling process works. From the website of FICCI Report 2018, Indian Minerals Yearbook 2017 (Metals & Alloys), Ministry of Mines (Govt. of India), data of production, Cu Scrap Generation, Exports of Cu and Imports of Cu has been collected from 2012 to 2016 and further data has been forecasted using forecasting analysis. International best practices has been retrieved from

government website of waste recycling and tomra case studies on recycling. Field work was there by visiting to the local collectors and to one of the recycling centre that is Namo E waste Management Limited.

2. DATA ANALYSIS & DISCUSSION

2.1 MARKET TRENDS: PRODUCTION, TRADE, SCRAP GENERATION

Paper is based on Secondary Data. As far as concerned with the Objective used the Quantitative Research Methodology, by using the Correlation which indicates the extent to which two or more variables fluctuate together and Regression Analysis which determines the relationship between dependent variable (Y) and other changing variables (Independent variables), here by having an impact of Production, Exports of Copper, Imports of Copper on Copper Scrap Generation.

Regression Equation can be represented as:

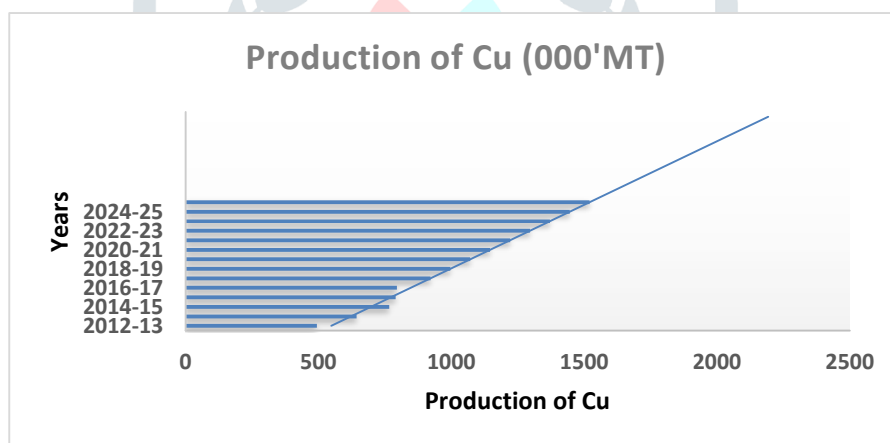
$$\text{Cu Scrap Generation}(y) = \beta_0 + \beta_1x_1(\text{Production}) + \beta_2x_2(\text{Exports of Cu}) + \beta_3x_3(\text{Imports of Cu}) + \epsilon$$

This multivariable regression equation represents the impact of predictor variables on response variable. β_0 represents the Y-Intercept, $\beta_1, \beta_2, \beta_3$ represents the regression coefficients. It is observed that Cu Scrap Generation is positively affected by Production and Imports of Cu and Negatively affected by Exports of Cu.

Here the data source of Production, Exports of Cu, Imports of Cu and Copper Scrap Generation is FICCI Report 2017, Indian Minerals Yearbook 2017 (Metals & Alloys), Ministry of Mines (Govt. of India). Here firstly we did the forecasting of various factors till 2025-26 using trend analysis which is verified by R^2 then perform Multivariate Regression Analysis to see the impact on Copper Scrap Generation. Here the assumption has been taken that whole Cu segregation Takes place therefore it is 100% recyclable, therefore our Cu Scrap Generation is the Consumption of Cu.

Factors growth in Future Years which has been forecasted using Trend Analysis:

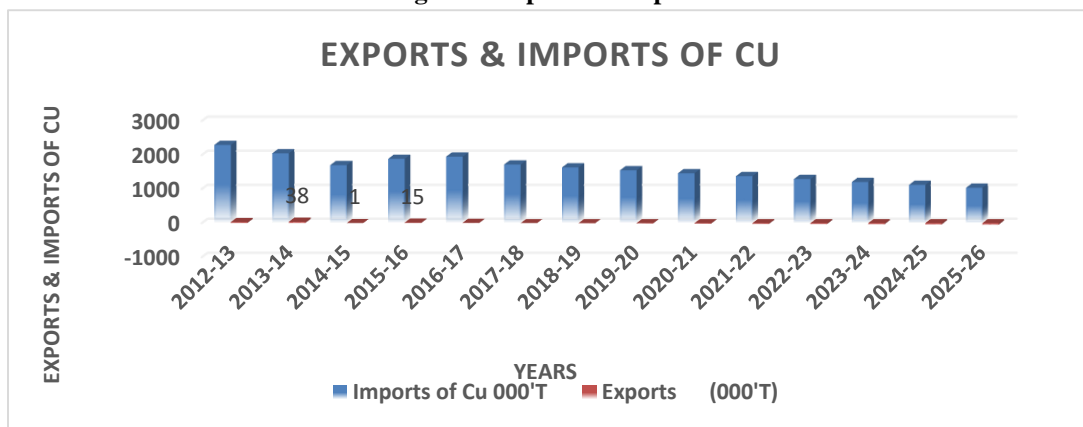
Figure6: Production of Cu



Source: Author's own calculation/Compilation from FICCI Report 2018

This graph represents that the production of Copper is continuously increasing throughout from 2017 to 2025 which is forecasted. It has been growing at a robust CAGR of 8.36% recording a level of production of 494 000'MT in FY 2012-13 to the highest level of production of 1520.6 000'MT in FY 2025-26.

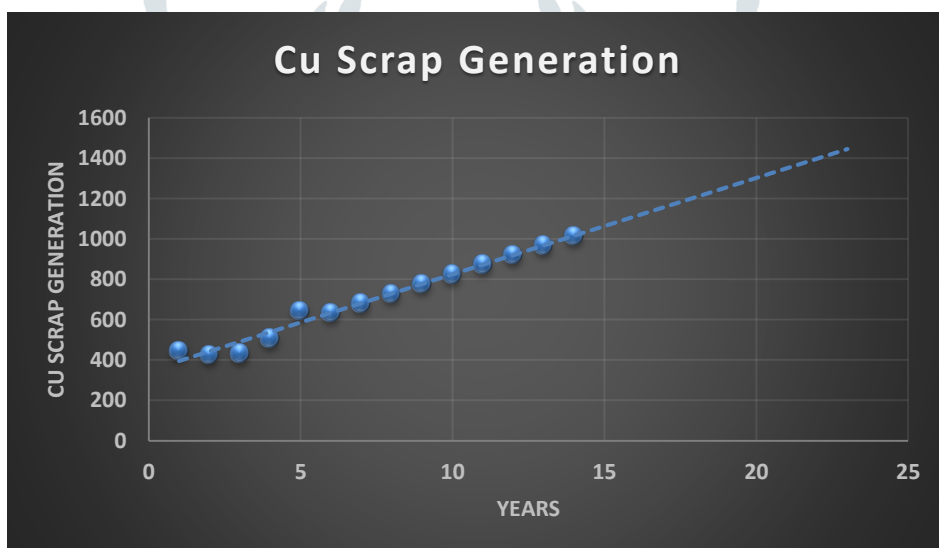
Figure7: Exports & Imports



Source: Author’s own calculation/Compilation from FICCI Report 2018

This graph represents the exports and imports of Copper. It shows that exports had shown a sudden increase from 1 000’tonne to 15 000’tonne from 2014-15 to 2015-16. (FICCI,2018)

Figure8: Copper Scrap Generation



Source: Author’s own calculation/Compilation from FICCI Report 2018

This graph represents that Cu Scrap Generation is continuously increasing which may be due to production or imports of Copper or Imports of Copper waste scrap etc. As copper is 100% recyclable as these scrap collected and extensively recycled to the converters in primary smelters.

2.2 RESULTS & DISCUSSION

Here it represents that Cu scrap generation is a dependent variable and the production of Cu, Exports of Cu, Imports of Cu are the independent variables which indicates the regression equation as:

Table 1: Regression Results

Factors	Coefficients	t Stat	P-value
Intercept	-1815.363444	-10.015273	1.567E-06
Production	1.214789038	14.733395	4.153E-08
Exports of Cu	-3.613217644	-4.4696964	0.001198
Imports of Cu	0.772645836	10.866571	7.384E-07

F- Value: It is close to 0 that is 3.3939E-12

Here the alpha is 0.05

$$y = -1815.36 + 1.211x_1 - 3.61x_2 + 0.77x_3 + \varepsilon \dots\dots\dots(1)$$

This regression case is overall significant by testing the significance of F as it is 3.39×10^{-12} which is very small number close to 0, which is less than 0.05 therefore it rejects the Null hypothesis, therefore the overall results are significant.

Null hypothesis is $H_0: \beta_1, \beta_2, \beta_3 = 0$

Alternate Hypothesis is $H_a: \beta_1, \beta_2, \beta_3 \neq 0$

This equation (1) represents that Cu Scrap Generation is positively related to Production which represents that if production increases which may lead to an increase in Cu scrap generation as if production of Cu increases which may lead to increase consumption therefore generate more scrap which is available to recycle as copper is 100% recyclable and therefore that scrap can be used, reused and dispersed again and again as getting copper (Metals) naturally can be expensive and time consuming, therefore recycling the scrap metal considered to be as the best option so that we can be able to conserve our resources and benefits to our economy and environment as it may lessens the Green House gas Emissions etc. and as Cu is 100% recyclable therefore we can say that whatever the amount we consume will be considered as scrap generation. To check individual significance we consider here P Value and t-test. Here the P Value is 4.15×10^{-8} which is very small amount, which is less than 0.05, therefore production has a significant impact on Cu Scrap Generation. According to t-test as alpha is 0.05 therefore critical value of t are $\pm t_{1-\alpha/2, n-2} = \pm t_{0.975, 12} = \pm 2.179$ and the calculated value of t in this case is 14.733 which is much larger therefore it rejects the null hypothesis, therefore the results are significant.

Similarly there are significant results for trade impact on Cu scrap generation according to p value and t test. As we observe that Exports of Cu has a negative impact on Cu Scrap generation which shows that if exports increase which may lead to fall in Consumption of Copper as the Cu has been supplied to another country so that it may lead to a fall in Cu scrap Generation in that particular country. Exports has a significant impact on Cu Scrap Generation as it has been tested through P Value and t test, according to P value, the P Value of exports is close to 0 which is less than 0.05 therefore it rejects the null hypothesis, it may lead to have significant result. According to t-test as alpha is 0.05 therefore critical value of t are $\pm t_{1-\alpha/2, n-2} = \pm t_{0.975, 12} = \pm 2.179$ and the calculated value of t for exports of Cu is 4.46 which is larger than critical region therefore rejects the null hypothesis, hence results are significant.

Similarly the Imports of Cu has a significant impact on Cu scrap generation, as if Imports increase which may lead to increase in consumption therefore it may lead to increase in more scrap generation which is available for recycling. P value has a significant impact as p value of imports is less than 0.05, which rejects the null hypothesis.

T test also has a significant impact as calculated value of t which is 10.86 which is greater than critical value 2.179 at 0.05 level of significance.

Therefore the results have overall and individual significance which has been tested through F value, P value and t test. The main objective to do this trend analysis & regression method is firstly to analyse how much scrap is generated by 2025 in future so that proper recycling methods can be adopted, proper collection mechanism should be there so that it may enhance the value chain which may improve our circular economy. Second objective is to analyse the impact of Production, Imports & Exports of Cu on Cu scrap generation. It explains Market Trend - Production, Consumption & Trade and the impact of factors on Copper scrap generation, did the trend analysis & forecasting of Copper Scrap Generation & of the various factors, to show the significance of variables or factors on Copper scrap generation, Multivariate Regression analysis has been performed. The results have been observed which shows that the Factors (Production of Copper & Imports of Copper) has positive impact on Copper scrap Generation whereas Exports of Copper has negative impact on Copper Scrap Generation & by testing through F value the results are overall significant and through P value test and t test the results are individually significant which shows that it has a significant impact on Copper Scrap Generation. The main objective to do this trend analysis & regression method is firstly to analyse how much scrap is generated by 2025 in future so that proper recycling methods can be adopted, proper collection mechanism should be there so that it may enhance the value chain which may improve our circular economy. Second objective is to analyse the impact of Production, Imports & Exports of Cu on Cu scrap generation.

3. INTERNATIONAL BEST PRACTICES:

3.1 MALAYSIA

ESM Facilities defined in national law/regulation can be one of the practice which Malaysia has adopted under the Environment Quality Act 1974, Environment Quality Order 1987, Environment Quality Regulation 2005, and Malaysian Standards 14001 ISO14001.



Malaysia initiated the project for Model Development for E-Waste Collection, Segregation & Transportation from households for recycling that is JICA Project for Technical Cooperation which enhance the e-waste collection from households through pilot projects by DOE. Mainly the Pilot Project has been designed to increase the collection points by setting up the new collection centres, to provide the service to take away e-waste from households when new products are delivered, to give enough incentive to households by the preparation of certain funds.

Similarly this Pilot Project also performs in India in the name of Namo e-waste Management Limited and many more (Recycler & PRO) where the e-waste collection from households has been done, then recycling occurred and new products are delivered at much cheaper rates to NGO's , Dealers etc. E.g: During the segregation process of various items, PCB's & copper have been separated so that the collected copper can be used to recycle and make new products out of it. India should increase the reach of these e-waste recyclers by giving awareness to the people so that these electronic items should be recycled and make best use of it.

Figure9: Namo e-waste Management Limited



Source: Field Visit: Namo e-waste Management Limited

3.2 CHINA

Jinlijia is one of China's best-managed scrap recycling company and operates on a large scale. It processes and recycles 200,000t (tonnes) of this mixed scrap per year. The first step in metal recycling is shredding. Jinlijia is able to shred an average 700t of mixed material each working day, or 13,000t per month. (case studies,n.d.)

Before the installation of FINDER, Jinlijia operated a relatively "basic" sorting line for simple and rough sorting. Eddy-current sorting, results in the separation of mixed non-ferrous metals. Jinlijia follows eddy-current sorting. If these materials could be recycled, will lead to a great improvement in operational efficiency. (case studies,n.d.).

The re-designed sorting process is indicated below:

In the redesigned non-ferrous metal sorting flow, the shredded scrap remove the magnetic ferrous metals. The resulting stream, containing no magnetic ferrous metal, is then separated, by drum-screen filtering, into four categories by size: <15mm; 15-30mm; 30-60mm, and >60mm. The FINDER sorting machine can maintain continuous sorting and highly efficient. The FINDER consumes only 4.3KW of power and provides a highly efficient sorting solution with low energy consumption and low emissions. Through the installation of FINDER overall operational cost has been reduced. It is a great sorting machine, combining high efficiency with high stability.

3.3 KOREA

Korea's WEEE (Waste Electrical and Electronic Equipment) association had direct responsibility for managing the Metropolitan Electronics Recycling Center (MERC). This plant first became operational in 2003 & recycled 21,000 tons per year. (Recovery of Waste, n.d.)

Replaces the MERC plant's existing mechanical treatment equipment with a more efficient **sensor-based sorting system**. Dense media separation (DMS) technology is used to separate waste. The introduction of a sensor-based sorting system, using AUTOSORT and COMBISENSE machines, was designed to realize two primary objectives:

- 1) To improve the separation of plastics according to their different colors and polymer types
- 2) To upgrade the quality of Al & Cu fractions recovered.

There is growing demand for premium-quality e-scrap, these upgrades would improve the economic viability of MERC's e-waste process. These aspirations encouraging the methodical management of e-waste and the adoption of a responsible 'life-cycle approach' to the purchase and eventual disposal of consumer products. This upgrade replaced the previous system which relied upon DMS gravitational separation. An optimum solution is the deployment of an AUTOSORT unit working alongside a COMBISENSE unit. This particular employed an array of detection technologies such as color line cameras, metal sensors and visual spectrometers capable of working flexibly and interactively to recover the specified scrap components. The role of the AUTOSORT unit was to sort plastics according to polymer type. Recover high-value fractions of copper and aluminum has been done through COMBISENSE unit. COMBISENSE sorting of e-scrap materials could recover aluminum fractions with a purity of 98%. & Copper fractions of 99% purity.

3.4 AURUBIS, LÜNEN, GERMANY

Aurubis Lünen produces high-quality copper which is recovered from copper containing scrap metal. Aurubis is now ranked one of the world's most modern and environmentally friendly facilities for melting and enriching non-ferrous and precious metals and has been ranked as the largest copper recycler worldwide. The Aurubis recycling equipment calls for operation of several units with FINDERS and COMBISENSE machines. A magnet first extracts the ferrous metals, non-ferrous fraction then passes an eddy current separator which divides the flow into two streams. One eddy current eject stream goes to the COMBISENSE for recovery of non-ferrous heavy metals & printed circuit boards. The main target is a maximum recovery of the non-ferrous-metal. Each FINDER separates metal fractions, it can detect & it is equipped with an electromagnetic sensor. The COMBISENSE handles the extraction of brass, copper from the aluminium fraction. The sensor-based sorting technologies were first deployed to handle this sorting process. Over the years various modifications and improvements is done such as new lamps, the replacement of valve blocks, and program optimisation to ensure all systems are always run at their most efficient levels.

Contributing to a sustainable circular economy

The copper recycling is an essential part of a sustainable circular economy, and key element is sensor-based sorting technology. Aurubis is the world's largest copper recycler.

3.5 DEDISA, CHANIA, GREECE

DEDISA, CHANIA, GREECE



Overview

DEDISA plant were developed by HELECTOR S.A., HELECTOR specializes in the design, technology provision, construction,

and operation of waste management projects, waste-management plant was designed to process a municipal waste stream of around 70,000 tons per year. As from 2015, this biological mechanical treatment plant has been renovated in order to upgrade its performance. A major aim was to increase the recovery of recyclables by 30%. The plant now operates nine AUTOSORT machines offering state-of-the-art optical sorting. (International best practices, n.d.)
The DEDISA upgrade project has two objectives:

1. A 30% increase in the production of recyclable materials;
2. The targeted achievement of high-efficiency processing and high-purity yields for each material.

For having an increase in efficiency, **new bag openers** were installed. With this it is possible to achieve the opening of smaller waste bags which enabled the separation of different materials. In the DEDISA plant format, squander rising up out of the second trommel screen is directed to the first of two optical sorters. This is the place the greater part of plastics are isolated and recouped, the staying waste material streams on to the following optical sorter where paper and board material is then arranged and expelled.

3.6 INDIA HAS DEVELOPED NFTDC – NON FERROUS MATERIALS TECHNOLOGY DEVELOPMENT CENTRE IN HYDERABAD:

All project activities bring together competence of NFTDC that is Design, Materials and Controls to render system level solutions. Some examples are given below:

Technology centers in Hyderabad



Main objective is to set up a Centre of Excellence for xEV electric drives so as to meet the R&D thrust areas in Electric Drives, (National Mission on Electric Mission) & to carry out extensive development activities in Electric Vehicle Motors & their control using state of art power Electronic Devices. (NFTDC, n.d.)

4 POLICY PRESCRIPTIONS

S.No	ISSUES	POLICY RECOMMENDATIONS
1.	Domestic Supply of Scrap	Increase consumer awareness on scrap disposal: <ul style="list-style-type: none"> • Guidelines on handling specific waste commodity • Introduction of user-fee for waste handling Integration of informal waste handlers in recycling value chain: <ul style="list-style-type: none"> • Identity cards for authorized waste pickers • Training of waste pickers on collection, segregation, aggregation and transport of each commodity • Social welfare benefits for waste pickers • Ward-wise registration of independent, individual itinerant waste pickers,

		waste aggregators and waste processors
2.	Impact of GST	<p>Protection of waste picker margins from GST</p> <ul style="list-style-type: none"> • Integrate and organize waste pickers as mentioned earlier – extend social welfare benefits to ensure above-subsistence conditions • Consider removal / reduction of GST on scrap as it is the lowest form of raw material
3.	Ease of Scrap Import	<p>Reduction / removal of import duty</p> <ul style="list-style-type: none"> • Reduction / removal of import duty on scrap to increase competitiveness of Indian recyclers till domestic supply is strengthened • <p>PSIC relaxation</p> <p>Installation of Radioactive Portal Monitors and Spectrographic Container Scanners in Indian ports to completely do away with PSIC from “safe countries”</p>
4.	Legal framework	<p>National Material Recycling Act and Rules</p> <ul style="list-style-type: none"> • Designing of legal framework for implementation of the provisions of this policy
5.	Behavioral transformation	<p>Cultural change in population</p> <ul style="list-style-type: none"> • Stricter and enforceable regulations • Public awareness campaigns • Incentivize to reduce/reuse/recycle used products

6.	<p>Waste Generation</p> <ol style="list-style-type: none"> 1. Low per capita consumption 2. Commodities used beyond useful life 3. Lack of awareness of using recycled products 4. Lack of knowledge in effective disposal <p>Waste collection and segregation</p> <ol style="list-style-type: none"> 1. Scrap collection low due to un-systematic processes 2. Limited knowhow in scrap segregation 3. Mostly informal 4. Import duty on scrap 5. Loss of CENVAT refunds with introduction of GST 6. Scrap overvalued, leading to higher CSD & IGST <p>Processing</p> <ol style="list-style-type: none"> 1. No credit related benefits for setting up recycling plant 2. Competition from cheap imports from FTA nations 	<ol style="list-style-type: none"> 1. Improving waste collection rates 2. Developing guidelines defining end of life usage for consumer products/automobiles 3. Develop license mechanism for waste collection, segregation & processing having minimum qualification requirements 4. Preparing standards and a quality certification program for recycled products 5. Stimulate recycling industry by providing financial/non-financial incentives. 6. Encourage R&D to develop technology for improving process efficiency 7. Revision of taxation of scrap imports 8. Revision of FTA to ensure local producers are not adversely affected 9. Capacity building of workers involved in waste segregation 10. Establish a comprehensive and structured recycling program which offers following benefits: <ul style="list-style-type: none"> • Support environmental sustainability goals • Generate significant revenue • Minimize disposal costs. • Reduce site legacy costs. 11. Set Up A Waste Minimisation Office 12. Extend fiscal benefits/income tax benefits/priority sector lending to metal recyclers <p>Benchmark</p> <ol style="list-style-type: none"> 13. Collaboration between private parties: <ol style="list-style-type: none"> 1. INDRA: <ol style="list-style-type: none"> 1. Renault and SUEZ partnered through their JV INDRA to create a competitive end-of-life vehicle treatment program. It recovered 355,000 vehicles & resold 95.4% of vehicle mass 2. Every Can Counts: <ol style="list-style-type: none"> 1. Initiative started by Minister of Waste, UK in 2009 to collect drink cans used by people at work & on the go. 2. Run by Alupro (industry funded, not-for-profit organization comprising aluminium producers, rollers, packers, reprocessors, exporters etc.) 3. Running in 14 countries with 15000 collection points reaching out to 21 million people 14. Initiatives by Government <ol style="list-style-type: none"> 1. Recycling batteries: <ol style="list-style-type: none"> 1. In cooperation with a private company, Lithuania Post helps resident dispose batteries in ecological way 2. Boxes kept in post office for waste batteries disposal. 3. Batteries collected and handed over for recycling to the company's partner. <p>Recommendation acc. to International Practices</p> <ol style="list-style-type: none"> 15. As Malaysia- Best scrap metal collector who has adopted Pilot Project, similarly India is in progressing stage by having Namoo e-waste management recycling centres and many more. 16. China adopted the installation of FINDER system as a technology which sorts and recover Non ferrous Metals. 17. Korea's Metropolitan Electronics Recycling Center, first plant became operational in 2003. This plant recycled 21,000 tons per year, adopted more efficient sensor based sorting system using AUTOSORT & COMBISENSE machines which has objective to upgrade the quality of copper fraction recovered, similarly as for Germany, Aurubis who is being the world's largest copper recycler, adopted AUTOSORT & COMBISENSE machines.
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