Report On Recycling Industry

(Focus on Paper Recycling)

14th November 2025

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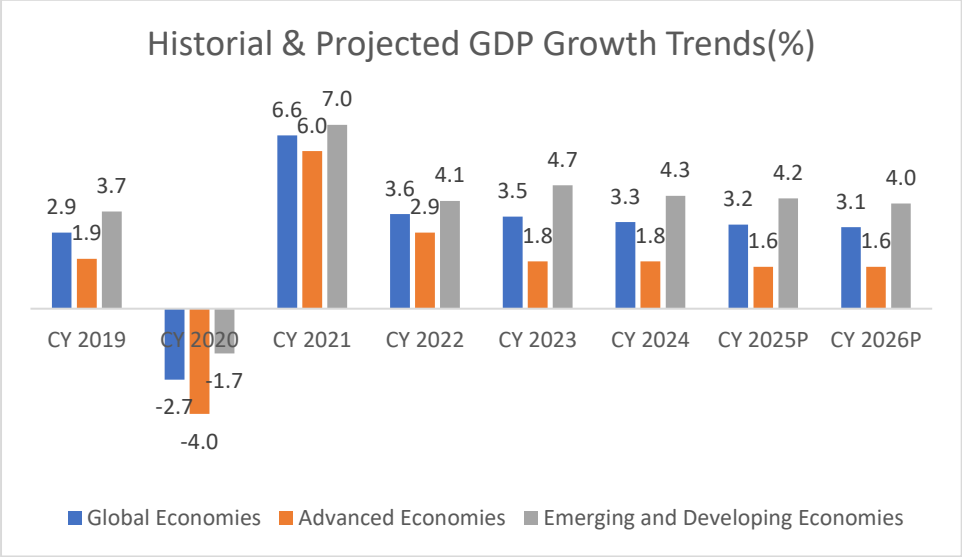
Global Macro-Economic Landscape

Global Economic Overview

The global economy, which recorded GDP growth at 3.3% in CY 2024, is expected to show resilience at 3.2% in CY 2025. This marks the slowest expansion since 2020 and reflects a -0.1%point downgrade from January 2025 forecast. Moreover, the projection for CY 2026 has also reduced to 3.1%. This slowdown is majorly attributed due to numerous factors such as high inflation in many economies despite central bank efforts to curb inflation, continuing energy market volatility driven by geopolitical tensions, and the extended uncertainty around the trade policies. High inflation and rising borrowing costs affected the private consumption on one hand while fiscal consolidation impacted the government consumption on the other hand. As a result, global GDP growth is projected to slow down from 3.3% in CY 2024 to 3.2% in CY 2025.

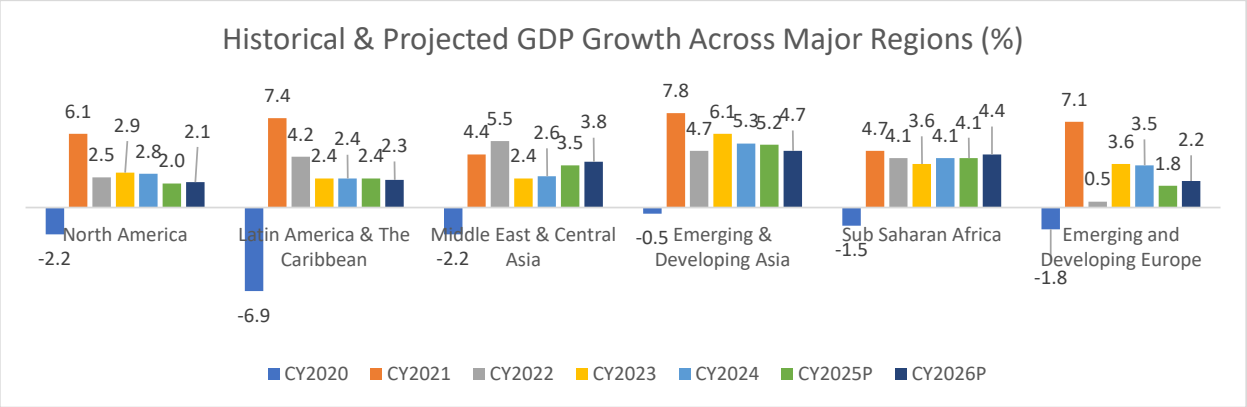


Source – IMF Global GDP Forecast Release October 2025

Note: Advanced Economies and Emerging & Developing Economies are as per the classification of the World Economic Outlook (WEO). This classification is not based on strict criteria, economic or otherwise, and it has evolved over time. It comprises of 40 countries under the Advanced Economies including the G7 (the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada) and selected countries from the Euro Zone (Germany, Italy, France etc.). The group of emerging market and developing economies (156) includes all those that are not classified as Advanced Economies (India, China, Brazil, Malaysia etc.)

Historical and Projected GDP Growth

GDP growth across major regions exhibited a mixed trend between 2022-23, with GDP growth in many regions including North America, Emerging and Developing Asia, and Emerging and Developing Europe slowing further in 2024. In 2025, GDP growth rate in Emerging and Developing Asia (India, China, Indonesia, Malaysia, etc.) is expected to moderate further to 5.2% from 5.3% in the previous year, while in the North America, it is expected to moderate to 2.0% in CY 2025 from 2.8% in CY 2024. Similarly in Emerging and Developing Europe is expected to moderate further to 1.8% from 3.5% in the previous year.



Source-IMF World Economic Outlook October 2025 update.

Except Middle East & Central Asia, all other regions like Emerging and Developing Asia, Emerging and Developing Europe, Latin America & The Caribbean, Sub Saharan Africa and North America, are expected to record a moderation in GDP growth rate in CY 2025 as compared to CY 2024. Further, growth in the United States is expected to come down at 2.0% in CY 2025 from 2.8% in CY 2024 due to lagged effects of monetary policy tightening, gradual fiscal tightening, and a softening in labor markets slowing aggregate demand.

Global Economic Outlook

The global economy is cautiously moving into a transitional phase, characterized by resilience amid uncertainty. Growth remains generally positive but varies across regions, influenced by changes in consumer demand, trade policy, and monetary and fiscal conditions. In advanced economies, household consumption and services continue to support activity, while manufacturing and export-driven sectors face challenges due to a weaker external environment.

The U.S. economy showed strong growth in Q2 2025 and is expected to benefit from lower interest rates starting in September. Australia also performed well, while Europe is dealing with stagnation. Canada's economy is slowing, and Germany's industrial sector remains under strain; Japan, however, is beginning to recover modestly. Among emerging markets, the Chinese Mainland maintains steady growth, supported by fiscal and credit stimulus, while India is accelerating due to strong domestic demand and investment inflows. Southeast Asian countries like Indonesia and Thailand, attractive for natural resources and semiconductors, are showing resilience amid supply chain diversifications. Several Latin American economies, such as Chile, are benefiting from improved commodity terms of trade, especially after raising copper price forecasts.

Global businesses are revising strategies as economic growth varies across regions and macro conditions shift. Multinationals are rebalancing geographic exposure—focusing on markets with strong domestic demand, stable policies, and clear regulations—while reassessing operations in slower or volatile economies. Supply chain diversification, once a defensive move, is now a structural strategy to access new consumers and reduce single-market risks. Investment is flowing to regions with predictable trade rules, critical inputs, and proximity to end-markets; for example, Mexico has seen increased FDI due to its U.S. proximity and

trade clarity. A subtle global shift is emerging despite ongoing risks, businesses are planning with the view that trade disruptions and tariff shocks may be managed through negotiation and gradual recalibration. Recent U.S.-Vietnam and EU-Indonesia trade talks emphasize phased tariff changes and cooperation over punitive actions. This tentative shift suggests a move from high volatility toward a more predictable, data-driven environment.

Trade tensions continue to affect global growth, especially in export-driven economies. However, signs suggest a shift toward a more managed phase of trade policy. Recent product-specific tariffs have been scoped and calibrated, often targeting manufacturers not investing in the U.S. The average U.S. tariff rate declined from 28% in April to around 17% by late 2025 (According to The Budget Lab at Yale).

This reflects two developments:

1. A wave of new trade deal announcements in September that have facilitated a concessional reduction in tariffs from the U.S., for example, the establishment of the 'US-EU Framework on an Agreement on Reciprocal, Fair, and Balanced Trade', the U.S.- Japan trade framework, and a 'Technology Prosperity Deal' memorandum of understanding signed with the U.K.

2. Recalibration by the U.S. of the products subject to tariffs as referred to in Annex II. In early September, the U.S. adjusted its trade framework, linking tariff exemptions more explicitly to security partnerships. Critical minerals were added to Annex II, granting them exemption from tariffs, while materials such as silicone and aluminum hydroxide lost exemption status. A new mechanism allows zero tariffs for countries signing both trade and security agreements with the U.S.

Businesses look increasingly willing to accept that tariffs are unlikely to be rolled back quickly. Instead, they are adapting their strategies – from diversifying sourcing to reconfiguring supply chains – to absorb, manage, or negotiate the impact of tariffs. We expect businesses operating in jurisdictions with clear trade frameworks and supportive domestic policies to begin showing stronger sentiment and investment intentions than those in more uncertain environments. Businesses are increasingly relying on domestic demand to counter tariff-driven export challenges.

Effective September 1, Canada removed many tariffs on U.S. goods imports that are compliant under the U.S.-Mexico-Canada Agreement (USMCA). Bilateral tariffs on autos, aluminum, and steel remain in place, though they are subject to ongoing discussions. The Canadian government has shown willingness to support sectors under pressure from the U.S., providing CAD1.2bn in loans and guarantees to the softwood and lumber industry (currently facing 32.5% U.S. tariffs). Asia Pacific countries are expanding trade partnerships beyond the U.S. Indonesia signed a landmark FTA with the EU, expected to double bilateral trade and eliminate tariffs on 98% of goods. India concluded a major trade deal with the U.K. and is in advanced negotiations with the EU.

Eastern Europe enters Q4 2025 in a fragile but stabilizing economic state. Poland and the Baltic states expect modest growth, supported by resilient consumption and easing inflation. Romania remains an outlier, facing the EU's highest inflation amid fiscal austerity. Regional exports are subdued due to weak German demand

and global trade tensions. Ukraine shows resilience through reconstruction and aid, while Russia and Belarus face slowing growth under sanctions.

In Central Asia, Uzbekistan and Kazakhstan continue steady expansion through industrial diversification and regional trade. Kazakhstan's expansionary fiscal stance is backed by oil revenues and reform plans. The Kyrgyz Republic and Tajikistan lead in growth, driven by remittances and domestic demand, though inflation persists. Turkmenistan's outlook remains muted due to hydrocarbon dependence.

Middle East & North Africa enters Q4 2025 with optimism as non-oil sector growth supports sustainable prospects. Governments focus on technology, tourism, manufacturing, financial services, and renewable energy. The UAE grew 3.9% y/y in Q1 2025, with non-oil contribution at 77%. Egypt launched its Narrative for Economic Development, a five-year plan for tourism, ICT, energy, and manufacturing. OPEC+ continues raising oil output to regain market share, but supply is expected to dip to 137,000 barrels/day in October. A cautious approach may firm crude prices, though subdued global demand remains a downside risk.

Global Growth Projection

At broader level, the global economy is expected to experience a slowdown in 2025, with GDP growth projected to decline to 3.2%, down from 3.3% in 2024. This deceleration reflects persistent inflationary pressure, geopolitical uncertainties and tightened monetary policies. However, a sightly recovery is anticipated in 2026, with growth projected to improve to 3.1%. In the United Kingdom, headline inflation, which began rising in 2024, is expected to continue increasing in 2025, partly due to changes in regulated prices. This rise is projected to be temporary, with a loosening labor market and moderating wage growth helping inflation return to target by end-2026. In the United States, inflation is expected to rise in the second half of 2025, as the impact of tariffs is no longer absorbed within supply chains and is instead passed on to consumers. Inflation is then expected to return to the Federal Reserve's 2 percent target in 2027. This forecast assumes modest second-round effects, implying upside risks to U.S. inflation and downside risks to employment.

Among emerging market and developing economies, inflation forecasts for Brazil and Mexico are revised upward. For Brazil, the revision is more pronounced and partly reflects the stabilization of inflation expectations above target, due to fiscal policy credibility challenges in the previous year, although currency appreciation is expected to provide relief in late 2025 and 2026. For Mexico, the upward revision is driven by volatile categories such as food and more persistent-than-expected services inflation. For several other economies, inflation forecasts are revised downward compared with the October 2024 WEO. In much of emerging and developing Asia, this is the case. The revision largely reflects lower-than-expected outturns,

with food, energy, and administrative prices playing a significant role—particularly in China, India, and Thailand.

In the United States, growth is projected to slow to 2.0 percent in 2025 and remain steady at 2.1 percent in 2026, broadly consistent with July projections and improved from April due to lower effective tariff rates, a fiscal boost from the OBBBA, and easing financial conditions. This reflects a significant slowdown from 2024 and a cumulative downward revision of 0.1 percentage point from the October 2024 WEO and 0.7 percentage point from the January 2025 WEO Update. The revision is primarily driven by greater policy uncertainty, higher trade barriers, and slower labor force and employment growth.

Growth in the euro area is expected to increase modestly to 1.2 percent in 2025 and to 1.1 percent in 2026. While this marks an improvement from April and July, it represents a cumulative downward revision of 0.4 percentage point compared to the October 2024 WEO. The main contributing factors are elevated uncertainty and higher tariffs. Recovering private consumption from higher real wages and fiscal easing in Germany in 2026 provide only a partial offset, while strong performance in Ireland supports growth in 2025. The euro area economy is expected to grow at potential in 2026.

For emerging market and developing economies, growth is projected to moderate from 4.3 percent in 2024 to 4.2 percent in 2025, and further to 4.0 percent in 2026. This is virtually unchanged from the July WEO Update and reflects a cumulative upward revision of 0.6 percentage point from the April 2025 WEO, but remains 0.2 percentage point lower than the October 2024 forecast, with low-income developing countries facing a larger downward revision than middle-income economies.

Growth in emerging and developing Asia is expected to decline from 5.3 percent in 2024 to 5.2 percent in 2025, and further to 4.7 percent in 2026. In several countries—particularly in ASEAN, among the most affected—growth forecasts closely followed changes in effective tariff rates. In China, the 2025 GDP growth forecast was revised downward by 0.6 percentage point in the April 2025 WEO due to escalating trade tensions with the United States and then revised upward by 0.8 percentage point in the July WEO Update following the pause on higher tariffs in May.

In Latin America and the Caribbean, growth is projected to remain stable at 2.4 percent in 2025 and decline slightly to 2.3 percent in 2026. The 2025 forecast is revised upward by 0.4 percentage point relative to April, driven by lower tariff rates for most countries in the region and stronger-than-expected incoming data. The revision is largely attributed to Mexico, which is expected to grow at 1.0 percent in 2025, 1.3 percentage points higher than forecast in the April 2025 WEO. For Brazil, the 2025 projection is revised upward, while the 2026 forecast is revised downward, partly due to the higher tariff rate on exports to the United States. For the region overall, the 2025–2026 forecast is cumulatively 0.5 percentage point lower than the October 2024 WEO, reflecting trade policy changes and uncertainty.

In emerging and developing Europe, growth is projected to decline significantly from 3.5 percent in 2024 to 1.8 percent in 2025, followed by a modest recovery to 2.2 percent in 2026. This decline is primarily driven by a sharp drop in Russia's growth forecast, from 4.3 percent in 2024 to 0.6 percent in 2025, and 1.0 percent

in 2026. The 2025 growth forecast is 0.9 percentage point lower than in the April 2025 WEO, largely due to recent data showing a concentration of fiscal expenditures in Q4 2024, which raised the 2024 GDP estimate from 4.1 percent to 4.3 percent. The payback effect is reflected in the 2025 projection.

India Macroeconomic Analysis

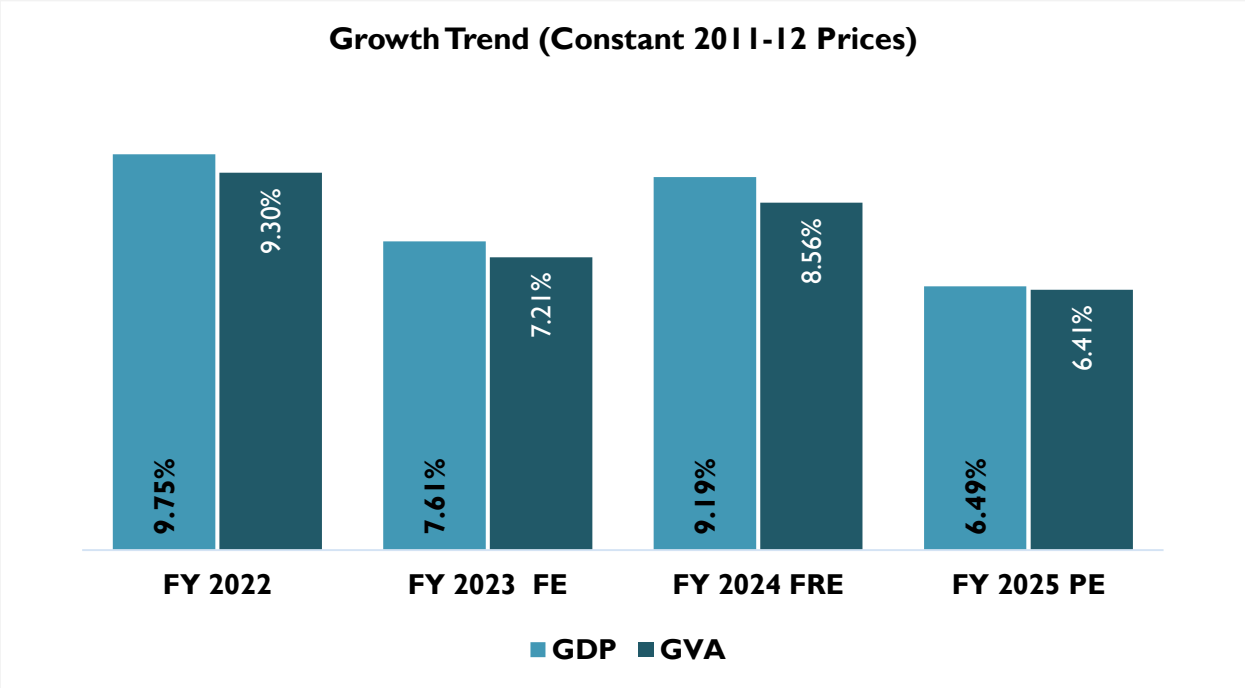
The International Monetary Fund (IMF), in its latest World Economic Outlook, has projected India's economy to grow at 6.6% in CY 2025, marking a 20-basis point upward revision from its previous estimate. This boost is largely credited to a strong first quarter performance in FY26, which helped offset the negative impact of increased U.S. tariffs on Indian exports. With this projection, India is set to remain one of the fastest growing emerging market and developing economies, outpacing China's expected growth of 4.8%. Despite global trade policy shifts and economic uncertainties, India's growth continues to be driven by resilient domestic demand and strong economic fundamentals. However, the IMF slightly lowered its forecast for CY 2026 to 6.2%, anticipating a natural moderation as the early momentum fades

Country	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025 P	CY 2026 P
India	–5.8%	9.7%	7.6%	9.2%	6.5%	6.6%	6.2%
China	2.3%	8.6%	3.1%	5.4%	5.0%	4.8%	4.2%
United States	-2.2%	6.1%	2.5%	2.9%	2.8%	2.0%	2.1%
Japan	-4.2%	2.7%	0.9%	1.4%	0.1%	1.1%	0.6%
United Kingdom	-10.3%	8.6%	4.8%	0.4%	1.1%	1.3%	1.3%
Russia	-2.7%	5.9%	-1.4%	4.1%	4.3%	0.6%	1.0%

Source: World Economic Outlook, October 2025

Historical GDP and GVA Growth trend

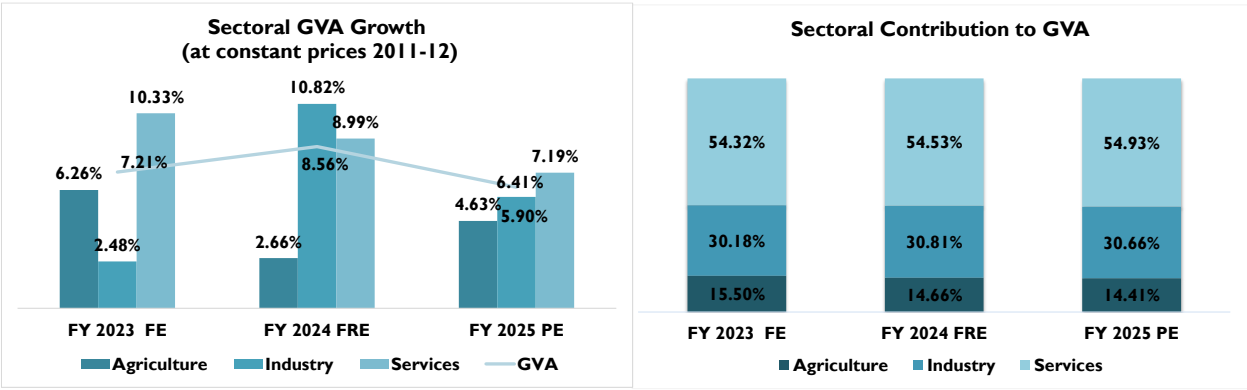
As per the latest estimates, India's GDP at constant prices is estimated to grow to INR 187.96 trillion in FY 2025 (Provisional Estimates) with the real GDP growth rates estimated to be 6.5% for FY 2025. Similarly, real Gross Value Added (GVA) growth stood is estimated to have moderated to 6.4% in FY 2025. Even amidst global economic uncertainties, India's economy exhibited resilience supported by robust consumption and government spending.



Source: Ministry of Statistics & Programme Implementation (MOSPI), National Account Statistics: FY2025.

FE is Final Estimates, FRE is First Revised Estimate and PE is Provisional Estimates

Sectoral Contribution to GVA and annual growth trend



Source: Ministry of Statistics & Programme Implementation (MOSPI)

FE is Final Estimates, FRE is First Revised Estimate and PE is Provisional Estimates

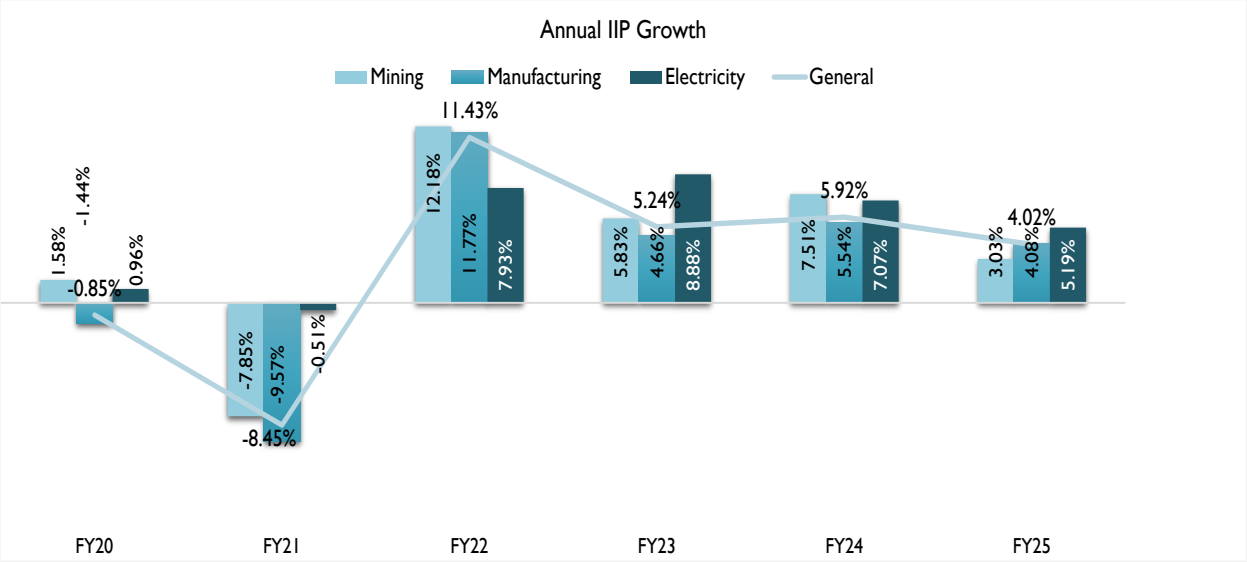
Sectoral analysis of GVA reveals that the industrial sector experienced a moderation in FY 2025, recording a 5.90% y-o-y growth against 10.82% year-on-year growth in FY 2024. Within the industrial sector, growth moderated across sub sector with mining, manufacturing, and construction activities growing by 2.69%, 4.52%, and 9.35% respectively in FY 2025, compared to 3.21%, 12.30%, and 10.41% in FY 2024. Growth in the utilities sector too moderated to 6.03% in FY 2025 from 8.64% in the previous year. The industrial sector's contribution to GVA moderated marginally from 30.81% in FY 2024 to 30.66% in FY 2025.

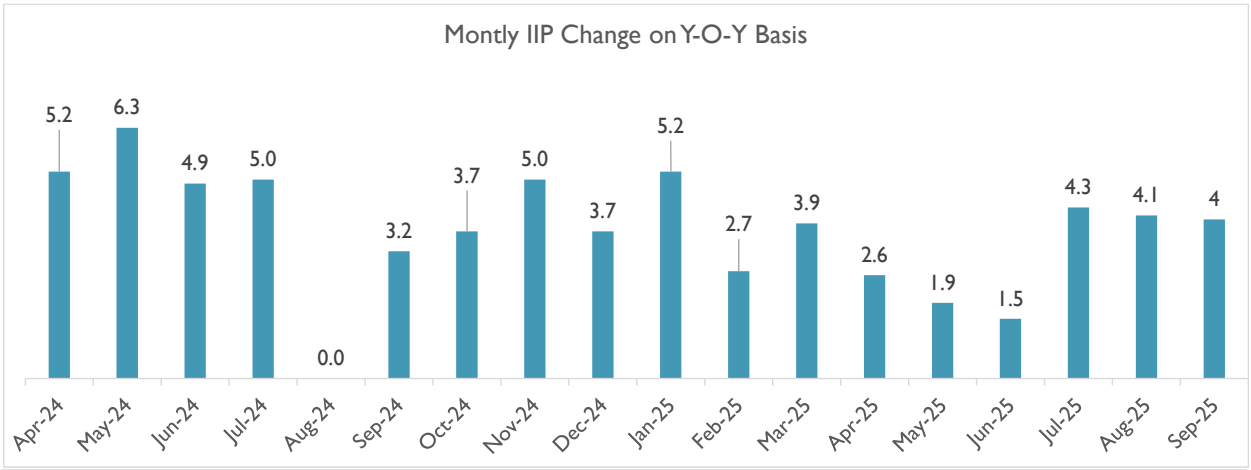
The services sector continued to be the main driver of economic growth, although its pace moderated. It expanded by 7.19% in FY 2025 from 8.99% in FY 2024. The services sector retained its position as the largest contributor to GVA, rising from 54.32% in FY 2023 to 54.53% in FY 2024, with a further increase to 54.93% in FY 2025.

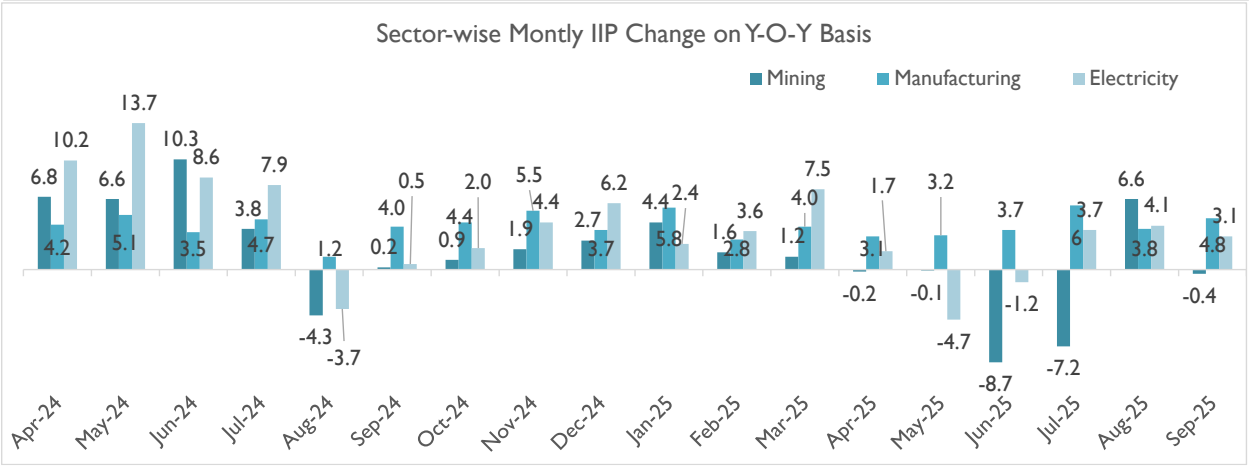
The agriculture sector saw an acceleration, with growth increasing from 2.66% in FY 2024 to 4.63% in FY 2025. However, its contribution to GVA declined marginally from 14.66% in FY 2024 to 14.41% in FY 2025. Overall, Gross Value Added (GVA) growth moderated to 6.41% in FY 2025 from 8.56% in FY 2024

Annual & Monthly IIP Growth

Industrial sector performance as measured by IIP index exhibited moderation in FY 2025, recording a 4.02% y-o-y growth against 5.92% increase in the previous year. The manufacturing index showed moderation and grew by 4.08% in FY 2025 against 5.54% in FY 2024. Mining sector index too moderated and exhibited a growth of 3.03% in FY 2025 against 7.51% in the previous years while the Electricity sector Index, also witnessed moderation of 5.19% in FY 2025 against 7.07% in the previous year.





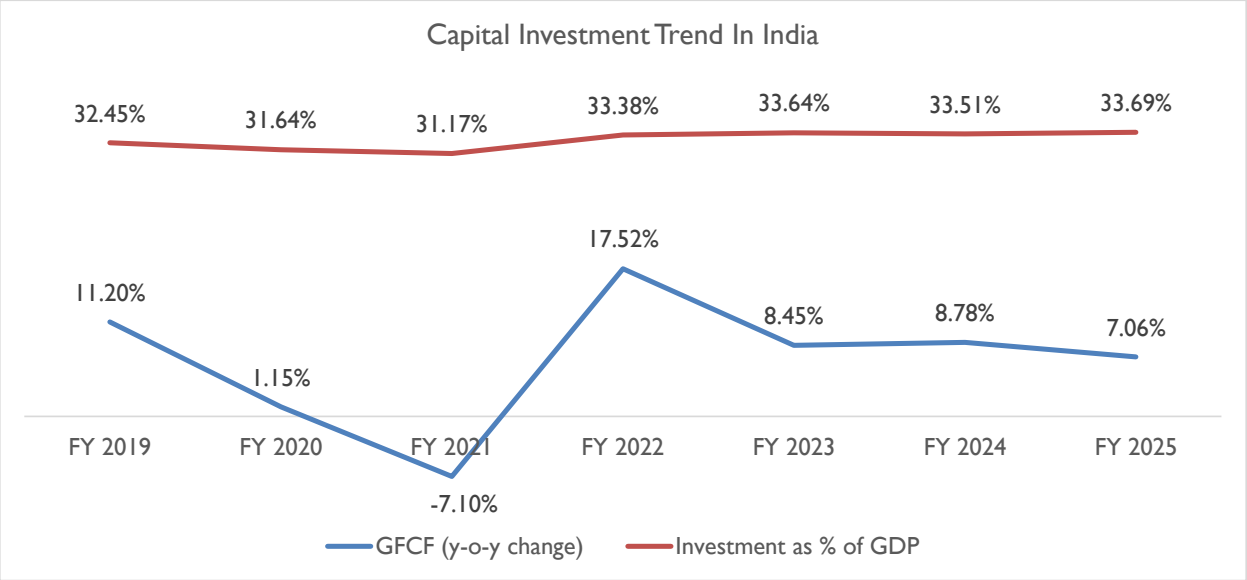


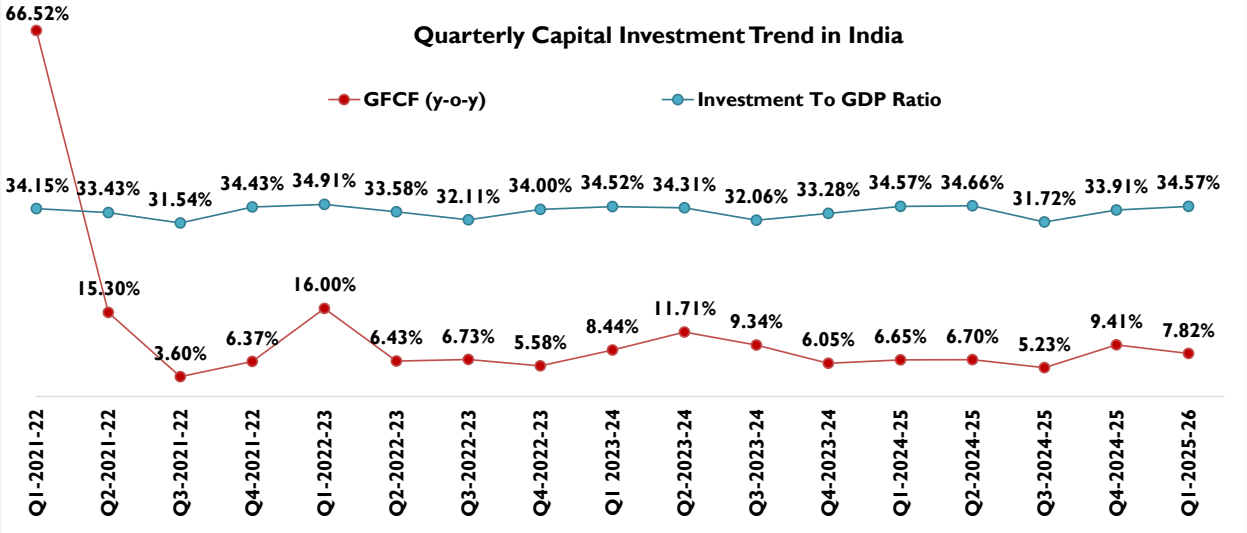
Source: Ministry of Statistics & Programme Implementation (MOSPI)

The IIP growth rate for the month of September 2025 is 4.0% which was 4.1% in the month of August 2025. The growth rates of the three sectors, Mining, Manufacturing and Electricity for the month of May 2025 are (-)0.4%, 4.8% and 3.1% respectively.

Annual and Quarterly: Investment & Consumption Scenario

Other major indicators such as Gross fixed capital formation (GFCF), a measure of investments, has shown fluctuation during FY 2025 as it registered 7.06% year-on-year growth against 8.78% yearly growth in FY 2024, taking the GFCF to GDP ratio measured to 33.69%.

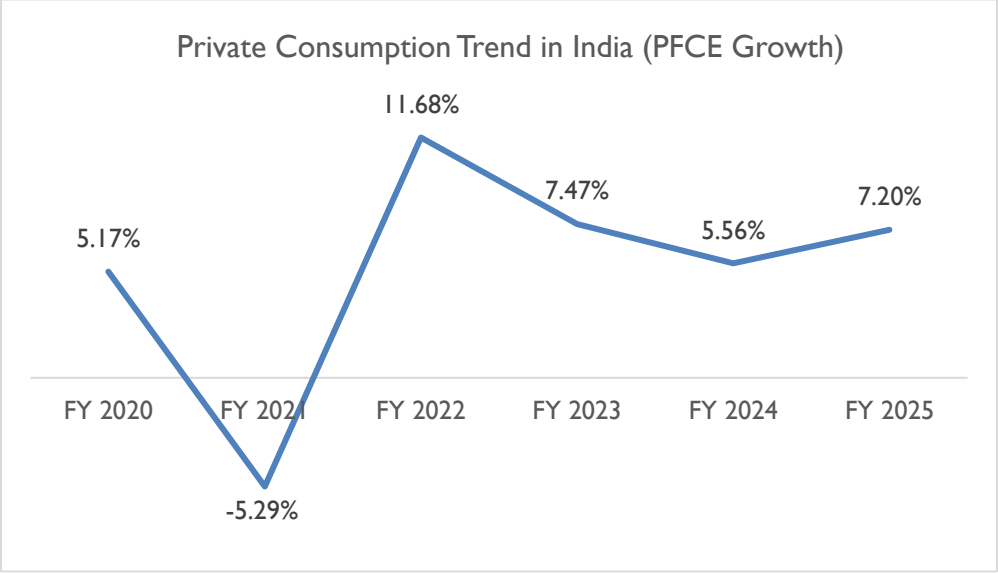


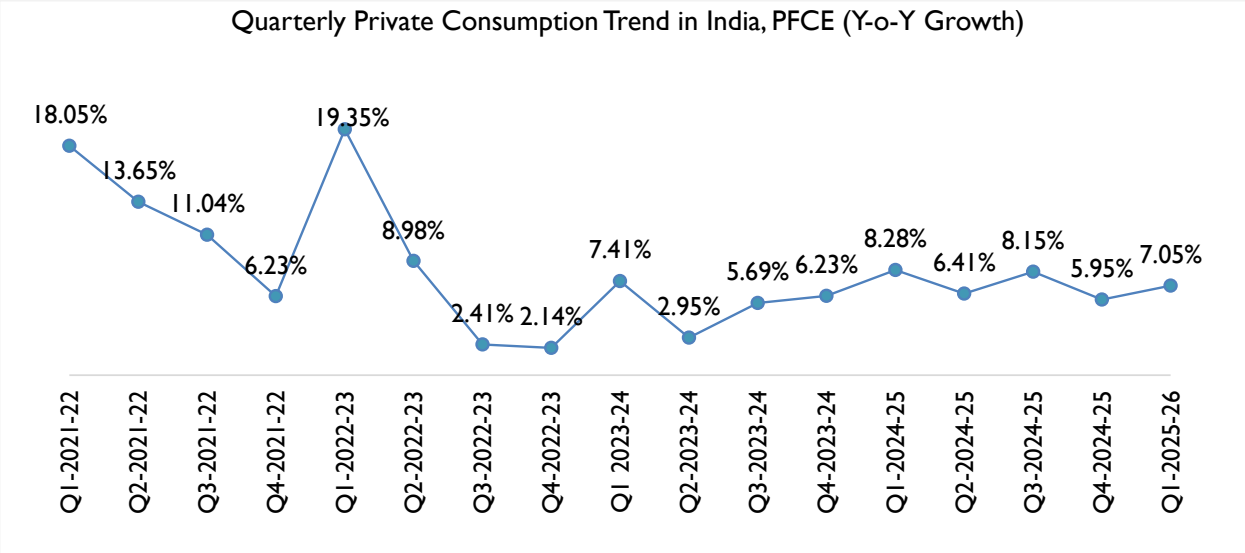


Source: Ministry of Statistics & Programme Implementation (MOSPI)

On a quarterly basis, GFCF showed a fluctuating trend in year-on-year growth. After a sharp spike of 66.52% in Q1 FY 2021-22, growth moderated significantly and remained volatile across subsequent quarters. In FY 2024, the growth rate eased to 6.05% in Q3 (Dec quarter) compared to 9.34% in Q2, as government capital spending slowed ahead of the 2024 general election. It improved slightly to 6.65% in Q1 FY 2024-25 but moderated again to 6.70% in Q2 and 5.23% in Q3, before rebounding to 9.41% in Q4. In Q1 FY 2025-26, growth stood at 7.82%, lower than the previous quarter.The GFCF to GDP ratio measured 34.57% in Q1 FY 2025-2026.

Private Consumption Scenario





Sources: MOSPI

Private Final Expenditure (PFCE) a realistic proxy to gauge household spending, observed growth in FY 2025 as compared to FY 2024. Quarterly Private Final Consumption Expenditure (PFCE) has reported 7.05% growth rate during Q1 of FY 2025-26 as compared to the 8.28% growth rate in the corresponding period of previous financial year.

Inflation Scenario

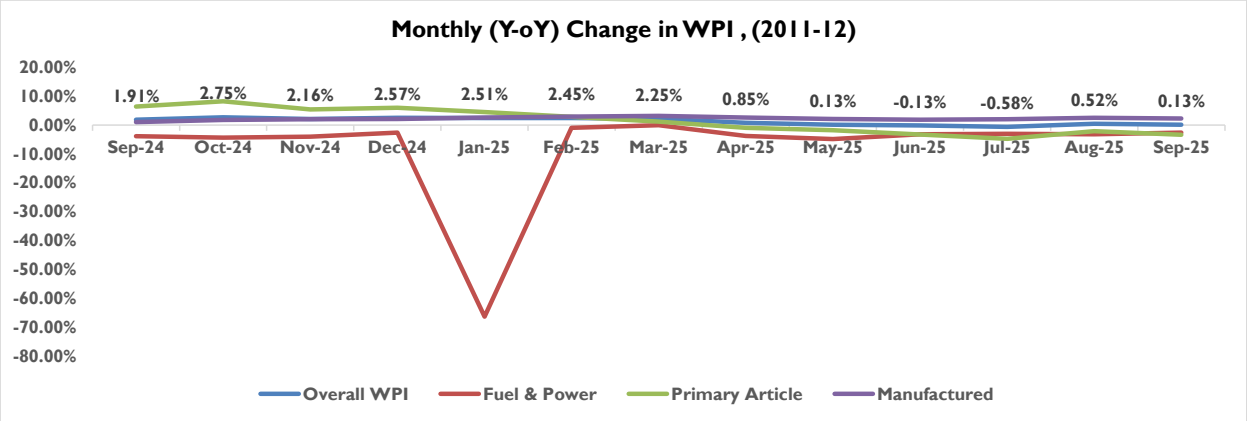
The inflation rate based on India's Wholesale Price Index (WPI) exhibited significant fluctuations across different sectors from September 2024 to September 2025. The annual rate of inflation based on All India Wholesale Price Index (WPI) number is 0.13% (provisional) for the month of September 2025 (over September, 2024). Positive rate of inflation in September 2025 is primarily due to increase in prices of

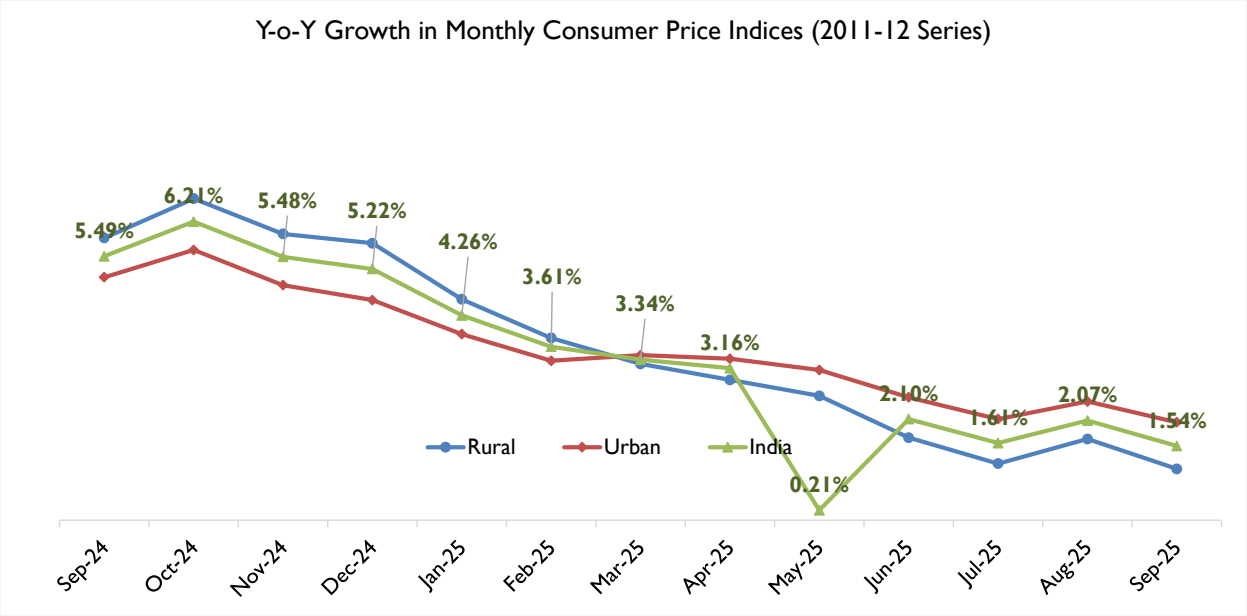
manufacture of food products, other manufacturing, non-food articles, other transport equipment and textiles etc.

By September 2025, Primary Articles (Weight 22.62%): - The index for this major group decreased by 1.05 % from 191.0 (provisional) for the month of August 2025 to 189.0 (provisional) in September 2025. Price of food articles (-1.38%) and non-food articles (-1.06%) decreased in September 2025 as compared to August 2025. The price of minerals (1.36%) and Crude Petroleum & Natural Gas (0.64%) increased in September 2025 as compared to August, 2025.

Moreover, Fuel & Power (Weight 13.15%): - The index for this major group decreased by 0.14% from 143.6 (provisional) for the month of August 2025 to 143.4 (provisional) in September 2025. The price of and mineral oils (-0.54%) and coal (-0.15%) decreased in September 2025 as compared to August 2025. The price of electricity (1.20%) increased in September 2025 as compared to August 2025.

Furthermore, Manufactured Products (Weight 64.23%): - The index for this major group increased by 0.21% from 144.9 (provisional) for the month of August 2025 to 145.2 (provisional) in September 2025. Out of the 22 NIC two-digit groups for manufactured products, 10 groups witnessed an increase in prices, 6 groups witnessed a decrease in prices and 6 groups witnessed no change in prices. Some of the important groups that showed month-overmonth increase in prices were other manufacturing; food products; electrical equipment; textiles and other non-metallic mineral products etc. Some of the groups that witnessed a decrease in prices were manufacture of rubber and plastics products; motor vehicles, trailers and semi-trailers; pharmaceuticals, medicinal chemical and botanical products; leather and related products and printing and reproduction of recorded media etc. in September, 2025 as compared to August 2025.

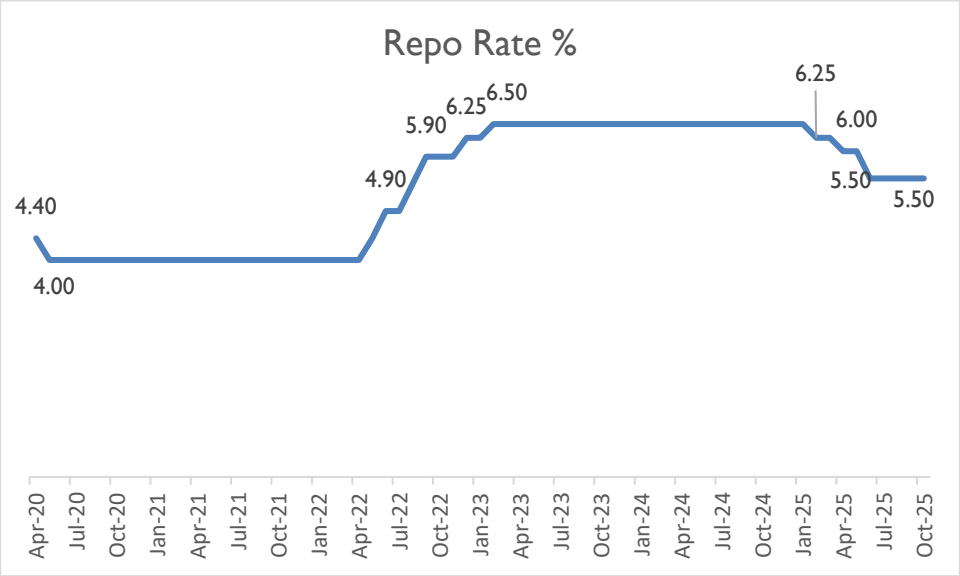




Source: MOSPI, Office of Economic Advisor

Retail inflation rate (as measured by the Consumer Price Index) in India showed notable fluctuations between September 2024 and September2025. Year-on-year inflation rate based on All India Consumer Price Index (CPI) for the month of September 2025 over September 2024 is 1.54% (Provisional). There is decrease of 53 basis points in headline inflation of September 2025 in comparison to August 2025. It is the lowest year-on-year inflation after June 2017.

Rural Inflation: A decrease in headline and food inflation in rural sector was observed in September 2025. The headline inflation is 1.07% (Provisional) in September 2025 while it was 1.69% in August 2025. While in Urban inflation, a decrease from 2.47% in August 2025 to 2.04% (Provisional) in September 2025was observed in headline inflation. The decline in headline inflation and food inflation during the month of September 2025 is mainly attributed to favorable base effect and to decline in inflation of Vegetables, Oil and fats, Fruits, Pulses and products, Cereal and products, Egg, Fuel and light etc. As part of its anti-inflationary stance, the Reserve Bank of India (RBI) hiked the repo rate by 250 basis points between May 2022 and 8 February 2023, holding it steady at 6.50% until January 2025. On 6 June 2025, the RBI reduced the repo rate by 50 basis points, bringing it to 5.50%, where it currently stands as per the October 2025 monetary policy review.



Sources: CMIE Economic Outlook

Growth Outlook

The Union Budget 2025-26 has laid the foundation for sustained growth by balancing demand stimulation, investment promotion and inclusive development. Inflation level is reaching within the central bank's target; the RBI may pursue further monetary easing that will support growth. The medium-term outlook is bright, fueled by the emphasis on physical and digital infrastructure spending. With a focus on stimulating demand, driving investment and ensuring inclusive development, the budget introduces measures such as tax relief, increased infrastructure spending and incentives for manufacturing and clean energy. These initiatives aim to accelerate growth while maintaining fiscal discipline, reinforcing India's long-term economic resilience. The expansion of tax relief i.e zero tax liability for individuals earning up to INR 12 lacs annually under the new tax regime is expected to strengthen household finances and, consequently, boost consumption.

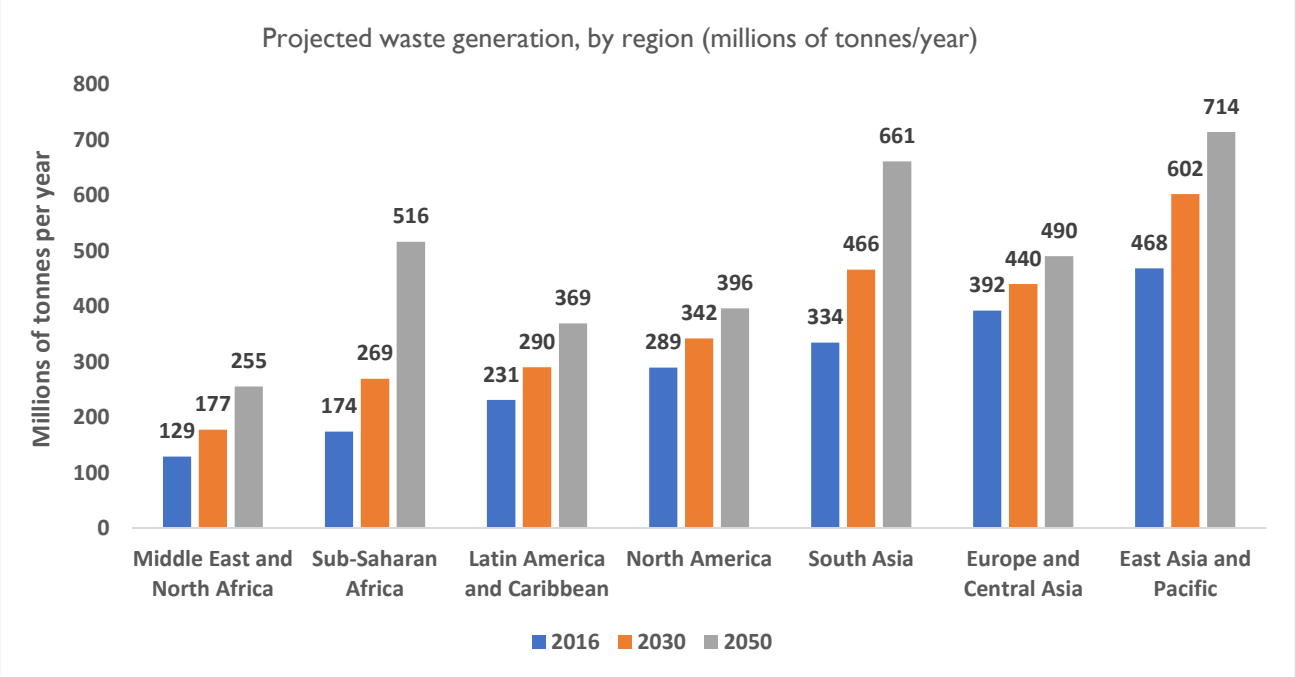
The external sector remains resilient, and key external vulnerability indicators continue to improve. However, tariff-related uncertainty is likely to weigh on exports and investment, prompting us to cut our CY26 GDP growth forecast to 6.2%.

Global Overview on Recycling Industry

Global Waste Generation is a pressing concern, with the world currently producing 2.01 billion tonnes of municipal solid waste annually, with at least 33% not being managed in an environmentally safe manner. On average, individuals generate 0.74 kg of waste per day, though this varies significantly, ranging from 0.11 kg to 4.54 kg. High-income countries, despite representing only 16% of the global population, are responsible for 34% of the world's waste, amounting to 683 million tonnes annually.

Looking ahead, global waste production is projected to reach 3.40 billion tonnes by 2050, outpacing population growth over the same period. Waste generation is closely linked to income levels, with high-income countries expected to see a 19% rise in per capita daily waste by 2050. In contrast, low- and middle-income countries may experience an increase of 40% or more. Waste generation initially declines at the lowest income levels but then rises rapidly as income increases, particularly in low-income nations. By 2050, waste output in low-income countries is expected to msore than triple.

Currently, the East Asia and Pacific region accounts for the largest share of global waste at 23%, while the Middle East and North Africa generate the least in absolute terms at 6%. However, the most rapid growth is occurring in Sub-Saharan Africa, South Asia, and the Middle East and North Africa, where waste production is projected to triple, double, and double, respectively, by 2050. In these regions, more than half of the waste is openly dumped, posing significant environmental, health, and economic risks. Addressing these challenges requires immediate action to improve waste management practices and sustainability efforts.

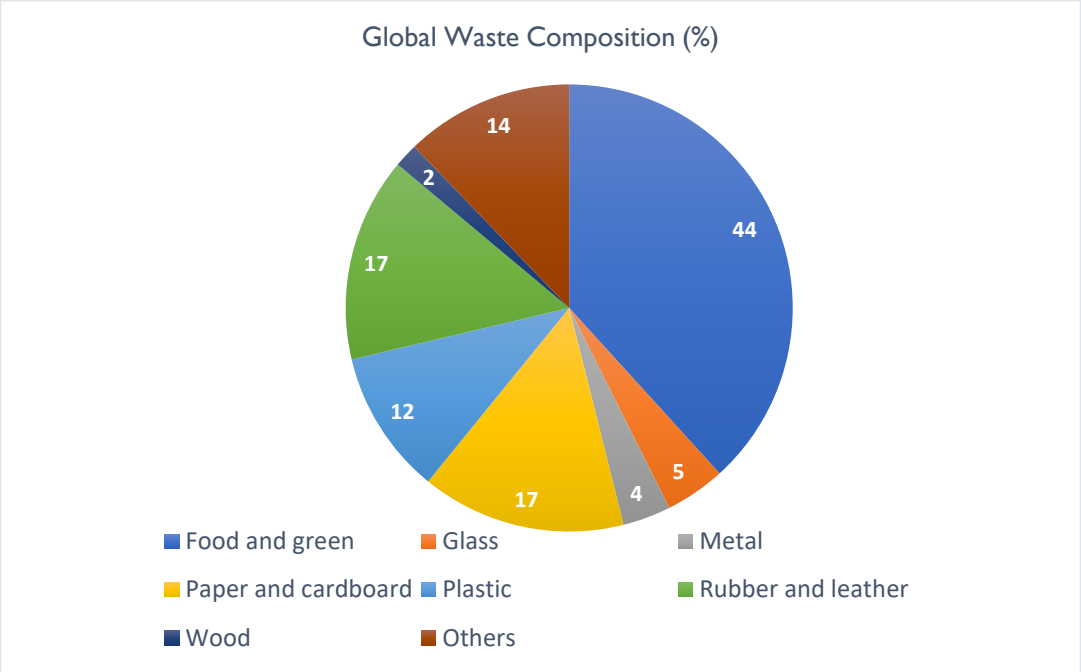


Source: A Global Snapshot of Solid Waste Management to 2050

Waste collection plays a vital role in waste management, but coverage differs significantly based on income levels. Upper-middle- and high-income countries achieve nearly universal waste collection, while low-income countries collect approximately 48% of waste in urban areas, with coverage dropping to 26% in rural regions.

Regionally, Sub-Saharan Africa has a collection rate of about 44%, whereas Europe, Central Asia, and North America collect at least 90% of waste.

Global waste composition (%) as per Solid waste management



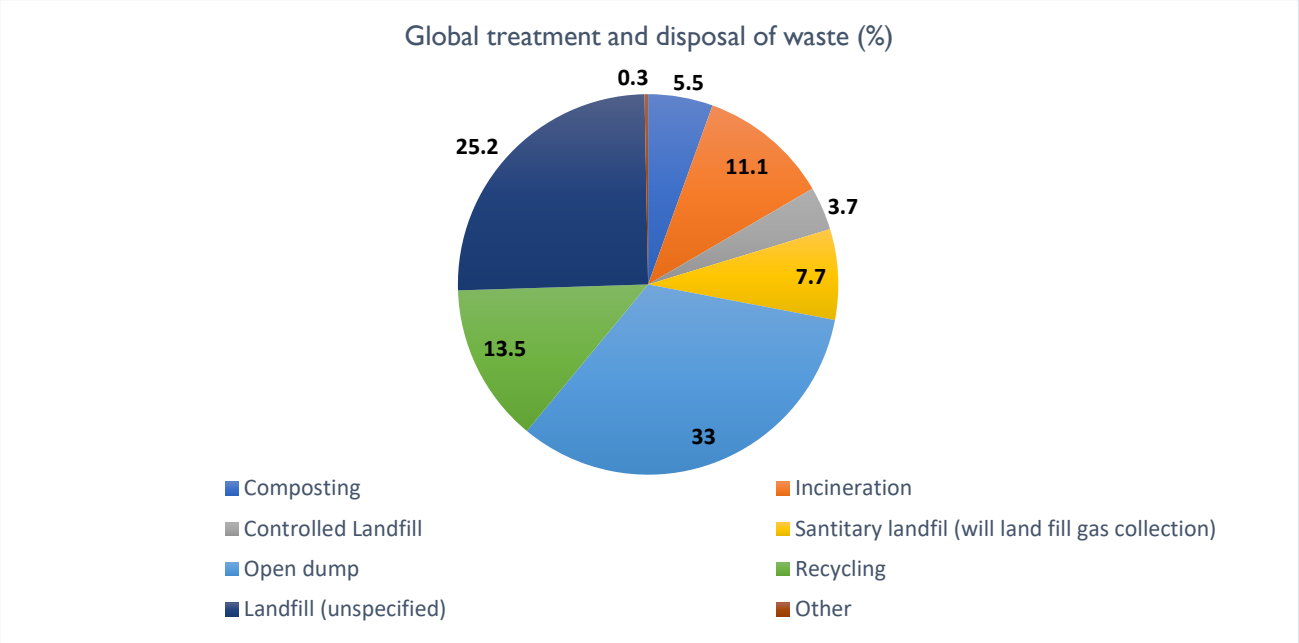
Source: The World Bank

The Global Waste Composition chart indicates that food and green waste constitutes 44% of global waste, highlighting the importance of composting and food waste reduction. Plastic waste accounts for 12%, pointing to challenges related to plastic pollution and the need for improved recycling. Paper and cardboard waste contribute 17%, suggesting that strengthening paper recycling programs could reduce landfill waste. Rubber and leather waste also make up 17%, influenced by industries like fashion, footwear, and automotive sectors. The "Others" category, comprising 14%, represents various miscellaneous waste types that require further classification for efficient management. Glass (5%), metal (4%), and wood (2%) constitute smaller portions but remain important for recycling and sustainable resource use. These findings underscore the need for targeted waste management policies, improved recycling systems, and sustainable material utilization to mitigate environmental impact.

- **Global treatment and disposal of waste (%) as per Solid waste management**

Technology alone cannot resolve the issue of unmanaged waste; effective waste management requires locally appropriate solutions. Globally, 37% of waste goes to landfills, including 8% in sanitary landfills with gas collection. 31% is openly dumped, 19% is recycled or composted, and 11% is incinerated.

High-income countries use regulated landfills and diversion methods, while 93% of waste in low-income countries is openly dumped. The Middle East and North Africa, Sub-Saharan Africa, and South Asia rely heavily on open dumping. Upper-middle-income countries landfill 54% of waste, whereas high-income nations landfill 39%, recycle or compost 36%, and incinerate 22%, primarily where land is scarce.



Source: The World Bank

In 2018, solid waste treatment and disposal generated 1.6 billion tonnes of CO_2-equivalent emissions, accounting for 5% of global emissions, primarily from open dumps and unmanaged landfills. Food waste contributes nearly 50% of these emissions. Without intervention, emissions could rise to 2.38 billion tonnes annually by 2050.

Solid waste management is typically a local responsibility, with 70% of countries having dedicated institutions for policy and regulation. Two-thirds of countries have waste management laws, but enforcement varies. About 70% of waste services are managed by local entities, with one-third involving public-private partnerships, which require proper incentives to be effective.

Funding remains a major challenge, especially for operational costs. In high-income countries, waste management costs over $100 per tonne, while lower-income countries spend around $35 per tonne but struggle with cost recovery. Transport alone costs $20–$50 per tonne. User fees range from $35 per year in low-income to $170 in high-income countries, with full cost recovery mostly seen in wealthier nations. Local governments fund 50% of waste system investments, with the rest coming from national subsidies and private sector contributions.

Market drivers

Circular Economy Initiatives

- The shift to a circular economy prioritizes resource reuse, remanufacturing, and recycling, reducing waste and boosting the recycling industry.
- Example- The EU Circular Economy Action Plan promotes sustainable product design, waste reduction, and increased recycling to minimize resource use and environmental impact.

Extended Producer Responsibility (EPR) Programs

- EPR policies make manufacturers responsible for their products' end-of-life management, promoting eco-friendly designs and recycling. The EU's WEEE Directive requires producers to handle e-waste, boosting recycling rates.
- Example- In Canada & EU: Companies are legally required to recycle or manage the waste from their products.

Regulatory Policies and International Agreements

- Governments promote recycling through policies like the EU Circular Economy Plan, China's waste import ban, and EPR laws, which make manufacturers responsible for product waste.
- Example- This ban on low-quality waste imports forced countries like the U.S. and U.K. to improve domestic recycling systems.

Consumer Awareness and Demand for Sustainability

- Rising environmental awareness drives demand for sustainable products, pushing businesses toward greener practices and boosting recycling growth.
- Example- Nike's Move to Zero: Nike uses recycled polyester and other sustainable materials in footwear and apparel.

Economic and Financial Benefits

- Recycling cuts costs, saves energy, and boosts supply chain efficiency while creating jobs and supporting local economies.
- Example- Aluminum Recycling in the U.S.: Recycling aluminum saves 95% of the energy required to make new aluminum from raw materials.

Regional trends

1 Asia

- India: India's plastic recycling industry is experiencing rapid growth, with projections suggesting it could reach USD 6.9 billion by 2033. Government efforts, along with a strong recycling rate of around 60%, underscore the country's dedication to effectively managing plastic waste.

  The recycling industry in India presently generates around ₹10,000 crores in GST revenue, with expectations to increase substantially to ₹35,000 crores in the near future as the industry grows.

- China: China has been a major player in the global recycling industry, particularly as an importer of recyclable materials. In recent years, the government has introduced stricter policies to regulate waste imports and encourage domestic recycling.

  In March 2025, China's Ministry of Ecology and Environment sought public feedback on proposed regulations that would allow the import of certain recycled materials, including remnants from spent lithium-ion batteries and recycled steel. This move aims to help China meet its growing demand for raw materials while maintaining environmental sustainability.

- Vietnam: Vietnam is a significant importer of plastic scrap but faces challenges in recycling both domestic and imported plastic waste. Due to improper sorting and an unregulated recycling sector, only about one-third of imported plastic waste is properly recycled.

  The lack of infrastructure and formal recycling policies has led to inefficiencies, with large amounts of plastic waste ending up in landfills or the environment. The government is working on policies to improve waste sorting and regulate the recycling sector, but challenges remain.

2 Europe

- Germany: Germany has a well-established recycling system, but recent reports indicate that it faces operational challenges. Up to 40% of waste in recycling bins is incorrectly sorted, making it difficult to process efficiently.

  This misclassification results in contamination, reducing the effectiveness of recycling efforts and increasing costs. Authorities are working on improving public awareness and enhancing waste-sorting technologies.

- United Kingdom & Germany – Recycling EV Batteries: The increasing use of electric vehicles (EVs) has led to a focus on recycling battery materials.

  Companies such as Altilium (UK) and tozero (Germany) have made advancements in recycling EV battery materials. Altilium's recycled cathode materials perform comparably to new ones, reducing CO_2 emissions by 70% and costs by 20%. Tozero is developing a "net zero" emission process for recycling graphite, aiming to produce 2,000 tonnes annually by 2027.

3 **Australia:**

Australia has been working towards a circular economy, focusing on reducing waste and reusing materials efficiently.

Organizations such as Planet Ark and Boston Global have launched the BG Planet Ark Circular Future Fund, which aims to raise up to $1 billion by 2030 to support waste reduction and sustainability initiatives. The initiative aligns with Australia's national goal to double its circularity by 2035 by investing in infrastructure and technology for better recycling and waste management.

4 United States & Middle East/North Africa

The U.S. has been working on increasing its plastic recycling rates. As of 2019, the U.S. had a plastic recycling rate of 4.5%, which is lower than several European countries.

The country faces challenges such as insufficient recycling infrastructure, contamination of recyclable materials, and lack of public awareness. Recent policy efforts, such as the National Recycling Strategy, aim to improve these conditions.

5 **Middle East & North Africa (MENA)**

- Egypt: The Zabbaleen Community's Recycling Efforts

In Cairo's Mansheyat Nasir, also known as "Garbage City," the Coptic Christian Zabbaleen community has developed an efficient waste recycling system, reportedly recycling 80% of the waste they collect. Despite facing challenges such as discrimination and poverty, the Zabbaleen manually sort waste and transform it into upcycled products like jewellery, rugs, and stationery, which are sold internationally. Organizations like the Association for the Protection of the Environment (APE) support this community by providing education and facilitating the sale of their crafts.

- Saudi Arabia: Advancements in Waste Management and Recycling

Saudi Arabia has been making strides in enhancing its waste management and recycling infrastructure. In December 2024, during French President Emmanuel Macron's visit to Riyadh, agreements were signed involving Saudi Arabia's Public Investment Fund, the Saudi Investment Recycling Company, and Veolia to improve waste management and recycling in the kingdom. These initiatives align with Saudi Arabia's broader goals to bolster its renewable energy capacity and environmental sustainability efforts.

- Turkey: Challenges in Waste Management

Turkey's ambition to become a "zero waste" nation has faced significant challenges. Instead of reducing waste, the country has become a major recipient of plastic waste from Europe. The improper disposal of foreign waste has led to environmental issues, including pollution and health hazards. This situation underscores the complexities and global challenges associated with waste management and recycling practices.

These developments highlight the diverse approaches and challenges in waste management and recycling across the MENA region. While some countries are making significant progress through innovative projects and community initiatives, others continue to face obstacles that require comprehensive strategies and international cooperation.

6 UK

In 2025, the UK introduced the Simpler Recycling legislation in England, standardizing recycling for businesses and public institutions by requiring separation of key materials like paper, glass, plastics, and food waste. This aims to increase recycling rates to 65% of municipal waste by 2035, aligning with existing schemes in Wales and Scotland. Additionally, the landfill tax rose to ₹13,250 per tonne to discourage landfill use and promote sustainable waste management.

Other key initiatives include a ban on disposable vapes from June 2025 to reduce plastic waste, and the launch of Extended Producer Responsibility (EPR) for packaging in October 2025, making producers responsible for packaging waste. The UK is also adopting AI technologies to improve waste sorting and collection efficiency, supporting its goal of a circular economy and lower environmental impact.

Global Recycling Industry- Economic Impact

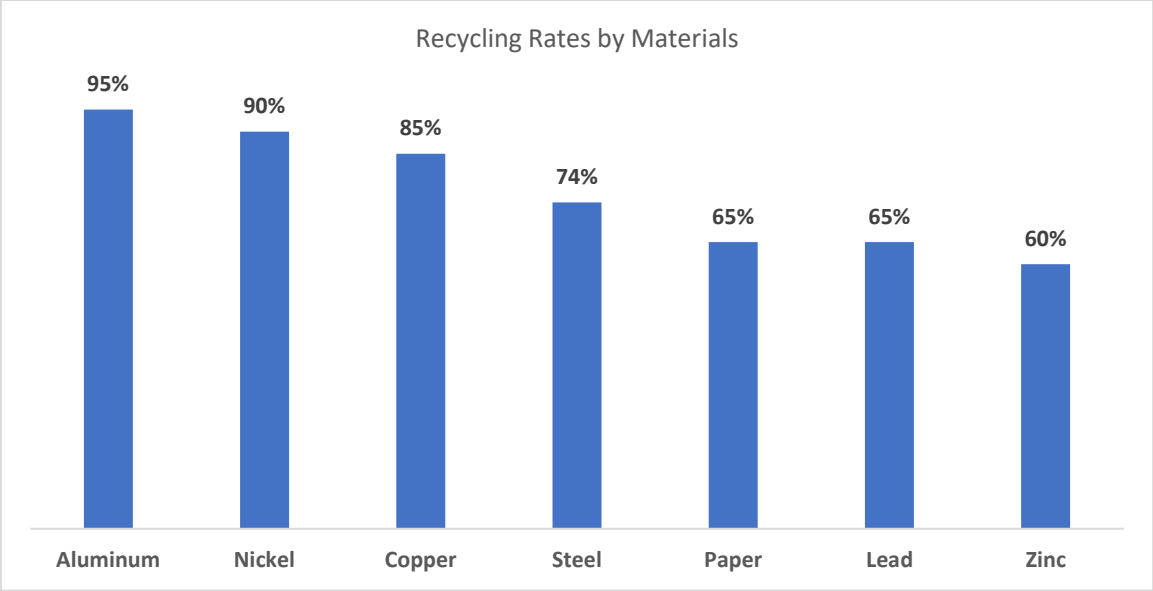
The recycling industry is a vital global sector, playing a significant role in environmental sustainability and economic development. With a workforce of approximately **1.6 million people worldwide**, the industry handles **over 600 million tonnes of recyclables annually**. This report provides an overview of the economic impact, technological advancements, and material-specific recycling rates within the industry.

Economic Impact

The recycling industry generates an **annual turnover exceeding USD 200 billion**, making it a key contributor to the global economy. This turnover is comparable to the GDP of countries such as **Portugal, Colombia, and Malaysia**. A substantial portion of this revenue, **approximately 10%,** is reinvested in new technologies, research, and development. This investment drives innovation, improves efficiency, and creates high-skilled employment opportunities within the sector.

Environmental Benefits

Recycling significantly reduces the reliance on virgin materials, conserving natural resources and minimizing environmental degradation. It also consumes considerably less energy compared to production processes that rely on raw materials. The **industry supplies approximately 40%** of **global raw material needs**, contributing to a more sustainable and circular economy.



Source: Recycled Materials Association

Aluminium has an impressive recycling rate of over 95%, attributed to its infinite recyclability without quality degradation, making it a preferred choice in packaging, automotive, and construction industries. Nickel, with a recycling rate of over 90%, is widely used in stainless steel production and batteries, particularly for electric vehicles, making its recovery increasingly vital. Copper, recycled at a rate of over 85%, retains its conductivity, ensuring its continued use in electrical wiring, plumbing, and renewable energy applications. Steel, with a recycling rate of approximately 74%, is extensively used in construction and

automotive manufacturing, and its recycling significantly reduces energy consumption compared to virgin steel production.

The U.S. recycled materials industry contributes approximately **$170 billion** to the **national economy**.

Employment Impact

- **Direct Employment**: The industry supports around **171,470 jobs**.
- **Indirect Employment**: An estimated **424,690 jobs** are supported through suppliers and related economic activities.
- **Total Employment:** The industry is linked to nearly **600,000 jobs** nationwide.

Economic Contributions

- **Exports**: In 2023, export-related economic activity was valued at around **$20.2 billion.**
- **Recycling Volume**: In 2022, more than **137 million metric tons** of materials were processed for recycling.

➢ Opportunities:

Advanced Recycling Technologies

Advancements in recycling technologies are improving waste management. Carbon Recycling International, for example, operates facilities that convert carbon dioxide emissions into methanol, a chemical used in various industries. Their George Olah Plant in Iceland captures CO_2 from geothermal power stations to produce renewable methanol, contributing to emission reduction efforts.

Circular Economy Business Models

Implementing circular economy principles helps businesses reduce waste by reusing and recycling materials. The Royal Mint applies this approach by repurposing electronic waste into luxury items. They have introduced a jewelry line made from recycled gold recovered from discarded electronics, integrating sustainability into their operations while exploring new revenue opportunities.

Plastic Waste Management

Addressing plastic pollution requires innovative solutions. Plastic Bank, a social enterprise, empowers communities in developing countries to collect plastic waste in exchange for goods and services. This model not only reduces ocean-bound plastic but also alleviates poverty by providing income opportunities.

Electronic Waste (E-Waste) Recycling

The rapid turnover of electronic devices has led to a surge in e-waste. Companies like ATRenew are addressing this issue by refurbishing and reselling pre-owned electronics. Founded in Shanghai, ATRenew has expanded globally, partnering with tech giants like Apple to reduce e-waste and promote a circular economy.

Metal Recycling

The demand for metals like copper is increasing with the growth of renewable energy and electric vehicles. Companies such as Glencore are investing in recycling electronic scrap to extract valuable metals. At their Horne Smelter in Quebec, they process discarded electronics and vehicles, contributing to a sustainable supply chain for essential materials.

➢ Challenges:

Contamination of Recyclable Materials

- A major obstacle in recycling is the contamination of recyclable materials. Items such as plastic bags and straws, often mistakenly placed in recycling bins, can disrupt recycling processes and increase operational costs. Frank Zeoli from Albany's Department of General Services highlights that many plastics are not recyclable, leading to inefficiencies in the system.

International Policy Shifts

- In 2018, China introduced Operation National Sword, which had a major effect on the global recycling market. This policy restricted the import of several waste materials, including specific plastics and papers, due to high contamination rates. Before this change, China was the leading importer of recyclable materials, and the abrupt shift forced many Western nations to seek alternative processing methods.

Exporting Waste to Countries with Lax Environmental Regulations

- The Pollution Haven Hypothesis suggests that stringent environmental regulations in developed countries can lead to the transfer of polluting industries to countries with more lenient standards. For example, used lead-acid batteries from the United States are increasingly sent to Mexico for recycling, where environmental enforcement may be less rigorous, posing health and environmental risks.

Technological and Economic Limitations

- Traditional recycling methods, especially for materials like polyester, often result in downgraded material quality. Innovative startups, such as Reju in Germany, are developing chemical recycling technologies to address this issue. However, challenges like sourcing affordable feedstock and developing efficient sorting methods persist, making widespread adoption difficult.

Proliferation of Non-Recyclable Plastics

- Certain everyday plastic items, such as sachets, polyester clothing, plastic bottles, food cartons, and wet wipes, contribute significantly to pollution due to their non-recyclable nature. For instance, plastic sachets used in Indonesia are non-recyclable and cause environmental damage. Addressing the pollution from these items requires global harmonization of plastic regulations and innovative waste management strategies.

Recycling Industry in India (Focus on Paper Recycling)

Industry Overview

Recycling plays a significant role in India's transition towards a circular economy, focusing on resource efficiency, waste reduction, and sustainable industrial growth. With increasing environmental concerns and government regulations, industries are adopting recycling practices to minimize their ecological footprint. Elaborate

Advantages/ Economic Benefit of Recycling Industry

The recycling industry plays a crucial role in **resource conservation, economic growth, waste management, and environmental sustainability**. As India moves toward a **circular economy**, recycling is increasingly recognized as an essential tool for **reducing raw material dependency, enhancing energy efficiency, and generating employment opportunities**. Below is a detailed overview of the key benefits of recycling:

1. Resource Conservation

Recycling significantly reduces the need for **virgin raw materials**, thereby preserving **natural resources** such as forests, mineral ores, and fossil fuels.

- **Paper Recycling**: Reduces the demand for fresh wood pulp, thereby preventing deforestation and decreasing water consumption.
- **Metal Recycling**: Extends the lifecycle of metals like **steel, aluminium, and copper**, reducing the need for mining activities that contribute to land degradation and pollution.
- **Plastic Recycling**: Minimizes dependence on petroleum-based raw materials, reducing fossil fuel extraction and the associated carbon footprint.

Additionally, recycling requires **less energy** than extracting and processing new materials, further supporting sustainability efforts.

2. Energy Efficiency and Cost Savings

Recycling materials requires considerably **less energy** than producing new materials from raw resources. This translates into **lower production costs** for industries and **reduced energy demand** for the country.

- **Paper Recycling**: According to the Bureau of Energy Efficiency (**BEE**), recycling paper saves approximately **40% of the energy** required for virgin paper production.
- **Aluminium Recycling**: Producing aluminium from recycled sources consumes **95% less energy** compared to refining it from bauxite ore.

- **Steel Recycling**: Using recycled steel saves about **60-74% of energy** compared to primary steel production.

Since industrial energy consumption is a significant contributor to **greenhouse gas emissions**, improving energy efficiency through recycling also helps mitigate climate change.

3. Waste Reduction and Landfill Management

India generates **62 million tonnes of municipal solid waste annually**, with a large portion ending up in **landfills and open dumps**, leading to severe environmental hazards. The **Solid Waste Management Rules, 2016** emphasize waste segregation, recycling, and extended producer responsibility (**EPR**) to reduce the strain on landfills.

- Recycling **diverts millions of tonnes** of waste from landfills, **reducing soil, air, and water contamination**.
- **Plastic waste recycling** helps prevent pollution in rivers and oceans, addressing the growing challenge of marine litter.
- **E-waste recycling** prevents hazardous substances like **lead, mercury, and cadmium** from contaminating soil and water sources.

By investing in advanced waste processing technologies such as **waste-to-energy plants, composting, and material recovery facilities**, India can further optimize landfill management.

4. Employment Generation and Economic Growth

The recycling industry is a significant **employment generator** in both **formal and informal sectors**, providing **millions of jobs** in waste collection, sorting, processing, and manufacturing.

- **The informal recycling sector**, including **ragpickers, scrap dealers, and small-scale recyclers**, plays a critical role in India's waste management system.
- **Government initiatives** such as the **Swachh Bharat Mission** and **National Resource Efficiency Policy (2019)** aim to **formalize and integrate informal waste workers**, improving working conditions and increasing their earning potential.
- The **recycling and waste management industry** is expected to grow, creating new employment opportunities in **sustainability consulting, waste management technology, and recycled product manufacturing**.

Developing a **structured recycling ecosystem** can enhance economic benefits while improving social inclusion for marginalized workers in the sector.

5. Reduced Environmental Pollution

Recycling reduces pollution in multiple ways, including **lower carbon emissions, reduced industrial waste discharge, and less air and water contamination**.

- The **National Action Plan on Climate Change (NAPCC)** promotes **waste-to-energy solutions, sustainable manufacturing, and circular economy initiatives** to **cut down pollution levels**.
- **Air Pollution Reduction**: Recycling reduces emissions from industries that would otherwise burn fossil fuels for raw material extraction.
- **Water Pollution Control**: Proper recycling of **plastic, paper, and metal waste** prevents toxic leachates from entering groundwater and rivers.
- **GHG Emissions Reduction**: Recycling metal and plastic waste significantly reduces CO_2 emissions compared to extracting and processing new materials.

By encouraging **waste recovery, industrial resource efficiency, and cleaner production techniques**, India can make significant progress toward **achieving its climate commitments** under the **Paris Agreement** and **UN Sustainable Development Goals (SDGs)**.

The recycling industry in India offers substantial **economic, environmental, and social benefits**, making it a vital sector for sustainable development. With the **right policies, infrastructure investments, and private sector participation**, the industry can **reduce waste, conserve energy, and create employment opportunities**. Moving forward, the focus should be on **scaling up recycling technologies, strengthening the supply chain for recovered materials, and ensuring regulatory compliance** to maximize long-term sustainability gains.

Current Growth Scenario in Indian Recycling Industry

India is among the largest producers of plastic waste globally, generating approximately **26,000 tons of plastic waste** every day, which amounts to around **9.5 million tons annually**. This significant volume is primarily driven by rapid urbanization, population growth, and the increasing consumption of plastic products. The major sources of plastic waste in the country include packaging, e-waste, biomedical waste, and automotive waste, with packaging accounting for the largest share.

Despite the alarming rate of plastic waste generation, India's recycling infrastructure remains underdeveloped. As of 2023, the country managed to recycle about **9.9 million tons** of plastic waste. However, this figure is projected to rise significantly to **23.7 million tons** by **2032**, supported by ongoing initiatives and advancements in recycling technologies

A notable characteristic of India's plastic waste management is the vital role played by the informal sector, which consists of small-scale recyclers and waste pickers. This sector handles a significant share of plastic

recycling, contributing to approximately 70% of the country's PET recycling. Waste pickers alone collect between **6.5 to 8.5 million tons** of **plastic waste annually**, recycling about **50% to 80%** of what they collect.

While the informal sector plays a crucial role in diverting plastic waste from landfills and reducing environmental pollution, it also faces challenges. The absence of formal regulation, coupled with inadequate infrastructure, exposes workers to serious environmental and health risks.

The Indian paper recycling industry is witnessing steady growth, with paper consumption registering a **CAGR of 6%** over the past decade, double the global average. The Indian paper recycling industry is poised for steady growth, with material consumption rising **16 million tonnes** in **FY 2023**, driven by rising domestic demand, growing manufacturing, and increased use of paper-based packaging in organized retail and e-commerce. The demand for recycled paper is growing rapidly due to sustainability trends and the rising cost of virgin fibre. While the newsprint and writing-printing paper segments are facing challenges due to digitalization and supply disruptions, the overall industry has rebounded strongly post-2020. Paper production (excluding newsprint) grew by **12.5%** year-on-year in **January 2023** and recorded a **6.7% growth** during **April 2022 - January 2023.**

Regulatory Landscape on Recycling Industry

India has been making significant strides in developing a circular economy through robust policies, regulations, and sustainability initiatives. The government has introduced measures to promote waste management, resource efficiency, and recycling across various industries. The following sections provide an in-depth look at the key regulatory aspects shaping the recycling industry in India.

Government Sustainability Initiatives

Promotion of Circular Economy Practices

A circular economy is an alternative to the traditional linear economy (take-make-dispose model), emphasizing sustainable resource use, waste reduction, and recycling. The Government of India has introduced various initiatives to integrate circular economy principles into industrial and consumer sectors.

Circular Economy Cell (CE Cell) by NITI Aayog:

- Established in September 2022, this unit is responsible for advancing resource efficiency and waste management strategies.
- It coordinates with different ministries and industry stakeholders to implement policies that promote recycling and reusability.
- The CE Cell supports India’s commitments under international climate agreements like the Paris Agreement.

National Circular Economy Roadmap for Plastics:

- Developed in collaboration with Australia, this roadmap provides guidelines for reducing plastic waste and increasing plastic recycling.
- It encourages businesses to adopt eco-friendly packaging and alternative materials.

12th Regional 3R and Circular Economy Forum:

- Held in March 2025, the forum focused on best practices in waste management and sustainability.
- New platforms like the SBM Waste to Wealth PMS Portal and 'India's Circular Sutra' were launched to support municipalities and businesses in adopting recycling models.

Increasing Awareness and Rising Demand for Recycled Materials

The demand for recycled materials has been rising in India due to economic benefits, government incentives, and environmental awareness campaigns. The government is actively promoting a **waste-to-wealth** approach, emphasizing the reuse of materials in manufacturing and construction sectors.

Waste to Wealth Initiative:

- Launched as part of India's Smart Cities Mission, it focuses on converting urban waste into valuable resources.
- Encourages industries to use recycled materials in manufacturing to reduce environmental impact.

Projected Economic Impact of Recycling:

- The recycling and circular economy sector in India is expected to reach a market value of over **USD 2 trillion by 2050**.
- Recycling is estimated to create **10 million jobs** across various sectors, including collection, sorting, processing, and remanufacturing.
- The projected USD 2 trillion market value of India's circular economy by 2050 encompasses a broad and integrated ecosystem for multiple sectors including waste management (municipal solid waste, plastics, e-waste), recycling and remanufacturing (metals, electronics, textiles), industrial symbiosis, the bio economy (bioenergy, bioplastics), sustainable construction, and green infrastructure.

Increasing Adherence to ESG (Environmental, Social, and Governance) Guidelines

Many businesses in India are now integrating **ESG** principles into their operations to meet sustainability goals. These guidelines ensure that companies adopt eco-friendly practices, reduce waste, and promote social responsibility.

CPCB Guidelines for Waste Management:

- The **Central Pollution Control Board (CPCB)** has issued standards for managing plastic, hazardous, and electronic waste.
- Recycling companies must adhere to these guidelines to ensure proper waste treatment and resource recovery.

Extended Producer Responsibility (EPR):

- EPR regulations mandate that manufacturers take responsibility for recycling their products after consumer use.
- The EPR framework includes partnerships with recyclers, refurbishes, and informal waste collectors to enhance recycling efficiency.

Major Regulations Pertaining to Recycling

Several regulations have been enacted to improve recycling rates, minimize waste, and ensure the responsible disposal of materials.

Plastic Waste Management Rules, 2016 (Amended in 2022)

- Establishes a legal framework for plastic waste collection, recycling, and extended producer responsibility (EPR).
- Prohibits certain single-use plastic products to curb pollution.
- Requires plastic producers to meet recycling targets.

Guidelines for Co-processing of Plastic Waste in Cement Kilns

- Promotes the use of plastic waste as an alternative fuel in cement manufacturing.
- Reduces dependence on fossil fuels and prevents plastic pollution.

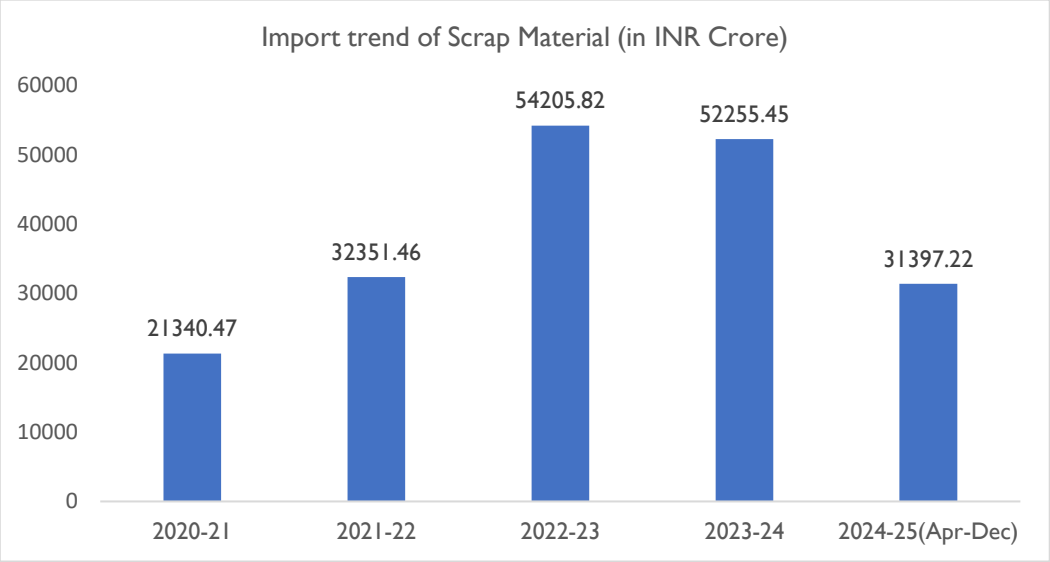
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

- Regulates the collection, transport, treatment, and disposal of hazardous waste.

- Ensures that hazardous materials, including metal scrap, are recycled safely without harming the environment.

India's recycling industry is witnessing significant growth, supported by government regulations, corporate initiatives, and international partnerships. With a strong focus on **circular economy principles, waste-to-wealth strategies, and ESG compliance,** the country is taking steps to integrate recycling into its broader economic framework. By adhering to regulatory guidelines and adopting sustainable waste management practices, India aims to **reduce environmental impact, create employment opportunities, and achieve long-term economic benefits** in the recycling sector.

Import trend of Scrap Material in India[1]



Source: Export Import Data Bank

The import trend of scrap material in India has seen significant growth over the years, peaking at **54,205.82 INR crore** in 2022-23. From **21,340.47 INR crore** in 2020-21, imports increased steadily, with the highest jump occurring between 2021-22 and 2022-23, when imports rose from **32,351.46 INR crore** to **54,205.82 INR crore** a nearly 67% surge. This sharp rise could be attributed to increasing industrial demand, supply chain disruptions for virgin raw materials, and India's expanding recycling and manufacturing sectors. However, in 2023-24, imports slightly declined to **52,255.45 INR crore**, marking a 3.6% decrease compared to the previous year. This dip might be linked to government policies promoting domestic recycling, increased tariffs, or a shift towards sustainable practices.

The latest data for 2024-25 (Apr-Dec) indicates imports of **31,397.22 INR crore**, covering just nine months. If this trend continues, the annual total may be slightly lower than 2023-24, signalling a possible stabilization or further decline in imports. Factors such as improved domestic scrap processing, evolving industrial

[1] HS Code- 7204 FERROUS WASTE AND SCRAP; REMELTING SCRAP INGOTS

requirements, or external economic conditions could be influencing this trend. The full-year data for 2024-25 will determine whether this decline is temporary or marks a long-term shift toward reduced reliance on imported scrap materials. If India continues strengthening its recycling infrastructure and raw material policies, imports may gradually decline in favour of locally sourced alternatives.

Recycling infrastructure in India

State/UT	Number of AD
Andhra Pradesh	10
Assam	01
Chhattisgarh	02
Delhi	06
Gujarat	40
Goa	02
Haryana	42
Himachal Pradesh	02
Jammu & Kashmir	03
Jharkhand	02
Karnataka	72
Kerala	01
Maharashtra	140
Madhya Pradesh	03
Orissa	07
Punjab	08
Rajasthan	27
Tamil Nadu	42
Telangana	23
Uttar Pradesh	121
Uttarakhand	02
West Bengal	05

Total	567

Source: Government of India Ministry of Environment, Forest and Climate Change

A state-wise breakdown of authorized dismantlers and recyclers in India, highlighting significant variations across regions. Maharashtra leads with 140 dismantlers/recyclers, followed by Uttar Pradesh with 121 and Karnataka with 72. Haryana and Tamil Nadu each have 42, while Gujarat has 40, indicating strong recycling infrastructure in these states.

On the other hand, some states like Assam, Kerala, and Chhattisgarh have only one or two authorized dismantlers, reflecting limited waste management facilities. Even Delhi, the capital, has only six dismantlers, which is relatively low given its high waste generation. States like Rajasthan (27), Telangana (23), and Punjab (8) fall in the mid-range.

The total number of dismantlers/recyclers across India stands at 567, showcasing a developing but uneven recycling network. States with high industrial activity and urbanization tend to have more dismantlers, while others still lack sufficient facilities. Strengthening waste management infrastructure in low-coverage regions could improve recycling efficiency and sustainability nationwide.

Assessing the Impact of Increasing Technology Penetration in the Recycling Industry

Technological advancements have significantly influenced the recycling industry in India, improving efficiency, resource utilization, and environmental sustainability. While paper recycling has seen notable progress, metal and plastic recycling have also benefited from increased automation and innovation. Below is an integrated assessment of the impact of technology penetration across these sectors, with a focus on paper recycling.

- **Advanced Sorting and Processing Technologies**

  - **Paper Recycling**

    - **Automated Sorting Systems**: Optical scanners and conveyor belts equipped with sensors efficiently separate different types of paper products, improving the quality of recycled materials.
    - **Single-Stream Recycling**: Consumers can dispose of all recyclables, including paper, in a single bin, with sorting handled at specialized facilities.
    - **Polyethylene-Coated Paper Recycling**: New processes allow for the separation of polyethylene layers from paper cups and cartons, enabling their recycling.

    Impact:

    - Higher efficiency in segregating recyclable paper from general waste.
    - Increased recycling rates by minimizing contamination and improving collection efficiency.
    - Better utilization of wastepaper for producing high-quality recycled products.

  - **Metal and Plastic Recycling**

    - **Eddy Current Separators**: Used for non-ferrous metal recovery from mixed waste streams.
    - **Artificial Intelligence (AI) and Machine Learning**: AI-driven robotic arms can identify and sort different types of plastics and metals.
    - **Infrared Spectroscopy**: Enables the sorting of plastic waste based on polymer type.

    Impact:

    - Faster and more precise sorting of recyclable materials.
    - Reduction in labour costs and improved resource efficiency.
    - Improved material recovery rates in metal and plastic recycling.

- **Circular Economy and Waste Reduction Initiatives**

  - **Paper Recycling**

    - **Recycling of Domestic Fiber**: Indian mills have developed technologies to reduce dependence on imported wastepaper by improving local collection and processing.
    - **Paper Industry's Shift Towards Sustainable Sourcing**: Advanced pulping techniques allow for better fibres recovery and lower water usage.

    Impact:

    - Reduction in import dependency for wastepaper.
    - The **Centre for Science and Environment (CSE)** has proposed ambitious recovery targets for the **recycled fiber-based (RCF)** paper industry, including a **95% domestic recovery rate by 2028**, with the goal of significantly enhancing local recycling initiatives.
    - Limited International Sourcing: Imports should be capped at **5% of total raw material needs**.
    - Emphasis on Domestic Sourcing: Focus on using recycled or virgin wastepaper sourced entirely within the country. However, the draft Extended Producer Responsibility (EPR) guidelines limit these targets to packaging-grade paper, which may undermine broader waste management objectives.
    - The **70% recovery target by 2025-26** is seen as overly lenient, as it is already nearly achieved, with CSE recommending **95% recovery from 2027-28**. The draft, however, sets a more modest **85% target during 2026-27**.

  - **Metal and Plastic Recycling**

    - **Automated Waste-to-Energy Conversion**: AI and IoT-based monitoring systems help in processing plastic waste into fuel and energy.
    - **Secondary Metal Recovery**: Use of advanced smelting and refining technologies for extracting valuable metals from scrap.

    Impact:

    - Reduction in landfill waste through effective reuse of materials.
    - Energy-efficient processing of recyclables, reducing carbon footprint.

- **Technological Adaptation and Infrastructure Development**

  - **Paper Recycling**

    - **Smart Recycling Bins and IoT-Based Collection**: Sensors track fill levels in paper waste bins and optimize collection routes.

- **Pulping and Deinking Advancements**: New enzymatic processes improve fibres recovery and reduce chemical usage in deinking recycled paper.

Impact:

- More efficient wastepaper collection and lower logistics costs.
- Higher-quality recycled paper suitable for premium applications.

- **Metal and Plastic Recycling**

- **Hydrometallurgical Processing**: Used for metal recovery from electronic waste and industrial scrap.
- **Plastic-to-Fuel Technologies**: Advanced pyrolysis processes convert plastic waste into alternative fuels.

Impact:

- Increased efficiency in extracting reusable materials from complex waste streams.
- Higher adoption of recycled materials in various industries.

Technological advancements in recycling, particularly in paper recycling, have improved efficiency, waste recovery rates, and overall sustainability. With ongoing investments in AI, automation, and waste-to-energy solutions, the industry is expected to evolve further, reducing environmental impact and supporting India's circular economy goals. However, challenges remain in terms of infrastructure development and policy implementation across metal and plastic recycling sectors.

Government Initiatives Supporting Recycling Industry

- **Paper Recycling**: National Resource Efficiency Policy (NREP) promotes sustainable material use.
- **Metal Recycling**: Steel Scrap Recycling Policy (SSRP) encourages organized scrap processing.
- **Plastic Recycling**: Extended Producer Responsibility (EPR) mandates corporate responsibility in plastic waste management.

This integrated approach highlights how technology is shaping the recycling industry, with paper recycling taking precedence while acknowledging parallel advancements in metal and plastic recycling.

Growth Outlook of the Indian Recycling industry in the next 5-6 years

The recycling industry in India is expected to witness substantial growth over the next five years, driven by government regulations, increased industrial waste, advancements in recycling technologies, and corporate sustainability initiatives. With a strong push towards a circular economy, key sectors including plastics, metals, e-waste, paper, and construction waste recycling are expected to scale up operations to meet sustainability goals and resource efficiency targets.

➢ Key Growth Drivers (2024-2029)

Stronger Government Regulations & Policies: The Extended Producer Responsibility (EPR) framework will continue to expand across plastics, e-waste, and battery recycling, compelling industries to improve waste collection and processing. Policies such as Swachh Bharat Mission, Plastic Waste Management Rules, and Battery Waste Management Rules will further boost recycling infrastructure.

ESG & Corporate Sustainability Initiatives: With growing compliance requirements, businesses will increase investments in closed-loop recycling systems to meet Environmental, Social, and Governance (ESG) standards. Sustainable supply chains will become a priority.

- **Urbanization & Industrialization:** Rapid urban expansion will generate higher waste volumes, increasing the demand for efficient waste processing and resource recovery solutions. Smart city projects will integrate waste-to-energy initiatives and automated recycling systems.
- **Technological Advancements in Recycling:** The adoption of AI-powered waste sorting, chemical recycling, and pyrolysis technology will enhance efficiency and output, particularly in plastics and electronic waste recycling. Automated material recovery facilities (MRFs) will improve collection and segregation processes.
- **Growth in E-Waste & Battery Recycling:** With rising smartphone adoption and electric vehicle (EV) penetration, lithium-ion battery recycling will become a major industry focus. India's position as one of the top e-waste generators will drive large-scale electronic waste processing and metal recovery.
- **Demand for Recycled Raw Materials:** Industries such as automotive, construction, and packaging will increasingly incorporate recycled plastic, metals, and glass into production, supporting cost reduction and environmental sustainability.

➢ Sector-Wise Growth Outlook (2024-2029):

Plastic Recycling: Increasing bans on single-use plastics and the growing adoption of mechanical and chemical recycling will drive demand for recycled PET, HDPE, and LDPE in packaging and manufacturing.

Metal Recycling: Scrap metal processing, particularly in steel and aluminium, will expand due to growing demand from automotive, construction, and infrastructure projects.

E-Waste Recycling: With an expected rise in electronic waste generation, India will see major investments in precious metal recovery, refurbished electronics, and secure disposal facilities.

Paper Recycling: Increased demand for recycled paper in packaging and publishing will encourage new wastepaper recovery facilities.

Construction & Demolition (C&D) Waste Recycling: Infrastructure growth will drive the recycling of concrete, bricks, and aggregates, reducing construction waste and promoting sustainable building practices.

- Between 2024 and 2029, India's recycling industry is expected to grow at a CAGR of 8-12%, with increasing private investments, waste-to-energy projects, smart waste management solutions, and government-backed sustainability incentives. Digital platforms for waste collection, AI-powered sorting, and circular economy models will drive innovation, making India a global leader in recycling and sustainable resource management.

Paper Recycling Industry

Overview of Indian Paper Industry

India's paper industry accounts for about 5% of global paper production, with an estimated turnover exceeding ₹80,000 crores and a contribution of approximately ₹5,000 crores to the exchequer. The industry provides direct employment to around 500,000 people and indirectly supports an additional 1.5 million jobs. It plays a significant role in the economy, contributing about 1.6% to India's GDP.

With around 850 paper mills, the industry produces approximately 25 million tonnes annually, projected to reach 35 million tonnes by 2030. It comprises various segments, including writing and printing paper, packaging materials, and specialty papers. The packaging paper and paperboard segment has been growing, with domestic consumption increasing at an annual rate of 8.2% in 2023-24.

The industry relies on diverse raw material sources, with about 21% of production based on hardwood and bamboo, 71% on recycled fibres, and 8% on agricultural residues like wheat straw and rice husk. Many paper mills use a mix of older and modern technologies. The geographical distribution of production and consumption plays a role in shaping market dynamics. Maharashtra is among the major paper-producing states.

India's per capita paper consumption is around 16 kg, which is lower than the global average of 57 kg. The market is expected to expand with economic growth, and an increase of one kg per capita in consumption could lead to a rise in demand by one million tonnes. However, the industry faces challenges such as wood fibre shortages, prompting the use of alternative raw materials and imports. Sustainability efforts focus on recycling and renewable resources to minimize environmental impact.

- Industry produces writing and printing papers, paperboard and packaging materials, newsprint, specialty papers, and other related products
- Industry maintains strong backward linkages with the farming community and is deeply rooted in agroforestry
- Industry has an annual turnover of approximately INR 800 billion (~USD 9.6 billion)
- Industry directly employs 0.5 million people and provides indirect employment to 1.5 million
- Industry has a total of 900 mills, with approximately 550 currently operational
- India contributes approximately 5% to the world's total paper production
- Industry produces around 25 million tonnes of paper annually

Current Market Scenario

Paper Production & Consumption Growth in India

India's paper industry has witnessed **steady growth over the past decade**, primarily driven by **rising domestic demand, industrial expansion, and increasing urbanization**. With a **Compound Annual Growth Rate (CAGR) of ~6%**, India has become one of the fastest-growing paper markets globally. However, the industry faces challenges such as **raw material shortages, environmental regulations, and digital disruptions**. Despite these hurdles, India's paper consumption is expected to continue its upward trajectory due to **booming packaging demand, government education initiatives, and sustainability efforts in production**.

- **Growth in Paper Production**

The **total installed capacity** of India's paper industry stands at **27.43 million tonnes**, with an **operational capacity of 22.73 million tonnes**. In **2023-24, total paper production was 24 million tonnes**. The total production share of wood, agro and wastepaper-based mills is estimated to be around 18 -20%, 6 – 8 % and 71 % respectively. The Indian paper sector has been expanding due to **growing demand from industries such as FMCG, e-commerce, and pharmaceuticals**, which rely heavily on paper-based packaging. However, **newsprint and writing paper production have seen a decline**, primarily due to the shift toward digital alternatives.

<table>
<tr><td>Segment wise Production</td><td colspan="2">Wood-Based</td><td>Agro Based</td><td colspan="3">Recycled Fibre</td></tr>
<tr><td rowspan="3">Production share</td><td colspan="2">21%</td><td>8%</td><td colspan="3">71%</td></tr>
<tr><td colspan="3">Large Mills</td><td>Medium Mills</td><td>Small Mills</td><td>Micro Mills</td></tr>
<tr><td colspan="3">Integrated</td><td colspan="3">Non-Integrated</td></tr>
<tr><td>Size Distribution (Operational Mills) total 526</td><td colspan="2">19</td><td>29</td><td>96</td><td>233</td><td>151</td></tr>
</table>

Source: Statistical Cell, CPPRI. IMPEX data taken from DGFT data base

Recycled Fibre (RCF) plays a crucial role in India's paper industry, contributing around **71.6% of the total paper production.** The sector's strong dependence on recycled fibre highlights both a commitment to environmental sustainability and the challenges associated with the limited availability and high cost of wood and agro-based raw materials in India.

- **Growth in Paper Consumption**

India's **paper consumption has been rising steadily**, with **total consumption reaching 22.83 million tonnes in 2021-22**. However, **per capita paper consumption remains low at ~15-16 kg**, significantly below the **global average of 57 kg** and **North America's 200 kg**. This indicates **immense growth potential**, especially as India undergoes **rapid urbanization and industrial expansion**. Paper demand has been fuelled by **higher literacy rates, expansion of education programs, and the rise of the organized retail sector**.

Paper		
Year	Production (Million tonnes)	Consumption (Million tonnes)
2020-21	21.7	18.6
2021-22	22.5	19.9
2022-23	23.7	21.6
2023-24	24	23.04

Source- Sources: CPPRI, DPIIT. Indian Paper Industry Association, Dun & Bradstreet Estimates

- India's paper industry saw consistent production growth from **21.7 million tonnes in 2020-21** to **24 million tonnes** in **2023-24,** while **consumption has increased** from **18.6 million tonnes** in **2020-21** to **23.04 million tonnes in 2023-24. On demand side, India's paper consumption is estimated to been growing at 6-7% annually where** the **packaging segment which grew by about 8.2% in FY 2024, dominates the domestic paper consumption** and accounted for **65% of total demand**. This majority share is largely driven by **e-commerce, FMCG, and pharmaceutical packaging needs**.
- **Printing & writing paper (P&W)** makes up **23.11% of the market**, although demand for **traditional office paper and newspapers has declined** due to digitalization. The **newsprint segment has been the most affected**, currently constituting just **5.11% of total consumption**, The remaining **7 % of paper consumption comes from specialty paper products**, such as **tissue paper, filter paper, security paper, and high-grade coated paper**, which are seeing steady growth.

Future Outlook & Growth Projection

The Indian paper industry is expected to **continue its growth trajectory**, driven by **sustained demand for packaging paper, increased recycling initiatives, and government support for agro-forestry**. Projections indicate that by **2025, total paper consumption will exceed 26-28 million tonnes**, with a **CAGR of ~6%**. The **packaging paper segment will be the primary driver of growth**, while **writing & printing paper demand will stabilize** as **education sector needs offset digitalization effects**.

To ensure long-term sustainability, **investments in modern recycling technologies and alternative raw materials (such as bagasse and agricultural waste)** are increasing. The **Government has also encouraged agro-forestry initiatives**, supporting the **development of high-quality tree clonal saplings** that are **disease-resistant and adaptable to diverse climatic conditions**. This is expected to **increase domestic wood pulp supply and reduce dependency on imports**. Additionally, **circular economy models in packaging** where companies **recycle and reuse packaging materials** are gaining traction, further supporting industry expansion.

Key Demand Drivers

Expansion of the Packaging Industry

India's packaging sector is experiencing rapid growth, driven by a burgeoning middle class and increased consumption of fast-moving consumer goods (FMCG). The rise in demand for packaging materials, especially corrugated boxes, necessitates the use of recycled paper to ensure sustainability and cost-effectiveness.

Environmental Sustainability Initiatives

The Indian government is actively promoting a circular economy to enhance resource efficiency and reduce waste. Policies and financial incentives, such as tax benefits and subsidies for the recycling industry, encourage the adoption of sustainable practices, thereby increasing the demand for recycled paper products.

Technological Advancements in Recycling

Investments in research and development have led to improved recycling technologies, making the process more efficient and economically viable. This technological progress supports the growth of the paper recycling industry by enhancing the quality and quantity of recycled paper. Indian companies are adopting advanced technologies to enhance fibre recovery and energy efficiency in recycled paper production. Innovations enable processing of challenging materials like poly-coated papers into new products.

Consumer Demand for Eco-Friendly Products

Rising environmental awareness among consumers has increased demand for recycled paper products, especially in packaging industries such as food and beverages.

Government Regulations and Policies

The implementation of policies aimed at promoting resource efficiency and circular economy practices has created a favourable environment for the recycling industry. Establishing bodies like the Bureau of Resource Efficiency (BRE) and integrating recycling initiatives into national missions underscore the government's commitment to sustainable waste management.

Regulatory Challenges

The imposition of a 2.5% Basic Customs Duty (BCD) on imported waste paper impacts costs, but legislative measures like mandatory recycling targets could address these challenges.

Analysis of Key Raw material sources for Paper Production in India (Agro, Wood, Recycled paper) and transition from wood and Agro based fibre to recycled fibre use in paper manufacturing

The paper manufacturing industry in India is a significant part of the economy, contributing to employment, exports, and the country's overall industrial growth. Historically, the primary raw materials for paper production were sourced from forests (wood-based) and agriculture (agro-based). However, due to growing environmental concerns, the industry is shifting towards using recycled paper. Let's dive deeper into the different sources of raw materials and the transition to recycled fibre use in Indian paper production.

- **Wood-Based Fibre**

Wood pulp has traditionally been one of the most important raw materials for paper production. It is sourced from hardwood and softwood trees, such as eucalyptus, bamboo, and casuarina, which are widely grown in various states across India, especially in the southern regions like Andhra Pradesh and Tamil Nadu.

Challenges: The environmental impact of deforestation, loss of biodiversity, and the depletion of natural resources have put pressure on the paper industry to reduce its dependency on wood-based fibres. The Government of India has also implemented regulations to safeguard forest areas, limiting the availability of wood for industrial use.

- **Agro-Based Fibre**

In addition to wood, India also has a history of using agro-residues such as bagasse (a by-product of sugarcane), wheat straw, rice straw, and jute for paper production. This is particularly significant in states like Uttar Pradesh, Punjab, and Bihar, where agriculture is a major part of the economy.

Advantages: Agro-residues are renewable and environmentally friendly alternatives to wood, making them a more sustainable option. Farmers can also benefit financially from selling agricultural waste, which would otherwise be burned or discarded.

Challenges: The seasonal availability of agro-residues and their limited strength compared to wood fibre make agro-based paper less durable, which affects its use for certain types of paper.

- **Recycled Fibre**

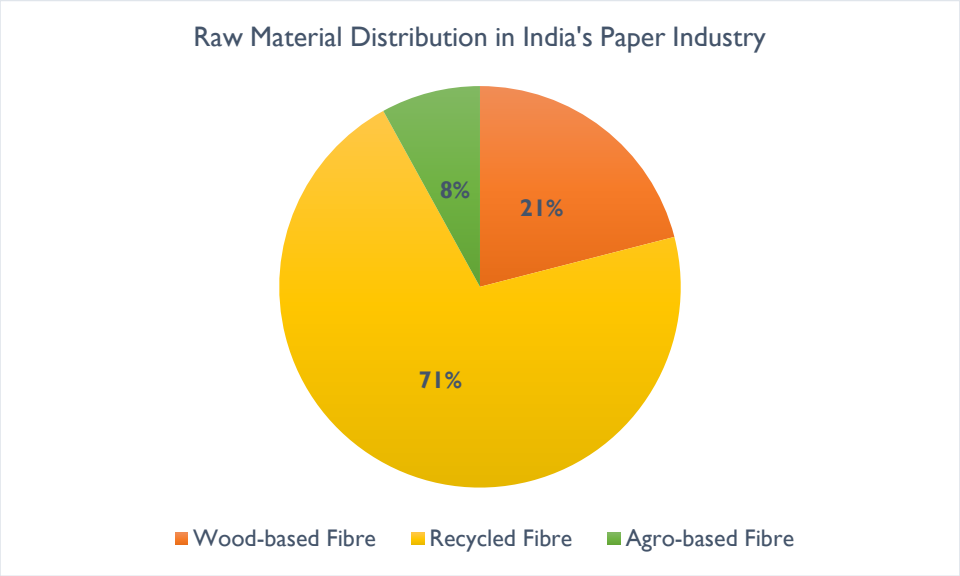
Recycled paper has emerged as a key alternative raw material in recent years. With increasing awareness of sustainability, the paper industry in India has been shifting its focus towards recycling waste paper. The government has encouraged this transition through various initiatives promoting waste management and recycling.

Advantages: Recycled paper reduces the demand for fresh wood and agro-residues, decreases the energy needed for production, and lowers carbon emissions. The circular economy model is gaining popularity, where used paper is collected, processed, and reused to create new paper products.

Challenges: Although recycling paper is beneficial for the environment, there are limitations in the quality of recycled paper, especially for high-quality printing or writing paper. The availability of clean and segregated waste paper is also a challenge in India, where waste management systems need to be more efficient.

- **Raw Material Composition in the Indian Paper Industry:**

The distribution of raw material usage in India's paper production is estimated as follows:



Source: Indian Paper Manufacturers Association (IPMA)

The raw material distribution in India's paper industry reveals a significant reliance on recycled fibre, which constitutes 71% of the total raw materials used, underscoring a commitment to sustainability and resource efficiency. Wood-based fibre accounts for 21%, representing the industry's continued, yet lesser, dependence on traditional forestry resources. The smallest fraction, 8%, is attributed to agro-based fibre, indicating a potential area for growth in utilizing agricultural residues for paper production.

According to the Indian Paper Manufacturers Association, India **imported approximately 2 million tonnes of paper and paperboard** during the year **2022–2023.** Due to the inefficiency of local waste paper collection systems, only **60%** of the recycled fibre required for producing paper and paperboard is sourced within the country, while the remaining **40%** of demand, India relies heavily on imports from developed regions such as the **USA, Europe, and the Middle East.**

Transition from Wood and Agro-Based Fibre to Recycled Fibre

The Indian paper industry has made significant strides in transitioning from wood and agro-based fibres to recycled fibres over the past two decades. A few key drivers of this shift include:

- **Government Regulations**: The government has set policies to restrict deforestation and promote sustainable practices in paper production. Under initiatives like the National Forest Policy and the National Agroforestry Policy, the industry is encouraged to use recycled materials and non-wood alternatives.
- **Sustainability Goals**: With the global focus on sustainability and reducing carbon footprints, companies are adopting eco-friendly practices. Recycling paper is a step toward achieving India's commitment to sustainable development and reducing its dependency on forest-based resources.
- **Technological Advancements**: Improved technologies in recycling and paper manufacturing processes have made it possible to produce better-quality recycled paper. The industry is investing in machinery that can handle waste paper efficiently, ensuring minimal contamination and higher yields.
- **Cost Efficiency**: Using recycled paper is cost-effective for manufacturers, as it reduces the expenses associated with sourcing raw materials. Recycled paper mills have lower operational costs compared to wood-based mills, further incentivizing this shift.

The paper manufacturing industry in India is moving towards a more sustainable future by reducing its dependence on wood and agro-based fibres in favour of recycled paper. The transition is driven by government policies, technological advancements, and growing environmental awareness. The shift to recycling helps conserve natural resources, reduce carbon emissions, and minimize the overall environmental impact of the paper industry. By embracing recycled fibre and adopting sustainable practices, India's paper industry is contributing to a greener, more responsible future.

Installed Capacity Growth and paper recycling infrastructure in India

The Indian paper industry has experienced significant growth in recent years, driven by increasing demand for paper products and a stronger focus on sustainability. The sector is transitioning toward eco-friendly practices, particularly in paper recycling, which has become a key focus for the industry.

Installed Capacity Growth

Installed capacity refers to the total production potential of paper mills, measured in tonnes per year. Over the last two decades, India's paper industry has witnessed a steady expansion in its installed capacity, supported by increasing demand in education, packaging, and printing sectors.

- **Current Capacity**: As of 2024, India's pulp and paper capacity has achieved a compound annual growth rate (CAGR) of 6.30% since 2019.

- **Growth Drivers**: The capacity expansion has been driven by various factors:

  - **Increased Demand**: The rising literacy rate, expanding print media, growing e-commerce packaging needs, and rapid urbanization have fuelled the demand for paper.
  - **Government Policies**: Incentives for the manufacturing sector, including initiatives like *Make in India*, have helped the paper industry to increase its production capacity.
  - **Technological Advancements**: Investments in modern machinery and technology have allowed companies to enhance efficiency and boost production output.

Projections indicate a **6 to 7% annual growth** in paper consumption in India, reaching **30 million tonnes** by **FY 2026-27**.

- **Paper Recycling Infrastructure in India**

India has become one of the largest consumers of recovered or recycled paper globally. The paper recycling industry is key to meeting the growing demand for paper products while reducing environmental impact.

- **Recycling Rate**: India's recovery rate is estimated to be around 25-28%, which is lower compared to global standards.
- **Recycling Capacity**: The country's recycling capacity is expanding, with modern paper mills being set up that focus primarily on recycled paper.

Challenges in Recycling:

- **Collection Systems**: One of the primary challenges to improving the recycling rate is the lack of organized waste paper collection systems, especially in smaller towns and rural areas.
- **Quality of Waste Paper**: Contamination and poor segregation of waste paper reduce the efficiency and quality of recycled paper, which poses a challenge for producing high-grade paper.

Government Initiatives:

- **Swachh Bharat Mission**: This initiative has helped improve the country's waste management system, including the collection of waste paper for recycling. It encourages municipalities and urban areas to enhance waste segregation practices.
- **Extended Producer Responsibility (EPR)**: The government has implemented EPR rules for packaging materials, pushing manufacturers to take responsibility for the recycling of the paper and packaging they produce.

Technological Advancements in Recycling:

- **Infrastructure Development**: Modern infrastructure and state-of-the-art technologies form the foundation of operations at various paper mills, allowing for effective production operations while upholding the highest standards of quality.
- **Energy Efficiency**: Modern recycling plants are focusing on energy efficiency and water conservation, reducing the overall environmental footprint of the recycling process.

The Indian government and the paper industry are committed to further expanding recycling infrastructure to meet the growing demand for sustainable paper products. With ongoing investments in waste management systems and modern recycling technologies, India is poised to become a global leader in paper recycling.

Major Factors Driving the Use of Recycled Paper in India for Paper Manufacturing

The paper manufacturing industry in India is undergoing a significant transformation, with a growing emphasis on the use of recycled paper. This shift is driven by multiple factors, including environmental sustainability, resource scarcity, and evolving market dynamics. As the country faces constraints in sourcing virgin wood pulp due to limited forest resources and restrictive policies, the use of recycled paper has emerged as a viable solution. Additionally, increasing awareness about the environmental impact of deforestation and the demand for sustainable packaging options has accelerated this transition.

Environmentally Sustainable Manufacturing Process

The shift towards recycled paper is closely tied to the growing demand for environmentally sustainable manufacturing processes. Producing paper from recycled fibres consumes significantly less energy and water compared to paper made from virgin wood pulp. Recycling also reduces greenhouse gas emissions, as it minimizes the need for deforestation and the related environmental impact of logging, transportation, and processing of raw wood.

Moreover, the recycling process promotes the circular economy by reusing waste paper and diverting it from landfills, where it would otherwise contribute to pollution and methane emissions. This approach is aligned with India's broader goals of reducing its carbon footprint, promoting resource efficiency, and moving toward sustainable development. Adopting recycled paper also helps companies meet global sustainability standards, contributing to corporate social responsibility (CSR) efforts.

The limited availability of virgin pulp

India's limited supply of virgin pulp has been a significant challenge for the paper manufacturing industry. The country has strict regulations on the use of forest resources, including restrictions on industrial plantations in degraded forest lands. As a result, India has a shortage of domestic wood pulp, compelling paper manufacturers to either import virgin pulp or rely more heavily on recycled fibres. Importing virgin pulp is expensive and can add to the operational costs of paper production.

Due to the scarcity of wood-based raw materials, the use of recycled paper provides a cost-effective alternative, helping companies optimize their supply chains and reduce their dependence on volatile import markets. The Indian Paper Manufacturers Association (IPMA) has been advocating for policy changes that allow the use of degraded forest land for pulpwood plantations. However, until such measures are enacted, recycled paper remains an essential resource to meet growing demand without over-reliance on imported virgin pulp.

Cost Effectiveness

India faces a shortage of wood pulp due to its limited forest resources. As a result, the country depends heavily on alternative raw materials like agricultural residues and recycled paper. Recycling post-consumer wastepaper helps bridge this gap, making paper production more economical and reducing reliance on expensive imported pulp.

- **Lower Production Costs:** Manufacturing paper from recycled fibre requires significantly less energy and water compared to using virgin pulp. Studies suggest that producing paper from recycled materials can reduce water consumption by up to 50% and lower air pollution by 74%.
- **Reduced Raw Material Dependence:** Recycling paper helps cut down the demand for fresh wood pulp, conserving natural resources and lowering procurement costs for manufacturers.
- **Import Reduction:** India imports large quantities of raw pulp and wastepaper from countries like the U.S. and Europe. By increasing domestic recycling, the industry can reduce reliance on imports, making production more self-sufficient and cost-efficient.
- **Operational Efficiency:** Many Indian paper mills use a mix of recycled paper and agricultural residues (such as bagasse and wheat straw) to optimize costs and sustainability. This approach enables them to remain competitive in a global market.

Government Sustainability Initiative

Environmental concerns and waste management policies have led the Indian government to introduce measures that encourage the use of recycled paper. One of the most significant initiatives is the **ban on single-use plastics**, which came into effect on **July 1, 2022**.

Under this ban, the production, sale, and use of specific plastic products with low utility and high littering potential have been restricted. The banned items include:

- Plastic cutlery (spoons, forks, knives, straws)
- Plastic plates, trays, and cups
- Packaging films
- Plastic sticks for balloons, candy, and ice creams

As a result, businesses and consumers are increasingly turning to paper-based alternatives for packaging and disposable products. This shift has created new opportunities for recycled paper manufacturers, who now supply materials for eco-friendly packaging, food containers, and paper bags.

In addition to the plastic ban, the government has introduced policies that directly support recycling and waste management:

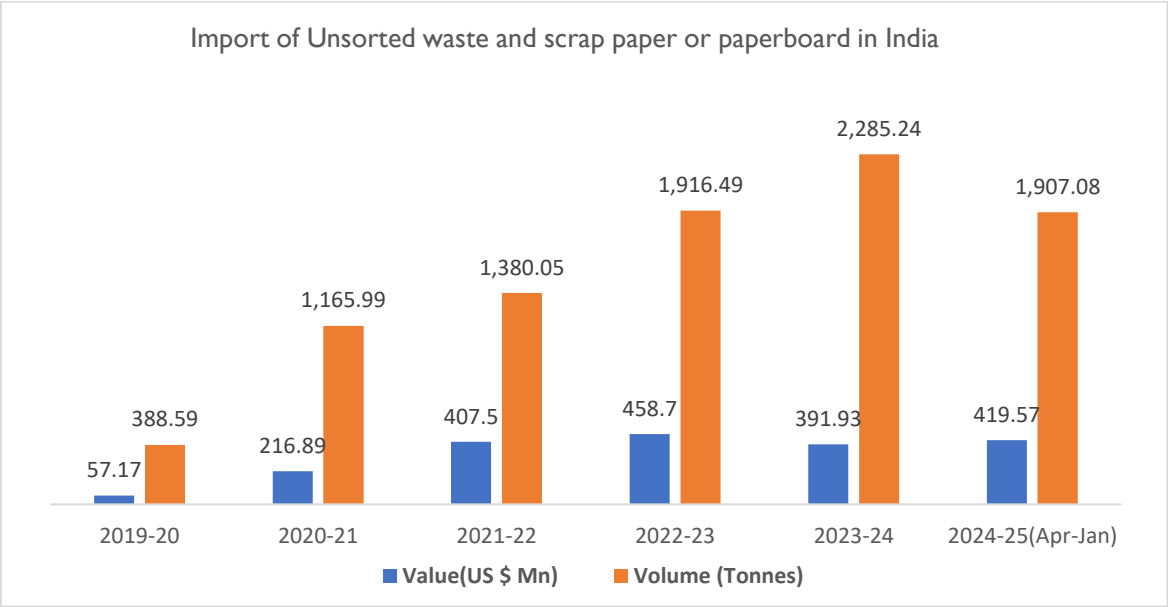
- **Extended Producer Responsibility (EPR):** Under this framework, companies are required to take responsibility for the collection and recycling of their paper and packaging waste. This encourages large corporations to invest in sustainable practices, boosting demand for recycled materials.
- **Swachh Bharat Abhiyan (Clean India Mission):** Launched in 2014, this initiative promotes waste segregation and recycling across cities and rural areas, ensuring better collection and processing of recyclable materials.
- **Incentives for Recycling Infrastructure:** Several state governments offer subsidies and incentives for setting up recycling plants, further strengthening the recycled paper supply chain.

India's Import Trend of Wastepaper in last 5 Years

The paper recycling industry in India relies heavily on imported wastepaper to meet its raw material demands due to limited domestic collection and availability. Over the last five years, India's wastepaper import trends have shown fluctuations influenced by global supply chain disruptions, pricing variations, and government policies on waste management and sustainability.

Year-Wise Import Trend Analysis

- **HS Code**: 47071000

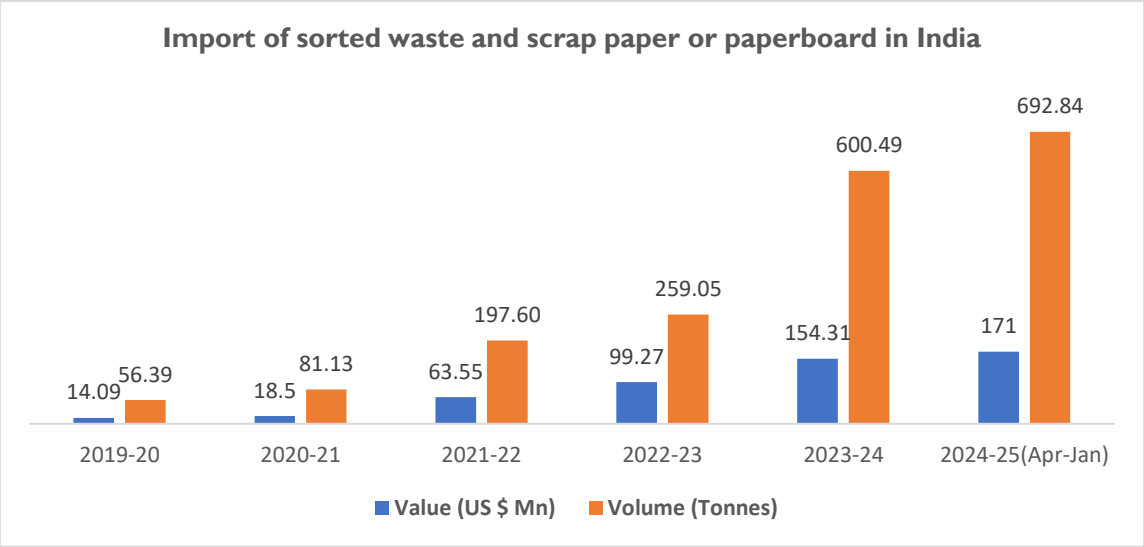


Source: Directorate General of Foreign Trade

India's import of unsorted waste and scrap paper significantly increased from **388.59 tonnes in 2019-20** to **2,285.24 tonnes in 2023-24**. The import value also rose, from **US $57.17 million in 2019-20** to **US $419.57 million in 2024-25 (April-January),** reflecting a growing investment in paper recycling.

This surge indicates the expansion of India's paper recycling sector, driven by circular economy initiatives and increasing demand for recycled materials. While there was a slight volume decrease in 2024-25, the overall trend confirms India's growing reliance on imported recyclable paper to support its manufacturing and sustainability goals.

- **HS Code**: 47072000

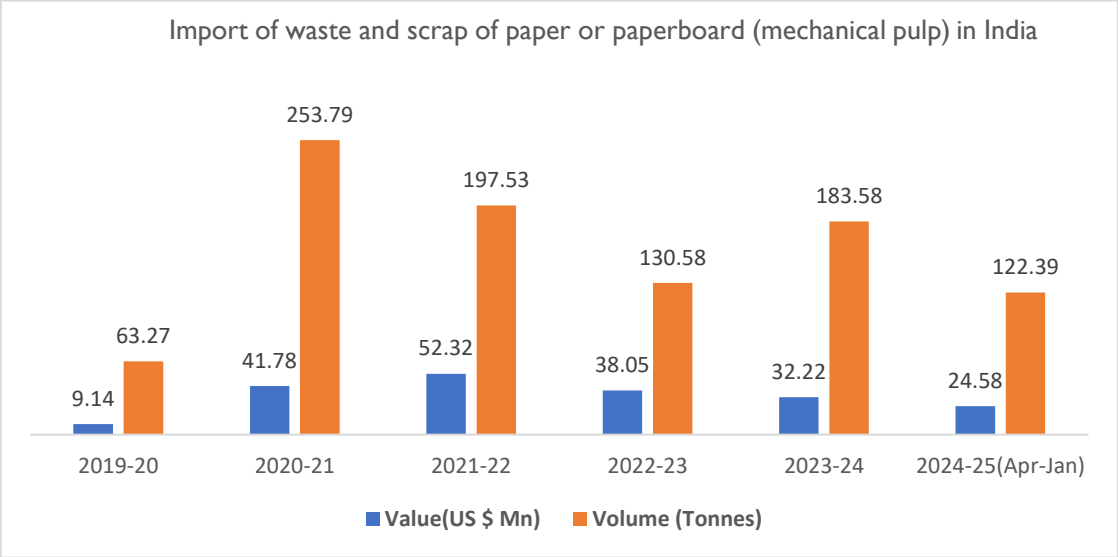


Source: Directorate General of Foreign Trade

India's import of sorted waste and scrap paper or paperboard has seen considerable expansion. The volume of these imports has consistently risen, starting at **56.39 metric tonnes in 2019-20** and surging to **692.84 metric tonnes by 2024-25.** This increase highlights a growing reliance on recycled paper resources within India, which could be due to increasing demand from the domestic paper and packaging industries.

In terms of value, the imports have also grown substantially, climbing from **US $14.09 million in 2019-20 to US $171 million in 2024-25.** The increase in both volume and value suggests not only a greater quantity of imports but also indicates fluctuations in the price of sorted waste and scrap paper over this period.

- **HS Code: 47073000**

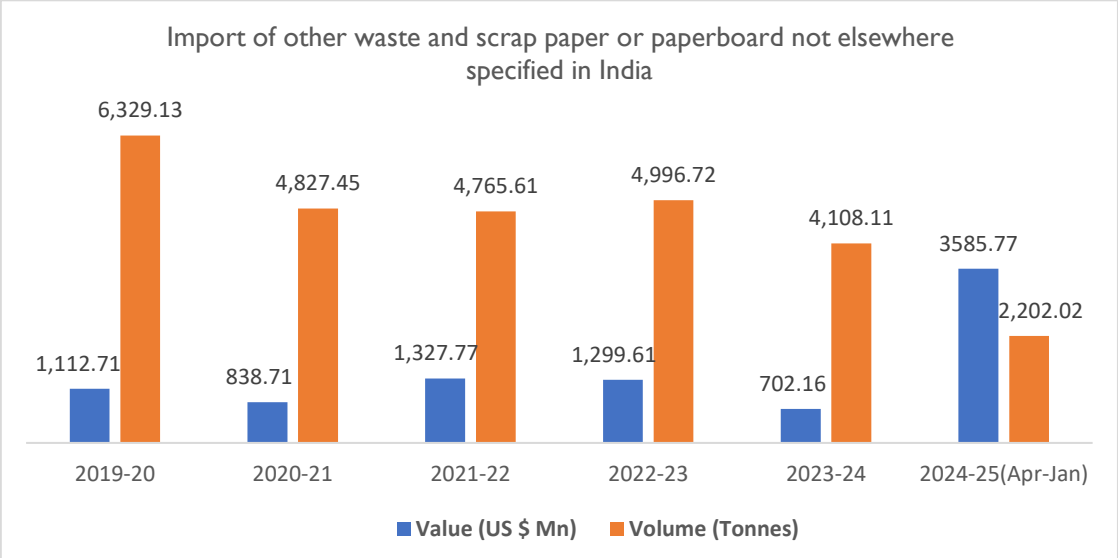


Source: Directorate General of Foreign Trade

From **2019-20 to 2021-22**, India's import of waste and scrap paper saw a fluctuating but generally increasing trend. Starting with a **value of US$9.14 million** and a **volume of 63.27 tonnes in 2019-20**, there was a significant surge in 2020-21, with the value reaching **US$41.78 million** and the volume peaking at **253.79 tonnes**. In 2021-22, while the value increased to **US$52.32 million**, the **volume decreased** to **197.53 tonnes**, indicating a higher cost per unit of imported waste paper.

However, from 2022-23 onwards, there was a decline in both the value and volume of imports. In 2022-23, the value decreased to **US$38.05 million** and the **volume** to **130.58 tonnes**. This downward trend continued into 2023-24, with the value dropping to **US$32.22 million** and the **volume to 183.58 tonnes**. For the period of **April-January 2024-25**, the **value was US$24.58 million** and the **volume** was **122.39 tonnes**, suggesting a continued decrease in the import of waste and scrap paper during this period.

- **HS Code**: 47079000



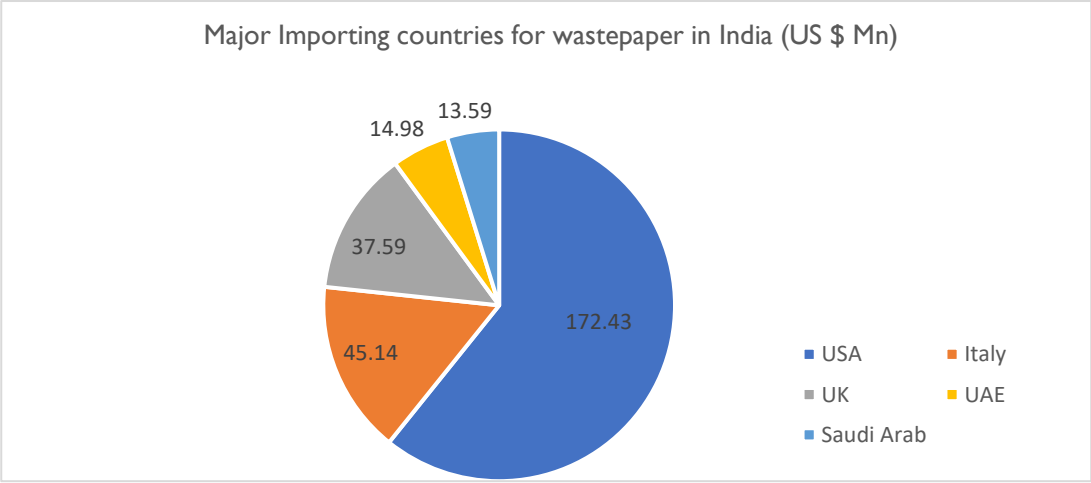
Source: Directorate General of Foreign Trade

India's import of waste and scrap paper has fluctuated between 2019-20 and 2024-25. The volume of imports was highest in **2019-20 at 6,329.13 tonnes**, decreasing in 2020-21. The import value peaked in **2021-22 at US$ 1,327.77 Mn**.

However, the partial data for 2024-25 shows a contrasting trend, with a significant increase in **value to US$ 3585.77 Mn** but a sharp decrease **in volume to 2,202.02 tonnes**. This suggests a shift towards importing higher-value waste paper or changes in import dynamics, potentially influenced by evolving regulations or market demands within India's paper industry.

Major Importing Partners for wastepaper in India

- Major Importing countries for unsorted waste and scrap paper for FY 2023-24

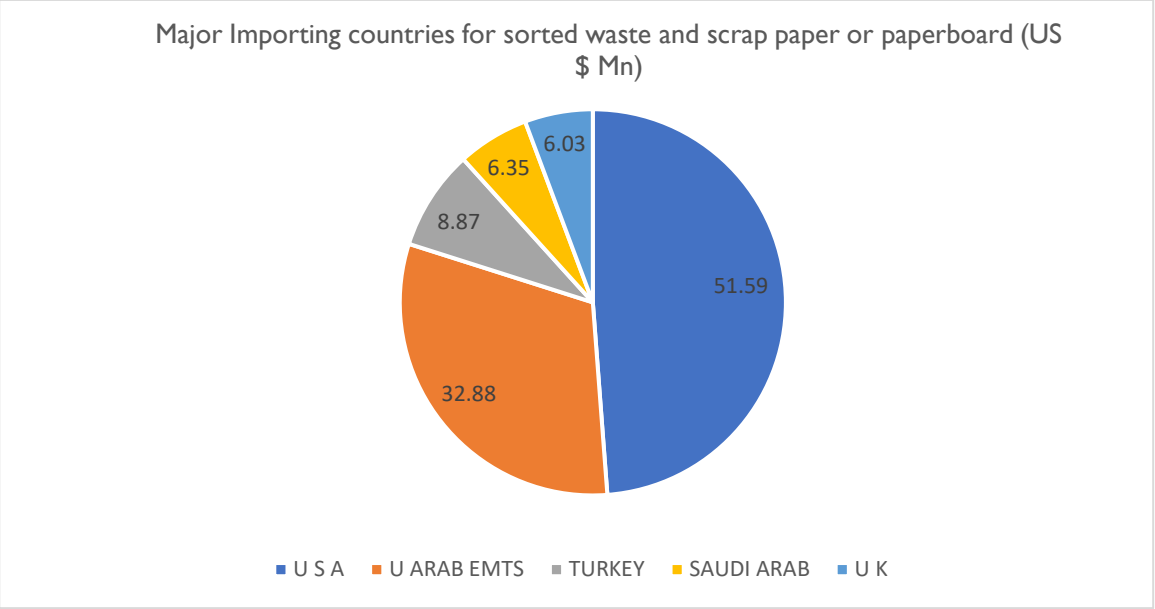


Source: Directorate General of Foreign Trade

Major importing countries for wastepaper in India for FY 2023-24 shows that **the United States is the largest supplier**, contributing **$172.43 million**, which accounts for the largest share of imports. **Italy** follows with **$45.14 million** and **the United Kingdom** with **$37.59 million**, reflecting a strong European presence in India's wastepaper imports.

Additionally, **Saudi Arabia** and **the UAE** contribute **$14.98 million** and **$13.59 million**, respectively. This data underscores India's **heavy reliance on the U.S.** for wastepaper, which could present a potential risk in case of trade disruptions. It highlights the need to either diversify import sources or enhance domestic wastepaper processing capabilities.

- Major Importing countries for sorted waste and scrap paper or paperboard for FY 2023-24

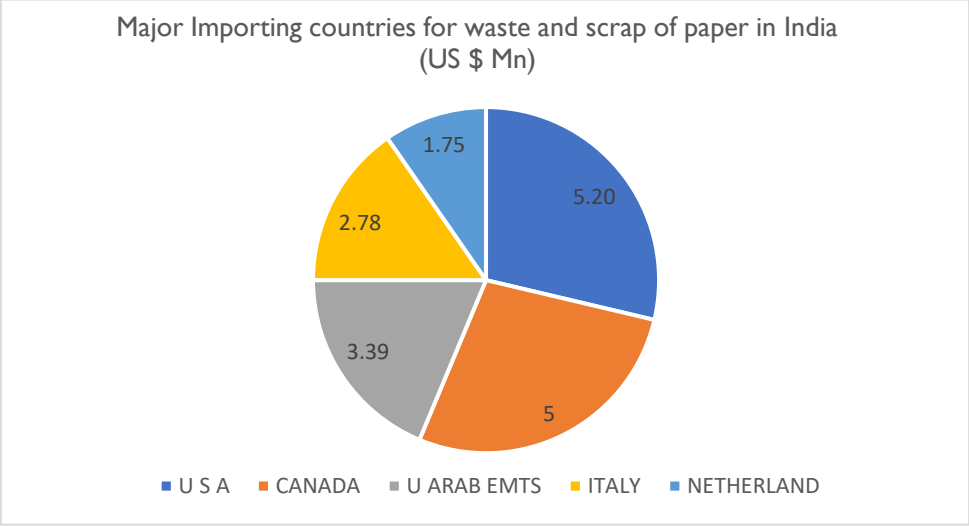


Source: Directorate General of Foreign Trade

The pie chart for FY 2023-24 shows that **the United States dominates India's imports of sorted waste and scrap paper/paperboard**, accounting for **$51.59 million** (nearly half of the total). **The United Arab Emirates follows at $32.88 million**, reflecting strong Gulf–India trade ties in higher-grade recycled paper.

Turkey's share of $8.87 million underscores its emerging role in the paperboard scrap market, while **Saudi Arabia ($6.35 million)** and **the UK ($6.03 million)** supply smaller but still significant volumes. This concentration over 80% from just two countries highlights both reliance on a narrow supplier base and the potential benefits of **diversifying import sources** or **strengthening domestic sorted-paper collection** to mitigate supply-chain risks.

- Major Importing countries for waste and scrap of paper or paperboard made mainly of mechanical pulp for FY 2023-24

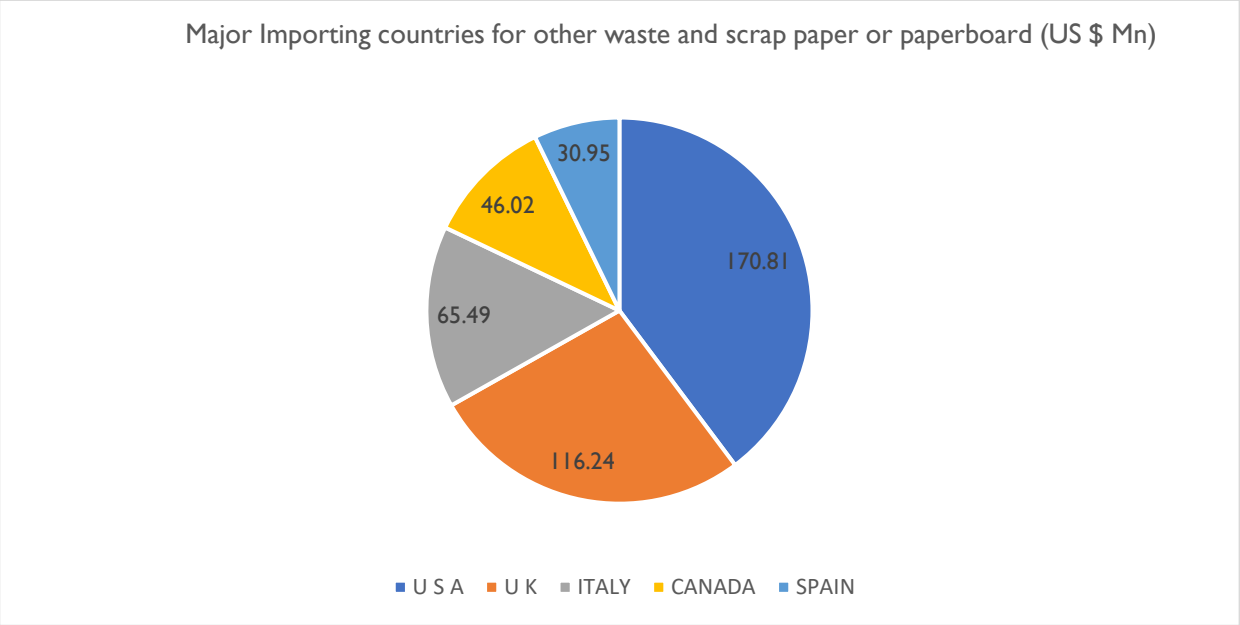


Source: Directorate General of Foreign Trade

For FY 2023-24, **the United States** is the largest supplier of wastepaper to India, contributing $51.59 million, making up nearly half of the total imports. **The United Arab Emirates** follows closely with **$32.88 million**, indicating strong trade ties in higher-grade recycled paper between the Gulf and India.

Other key suppliers include **Turkey**, with **$8.87 million**, and **Saudi Arabia** and **the UK**, at **$6.35 million** and **$6.03 million**, respectively. This concentration of imports over 80% from just two countries highlights India's dependency on a narrow supplier base, emphasizing the need for **diversifying import sources** or **boosting domestic wastepaper collection** to mitigate supply chain risks.

- Major Importing countries for other waste and scrap paper or paperboard for FY 2023-24



Source: Directorate General of Foreign Trade

For FY 2023-24, **India's major imports of other waste and scrap paper or paperboard** were largely sourced from **the United States**, accounting for **$170.81 million**, which makes it the top supplier in this category. **The United Kingdom** followed with **$116.24 million**, indicating a strong bilateral trade in recyclable paper materials.

Additional significant contributions came from **Italy** at **$65.49 million**, **Canada** with **$46.02 million**, and **Spain** at **$30.95 million**. This diversified sourcing pattern showcases India's growing reliance on multiple geographies for wastepaper imports, underlining its expanding recycling and paper manufacturing industry.

Technology Impact on the Paper Recycling Industry and Digital Trade Platforms

The paper recycling industry in India has seen a significant transformation with the adoption of technology. Advanced digital platforms and smart trading exchanges have revolutionized the way waste paper is collected, traded, and utilized for manufacturing. These innovations have streamlined processes, improved transparency, and increased efficiency, benefiting both suppliers and buyers.

With the rising demand for **sustainable materials** and **eco-friendly alternatives**, technology has played a crucial role in optimizing waste paper supply chains. Traditional methods of sourcing recycled paper often involved **multiple intermediaries, lack of price transparency, and logistical inefficiencies**. However, with the emergence of **digital trade platforms**, these challenges are being effectively addressed.

Business Model of Paper Trade Exchange Platforms

Digital trading platforms for paper recycling function as **marketplaces** that connect suppliers (waste paper aggregators, scrap dealers) with buyers (recyclers, paper mills, and manufacturers). These platforms have introduced new business models, making procurement more **efficient, cost-effective, and scalable**.

- **B2B Marketplace Model**

One of the most commonly adopted business models is the **Business-to-Business (B2B) digital marketplace**, where suppliers list their products and buyers place orders based on real-time availability and pricing. These platforms act as intermediaries, ensuring smooth transactions and maintaining quality standards.

This model reduces reliance on middlemen, thereby lowering procurement costs for businesses involved in paper recycling. By directly connecting waste paper suppliers with manufacturers and recyclers, digital platforms help streamline transactions and enhance pricing transparency. These platforms generate revenue through various means, including commission-based transactions, premium memberships, and advertisement placements for suppliers seeking greater visibility. Some prominent examples of such platforms include

Recykal, Scrapo, and POM, which facilitate seamless integration between waste paper sellers and manufacturers, ensuring efficient and sustainable trade.

Example- Exim Routes, Recykal, ScrapUncle, Namo ewaste and The Kabadiwala

- **Block Chain-Enabled Trade Model**

Block chain technology is increasingly being integrated into digital trade platforms to enhance **trust, security, and transparency**. This model ensures that each transaction is **recorded on a tamper-proof digital ledger**, allowing buyers to verify the source and quality of the waste paper they procure.

Smart contracts eliminate disputes by automating payment and delivery processes, ensuring secure and transparent transactions between buyers and sellers. These contracts operate on block chain technology, which provides traceability, allowing companies to verify the origin and quality of recycled paper. This feature helps businesses comply with sustainability standards and government regulations, promoting responsible sourcing practices. The revenue model for such platforms typically includes subscription-based premium access for verified users, along with data-driven insights that assist market participants in making informed trading decisions.

Example- Recykal, Bollant Industries, EcoEx and Allerin

- **AI-Driven Smart Trading Platforms**

Artificial intelligence (AI) and machine learning (ML) are now being used to optimize paper trading platforms. These technologies **analyse market trends, predict price fluctuations, and automate procurement strategies**, ensuring that businesses get the best deals with minimal risk.

AI-powered platforms help recyclers and manufacturers track supply chain bottlenecks and identify alternative sources of raw materials, ensuring a steady supply for production. These platforms analyse market trends and provide data-driven recommendations to buyers, helping them determine the best time to purchase waste paper based on pricing fluctuations. Often operating on a subscription-based model, these platforms offer premium features such as real-time analytics, predictive insights, and automated procurement strategies, enabling businesses to optimize costs and improve efficiency.

Example- Exim Routes, MetalMandi, Ishitva Robotic Systems and Waste Ventures India

Key attribute and Advantages for trading partners

The implementation of technology in the paper recycling trade has brought several advantages to both buyers and suppliers. Some of the most significant benefits include:

- **Increased Market Access and Efficiency**

With the integration of digital trade platforms, businesses can now connect with suppliers and buyers beyond geographical boundaries, enabling a more efficient and globalized paper recycling industry. Paper mills and

recyclers can source waste paper from international markets, ensuring a continuous supply while benefiting from competitive pricing. These platforms offer buyers the flexibility to choose from various types of waste paper, including Old Corrugated Containers (OCC), newsprint, Kraft paper, and de-inked pulp, based on their specific requirements. This global access helps businesses mitigate raw material shortages by diversifying their supplier base across different regions, reducing dependency on any single market and ensuring a more stable supply chain.

- **Enhanced Transparency and Trust in Transactions**

Traditional waste paper procurement faced significant challenges due to the lack of transparency in pricing and quality assurance, often leading to fraud and inconsistencies in material standards. However, the introduction of digital trade platforms has transformed the industry by making transactions trackable and verifiable, reducing the risks associated with substandard materials. These platforms implement verified supplier listings, where suppliers undergo strict quality checks and certification processes, ensuring that buyers receive high-quality raw materials. Additionally, block chain-backed smart contracts automate payments and deliveries, ensuring that funds are only released once all trade conditions are met, thereby eliminating disputes and fostering trust in the supply chain.

- **Cost Reduction and Sustainability**

Technology-driven platforms have significantly reduced procurement and logistics costs for trading partners by leveraging AI-powered route optimization, which helps companies' lower transportation expenses and minimize their carbon footprint. Many of these platforms prioritize local sourcing, allowing businesses to cut down on shipping distances and emissions, making the supply chain more sustainable. Additionally, optimized logistics planning ensures faster delivery times and lower freight costs, improving overall efficiency and reducing operational expenses.

- **Real-Time Market Analytics for Better Decision-Making**

Data has become a valuable asset in the paper recycling industry, with digital platforms offering real-time price tracking, demand forecasting, and trend analysis to help businesses make informed purchasing decisions. AI-powered predictive analytics enable companies to strategically plan inventory purchases based on expected market conditions, reducing risks associated with price fluctuations. Additionally, these platforms allow buyers and suppliers to adjust pricing dynamically, enhancing profitability and supply chain efficiency by ensuring competitive pricing and optimized procurement strategies.

Regulatory Landscape Paper Recycling

The Indian government has implemented several policies and regulations aimed at promoting sustainable practices in paper recycling, recognizing the critical role that recycling plays in conserving resources, reducing environmental impact, and transitioning towards a circular economy. Given the rapid industrialization and increasing consumption of paper products, it is essential to have a robust framework that encourages recycling and reduces the dependence on virgin resources.

Major Government Initiatives

These initiatives collectively aim to enhance waste management systems, promote circular economy principles, and reduce the environmental footprint of the paper industry. By integrating policy measures with public participation and industry responsibility, the government seeks to improve recycling rates and ensure the sustainable utilization of resources.

- **Extended Producer Responsibility (EPR) Rules, 2024:** The EPR Rules, 2024, issued by the Ministry of Environment, Forest, and Climate Change (MoEFCC), are set to be enforced starting April 2026. These rules hold producers, importers, and brand owners (PIBOs) responsible for managing the entire lifecycle of their packaging materials, including paper. The framework requires companies to ensure the collection, recycling, and environmentally sound disposal of these materials. By setting progressive recycling targets, the EPR framework aims to reduce reliance on virgin resources and promote the use of recycled materials.

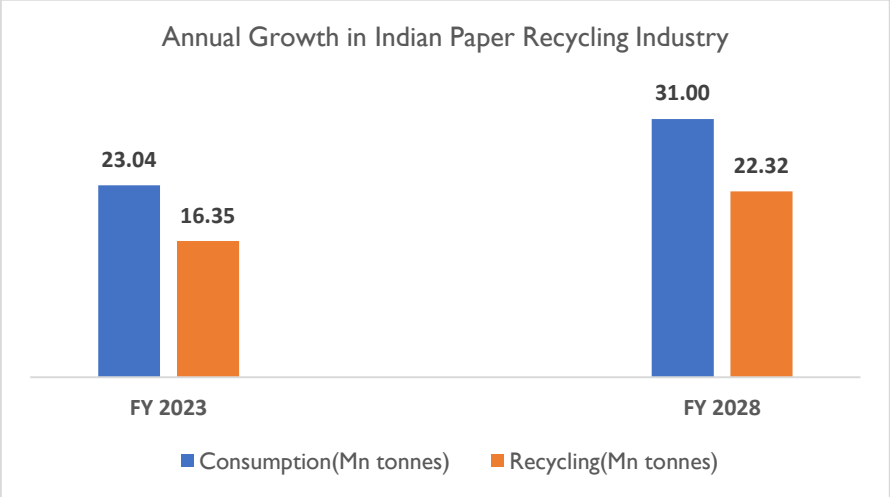
- **Swachh Bharat Mission (Urban): Focus on Paper Waste Management:** The Swachh Bharat Mission (Urban) focuses on improving urban sanitation and waste management across the country. The mission encourages the segregation of dry waste (such as paper) from wet waste at the source to facilitate recycling. It also promotes the development of infrastructure like material recovery facilities (MRFs) to process recyclable materials, including paper. This initiative emphasizes public awareness and engagement to foster a culture of recycling among citizens.

- **Green India Mission:** The Green India Mission, part of the broader National Action Plan on Climate Change (NAPCC), supports afforestation and forest conservation. By promoting sustainable forestry practices, the mission indirectly contributes to paper recycling by reducing the demand for virgin wood pulp. The mission focuses on increasing India's forest cover, thus helping conserve resources and encourage the use of recycled materials in the paper industry.

Growth Forecast

Expected growth in paper consumption and paper recycling business in India (next 3 – 5 years)

The Indian paper recycling industry is poised for steady growth, with overall paper consumption rising **from 23.04 million tonnes** in **FY 2024 to 31 Mn tonnes by 2028, registering a CAGR of about 7.3%.**



Source: D&B research

In India, approximately **71%** of paper and paperboard consumed annually are recycled, reflecting a strong recycling culture. The recycling volume is projected to grow steadily from **16.35 million tonnes** in **FY 2024** to **15.73 million tonnes** in **FY 2028**, and further to **22.23 million tonnes** by **FY 2028.**

Growth prospects for online paper recycling trade exchange platform in India

In India, the paper recycling trade has traditionally been an unorganized sector, heavily dependent on scrap dealers, middlemen, and informal aggregators. However, with the increasing demand for sustainable practices, there has been a notable shift towards online paper recycling trade exchange platforms. India is one of the largest consumers of paper in Asia, and approximately 30-35% of its paper production relies on recycled or recovered paper, sourced both domestically and internationally. This dependency, combined with rising environmental concerns and the need for traceable supply chains, has given rise to digital platforms facilitating the organized trade of waste paper.

Online paper recycling platforms in India are gaining traction due to multiple factors. Firstly, they help digitize the highly informal scrap trading process, allowing for more transparent and efficient transactions. Secondly, there is a growing push from corporates to meet sustainability and Extended Producer Responsibility (EPR) obligations, making traceable and documented recycling more important than ever. These platforms provide better pricing transparency, often displaying real-time rates for various grades of paper waste such as Old Corrugated Containers (OCC), Old Newspaper (ONP), Sorted Office Paper (SOP), white paper, and mixed paper. Many platforms also integrate logistics, certification, and documentation services, making it easier for companies to comply with environmental standards.

Some of the key players in the Indian online paper recycling ecosystem include Recykal Marketplace, which is one of the largest platforms connecting brands, recyclers, scrap aggregators, and waste pickers. It serves major clients like Hindustan Unilever, Coca-Cola, and ITC. ScrapUncle and The Kabadiwala are tech-enabled platforms providing doorstep collection and trade of paper and other recyclables, primarily targeting urban and semi-urban areas. Cero Recycling, backed by Mahindra Group, also operates as a B2B platform handling bulk waste paper, among other recyclable materials. Additionally, social enterprises like the Paperman Foundation are helping digitize the scrap value chain, connecting waste pickers to organized buyers.

As per the primary approach, Recykal operates exclusively within India and does not engage in import or export activities. However, they have plans to expand into international markets in the future. At present, their services are primarily tailored for large-scale organizations.

The market is witnessing key trends such as the rise of branded recyclers, where companies prefer platforms that can provide traceable and verifiable proof of responsible paper disposal. With the introduction of EPR compliance norms, corporates and large institutions are actively seeking formal, online solutions to dispose of their paper waste responsibly. Paper mills and packaging industries are increasingly sourcing industrial paper waste such as corrugated boxes and printing trimmings through these platforms. There is also growing interest in integrating technologies like block chain and AI to enhance supply chain traceability.

Despite these advancements, several challenges persist. The sector remains largely dominated by informal players who offer lower-cost services but without traceability or documentation. Fragmentation is a significant issue as there is no single dominant online platform for paper recycling across India. Logistics inefficiencies also affect the sector since paper scrap is bulky and has low per-unit value, making transportation costly. Moreover, price volatility due to fluctuations in global pulp and paper prices often creates uncertainty for both buyers and sellers. Lastly, there is limited awareness, especially among small offices and businesses, about the availability and benefits of organized online platforms for waste paper trade.

The typical users of these platforms include corporate offices generating office paper waste, e-commerce and logistics companies generating significant volumes of used corrugated boxes, printing presses generating paper trimmings, and paper mills and packaging units sourcing waste paper for production. By providing digital tools, pricing transparency, and end-to-end solutions, these online platforms are slowly formalizing the Indian paper recycling industry, aligning it with sustainability goals and modern supply chain requirements.

Key threats & challenges for recyclable with focus on paper recycling in India

Threats:

Limited Availability of Raw Materials

- A significant portion of waste paper used for recycling is imported, making the industry vulnerable to global price fluctuations and supply chain disruptions.
- Domestic waste paper collection remains inefficient, leading to a supply-demand gap.

Environmental Regulations & Compliance Costs

- Effluent treatment and disposal challenges create additional financial burdens.
- Stringent environmental norms and compliance requirements increase operational costs for recycling plants.

Competition from Virgin Paper Production

- Quality perception issues make businesses prefer virgin paper over recycled alternatives.
- Availability of cheaper virgin pulp paper, often subsidized or imported, poses a threat to the demand for recycled paper.

Challenges:

Inefficient Waste Collection & Segregation

- Lack of a structured waste collection system results in lower recovery rates of recyclable paper.
- Contamination of waste paper with other materials reduces recycling efficiency and increases processing costs.

High Energy & Water Consumption in Recycling

- Paper recycling requires significant water and energy resources, making it costly and less sustainable in regions facing resource scarcity.
- Implementation of energy-efficient and water-saving technologies remains a challenge due to high initial investment costs.

Lack of Consumer Awareness & Market Demand

- Limited awareness about the benefits of recycled paper affects its market acceptance.
- Businesses and consumers often prefer fresh paper due to quality concerns, reducing demand for recycled alternatives.

Competitive Landscape

Analysis Competitive Landscape

The global paper recycling industry is characterized by a fragmented yet increasingly competitive landscape, driven by rising environmental awareness, tightening regulations on waste management, and a growing demand for sustainable raw materials across manufacturing sectors. Numerous regional and international players operate across the value chain from collection and processing to distribution of recovered fiber (RCF) with strategic variations in their business models and market penetration strategies.

A comparative analysis of key players such as LCI Lavorazione Carta, Brown Fiber Overseas Trading, Indicaa Group Limited, and Ocean Line FZE reveals distinct strengths and operational footprints. Hence, Competitor Benchmarking shows LCI ahead in operational sustainability and mill integration, while Brown Fiber scores higher on global scale and supply diversity. Indica benefits from logistical agility and localized sourcing networks, while Ocean Line excels in bridging Africa-Asia trade corridors and flexible port operations.

From a market entry lens, offline international RCF imports remain the dominant mode for most players due to established trade routes and bulk handling advantages. However, integration with digital and tech-enabled platforms for traceability, procurement automation, or digital quality assurance is rapidly transforming traditional models. Companies with embedded tech solutions are gaining a competitive edge by reducing inefficiencies, enhancing transparency, and improving compliance with increasingly strict ESG standards. Early movers coupling physical RCF trade with tech-based sourcing, grading, and inventory systems are setting new benchmarks in operational excellence and customer trust, and this dual approach is expected to shape the future trajectory of competition in the paper recycling industry.

Adopting technology in the paper recycling industry presents several hurdles, including significant initial costs for infrastructure, software, and training, which may be difficult for smaller players to justify without clear short-term returns. Additionally, the required expertise to implement and manage digital platforms is often lacking, leading to skill gaps and resistance from employees accustomed to traditional processes. This resistance, along with operational disruptions during the transition, can further delay adoption, particularly in industries with a deep-rooted reliance on established methods. Long-term integration and maintenance costs, as well as cybersecurity risks and regulatory compliance challenges, also pose significant concerns. To overcome these barriers, companies must strategically invest in change management, training, and scalable technologies that demonstrate long-term value and competitive advantage.

In conclusion, the competitive landscape of the paper recycling industry is evolving rapidly, shaped by a blend of traditional trade mechanisms and emerging digital innovations. While established players like LCI Lavorazione Carta and Brown Fiber Overseas Trading leverage scale and infrastructure, agile firms such as Indica Group Limited and Ocean Line FZE capitalize on regional flexibility and adaptive sourcing strategies. The integration of tech solutions into the RCF import-export model is becoming a key differentiator, enabling companies to enhance transparency, optimize operations, and align with global sustainability trends.

Tariff Impact on India's Paper Recycling Industry

The proposed imposition of a 26% import tariff by the U.S. on Indian paper products, effective from April 2025, is poised to have significant implications for India's paper recycling industry. This move is likely to affect both the demand for Indian exports and the cost structure of domestic production, particularly impacting small and mid-sized paper mills that form the backbone of the industry.

A key concern arises from the fact that many Indian paper mills are heavily reliant on exports to the U.S. market. The increased tariffs will make Indian paper goods more expensive and less competitive in the U.S., which may result in a decline in demand. As a result, manufacturers may be compelled to reorient their export strategies by targeting alternative international markets, which may involve new logistical and regulatory challenges. For smaller mills, such adjustments can be both financially and operationally burdensome, potentially affecting their sustainability and growth.

On the import side, the impact is equally concerning. India imports a substantial volume of wastepaper from the U.S., which serves as a critical raw material for recycled paper production. Any rise in import costs due to tariffs will directly increase raw material expenses for Indian mills. Since wastepaper forms a major component of the production input for recycled paper goods, this could lead to elevated manufacturing costs, squeezing margins and possibly leading to higher prices for end consumers.

Furthermore, the tariff hike could unintentionally open the Indian market to a surge in low-cost finished paper imports from countries such as China, Indonesia, Vietnam, and Thailand. These countries have competitive pricing advantages and may capitalize on the vacuum created by declining Indian exports to the U.S. This influx of cheaper imports could intensify price competition in the domestic market, putting additional pressure on Indian paper recyclers, particularly those with limited scale or outdated infrastructure.

In conclusion, the proposed U.S. tariffs are expected to deliver a dual shock to India's paper recycling industry by raising the cost of raw material imports and diminishing the competitiveness of Indian paper products in global markets. For small and medium-sized recycling units, which already operate under tight financial constraints, these developments could pose significant risks to operational viability and long-term growth. Strategic policy support and efforts to diversify both sourcing and export destinations may be critical to mitigate these impacts.

Major Key Players In The Industry:

Lavorazione Carta Riciclata Italiana S.r.l. (LCI)

Headquarters: Italy, Europe

Overview: LCI was founded in Italy in 2007 as a result of a strategic partnership between Rowe GmbH and UPM-Kymmene Oyj to meet the increasing demand for quality wastepaper sourced from Italy. The company operates in the recovered paper trade, focusing on the procurement of baled paper and cardboard from sorting facilities and supplying these materials to paper mills for recycling into new products. LCI contributes to the Italian market by working to improve the quality of materials from separate waste collection and partnering with sorting platforms to support the reuse of collected paper and cardboard. The company maintains a focus on sustainability, operational efficiency, and circular economy practices, establishing itself as a dependable partner in both the national and international paper recycling sector.

Product & Service Offerings:

- **Waste Paper Collection & Procurement**: LCI provides dependable and consistent waste paper collection services to its suppliers, even during periods of market volatility. Managing over 50 varieties of paper, the company emphasizes strict quality standards, requiring careful material selection and packaging at the source.
- **Recovered Paper Sales & Distribution**: LCI ensures year-round availability of high-quality, diversified paper products. From procurement to distribution, each step is marked by thorough inspection, reinforcing LCI's reputation for reliability and professionalism.
- **End-to-End Recycling Solutions for Businesses**: LCI partners with companies aiming to meet high environmental standards by offering:
    - Tailored waste storage containers
    - Efficient collection, sorting, pulping, and baling processes
    - Certification for end-of-life paper recycling and CO_2 emissions reduction
- **Extensive National & International Supply Network**: With a broad logistics network, LCI serves businesses of all sizes across Italy and international markets, offering customized solutions for efficient paper waste management.
- **Sustainability Certification & Environmental Reporting**: LCI provides verifiable documentation and certifications that quantify clients' environmental contributions, supporting their ESG goals and promoting a 100% green business model.

Key Strengths:

- **Specialized in Recovered Paper Trade**: Expertise in handling over 50 types of paper, ensuring high-quality supply.
- **Robust National & International Network**: Wide logistics and sourcing network across Italy and global markets.
- **Commitment to Sustainability**: Certified recycling processes supporting CO_2 reduction and circular economy practices.
- **Customized Client Solutions**: Tailored collection, storage, and recycling services for businesses of all sizes.
- **Operational Reliability**: Consistent supply and service even during market fluctuations.

Brown Fiber Overseas

Headquarters: Dubai, UAE

Overview: Brown Fiber Overseas is an international waste paper trading and brokerage company that manages the movement of around 500,000 tons of recovered fiber each year within India. With its headquarters in Dubai, the company maintains a broad sourcing network through offices in Istanbul, Singapore, Cape Town, and the United States. It also has sales and support offices in Mumbai and Coimbatore, which help coordinate supply chain activities for corporate paper mills as well as small and medium-sized manufacturers.

Product & Service Offerings:

- **Waste Paper Trading:** Fine Paper, Newsprint, Container Board, Core Board, Duplex Board, Tissue, Poster and Low GSM Kraft
- **Finished Paper Products:** Fluting Media, Test Liner, Kraft Liner Board, Core Board, Bag Paper, Duplex Board and Folding Box Board

Key Strengths:

- **Global Sourcing Network**: Buying offices strategically located in Istanbul, Singapore, Cape Town, and the United States ensure diverse and consistent procurement of quality waste paper.
- **Strong Market Presence in India**: Trades and brokers nearly half a million tons of waste paper annually to India, serving a wide range of paper mills.
- **Expertise in Quality Control**: Dedicated inspection teams and internal quality assurance processes ensure reliable sourcing and customer satisfaction.

- **Comprehensive Documentation & Logistics Support**: In-house capabilities in customs clearance, shipping, and documentation streamline international trade operations.
- **Diverse Product Offering**: Supplies both waste paper grades and prime paper rolls to meet the needs of paper manufacturers and packaging converters.

Indicaa Group Limited

Headquarters: Dubai, UAE

Overview: Indicaa Group was incorporated in 1993 and began its commercial operations focusing on trading steel products, the company quickly identified the potential in the ferrous scrap metal trade, particularly in containerized scrap metal shipments between the Middle East and the Indian subcontinent. Indicaa expanded its operations to Africa, which proved to be a significant milestone, and continued to grow its reach into Southeast Asia and Vietnam.

In the following years, Indicaa's trading volumes increased, reaching 500,000 tons by 2005. The company continued to expand into new markets, including Europe, the USA, and Brazil, ensuring a broader sourcing network for containerized scrap metal The company's growth has been underpinned by its logistics capabilities and its ability to adapt to the global supply chain.

Product & Service Offerings

- Ferrous Scrap
- Non-Ferrous Scrap
- Paper Scrap
- Billets

Key Strengths

- **Global Supply Chain Expertise**: Indicaa operates across 40+ countries with over 200 locations, showcasing a robust international logistics network.
- **Diversified Sourcing**: The company sources recyclable materials like ferrous/non-ferrous metals and recovered paper from multiple continents, reducing supply risk.
- **Established Market Presence**: Indicaa has strong footholds in key recycling markets such as the Middle East, Africa, South Asia, and Southeast Asia.
- **Containerized Trade Focus**: Specialization in containerized scrap trade provides flexibility and efficiency in international shipping.

Ocean Line FZE

Headquarters: Dubai, UAE

Overview: Ocean Line Trading is a well-established recyclable waste reprocessing company operating out of Dubai, UAE. The company focuses on various stages of waste management, including the collection, segregation, upgrading, shredding, compaction, and reprocessing of recyclable materials, particularly waste paper. Through these processes, it supports the recycling supply chain by supplying processed materials to businesses involved in paper manufacturing and related industries. Ocean Line Trading emphasizes sustainable practices and maintains a business approach grounded in ethical standards. The company works to create consistent value for its customers through reliable service, while also contributing to environmental responsibility and supporting the welfare of its workforce and the broader community.

Product & Service Offerings: Ocean Line Trading offers a diverse range of recovered paper grades, catering to various industrial recycling needs. Their product portfolio includes:

- Old Corrugated Cartons
- New Corrugated Cuttings
- Newspapers
- Box Board Cuttings
- Kraft Papers
- White Papers

Key Strengths

- **Market Leadership**: Recognized as one of the largest waste paper collectors and distributors in the region.
- **Comprehensive Services**: Offers end-to-end waste management solutions, including one-time cleanouts, regular programs, and customized shredding services.
- **Sustainability Focus**: Committed to responsible and sustainable practices in all operations.
- **Strategic Location**: Based in Dubai, providing strategic access to markets across the Middle East and Asia.
- **Ethical Practices**: Emphasizes integrity and accountability in all business dealings.

Company Profile: Exim Routes Limited

Company Overview: Exim Routes specializes in trading recyclable materials, particularly various grades of recycled paper sourced globally and supplied to leading Indian paper mills. Their product portfolio includes mechanical grades like Old Newsprint (ONP) and soft mixed waste, brown grades such as Old Corrugated Containers (OCC) and sack kraft, and white grades like Sorted Office Paper (SOP) and tissue. These materials are essential for manufacturing new paper products, playing a crucial role in resource conservation and waste reduction.

Established in 2013, Exim Routes has expanded its presence across multiple regions, including Singapore (2018), the United States (2021), the United Kingdom and Europe (2023), and Sri Lanka and South Africa (2024). As of 2024, the company operates in over 25 countries, collaborating with more than 500 yards and mills while handling over 15 different paper grades. The company's leadership team consists of professionals with expertise in paper engineering, commodity trading, and industry experience from organizations such as Amazon, McKinsey, Ernst & Young, and Deloitte.

In 2024, Exim Routes introduced the Exim Routes Intelligence System (ERIS), an AI-enabled B2B marketplace designed to enhance decision-making and reduce risk for trading partners. ERIS streamlines trade matching, provides market insights, and optimizes logistics and financing solutions for businesses involved in the recycling supply chain. Committed to innovation and sustainability, Exim Routes aims to build efficient solutions that strengthen the global recycling ecosystem while ensuring quality and reliability in its operations.

Product & Service Offerings: Exim Routes Limited offers a diverse range of products and services tailored to the paper industry. Their offerings include

- **Recovered Paper Grades:**
  - **Mechanical Grades:** ONP (Old Newspaper), News Paper & Pamphlets, Soft Mix Waste, Text Books, and Magazines
  - **Brown Grades:** OCC (Old Corrugated Containers), Mix, Board Box Cutting, Scan Board, Sack Kraft, NDLKC (New Double Lined Kraft Corrugated Cuttings), NCC (New Corrugated Cuttings).
  - **White Grades:** SOP (Sorted Office Paper), SWL (Sorted White Ledger), HWS (Hard White Shavings) / PWC (Printed White Cuttings), Cup Stock, Tissue
  - **Finished Paper Products:** Duplex Board, Kraft Paper, Writing & Printing Paper, Newsprint, Copier Paper
- **Services:**
  - **Paper Recyclables**: End-to-end management of the procurement and sale of paper recyclables, including coordination of key intermediary processes such as logistics from the source yard to Indian ports, as well as overseeing payment flows and cash management.

- **Tech-Enabled Insights and Analytics:** Utilization of our proprietary technology platform to efficiently scale the paper recyclables business while delivering data-driven insights and analytics to both internal stakeholders and customers.
- **Quality Inspection:** Comprehensive quality assurance facilitated by our dedicated in-house inspection team to ensure material consistency and compliance with specifications.
- **Logistics Services:** Specialized container handling and logistical support services offered to select clients, tailored to optimize the transportation and delivery of recyclables.

Key customer segments served

- **Paper Mills (Buyers):** Exim Routes supplies recovered paper grades such as mechanical, brown, and white grades to leading Indian and Asian paper mills for manufacturing fresh paper.
- **Suppliers (Yards & Material Recovery Facilities):** The company collaborates with suppliers globally to source various waste paper grades, facilitating recycling and sustainability efforts.

Key Strengths

- **Global Outreach:** The company maintains a robust network, collaborating with over 500 yards and mills across more than 25 countries, handling 15+ paper grades.
- **Deep Industry Expertise:** With over a decade of experience in trading various recovered paper grades, Exim Routes has developed profound knowledge and insights into the paper recycling sector.
- **Experienced Leadership Team:** The executive team comprises professionals with backgrounds in paper engineering, commodity trading, and roles at renowned organizations such as Amazon, McKinsey, Ernst & Young, and Deloitte, bringing a wealth of expertise to the company.
- **Technological Innovation:** Exim Routes is pioneering the development of ERIS (Exim Routes Intelligence System), the world's first AI-enabled closed B2B platform designed to facilitate trading and provide valuable insights for buyers and sellers in the recyclable materials market.
- **Zero Tolerance for Claims:** The company emphasizes a commitment to quality assurance, aiming to minimize disputes and uphold high standards in all transactions.

Financial Analysis:

	Exim Routes Limited		
All Values in INR Millions	**FY2025**	**FY2024**	**FY2023**
Total Income	1,209.9	746.8	368.7
Revenue from Operations	1,203.3	725.0	368.5
EBITDA	124.5	49.9	6.6
EBITDA Margin (in %)	10.3	6.9%	1.8%
PBT	97.8	47.2	5.3
PAT	75.5	41.1	4.1
PAT Margin (in %)	6.2	5.5%	1.1%
Operating Cash Flow	-14.3	-7.1	-6.2
Shareholder Equity	236.4	50.2	7.3
Depreciation	24.3	2.4	1.4
Finance Cost	2.4	0.3	0.1
Total Asset	517.9	239.4	65.9
Net Worth (Shareholder Equity)	236.4	50.2	7.3
Short Term Borrowing	27.2	37.0	-
Long Term Borrowing	18.9	7.2	28.9
Debt Equity Ratio	0.2	0.9	0.0
Return on Capital Employed (in %)	35.5	50.3%	0.0%
Return on Equity (in %)	31.9	81.9%	56.2%
Return On Asset (in %)	14.6	17.2%	6.2%
Capital Employed	282.5	94.4	0.0
Total Borrowing	46.1	44.2	0.0
Interest Coverage Ratio	41.4	158.3	52.0

Note: For above companies consolidated balance sheet is considered

Revenue Growth

- **Total Income** has grown sharply from INR 79.2 million in FY2022 to INR 368.7 million in FY2023, and then to INR 746.8 million in FY2024. and further to INR 1,209.9 million in FY2025.
- This reflects a continued **CAGR of over 150%** over three years, indicating sustained and rapid business scaling.

EBITDA and Margins

- EBITDA rose from INR 2.3 million in FY2022 to INR 6.6 million in FY2023 and surged to INR 49.9 million in FY2024. and further increased to INR 124.5 million in FY2025.

- **EBITDA Margin** improved significantly from 2.9% in FY2022 to 6.9% in FY2024 and reached 10.3% in FY2025, reflecting enhanced operational efficiency and scale benefits.

Profitability (PBT & PAT)

- **PBT** increased from INR 1.9 million (FY2022) to INR 5.3 million (FY2023), and then sharply to INR 47.2 million (FY2024). and further to INR 97.8 million in FY2025.
- **PAT** followed the same trend: INR 1.4 million → INR 4.1 million → INR 41.1 million → 75.5 million and **PAT Margin** grew to **6.2% in FY2025**, up from 1.8% in FY2022, showing stronger bottom-line performance.