Report On Recycling Industry

(Focus on Paper Recycling)

May 2025

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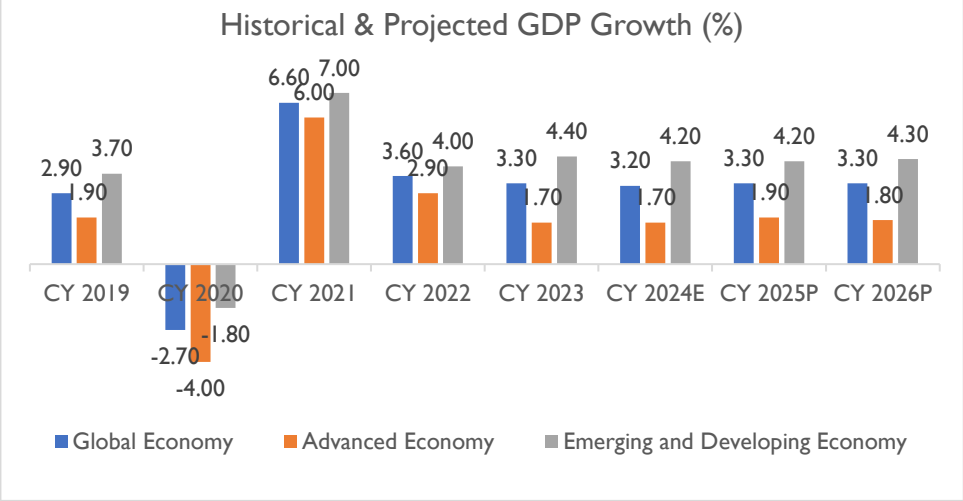
Global Economic Overview

The global economy, which grew by 3.30% in CY 2023, is expected to record a sluggish growth of 3.20% in 2024 before rising modestly to 3.30% in 2025. The year 2024 continued to remain a challenging year marked by uncertainties and transformative shifts. Numerous factors such as high inflation in many economies despite central bank effort to curb inflation, continuing energy market volatility driven by geopolitical tensions particularly in Ukraine and Middle East, and the re-election of Donald Trump as US President extended uncertainty around the trade policies as well as overall global economic growth. 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 estimated to grow by 3.20% in CY 2024 as compared to 3.30% in CY 2023.



Source – IMF Global GDP Forecast Release January 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.)

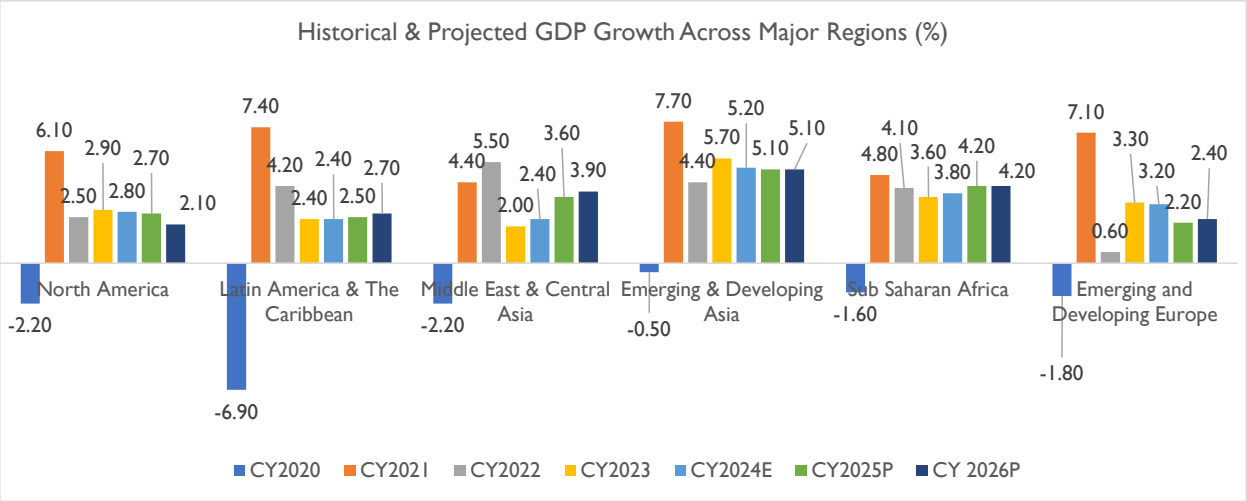
Global Economic Outlook

At broader level, the overall world GDP growth is expected to grow modestly by 3.30% in 2025 and 2026 up from 3.20% in 2024. The real GDP in advanced economies is projected to grow 1.90% in 2025, up from 1.70% in 2024 while the GDP growth in emerging economies is expected to continue growing at 4.20% as in 2024. Global inflation is expected to decline steadily, to 4.20% in 2025 and to 3.50% in 2026 still somewhat higher than the 3.10% pace in 2019. In advanced economies, where inflation surged to multidecade highs following the pandemic, price pressures are expected to moderate but remain uneven. Wage cost pressures, potential tariffs and limited innovation undermining global competitiveness in some sectors are likely to persist across European economies and the UK. In the US, we expect the moderating trend in inflation will

remain in place through early 2025, though it could then change as deregulation, potential immigration restrictions and tariffs lead to a renewed inflation impulse. In contrast to President-elect Trump's first term, these inflationary pressures would come in a new paradigm defined by fragile supply conditions, elevated geopolitical tensions and structural upside risks to inflation. Geopolitical tensions such as the wars in Ukraine and the Middle East could further exacerbate inflation volatility, particularly in energy and agricultural commodities. Furthermore, escalating tariff battles, exemplified by the US-China trade war, US tariff imposition beyond China to other countries and the economic uncertainty, threaten global economic growth by increasing the protectionist measure worldwide, reducing trade volume and creating inefficiencies.

Historical and Projected Regional 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 in Emerging and Developing Asia (India, China, Indonesia, Malaysia, etc.) is expected to decrease further from 5.20% in CY 2024 to 5.10%, while in the North America, it is expected to decrease from 2.8% 0in CY 2024 to 2.70% in CY 2025.



Source-IMF World Economic Outlook January 2025 update.

Except for Emerging and Developing Asia, Emerging and Developing Europe and North America, all other regions are expected to record an increase in GDP growth rate in CY 2025 as compared to CY 2024. Further, growth in the United States is expected to come down at 2.71% in CY 2025 from 2.80% in CY 2024 due to lagged effects of monetary policy tightening, gradual fiscal tightening, and a softening in labour markets slowing aggregate demand. India and China saw greater-than-anticipated growth in 2023 due to heightened government spending and robust domestic demand, respectively and expected to slow down due gradually in 2024 and in subsequent two years. Mainland China will face a different macroeconomic challenge: the risk of deflation due to subdued consumer spending trends, cautious business investment and ongoing deleveraging in the property sector. This has prompted authorities to announce stimulus measures to prevent exacerbating deflationary pressures. Indeed, deflation could slow the economic recovery by delaying consumer purchases, eroding corporate revenues and worsening real debt burdens, particularly if property

sector weakness and slowing exports continue to weigh on private sector confidence. Emerging markets will grapple with the challenge of curbing inflation while contending with fragile supply chains, volatile commodity prices and foreign exchange fluctuations. Sub-Saharan Africa's expected growth in 2024 is attributed to the diminishing negative impacts of previous weather shocks and gradual improvements in supply issues.

India Macroeconomic Analysis

India emerged as one of the fastest growth economies amongst the leading advanced economies and emerging economies. In CY 2024, even amidst geopolitical uncertainties, particularly those affecting global energy and commodity markets, India continues to remain one of the fastest growing economies in the world and is estimated to register a GDP growth of 6.50%.

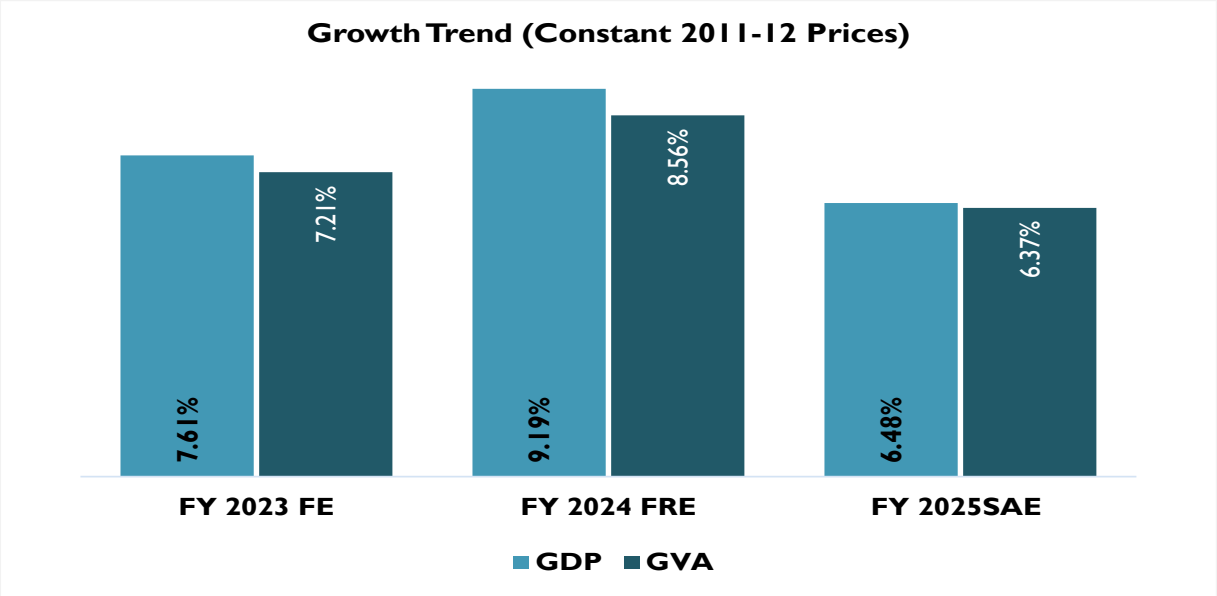
Country	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024 E	CY 2025 P	CY 2026 P
India	-7.30%	8.90%	7.20%	8.20%	6.50%	6.50%	6.50%
China	2.30%	8.10%	3.00%	5.20%	4.80%	4.60%	4.50%
United States	-3.40%	5.70%	2.10%	2.90%	2.80%	2.71%	2.10%
Japan	-4.60%	1.60%	1.00%	1.70%	-0.20%	1.10%	0.80%
United Kingdom	-9.80%	7.40%	4.10%	0.30%	0.90%	1.60%	1.50%
Russia	-3.00%	4.70%	-2.10%	3.60%	3.80%	1.40%	1.20%

Source: World Economic Outlook, January 2025

The Government stepped spending on infrastructure projects to boost the economic growth had a positive impact on economic growth. The capital expenditure of the central government increased by an average of 26.52% during FY 2023-FY 2024 which slowed to 7.27% in FY 2025 which is expected to translate in moderating GDP growth of 6.5% in 2024. In the Union Budget 2025-2026, the government announced INR 11.21 billion capex on infrastructure (10.12% higher than previous year revised estimates) coupled with INR 1.5 trillion in interest-free loans to states. This has provided much-needed confidence to the private sector, and in turn, expected to attract the private investment.

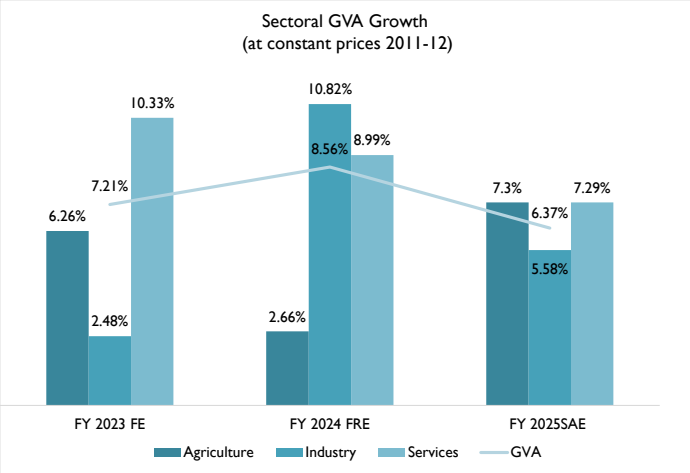
Historical GDP and GVA Growth trend

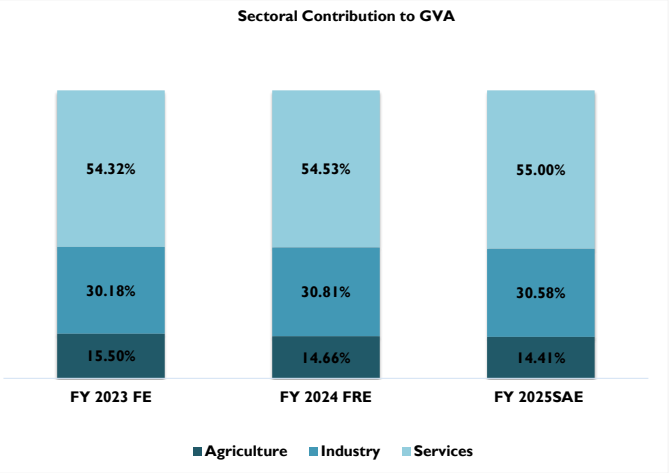
As per the latest estimates, India's GDP at constant prices is estimated to grow to INR 187.95 trillion in FY 2025 (Second Advance Estimates) with the real GDP growth rates estimated to be 6.5% for FY 2025. Similarly, real Gross Value Added (GVA) growth stood at 7.2% in FY 2023, rose to 8.6% in FY 2024, and is expected to moderate 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, 2024-25

Sectoral Contribution to GVA and annual growth trend





Source: Ministry of Statistics & Programme Implementation (MOSPI)

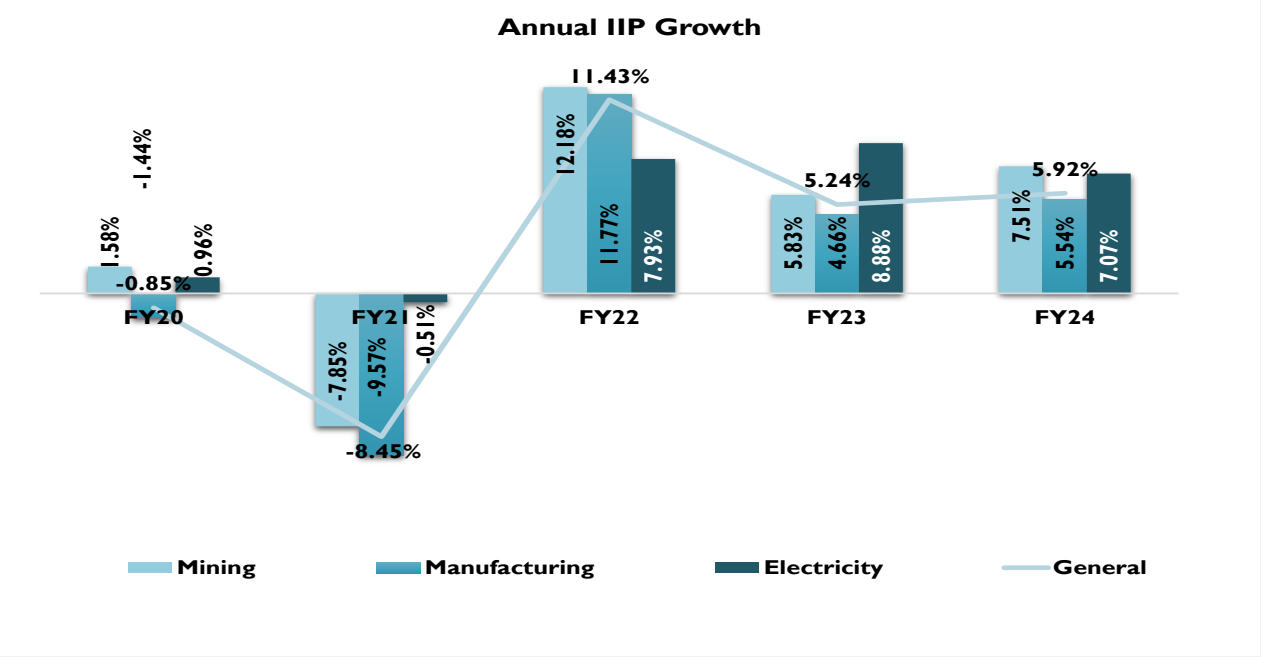
Sectoral analysis of GVA reveals that the industrial sector experienced a moderation in FY 2025, recording a 5.58% y-o-y growth against 10.82% year-on-year growth in FY 2024. Within the industrial sector, growth moderated across sub sector with mining, manufacturing, and construction activities growing by 2.76%, 4.29%, and 8.64% 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 30.58% in FY 2025.

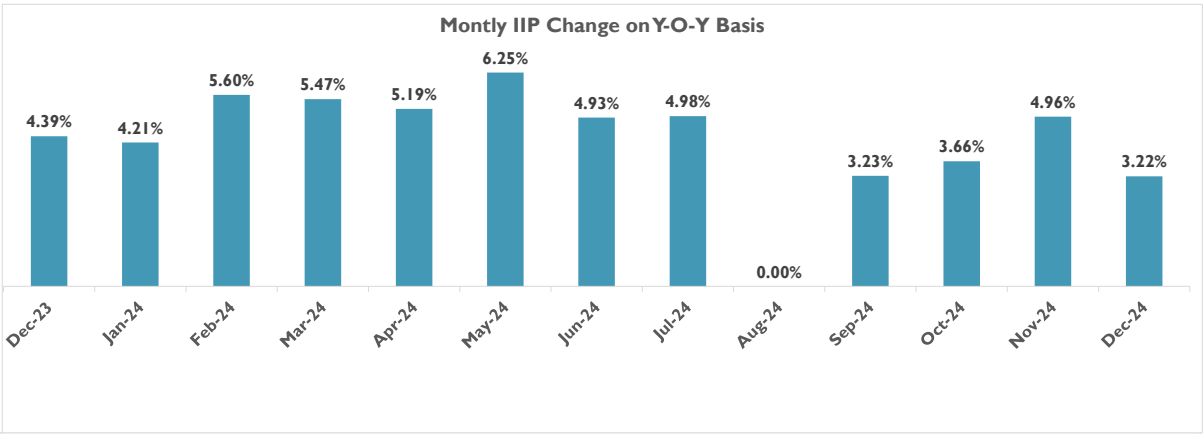
The services sector continued to be the main driver of economic growth, although its pace moderated. It expanded by7.29% in FY 2025 from 8.99% in FY 2024. The services sector retained its position as the largest contributor to GVA, rising from 54.32% in FY 2023 to 54.53% in FY 2024, with a further increase to 55.00% projected in FY 2025.

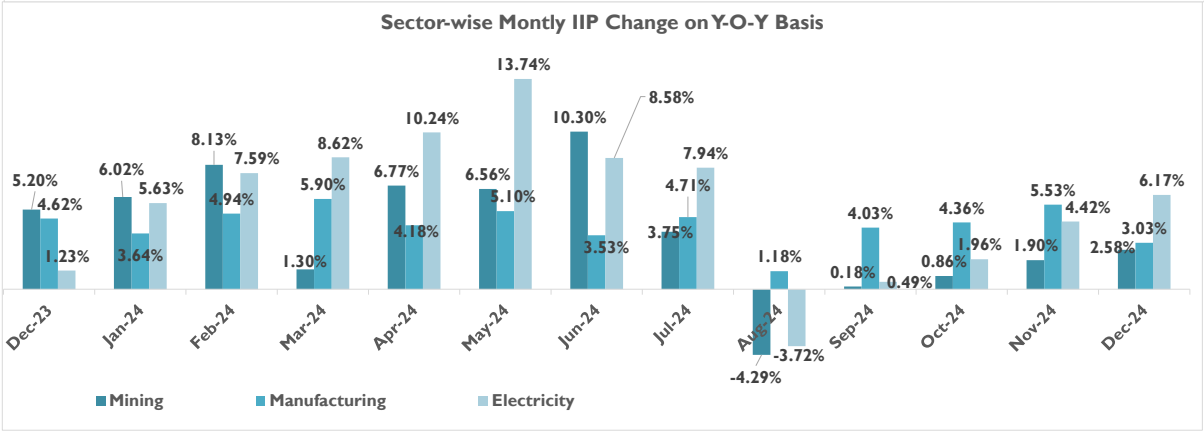
The agriculture sector saw an acceleration, with growth increasing from 2.66% in FY 2024 to 4.59 in FY 2025. However, its contribution to GVA declined marginally from 14.66% in FY 2024 to 14.41% in FY 2025. Overall, Gross Value Added (GVA) growth moderated to 6.37% in FY 2025 from 8.56% in FY 2024

Annual & Monthly IIP Growth

Industrial sector performance as measured by IIP index grew by 5.92% in FY 2024 (against 5.24% in FY 2023) backed by the increased in Manufacturing index, which has 77.63% weightage in overall index. The manufacturing index grew by 5.54% in FY 2024 against 4.66% year-on-year growth in FY 2023. Mining sector index too grew by 7.51% in FY 2024 against 5.83% in the previous years while the Electricity sector Index, witnessed an improvement of 7.07% in FY 2024 against 8.88% in the previous year.





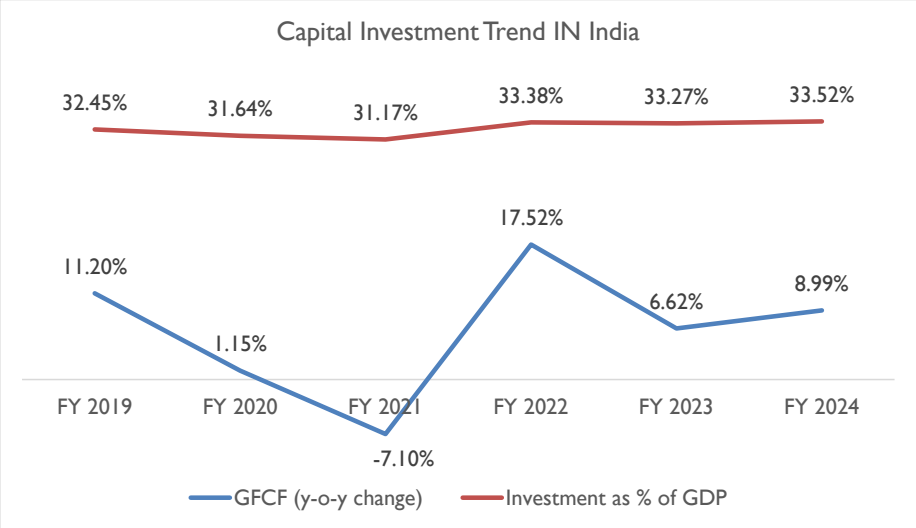


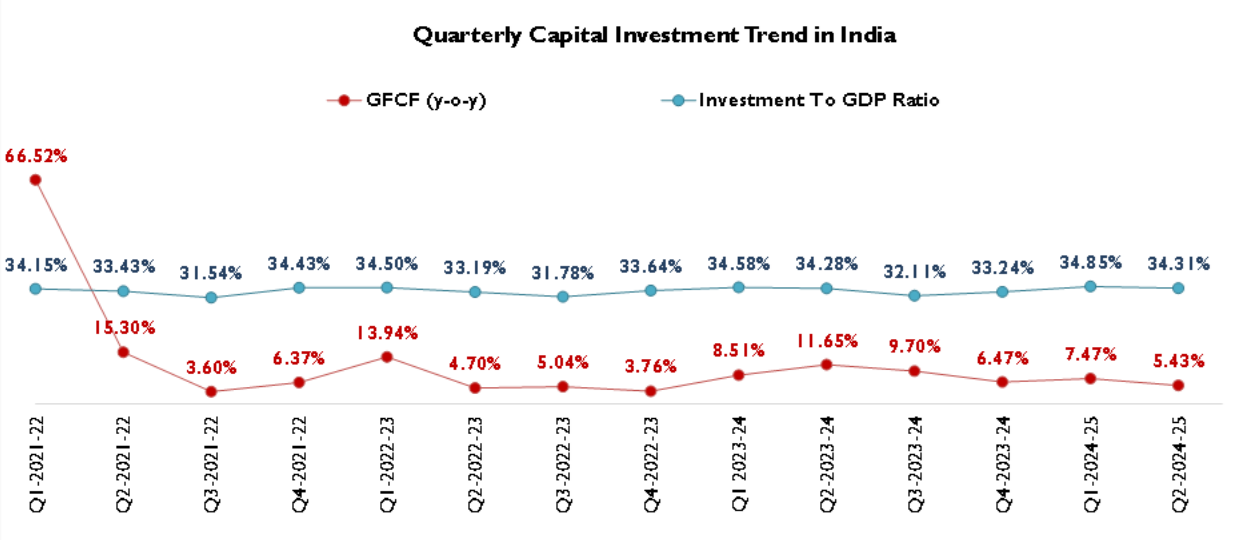
Source: Ministry of Statistics & Programme Implementation (MOSPI)

In the current fiscal FY 2025, the monthly IIP measured index has reported steady improvement over the last fiscal during the first quarter but in later month starting from July 2024 its year-on-year growth moderated due to the high base effect as month year-on-year growth between July 2023 to October 2023 ranged in between 6.18% -11.89% range. Overall month IIP index growth moderated to 3.22% in December 2024 against 4.96% growth in the November 2024 and 4.39% growth in December 2023. Both manufacturing and mining index indicated moderation in December 2024 over the previous month as well as against December 2023 while growth in electricity Index improved considerably against November 2024 and December 2023,

Annual and Quarterly: Investment & Consumption Scenario

Other major indicators such as Gross fixed capital formation (GFCF), a measure of investments, gained strength during FY 2024 as it registered 8.99% year-on-year growth against 6.62% yearly growth in FY 2023, taking the GFCF to GDP ratio measured to 33.52%, the highest in last six years.

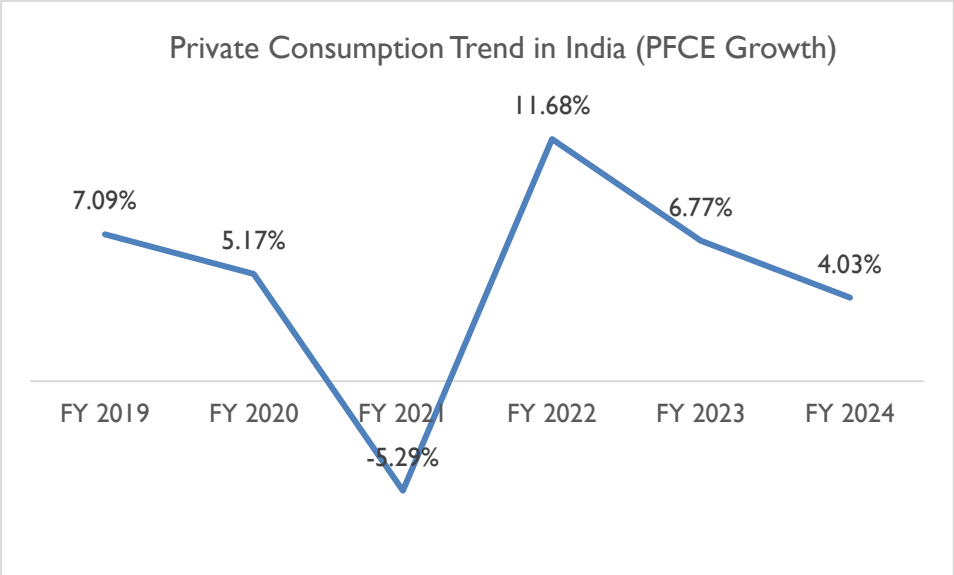


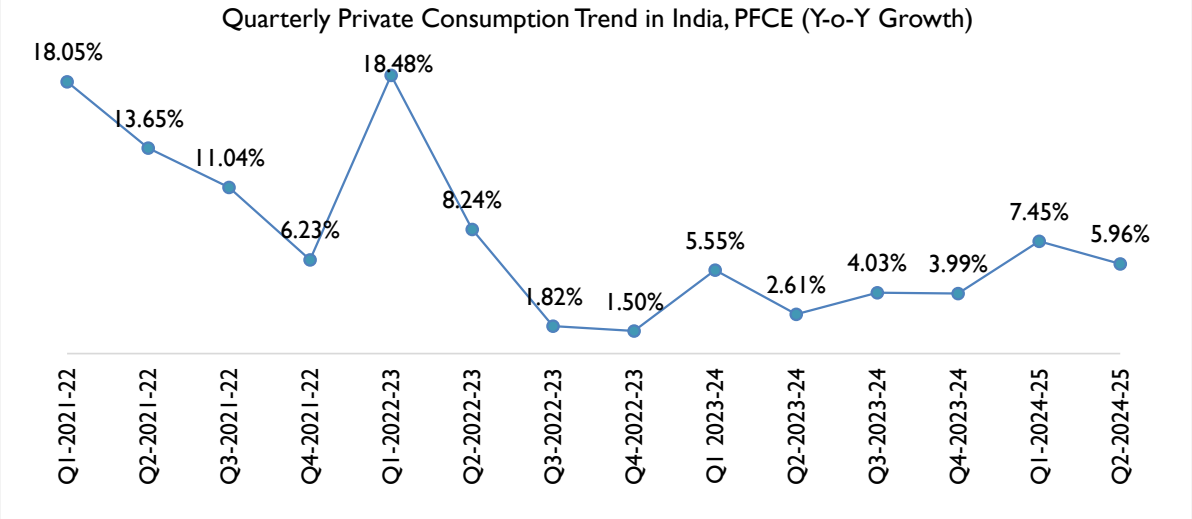


Source: Ministry of Statistics & Programme Implementation (MOSPI)

On quarterly basis, GFCF exhibited a fluctuating trend in quarterly growth over the previous year same quarter. In FY 2024, the growth rate moderated to 6.47% in March quarter against the previous two quarter as government went slow on capital spending amidst the 2024 general election while it observed an improvement in Q1 FY 2025 by growing at 7.47% against 6.47% in the previous quarter. Still, the growth rate remained lower compared to the same quarter in the previous year. The GFCF to GDP ratio measured 34.31% in Q2 FY 2025.

Private Consumption Scenario





Sources: MOSPI

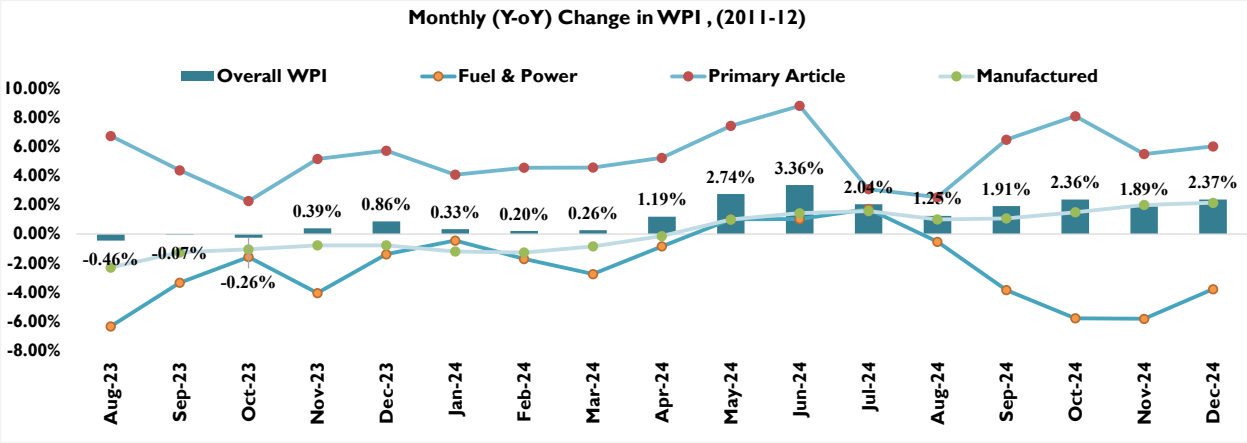
Private Final Expenditure (PFCE) a realistic proxy to gauge household spending, observed decelerated in FY 2023 and FY 2024 amidst high inflation. However, quarterly data indicated some improvement in the current fiscal as the growth rate improved over the corresponding period in the last fiscal.

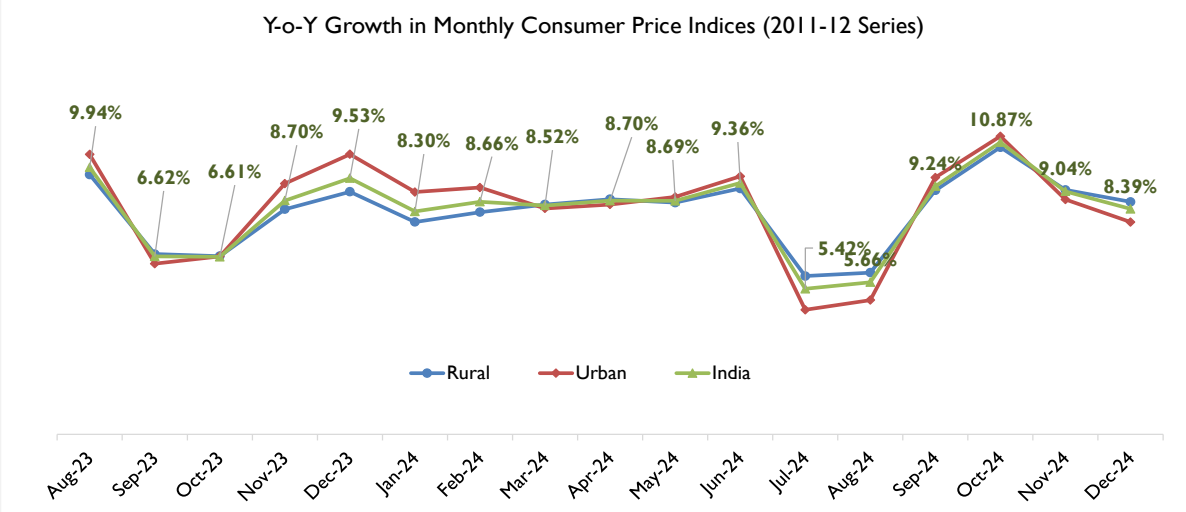
Inflation Scenario

The inflation rate based on India's Wholesale Price Index (WPI) exhibited significant fluctuations across different sectors from August 2023 to December 2024. Overall WPI number measured 2.37% higher in

December 2024. Increasing inflation in December 2024 was primarily due to increase in prices of food articles, manufacture of food products, other manufacturing, manufacture of textiles and non-food articles etc. By December 2024, Primary Articles WPI inflation moderated compared to October prices level but increase marginally compared to the previous month and observed 6.02% year-on-year growth over the same month last year. The Price of food articles observed a decline of (-3.08%) and crude petroleum & natural gas (- 2.87%) in December 2024 compared to the previous month i.e. November 2024. However, the Price of non-food articles grew by 2.53% and minerals by 0.48% in December 2024 as compared to November 2024.

Moreover, power & fuel, the index for this major group increased by 1.90% to 149.90 in December 2024 from 147.10 in the month of November 2024. Price of electricity (8.81%) and coal (0.07%) increased in December 2024. The price of mineral oils (-0.06%) decreased in December 2024 as compared to November 2024.

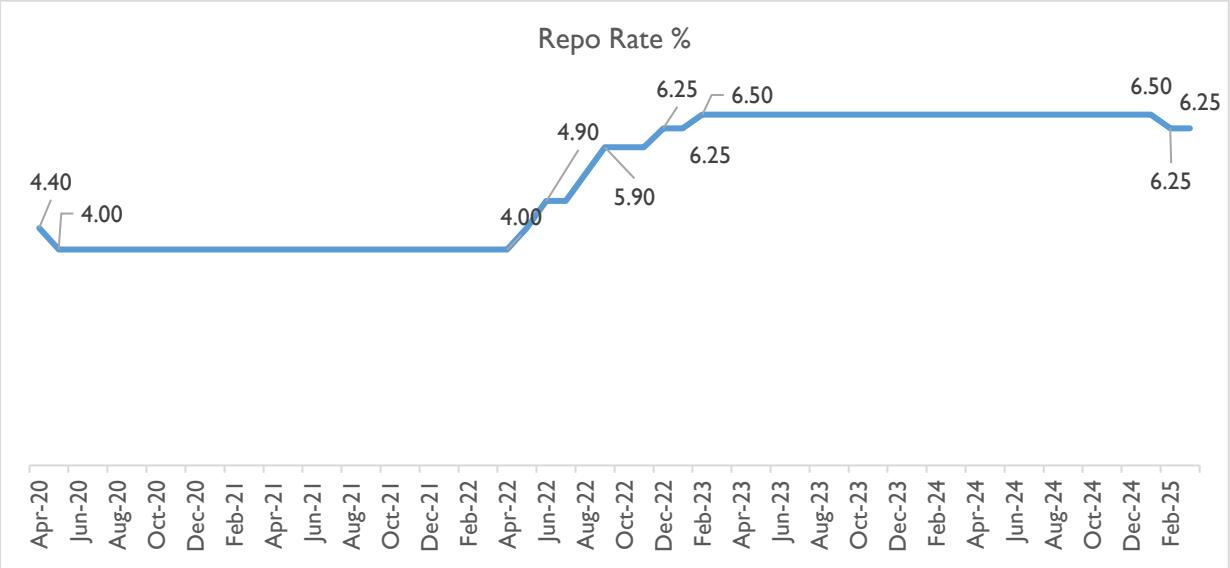




Source: MOSPI, Office of Economic Advisor

Retail inflation rate (as measured by the Consumer Price Index) in India showed notable fluctuations between August 2023 and December 2024. Overall, the national CPI inflation rate increased to 9.94% in August 2023 but moderated to 8.39% by December 2024, indicating a gradual easing of inflationary pressures across both rural and urban areas. Rural CPI inflation peaked at 9.67% in August 2023, declining to 8.65 % in December 2024. Urban CPI inflation followed a similar trend, rising to 10.42% in August 2023 and then dropping to 7.90% in December 2024. CPI measured above 6.00% tolerance limit of the central bank since July 2023. As

a part of an anti-inflationary measure, the RBI has hiked the repo rate by 250 bps since May 2022 and 8 Feb 2023 while it held the rate steady at 6.50 % till January 2025. In February, RBI reduced the repo rate for the first time in the last 5 year by 25 basis point to 6.25% from 6.50% previously.



Sources: CMIE Economic Outlook

Growth Outlook

India's H1 FY2024-25 GDP slowdown is cyclical, influenced by credit tightening and delayed fiscal spending, but strong fundamentals should drive growth in the latter half. The continuity of the NDA government supports ongoing reforms, including labor and land reforms, and efforts to control retail inflation by managing food prices. Inflation eased to 5.5% in November 2024, but risks from high food prices and geopolitical tensions remain. Rural demand has been resilient due to favorable monsoons and agricultural output, while urban demand faces pressure.

Externally, global geopolitical tensions, including the Gaza conflict, pose risks to global stability. The Indian rupee weakened in October 2024 but outperformed its peers, supported by RBI interventions and high FX reserves. Despite this, external pressures, including US monetary policy, will continue to strain the rupee in the near term.

India's projected GDP growth for CY 2025 is 6.50%, the fastest among major emerging markets, and is expected to maintain this growth rate through 2029. Inflation is expected to slow, with improvements in infrastructure, digital technology, and ease of doing business supporting long-term growth. The Union Budget 2025-26 also targets a reduced fiscal deficit of 4.4% (lower than the revised estimate of 4.8% of GDP in 2024-25), highlighting India's capacity to grow while adhering to fiscal goals. Capital expenditure has been significantly boosted, projected at 3.4% of GDP (INR 11.1 trillion) for FY2025-26, the highest in 21 years. Investments in port connectivity and commodity corridors aim to enhance manufacturing competitiveness and achieve export targets.

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.

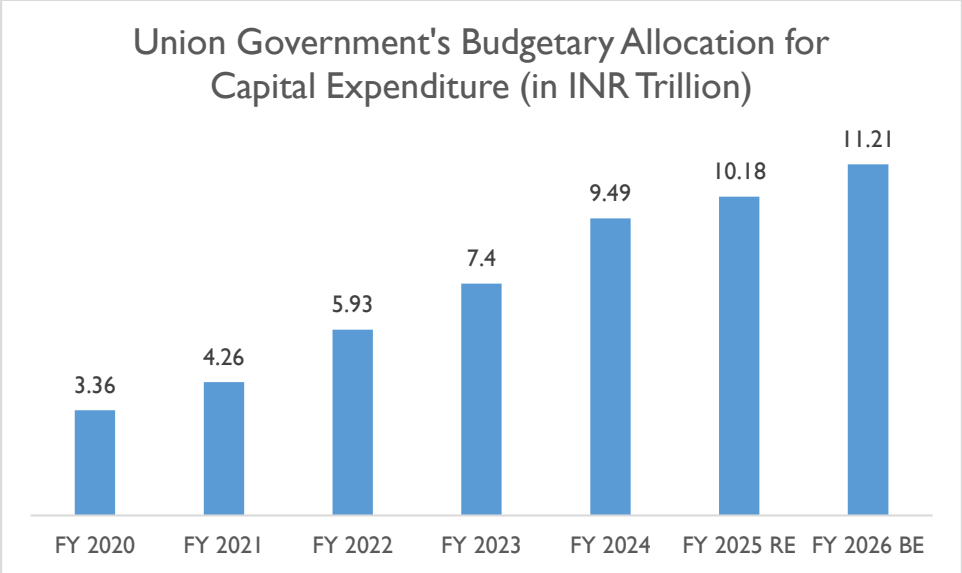
Some of the key factors that would propel India's economic growth in the coming years.

Government focus on infrastructure development

Infrastructure development has remained recurring theme in India's economic development. As India aims to grow to a USD 5 trillion economy by 2027, Construction sector that include Infrastructure construction will be critical for boosting economic growth as it is the key growth enabler for several other sector. Infrastructure development provides impetus to other sectors like cement, bitumen, iron and steel, chemicals, bricks, paints, tiles, financial services among others. A unit increase in expenditure in construction sector has a multiplier effect on other sectors with a capacity to generate income as high as five times in other sectors. The sector enjoys intense focus from the Government which is well reflection in higher budgetary allocations. To push the infrastructure development, government has also announced higher budgetary allocation, various

arrangement for raising funds through road asset monetization plan and converting of NHAI's existing InvIT into a public one is also planned. With economic targeting to reach USD 5 trillion economy by 2027, demand for various infrastructure facilities such as power, cargo movement, passenger movement is likely to grow which necessitate steady capacity addition in infrastructure facilities.

The launch of flagship policies like National Infrastructure Pipeline (NIP), and PM Gati Shakti plan have provided the coordination & collaboration that was lacking earlier. Both NIP and PM Gati Shakti are ambitious billion-dollar plans that aim to transform India's infrastructure, elevating it to the next level. These projects are expected to improve freight movement, debottleneck the logistics sector, and improve the industrial production landscape, which would provide the incremental growth in GDP.



Union Budget, Government of India

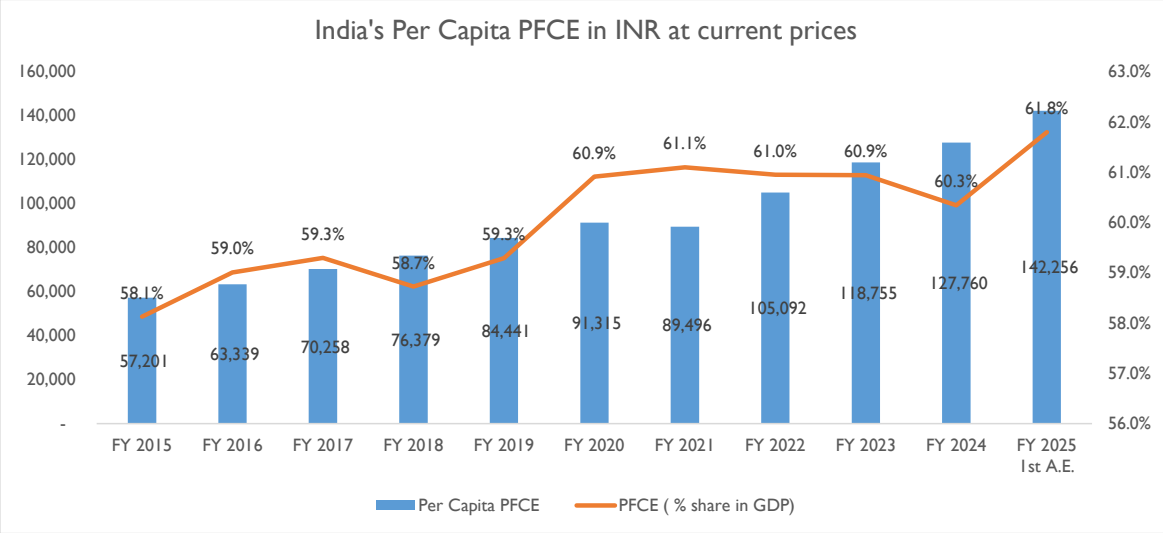
Development of Domestic Manufacturing Capability

The Government launched Production Linked Incentive (PLI) scheme in early 2020, initially aimed at improving domestic manufacturing capability in large scale electronic manufacturing and gradually extended to other sectors. At present it covers 14 sectors, ranging from medical devices to solar PV modules. The PLI scheme provides incentives to companies on incremental sales of products manufactured in India. This incentive structure is aimed to attracting private investment into setting up manufacturing units and thereby beef up the domestic production capabilities. The overall incentives earmarked for PLI scheme is estimated to be INR 2 trillion. If fully realizing the PLI scheme would have the ability to add nearly 4% to annual GDP growth, by way of incremental revenue generated from the newly formed manufacturing units.

Strong Domestic Demand

Domestic demand has traditionally been one of the strong drivers of Indian economy. After a brief lull caused by Covid-19 pandemic, the domestic demand is recovering. Consumer confidence surveys by Reserve Bank / other institutions are points to an improvement in consumer confidence index, which is a precursor of improving demand. India has a strong middle-class segment which has been the major driver of domestic

demand. Factors like fast paced urbanization and improving income scenario in rural markets are expected to accelerate domestic demand further. This revival is perfectly captured by the private final consumption expenditure (PFCE) metric. The PFCE at current prices is on steady rise from FY 2022 onwards. Between FY 2015-25, PFCE in India has improved by nearly 2.5 times its share in GDP has increased from 58.1% to about 61.8% in FY 2025 (as per the first advance estimates).

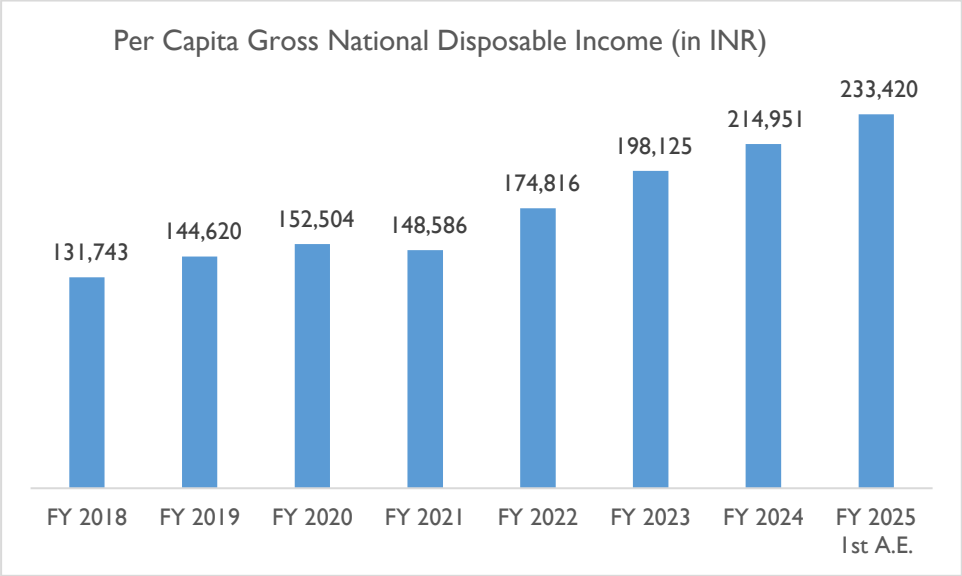


Source: Ministry of Statistics & Programme Implementation (MOSPI)

There are two factors that are driving this domestic demand: One the large pool of consumers and second the improvement in purchasing power.

- The share of middle class increased from nearly 14% in 2005 to nearly 30% in 2021 and is expected to cross 60% by 2047 [1]. This expanding middle class household segment is fuelling India's growth story and would continue to play a key role in propelling India's economic growth.
- Consumer driven domestic demand is majorly fuelled by this growth in per capita income. As per National Statistics Office (NSO) As per National Statistics Office (NSO), India's per capita net national income (at constant prices) stood at INR 106,744 in FY 2024 against INR 99,404 in FY 2023 and INR 87,586 in FY 2018. This increase in per capita income has impacted the purchasing pattern as well as disposable income. The disposable income during the FY 2018-25 has increased from INR 131,753 to INR 233,420, increasing at CAGR 8.5% while in FY 2025 it is estimated to grow at 8.59% on year-on-year basis in FY 2025 against 8.49% in FY 2024.

[1] As per the survey conducted by People Research on India's Consumer Economy. Households with annual income in the range of INR 5 – 30 lakh is considered as middle-class households.

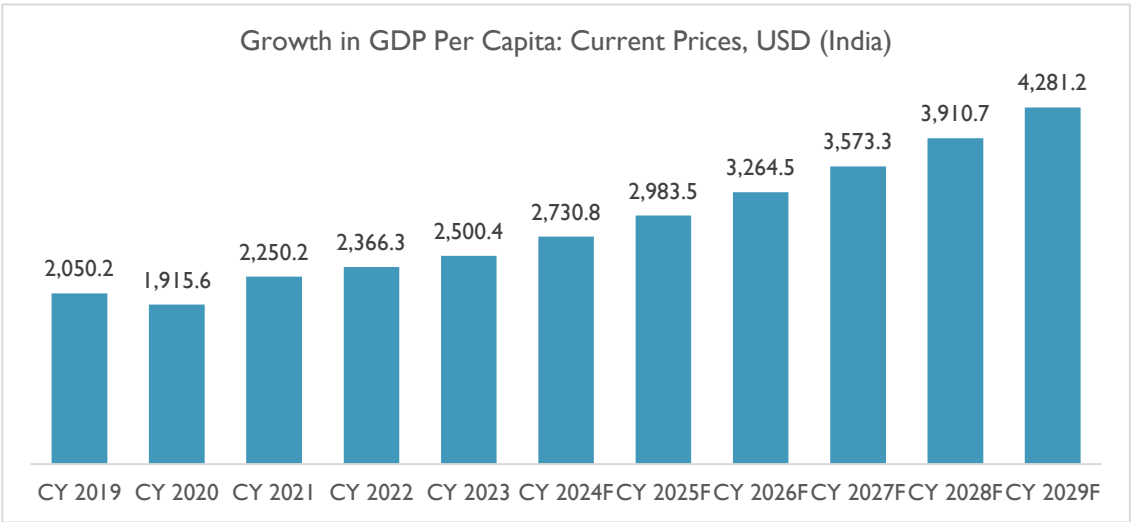


Source: Ministry of Statistics & Programme Implementation (MOSPI)

India's Per capita GDP trends

India is poised to become the world's third-largest economy with a projected GDP of USD 5 trillion within the next three years, driven by ongoing reforms. As one of the fastest-growing major economies, India currently holds the position of the fifth-largest economy globally, following the US, China, Japan, and Germany. By 2027-28, it is anticipated that India will surpass both Germany and Japan, reaching the third-largest spot. This growth is bolstered by a surge in foreign investments and a wave of new trade agreements with India's burgeoning market of 1.4 billion people. The aviation industry is witnessing unprecedented orders, global electronics manufacturers are expanding their production capabilities, and suppliers traditionally concentrated in southern China's manufacturing hubs are now shifting towards India.

To achieve its vision of becoming the world's third-largest economy by 2027-28, India will need to implement transformative industrial and governmental policies. These policies will be crucial for sustaining the consistent growth of the nation's per capita GDP over the long term.

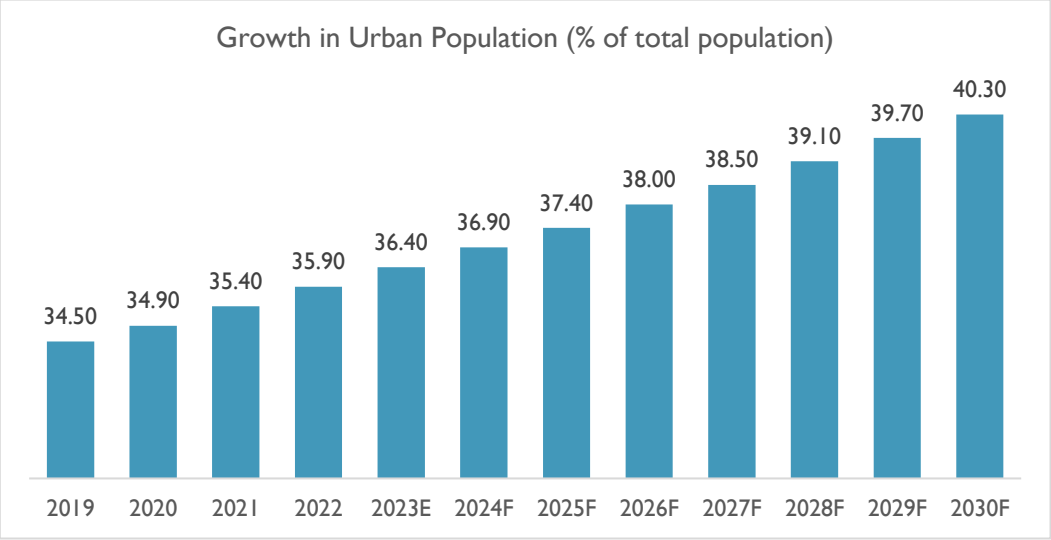


Source: IMF

From CY 2024-29, India's per capita GDP is projected to grow at a compound annual growth rate of 9.4%. This growth will be driven by the service sector, which now accounts for over 50% of India's GDP, marking a significant shift from agriculture to services.

Increasing Urbanization

As per the handbook of urban statistics 2022, India's urban population has been on a steady rise, with urban dwellers accounting for over 469 million in 2021, is projected to soar to over 558 million by 2031 and further exceed to 600 million by 2036.



Source: World Bank, [2] D&B Research and Estimates

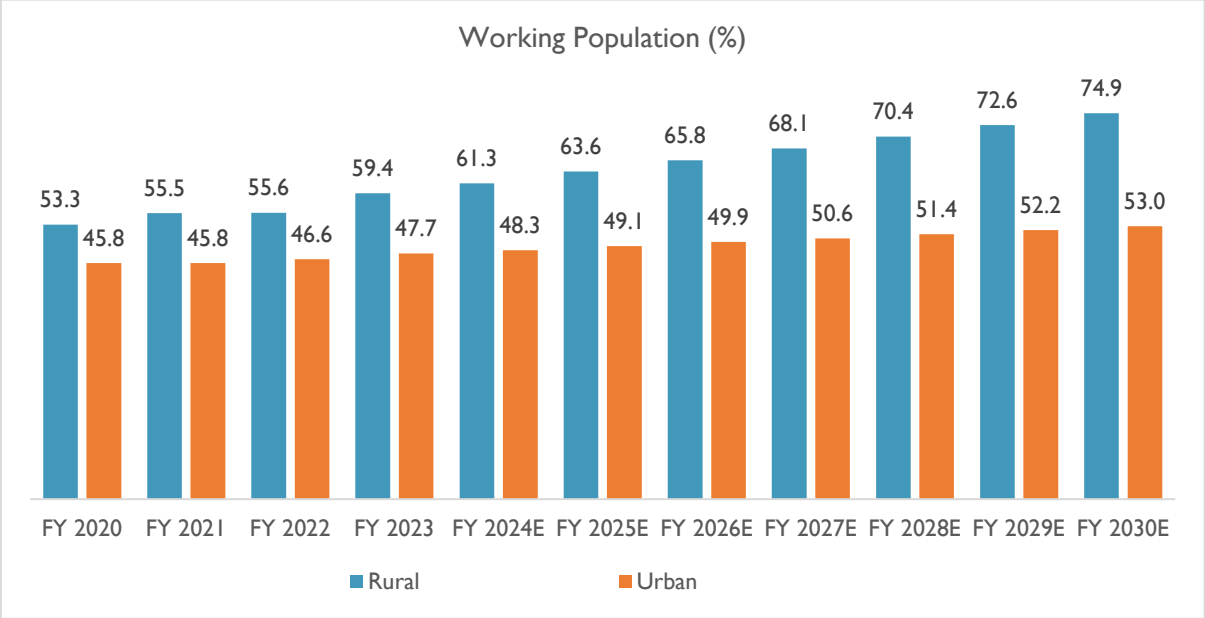
The share of urban population in total population has been quickly escalating. In 2019, 34.5% of the total population was urban. By 2023, this is estimated to have reached to 36.4%, showing an increment of 2.1% in a span of four years. The share of urban population is further forecasted to cross 40% by 2030. This increase in urban population is set to demand drastic changes in infrastructure development. Cities are a major driver for the construction industry. With cities expanding rapidly, there will be an increased need for improved housing, water supply, sewage systems, and electricity. Urban planning will need to account for higher population densities, necessitating the development of smart cities with integrated technology for efficient management of resources and services. The Smart Cities Mission targeted at 100 cities is aimed at improving the quality of life through modernized/ technology driven urban planning. This transformation will also require significant investment in public health, education, and recreational facilities to enhance the quality of urban living. The surge in urban population will also propel demand for improvement in multimodal transport infrastructure for freight and passenger travel requirement..

[2] https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2022&locations=IN&skipRedirection=true&start=1960&view=chart

Rural Vs Urban Working Population Age Group

As India continues to experience economic growth and development, the working population in both rural and urban areas is increasing. In case of urban population, this growth is marked from a share of 45.8% in FY20 to 47.7% in FY23, whereas in rural areas, it grew from 53.3% in FY20 to 59.4% in FY23.

This growth is driven by a combination of factors, including demographic changes, economic policies, and the expansion of various industries. The rise in employment opportunities across sectors such as agriculture, manufacturing, services, and information technology has contributed to the overall increase in the working population, thereby fostering economic stability and enhancing the standard of living for many Indians.



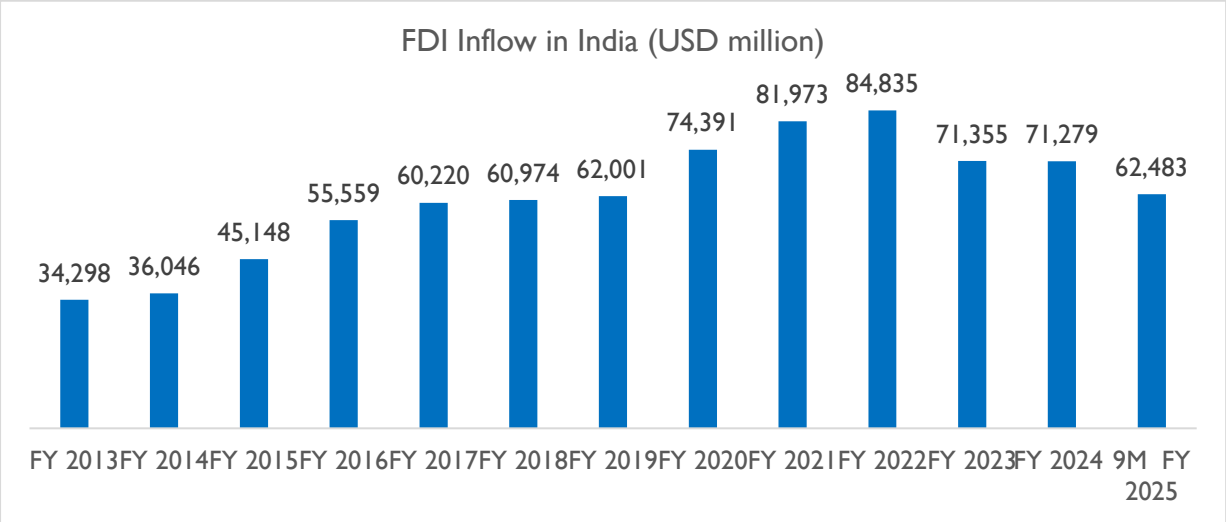
Source: Periodic Labour Force Survey (PLFS) Annual Report 2022-2023, D&B Research and Estimates

In urban areas, the working population is growing rapidly due to the proliferation of jobs in sectors like IT, finance, retail, and healthcare. Additionally, the development of infrastructure, such as improved transportation networks and housing, has made urban centers more accessible and desirable for the working population. In rural areas, the working population remains substantial, primarily due to the dominance of the agricultural sector. Government initiatives aimed at rural development, such as improved access to education and skill development programs, have also played a crucial role in enhancing employment prospects in these regions. The dominance of the rural working population over their urban counterparts can be attributed to the agricultural sector's labour-intensive nature ensures a consistent demand for human labor despite advancements in mechanization, sustaining employment rates in rural areas.

Foreign Direct Investment Trend in India

FDI inflow in India has observed a steady increase between FY 2013 till FY 2022 while it witnessed a decline of 15% in FY 2023 and of -0.1% in FY 2024 due to several factors, including the ongoing conflict between Russia and Ukraine, changes in US monetary policy, and other global uncertainties. However, the country has received substantial FDI inflow between from April 2000-December 2024. This increasing FDI can be attributed to the new investment facilitation measures like the National Single-Window System (NSWS),

which streamlines the approval and clearance process for investors, entrepreneurs, and businesses sectoral along with PLI schemes, emerging growth prospects in tier-2 and tier-3 cities. Further, tax compliance for startups and foreign investors have been simplified where the Income Tax Act, 1961 has been amended in 2024 to abolish angel tax and to reduce income tax rate chargeable on income of a foreign company.



Sources: Department for Promotion of Industry and Internal Trade

- India ranked as the 3rd largest recipient of greenfield projects with 1,008 greenfield project announcements, as per the World Investment Report 2023. The number of international project finance deals in India also increased by 64%, making it the recipient of the second largest number of international project finance deals.
- India's ranking in the World Competitive Index 2024 jumped three positions to 40th, from 43rd in 2021. Additionally, India was named as the 48th most innovative country among the top 50 nations, securing the 40th position out of 132 economies in the Global Innovation Index 2023, improving from 81st position in 2015.

Global Overview on Recycling Industry

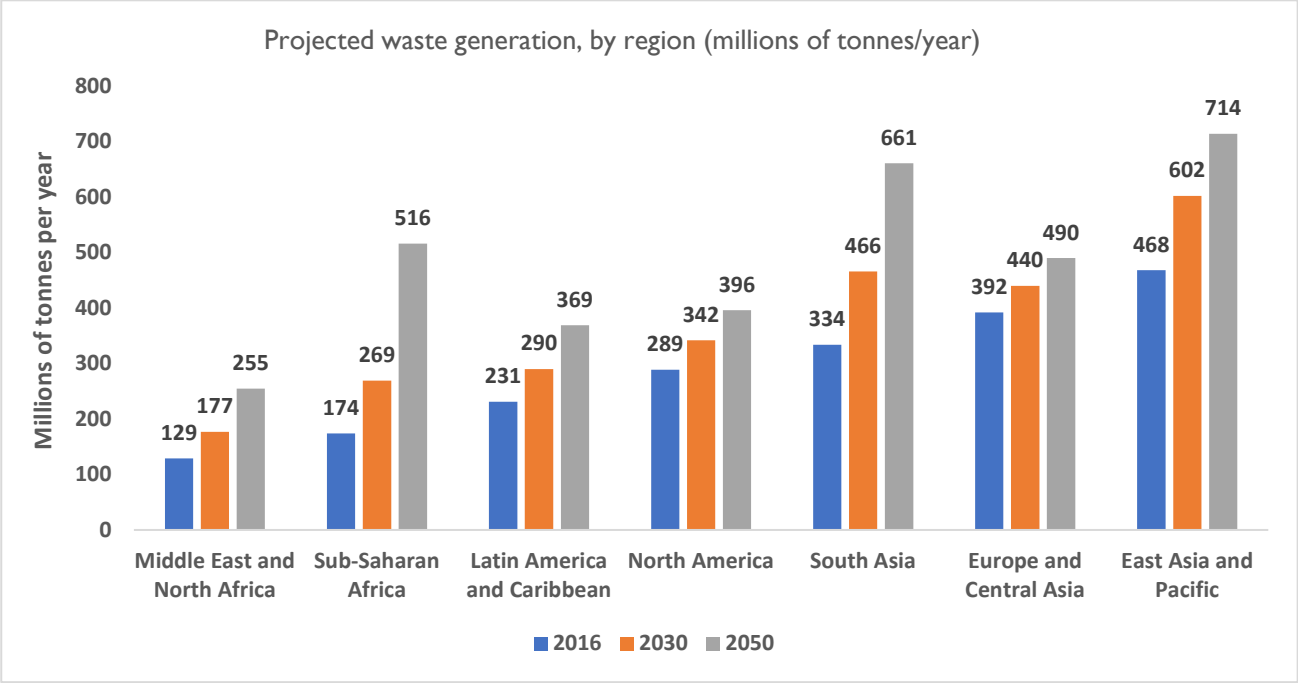
Overview

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

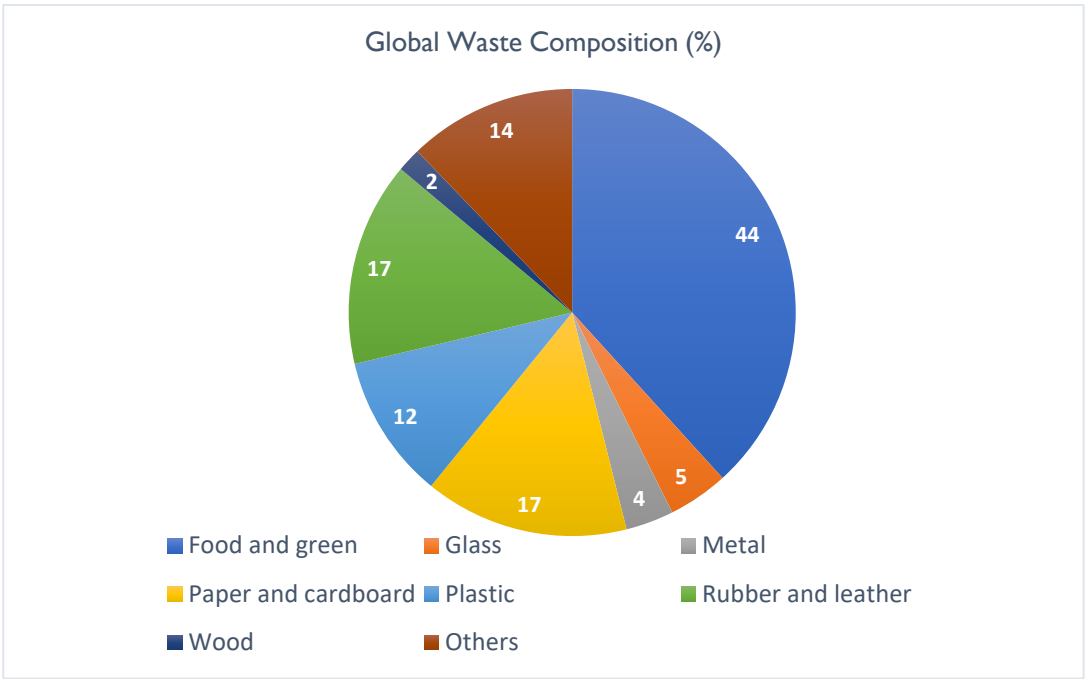
requires immediate action to improve waste management practices and sustainability efforts.



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



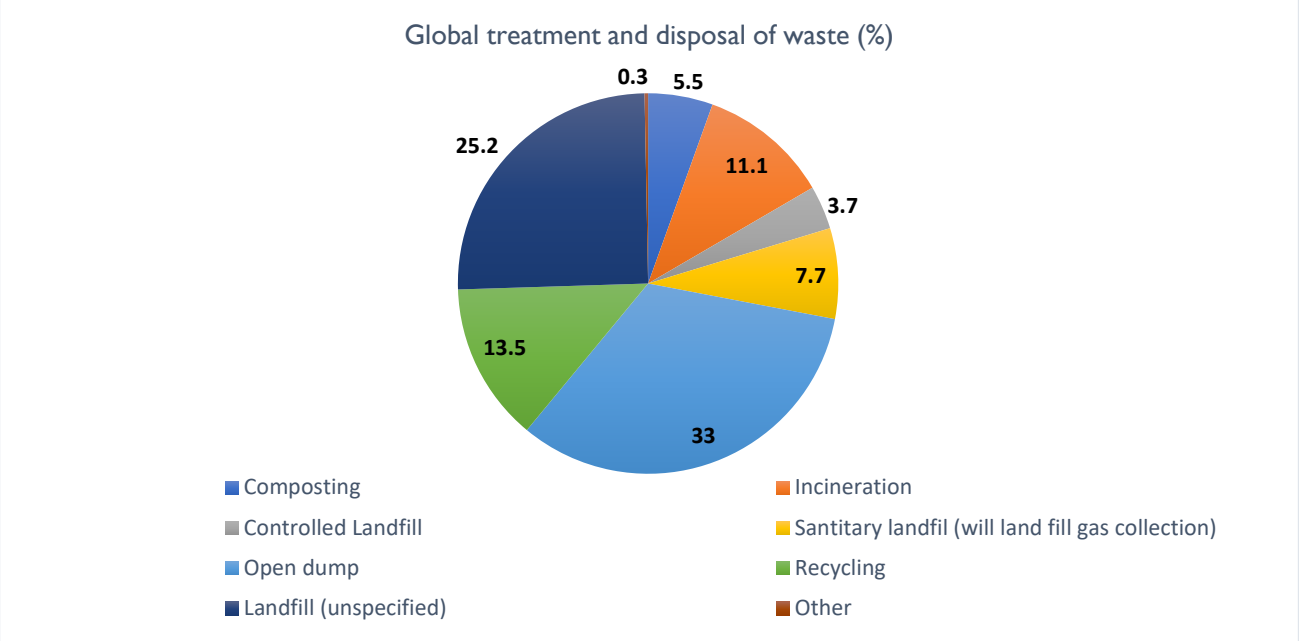
Source: The World Bank

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

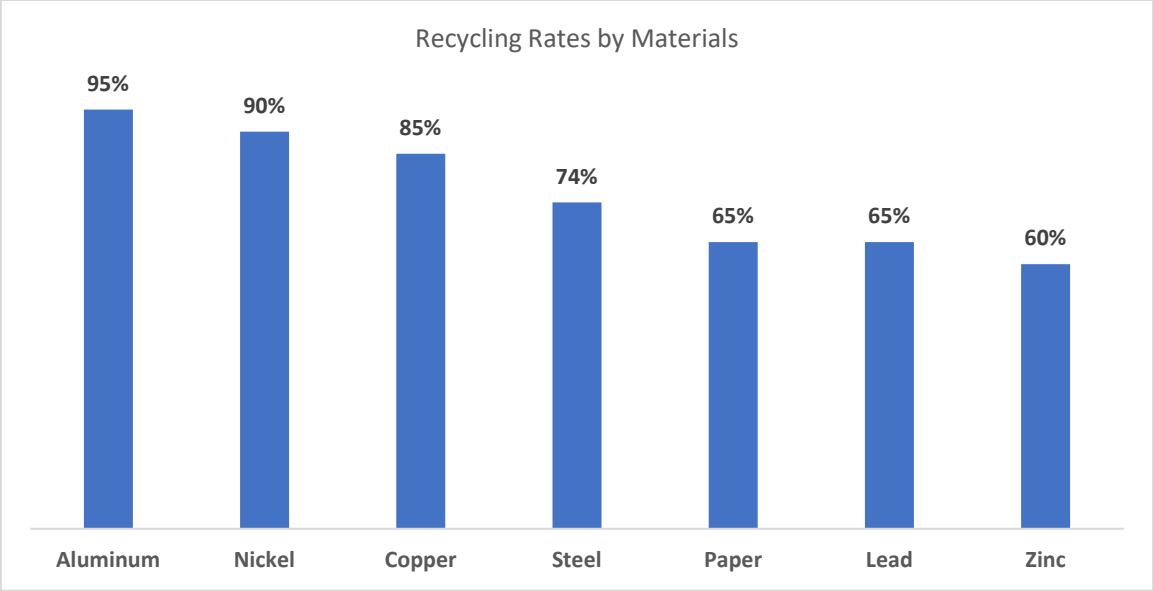
The recycling industry is a vital global sector, playing a significant role in environmental sustainability and economic development. With a workforce of approximately **1.6 million people worldwide**, the industry handles **over 600 million tonnes of recyclables annually**. This report provides an overview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

➢ 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.

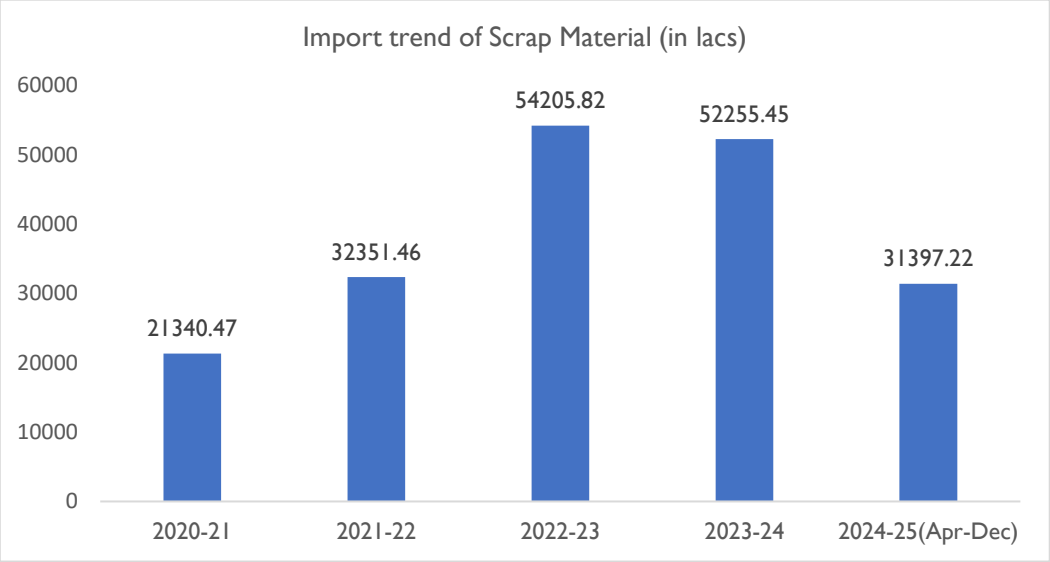
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

- 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



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 lacs in 2022-23**. From **21,340.47 lacs in 2020-21**, imports increased steadily, with the highest jump occurring between **2021-22 and 2022-23**, when imports rose from **32,351.46 lacs to 54,205.82 lacs** 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 lacs**, 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 lacs**, 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 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**

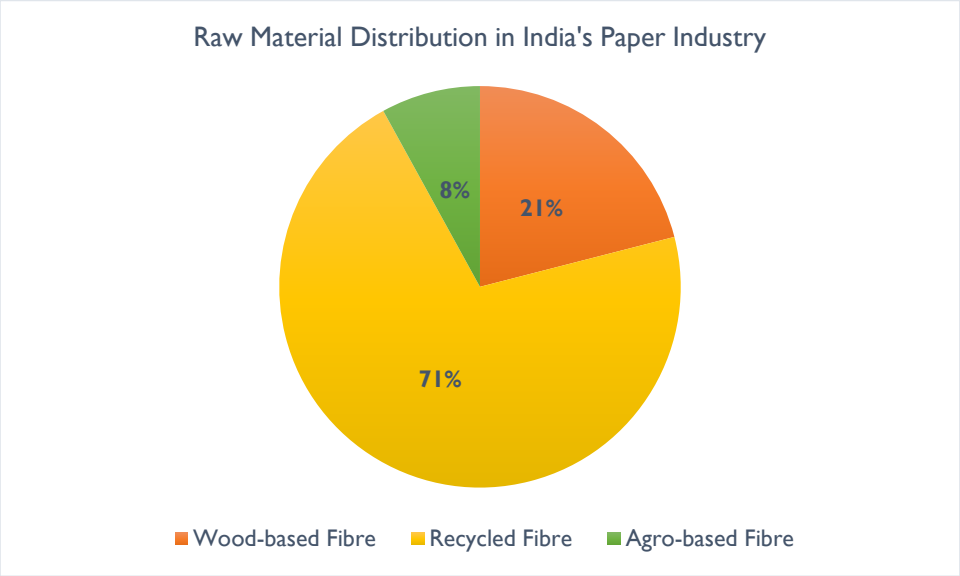
Recycled paper has emerged as a key alternative raw material in recent years. With increasing awareness of sustainability, the paper industry in India has been shifting its focus towards recycling waste paper. The government has encouraged this transition through various initiatives promoting waste management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

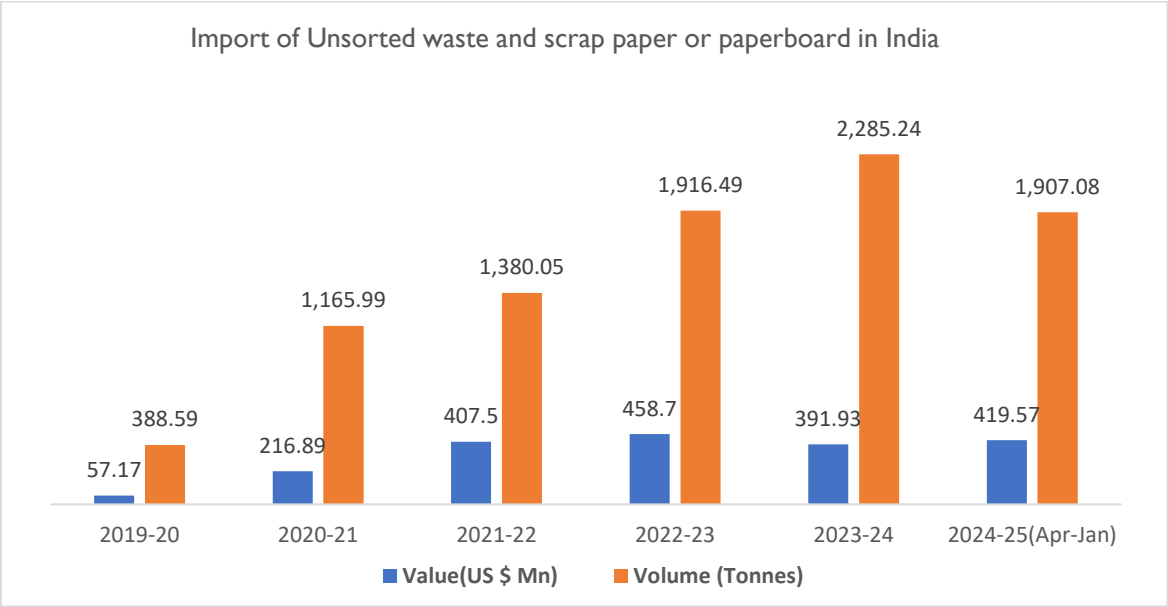
- **Extended Producer Responsibility (EPR):** Under this framework, companies are required to take responsibility for the collection and recycling of their paper and packaging waste. This encourages large corporations to invest in sustainable practices, boosting demand for recycled materials.
- **Swachh 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

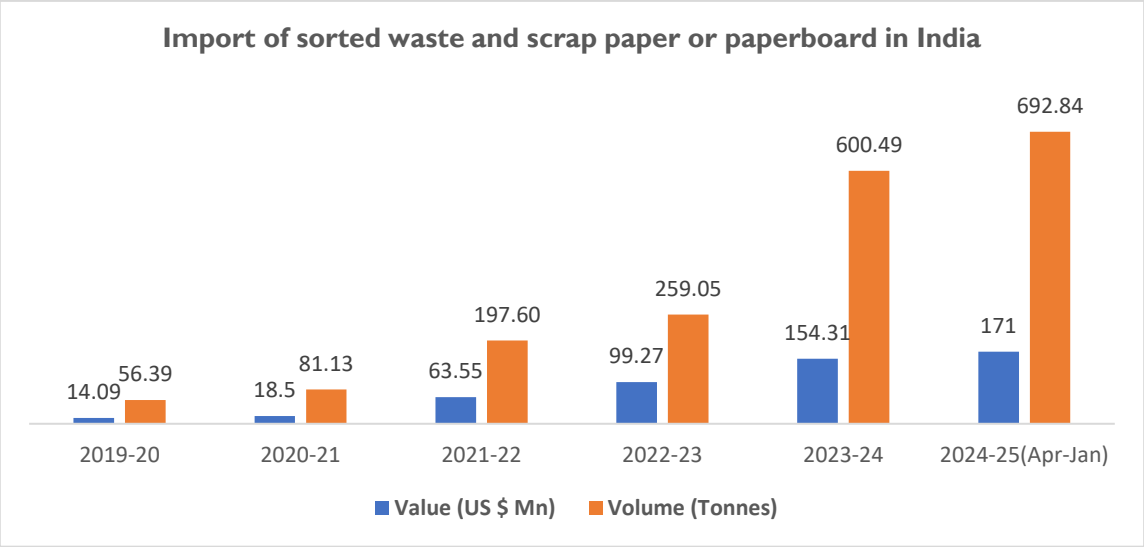


Source: Directorate General of Foreign Trade

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

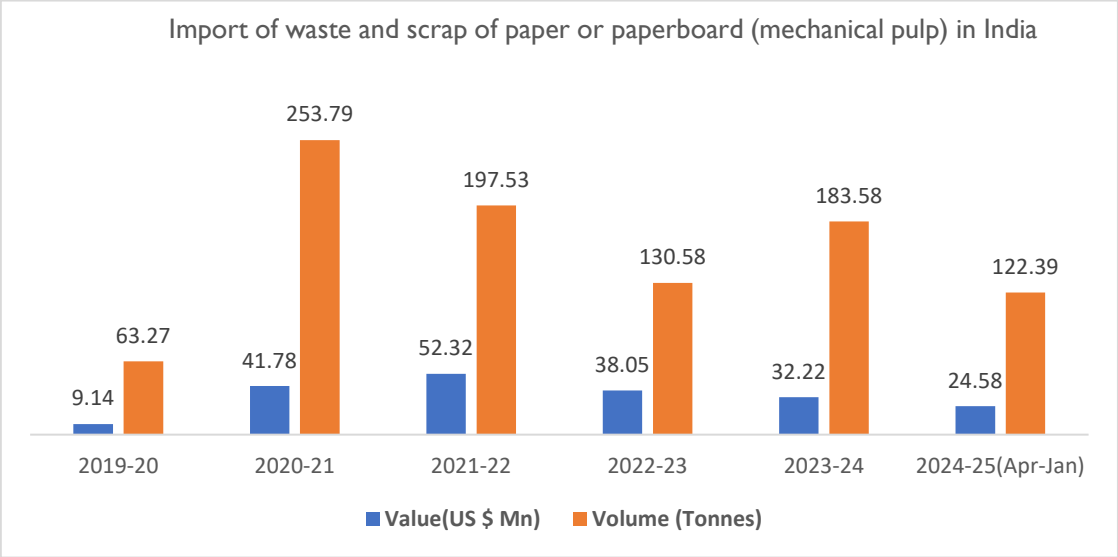


Source: Directorate General of Foreign Trade

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**

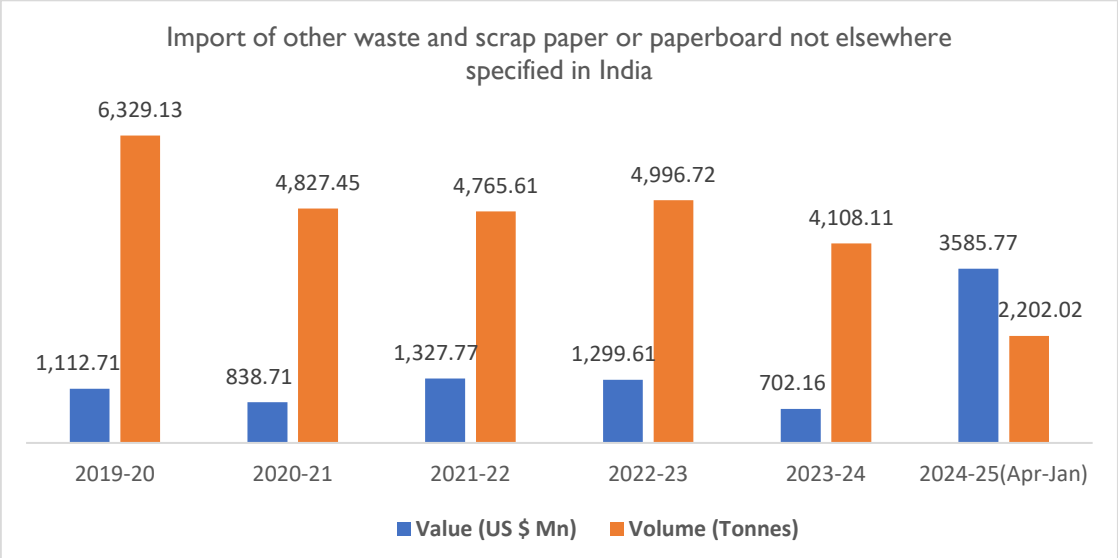


Source: Directorate General of Foreign Trade

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



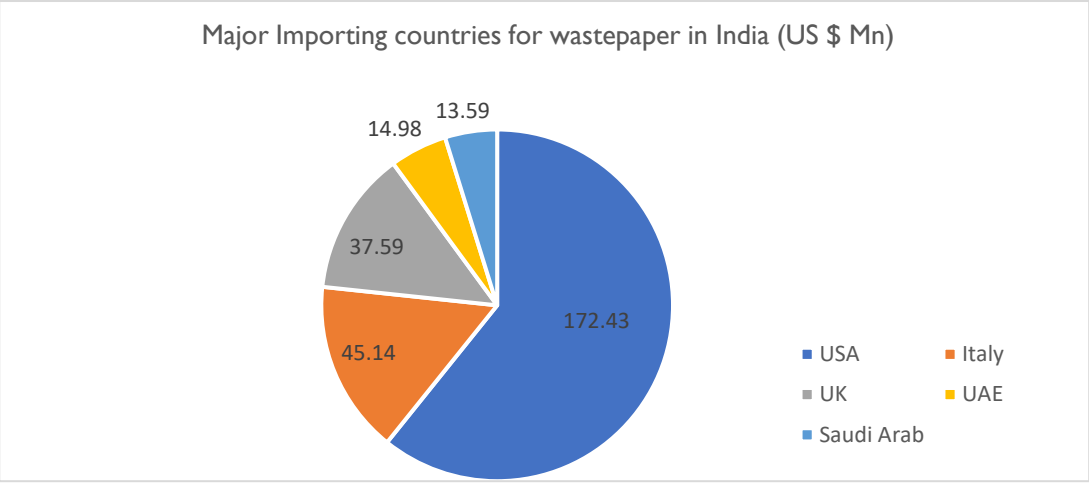
Source: Directorate General of Foreign Trade

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

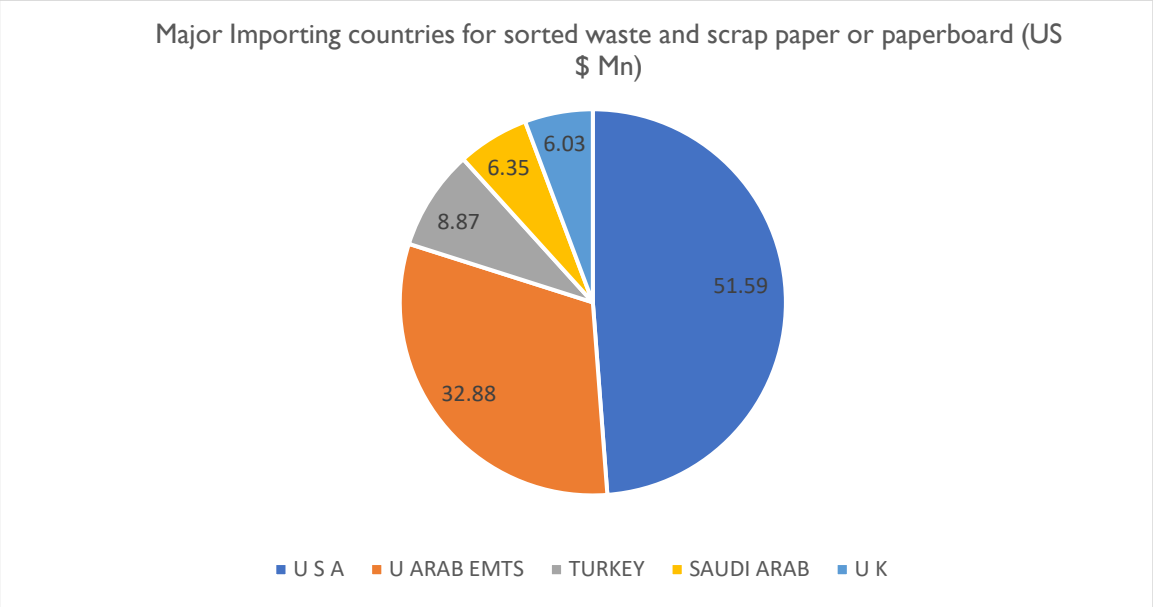


Source: Directorate General of Foreign Trade

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

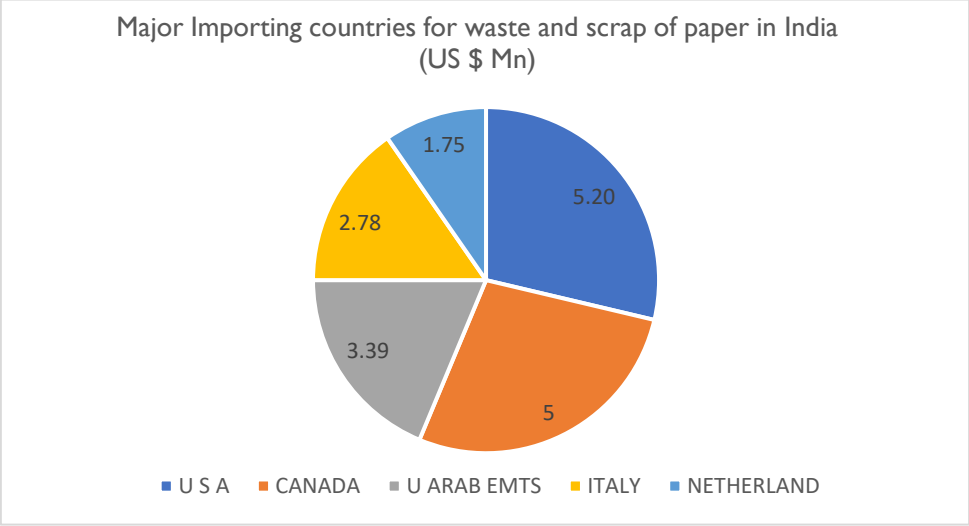


Source: Directorate General of Foreign Trade

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

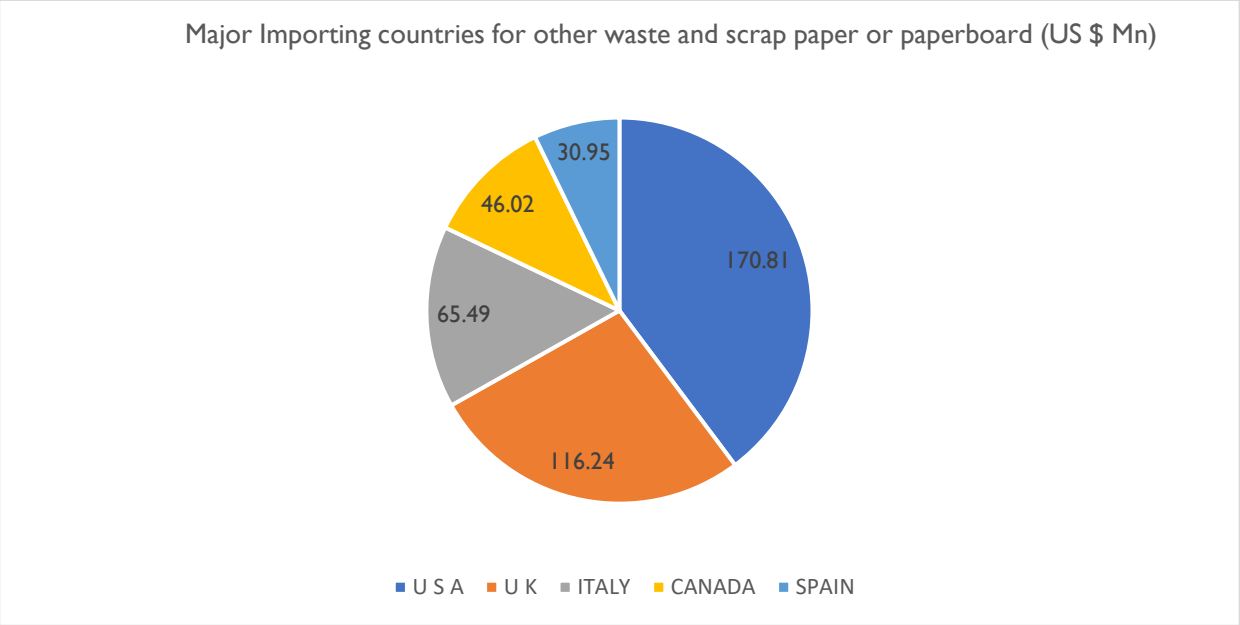


Source: Directorate General of Foreign Trade

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- 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- 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.

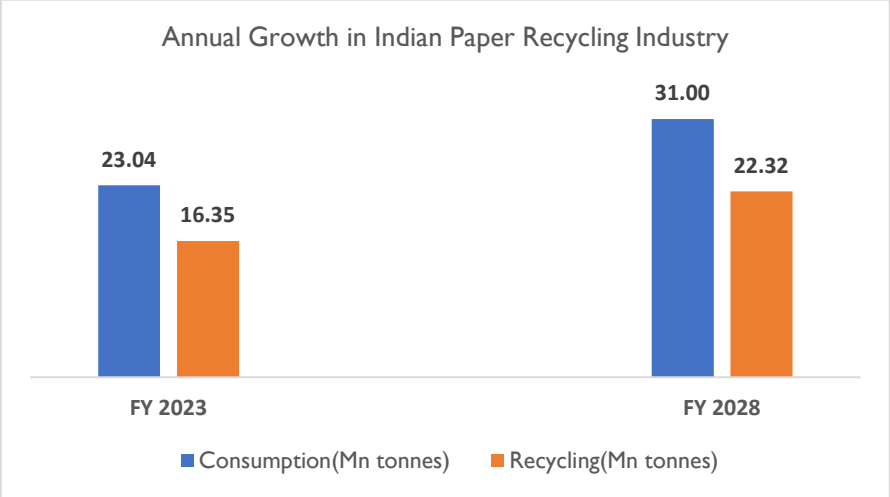
- **Swachh Bharat Mission (Urban): Focus on Paper Waste Management:** The Swachh Bharat Mission (Urban) focuses on improving urban sanitation and waste management across the country. The mission encourages the segregation of dry waste (such as paper) from wet waste at the source to facilitate recycling. 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.

Peer Profiling

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 Private Limited		
All Values in INR Millions	**FY2024**	**FY2023**	**FY2022**
Total Income	746.8	368.7	79.2
Revenue from Operations	725.0	368.5	78.5
EBITDA	49.9	6.6	2.3
EBITDA Margin (in %)	6.9%	1.8%	2.9%
PBT	47.2	5.3	1.9
PAT	41.1	4.1	1.4
PAT Margin (in %)	5.5%	1.1%	1.8%
Operating Cash Flow	-7.1	-6.2	1.5
Shareholder Equity	50.2	7.3	3.2
Depreciation	2.4	1.4	0.8
Finance Cost	0.3	0.1	0.3
Total Asset	239.4	65.9	27.2
Net Worth (Shareholder Equity)	50.2	7.3	3.2
Short Term Borrowing	37.0	-	1.2
Long Term Borrowing	7.2	28.9	13.4
Debt Equity Ratio	0.9	0.0	4.6
Return on Capital Employed (in %)	50.3%	0.0%	12.4%
Return on Equity (in %)	81.9%	56.2%	43.8%
Return On Asset (in %)	17.2%	6.2%	5.1%
Capital Employed	94.4	0.0	17.8
Total Borrowing	44.2	0.0	14.6
Interest Coverage Ratio	158.3	52.0	5.0

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.
- This reflects a **CAGR of approximately 240%** over two years, indicating rapid 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.
- **EBITDA Margin** improved significantly from 2.9% in FY2022 to 6.9% in FY2024, reflecting better operational efficiency.

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).
- **PAT** followed the same trend: INR 1.4 million → INR 4.1 million → INR 41.1 million and **PAT Margin** grew to **5.5% in FY2024**, up from 1.8% in FY2022, showing stronger bottom-line performance.