



Innovate
UK

Innovate UK Global Expert Mission Report

Sustainable Plastic Packaging in India

May 2023



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01. Summary

Innovate UK worked closely with key stakeholders including UKRI India, WRAP and Confederation of Indian Industries (CII) to organise a Global Expert Mission to India. Leveraging UKRI-funded India Plastics Pact (IPP), the Circular Plastics Global Expert Mission (GEM) brought together key stakeholders from the plastic sector to investigate the research and innovation ecosystem in India's circular plastics sector and economy.

The Mission to India provided an opportunity to showcase many of the innovation technologies that the UK are spearheading through Innovate UK and its Smart Sustainable Plastic Packaging Challenge (SSPP) in the field of circular plastics.

The UK technologies and innovations presented during the mission was recognised by key Indian stakeholders to have direct application to the challenges of plastic pollution in India. There was a strong desire for continued cooperation between the two countries in the plastics sector with an opportunity for the UK and India to focus on advanced recycling technologies.

The Mission identified several opportunities for collaboration including chemical and dissolution recycling technologies, mechanical sorting and recycling technologies, transition from the use of Multi Layered Plastic (MLP) to mono-material films, film sorting technologies and reuse and refilled. The implementation of the Extended Producer Responsibility (EPR) systems in India is a significant step towards managing plastic waste but also represents some challenges. Businesses are required to comply with EPR regulations which will open new opportunities for UK businesses to engage with the India market on technology transfer and R&D including software development.

There are additional challenges to consider, such as traceability and pricing of plastic feedstock, intellectual property rights, and the need for advanced recycling technologies like chemical recycling to demonstrate economic viability in order to encourage investment and adoption. While these pose barriers to future bilateral collaboration, there is an opportunity foster the relationships established in the GEM to address and overcome these challenges.

02. Acronyms

B2B	Business to Business	PCR	Post-consumer Recycled Plastics
B2C	Business to Consumer	PE	Polyethylene
CII	Confederation of Indian Industries	PET	Polyethylene Terephthalate
DBT	Department for Business and Trade	PP	Polypropylene
DSIT	Department for Science, Innovation and Technology	PS	Polystyrene
EPR	Extended Producer Responsibility	PVC	Polyvinyl Chloride
FCDO	Foreign, Commonwealth and Development Office	ROI	Return On Investment
FMCG	Fast Moving Consumer Goods	rPET	Recycled Polyethylene Terephthalate
IPP	India Plastics Pact	WRAP	Waste and Resources Action Programme
IWS	Informal Waste System	SIN	Science and Innovation Network
GEM	Global Expert Mission	SSPP	Smart Sustainable Plastic Packaging Challenge
MLP	Multi Layered Plastic	UKRI	UK Research and Innovation



03. Introduction

Innovate UK Global Expert Missions

Innovate UK supports business-led innovation and is part of UK Research and Innovation (UKRI).¹ UKRI convenes, catalyses and invests in close collaboration with others to build a thriving, inclusive research and innovation system. To this end, Innovate UK helps businesses to identify the commercial potential in new technologies and turn them into new products and services that will generate economic growth and increase productivity. With a strong business focus, Innovate UK drives growth by working with companies to de-risk, enable and support innovation. Innovate UK exists to connect innovators with new partners and new opportunities beyond their existing thinking – accelerating ambitious ideas into real-world solutions. Innovate UK is part of the Innovate UK group.

As innovation is increasingly a global endeavour and the ambition of UK businesses to become truly international enterprises is at its highest, Innovate UK established its Global Expert Mission (GEM)² programme in 2017. Delivered by Innovate UK, in partnership with the FCDO Science and Innovation Network (SIN),³ GEMs help further Innovate UK's global strategy by providing the evidence base for where it should invest and by providing the opportunities for UK businesses to build partnerships and collaborations with key economies.



¹ <https://www.ukri.org/>

² <https://iuk.ktn-uk.org/programme/global-expert-missions/>

³ <https://www.gov.uk/world/organisations/uk-science-and-innovation-network>

Mission Overview and Objectives

The Sustainable Plastics GEM, brought together stakeholders from the UK and India plastics value chain to exchange knowledge and showcase developments in advancing a circular economy for plastics, including advances in recycling (particularly chemical and dissolution recycling), data management systems and opportunities to valorise waste plastics.

The GEM explored the technology and innovation landscape in India focussing on feedstock availability, supply chain dynamics, compliance, and regulatory and policy frameworks.

The GEM builds on the commitments in the 2030 Roadmap for India-UK Future Relations,⁴ which is designed to strengthen cooperation to support India's transition to a resource-efficient and circular economy, and to identify, develop and deploy technologies.

India generates an estimated 9.44Mt⁵ of plastic each year, and there is a critical need to tackle the growing mismanaged plastics impact, estimated to stand at 2.5Mt per year in India by 2025. Given the scale of the plastic waste challenge in India, there is an urgency to explore bi- and multilateral innovation opportunities to deliver clean growth in the UK and Indian plastics industry, with a reduction in the most problematic plastic waste entering the environment.

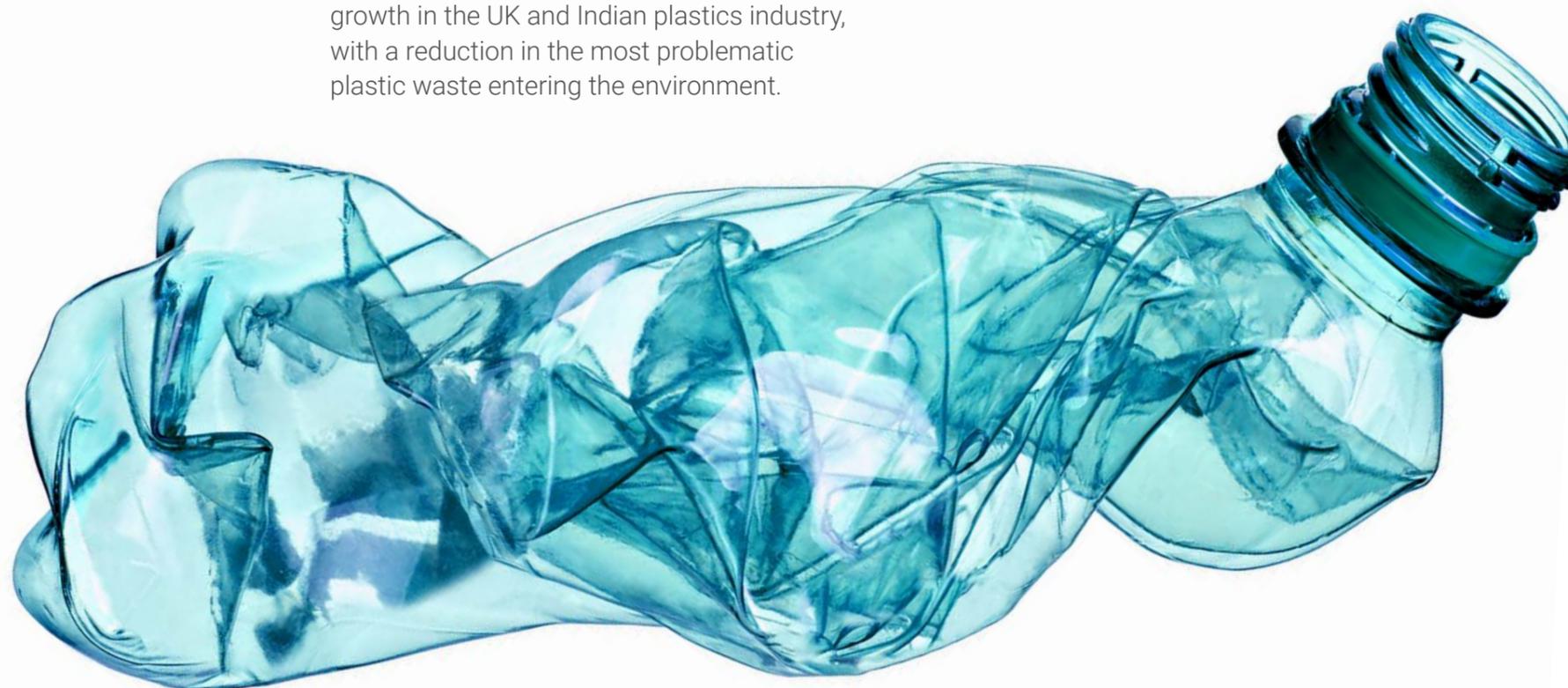
Mission Scope

The GEM objectives focused on how UK innovators can collaborate with Indian partners to improve mechanisms to collect, recycle and valorise plastic packaging (excluding incineration).

In May 2023 Innovate UK delivered the Global Expert Mission to Mumbai, India. A group of UK experts met with key stakeholders from private and public sector organisations in India to better understand the plastics supply and innovation landscape and explore the potential for collaboration in the sector.

The Mission explored synergies between India and the UK for collaboration to enhance the circular supply chains that reduce the carbon intensity of plastic packaging and develop solutions that underpin the Indian Plastic Pact⁶ targets, including:

- Tackle unnecessary and problematic single-use plastic packaging.
- 100% of plastic packaging to be reusable, recyclable, or compostable.
- 50% of plastic packaging to be effectively recycled.
- 25% average recycled content across all plastic packaging.



⁴ 2030 Roadmap for India-UK future relations - GOV.UK (www.gov.uk)

⁵ SBM Plastic Waste Book.pdf (swachhbharaturban.gov.in)

⁶ <https://www.indiaplasticspact.org/>



The India Plastics Pact (IPP) launched in 2021 and unites businesses, governments, NGOs and citizens to create a circular plastics economy in India. It was developed by the Confederation of Indian Industry (CII) and WWF India, and WRAP. The CII-ITC Centre of Excellence for Sustainable Development (CESD) anchors the India Plastics Pact, within CII. Having instigated the Pact, WRAP continues to provide technical and operational support. The Pact was established with funding from UKRI Global. It is one of 14 Plastics Pacts across the globe.

48 major Indian organisations from across the plastics value chain are currently part of the India Plastics Pact, including major brand owners, packaging producers, resin producers, waste management organisations and recyclers. For further information, see www.indiaplasticspact.org



Principal Themes

Technical areas within the scope of the GEM included:

Chemical recycling and dissolution

recycling – Innovative recycling technologies to overcome barriers to greater use of recycled plastics in new/existing packaging applications, including sachets, multilayer and film recycling.

Digital solutions for a circular plastics economy

– Technologies for the plastic packaging value chain helping companies and organisations to track material placed on the market and support EPR reporting, with innovations to support integrating the informal waste sector with a focus on transparent pricing, traceability, and inclusion. in the UK and to explore opportunities for the UK to collaborate with the best Indian organisations and companies.

The primary outcome of the GEM is to provide evidence to support public/private funding in the UK and to explore opportunities for the UK to collaborate with the best Indian organisations and companies.

Built around UK business, policy and research representation, the GEM aimed to:

1. Inform UK businesses and government

The findings and opinions of experts on the topic of the GEMs are made available to UK businesses and government departments. These inform UK businesses about potential opportunities for innovation in the country and the UK government on how it can help UK businesses make the most of those opportunities.

2. Build International Collaborations

The expert insights will help inform how Innovate UK can best help UK businesses find and exploit the opportunities for innovation partnerships. The GEM creates connections with key organisations and people that will deepen and widen the collaboration with the partner country to benefit UK business.

3. Share UK Capabilities

During the Mission, the delegation of experts will use the opportunity to promote and share the UK's innovation strengths.





Background

The UN Global Resolution⁷ to end plastic pollution was signed in March 2022 and paves the way for developing an international legally binding agreement by the end of 2024 that encompasses the full lifecycle of plastic, including its production, design and disposal. Innovation and collaboration will be critical to achieving the step change signalled by this game-changing agreement.

The UK has been clear in its intention to act on the plastic pollution problem. Launched in January 2018, the 25-Year Environment Plan⁸ set out ambitions for domestic reforms to reduce plastic waste and articulates the UK's intentions to "take on an even more prominent international role in protecting the planet".

The Resources & Waste Strategy for England 2018⁹ also includes a series of commitments to underpin the government's ambitions, including to:

- Drive international political commitments through the Commonwealth Clean Oceans Alliance.
- Support developing nations to tackle pollution and reduce plastic waste; and
- Tackle international barriers to a circular economy.

⁷ UNEP 2022 UNITED (unep.org)

⁸ 25 Year Environment Plan - GOV.UK (www.gov.uk)

⁹ Resources and waste strategy: at a glance - GOV.UK (www.gov.uk)

UKRI's International Research and Innovation Strategy¹⁰ is aligned with these goals and includes commitments to maximise the impact of UK research to help address the world's greatest challenges, with a particular focus on the thematic priority of a Clean Environment and Sustainable Growth. Investment through its £60 million Smart Sustainable Plastic Packaging (SSPP)¹¹ Challenge is already establishing the UK as a leading innovator in smart and sustainable plastic packaging solutions, and the aim now is to promote business-led innovation and commercialisation from the UK with Indian partners, harnessing their collective power to find more sustainable solutions to the problem of plastic waste.

A 2020 Accenture report¹² suggests a \$100 billion market for sustainable plastic packaging in India alone by 2030. As the Ellen McArthur Foundation states, the private sector can play a crucial role in developing innovative packaging design, materials, recovery systems and recycling technologies that valorise used plastics and reduce plastic waste.

The Government of India established the Waste to Wealth Mission¹³ in 2021 to leverage science, technology, and innovation to create circular economy models that are financially viable and sustainable for waste management to streamline waste handling in the country. Amendments to the Plastic Waste Management Rules in 2022 indicate the Indian government's ambition to tackle plastic waste and move towards a more circular economy for plastics. These regulatory changes have set clear targets to drive up the use of recycled content in packaging and eliminate single-use plastic packaging. Amendments to the Extended Producer Responsibility (EPR) guidelines¹⁴ will drive market demand for good quality recyclate and collected recyclables.

Through Innovate UK engagement with UK companies involved in the SSPP Challenge, UKRI established a number of SMEs from the UK plastic packaging supply chain were interested in exploring and understanding the Indian market. These include chemical and dissolution recyclers, packaging data and software specialists, and packaging recyclability, design and labelling initiatives.

¹⁰ UKRI strategy 2022 to 2027 – UKRI

¹¹ Smart sustainable plastic packaging – UKRI

¹² Accenture 2020 Accenture-FICCI Report On 'Strategies For Sustainable Plastic Packaging In India' - India CSR

¹³ Waste to Wealth

¹⁴ Ministry of Environment, Forest and Climate Change, Government of India (2022). Guidelines on Extended Producer Responsibility for Plastic Packaging. G.S.R. 133(E). <https://egazette.nic.in/WriteReadData/2022/233568.pdf>





04. Market Overview

Driven by increasing population, economy and a shift in consumption patterns, India's FMCG sector has been steadily growing over the years, with revenues reaching US\$110 billion in 2020.¹⁵ FMCG products can broadly be classified into three segments: food and beverage; home care and personal care; and consumer health. A 2015 study showed that the food and beverages segment contributed about 89% of the FMCG sector's revenue, while the home and personal care, and consumer health segments contributed only 9% and 2%, respectively.

Unlike in Europe, the retail and distribution of consumer goods are not dominated by major supermarket chains but instead are sold through a more fragmented distribution and retail system. While major supermarkets do exist in large cities, small local shops, local markets and stallholders play a vital role. E-commerce retailing for food, grocery products and fast food is a major and rapidly growing sector in urban areas and cities. Consequently, major brand owners rather than retailers have a dominant role in the grocery and packaging sector.

Growth in the consumption of FMCG goods has resulted in a rapid growth in plastics packaging consumed and therefore rapidly increasing quantities of waste plastics. Indian plastic packaging waste is broadly segmented into three broad segments: PET bottles, rigid packaging and films and flexibles.

The relative share of flexible packaging in plastic packaging is higher in countries such as India due to its relatively low cost and versatility. In 2021, almost 21 million metric tons (mT) of plastics were consumed in India;¹⁶ 59% of this went into packaging (by weight), out of which 72% went into flexible packaging (by weight). By comparison, flexible packaging accounted for only one-sixth (approximately 17%) of the packaging material used (by weight) in Europe.¹⁷

In India, flexible packaging is also commonly used for small format packaging (<50 ml or 50 g in size) to enable brands and suppliers to offer products at a low unit cost to the consumer – vital for the lower-income sections of society. Three out of four FMCG products sold in India are packaged in such formats.

¹⁵ CEFLEX (2020). Designing for a Circular Economy. <https://guidelines.ceflex.eu/j>

¹⁶ Plastindia Foundation. (2022). Plastics Industry Status Report – India – 2021-22. <https://plastindia.org/plastic-industry-status-report/>

¹⁷ India Plastics Pact (2022). Insights report: small formats and sachets. http://indiaplasticspact.org/wp-content/uploads/2023/03/Small_Formats_and_Sachets_Insight_Report_IPP.pdf

PET bottle recycling is relatively advanced having provided feedstock to the polyester textiles market for many years. More recently there has been increased investment and expansion of PET recycling fuelled in part by the lifting of restrictions on food contact for recycled PET (rPET) and strong international demand.

Recycling of rigid polyolefins is reliant largely on down-cycling and in the informal recycling sector.

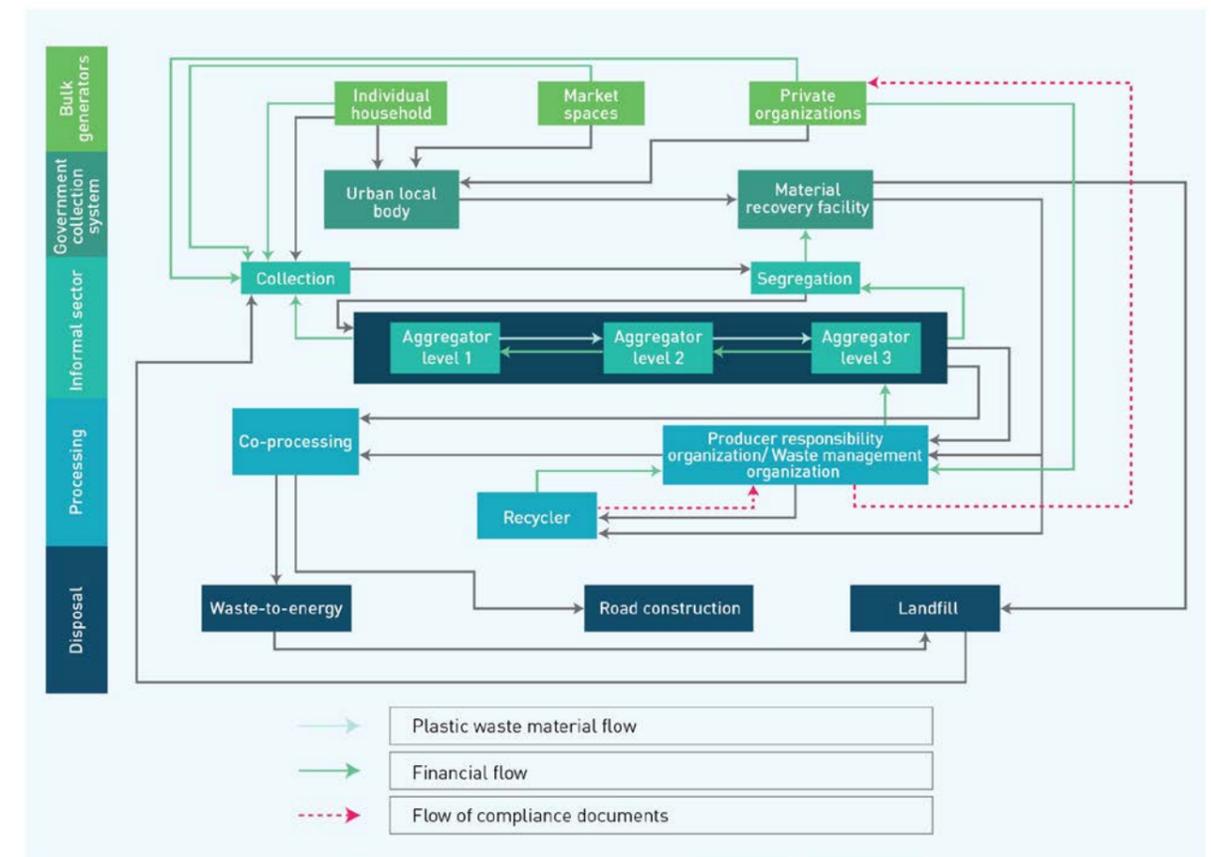
Recycling of flexibles is restricted to clear, larger polyethylene films and bags (e.g., milk pouches and secondary packaging films). MLP (multi-layer packaging) comprising multi-layer and multi-material (poly-Alu, and poly-poly), remain a major challenge for the waste sector with limited end markets outside energy recovery (e.g., cement kilns) and construction products.



The Indian plastics packaging sector shares many similarities with Europe and the UK in the range of polymers used for packaging and the designs and formats, but there are significant differences. While PET, PE and PP are the major packaging polymers in Europe, India still has a significant proportion of PVC and PS (including EPS) packaging in the grocery and fast-food sectors. The differences however are far more pronounced in the downstream stages of waste management and collection once the packaging has served its purpose and becomes waste.

The majority of household and municipal waste plastics are collected by the informal waste sector (IWS) in a variety of different systems and approaches. This system is far more flexible than the heavily automated waste collection and sorting in the UK and can provide highly separated streams of waste plastic at high quality and relatively low contamination. However, waste will only be collected and sorted if there is sufficient value in the waste plastic with an end market.

During the GEM, it was established from interaction with multiple parties that the cost of waste to a recycler/end market compared to virgin is relatively high in India for many grades of waste plastic. This may be due to a number of factors including the large number of steps and intermediaries the waste may go through and the associated transport costs, the large number of competing and growing (non-packaging) end markets.



A schematic flow of plastic waste through the value chain (many steps in this flow are common to other waste streams)¹⁸



¹⁸ IPP Insights report 2023: The role of the informal waste sector in the Indian waste plastics system

In general, waste generated by individual households, commercial and industrial establishments is collected, sorted, and segregated into different streams of recyclable material. These are sold to aggregators who deal in specific materials and then channelised to recyclers or to co-processing destinations such as cement kilns, waste-to-energy plants and road construction. Any remaining (residual) waste is sent to landfills.

The use of post-consumer recycled plastics (PCR) back into plastic packaging is in its infancy in India, due in part to the lack of legislation permitting PCR use in food applications which was recently enacted and the lack of drivers or motivation in the FMCG sector to use PCR and low historical focus on higher-end markets

From a plastic production perspective, India has been heavily reliant on imports.¹⁹ However, in recent years the government has implemented policies to reduce its dependence on plastic imports and boost domestic production. These policies aimed to promote “Make in India” initiatives and enhance the domestic manufacturing sector, including plastics. The government has encouraged investments in the plastics industry to create jobs and reduce imports. The domestic thermoplastic resin production capacity is over 18mT per annum²⁰ and the major producers include;

1. Reliance Industries Limited: Reliance Industries, a conglomerate with its headquarters in Mumbai, is one of the largest producers of plastics in India. Its subsidiary, Reliance Industries Petrochemicals, operates one of the world’s largest integrated petrochemical complexes, manufacturing a wide range of polymers and plastics.

- 2. Indian Oil Corporation Limited (IOCL):** IOCL is a state-owned oil and gas company that also has a significant presence in the petrochemical sector. It produces a variety of plastics and polymers, including polypropylene and polyethylene, through its petrochemical division.
- 3. Haldia Petrochemicals Limited:** Haldia Petrochemicals, based in Kolkata. It produces a diverse range of polymers, including polypropylene, polyethylene, and polyvinyl chloride (PVC).
- 4. GAIL (India) Limited:** GAIL is a state-owned natural gas processing and distribution company. It also has a significant presence in the petrochemical industry and produces various types of polymers, including polyethylene, polypropylene, and polyvinyl chloride.

These major players can wield a significant economic and sometimes political influence in the sector.

From a policy perspective, the Government of India has introduced a number of ambitious initiatives to help address the rise of plastic waste including a series of bans on select ‘single use plastic’ items, ambitious Extended Producer Responsibility (EPR) legislation and a national ‘clean India’ programme (*Swachh Bharat Mission*).²¹ Plastics recycling is set to grow in India on the back of an ambitious Extended Producer Responsibility regulation with targets for collection, recycling and incorporation of recycled content back into packaging.



¹⁹ TPCI Trade Promotion Council of India 2023 : Is plastics industry seeking attention? (tpci.in)

²⁰ Plastics Industry Status Report – India - 2022 (plastindia.org)

²¹ Swachh Bharat Abhiyan | Prime Minister of India (pmindia.gov.in)

05. The Innovation Landscape

Innovation Support

There are several research institutes in India that focus on plastics and polymer research. The most prominent ones include:

- 1. Central Institute of Plastics Engineering and Technology (CIPET)²²** CIPET is a premier national research and development institute in the field of plastics engineering and technology. It has various centres across India and offers academic programs, research facilities, and technical support for the plastics industry.
- 2. Indian Institute of Technology (IIT)²³ Delhi** - Polymer Science and Engineering Department: IIT Delhi has a dedicated department focused on polymer science and engineering. It conducts research in areas such as polymer synthesis, characterisation, processing, and applications.
- 3. National Chemical Laboratory (NCL)²⁴, Pune** NCL is a constituent laboratory of the Council of Scientific and Industrial Research (CSIR) and conducts research in various areas, including polymer science and engineering. It has expertise in polymer synthesis, modification, processing, and applications.
- 4. Institute of Chemical Technology (ICT),²⁵ Mumbai** ICT is a university dedicated to chemical technology and offers programs and research facilities in the field of polymer science and engineering. It collaborates with industries and research organisations for applied research in polymers.
- 5. National Institute of Technology (NIT)²⁶ Calicut** - Department of Polymer Science and Rubber Technology: NIT Calicut has a department specifically dedicated to polymer science and rubber technology. It offers academic programs and carries out research in various aspects of polymer science and engineering.
- 6. The Energy and Resources Institute (TERI)²⁷** – TERI is a research institute in New Delhi that specialises in the fields of energy, environment and sustainable development. Established in 1974, it was formerly known as the Tata Energy Research Institute. In 2021 it published a Circular Economy for Plastics in India: A Roadmap.²⁸



These institutes, along with other universities, business research centres and research organisations, contribute significantly to the research and development of plastics and polymers in India.

²² <https://www.cipet.gov.in/>

²³ <https://home.iitd.ac.in/>

²⁴ <https://www.ncl-india.org/>

²⁵ <https://www.ictmumbai.edu.in/>

²⁶ <https://nitc.ac.in/>

²⁷ <https://www.teriin.org/>

²⁸ TERI 2021 Circular-Economy-Plastics-India-Roadmap.pdf (teriin.org)

Central Institute of Plastics Engineering and Technology (CIPET)

The Central Institute of Plastics Engineering and Technology (CIPET) in India has been actively involved in various innovative activities focused on plastic recycling and chemical recycling which include:

Circular Economy Centres of Plastic Waste Management: CIPET is planning to establish five circular economy centres for plastic waste management as a pilot project in five different locations - Gujarat, Uttar Pradesh, Bihar, and Karnataka²⁹. The goal of these centres is to develop a sustainable ecosystem for recycling and granulation to manufacture new plastic products or fuels/wax.³⁰

Technology Transfer: As part of its efforts to explore how waste can be managed, CIPET plans to teach the latest methods in plastic reuse to civic bodies and private entities through technology transfer.³⁰

Research on Plastic Waste Recycling: CIPET is actively involved in conducting research to identify and recommend recycling technologies for plastic waste in India. They have also mapped out plastic recycling clusters and reprocessing infrastructure across the country.³¹

²⁹ Plastic Recycling: CIPET To Teach Bodies Latest Reuse Technology (glamsham.com)

³⁰ CIPET to open plastic recycling centres across India- The New Indian Express

³¹ Plastic waste recycling: existing Indian scenario and future opportunities | SpringerLink

Indian Institute of Technology (IIT)

The Indian Institutes of Technology (IITs) have been at the forefront of research and innovation in the field of plastic recycling and chemical recycling. Some of their initiatives include:

1. Recycling Technological Options:

IITs have been involved in suggesting recycling technological options in India and illustrating plastic recycling clusters and reprocessing infrastructure for plastic waste (PW) recycling in India.³²

2. Punch the Plastic Campaign:

IIT Madras launched a campaign named – Punch the Plastic – which deploys a new method to collect clean and dry plastic packaging for recycling on campus.³³

3. Waste Management Technology Program:

The Department of Science & Technology (DST) has supported various projects under the Waste Management Technology (WMT) program that focus on innovative methods for plastic waste management.³⁴

These initiatives highlight the commitment of IITs towards addressing the issue of plastic waste through innovative solutions.

³² Plastic waste recycling: existing Indian scenario and future opportunities | SpringerLink

³³ Madras Launches Campaign To Segregate Plastic Waste On Campus | Chennai News - Times of India (indiatimes.com)

³⁴ India tackles plastic pollution with recycling initiatives | FairPlanet



White Papers and Policies

There are several major policy documents in India that relate to Research and Development (R&D). Here are some of the key ones:

1. **Science, Technology, and Innovation Policy (STIP) 2020:**³⁵ This policy document aims to create a robust ecosystem for research, development, and innovation in India. It outlines the vision and strategy for promoting R&D in various sectors and sets goals for increasing investment in R&D, strengthening collaboration between academia, industry, and government, and fostering innovation-led entrepreneurship.
2. **National Intellectual Property Rights (IPR) Policy 2016:**³⁶ This policy focuses on fostering creativity and innovation by protecting and promoting intellectual property rights. It aims to strengthen the IP ecosystem in India and enhance the R&D environment by encouraging innovation, technology transfer, and commercialisation of research.

The policies that impact more directly on the plastics packaging sector include:

1. **Plastic Waste Management (PWM) Rules, 2011³⁷ and 2022³⁸** promote a circular economy and to strengthen the collection of plastic waste. The PWM rules for 2021 mainly focused on storing, transporting, dispensing, or packaging recycled plastic items; however, the PWM for 2022 focus on collecting, reusing, and reusing plastic recycling waste. The 2022 amendments support the circular economy and provide stakeholders with clear directives.
2. **Extended Producer Responsibility (EPR) guidelines 2022³⁹** have provided a clear policy direction to businesses for a circular plastics economy, with ambitious targets and timescales. The EPR regulations have targets for the reuse, collection, and recycling of plastic packaging and the incorporation of recycled content back into packaging. The burden of the EPR regulation falls on PIBOs (Producers, Importers and Brand Owners) who are mandated to achieve the targets for their businesses.

³⁵ Department of Science & technology STIP 2020 Microsoft Word - STIP_Doc_1.4_Dec2020.docx (dst.gov.in)

³⁶ Intellectual Property India 2016 2016-_National_IPR_Policy-2016__English_and_Hindi.pdf (ipindia.gov.in)

³⁷ CPCB PWM 2016 (amended 2021) Notification-12-08-2021.pdf (cpcb.nic.in)

³⁸ CPCB PWM Rules 2022 amendment, 2-amendment-pwmrules-2022.pdf (cpcb.nic.in)

³⁹ Ministry of Environment, Forest and Climate Change, Government of India (2022). Guidelines on Extended Producer Responsibility for Plastic Packaging. G.S.R. 133(E). <https://egazette.nic.in/WriteReadData/2022/233568.pdf>

EPR targets for brand owners for recycling and incorporation of recycled content back into plastic packaging

Plastic Packaging Category I: RIGIDS	TARGETS			
	2024/25	2025/26	2026/27	2027/28
Recycling	50%	60%	70%	80%
Incorporation of recycled content		30%	40%	60%

Plastic Packaging Category II: FLEXIBLES	TARGETS			
	2024/25	2025/26	2026/27	2027/28
Recycling	30%	40%	50%	60%
Incorporation of recycled content		10%	10%	20%

Plastic Packaging Category III: MULTI-MATERIAL FLEXIBLES	TARGETS			
	2024/25	2025/26	2026/27	2027/28
Recycling	30%	40%	50%	60%
Incorporation of recycled content		5%	5%	10%

To achieve the EPR target of collection, recycling and incorporation of recycled content in packaging, there are several identified gaps that will need to be addressed.

1. The capacity to recycle plastic waste exists, but the challenge lies in segregating, aggregating and channelising collected waste to recyclers.
2. The capacity for high-quality (closed-loop) recycling is low (about 36,500 tpa for PET and 73,000 tpa for polyolefins)
3. It is estimated that in 2025-26, over 700,000 tpa of high-quality recycling will be required.
4. In 2028-29, the additional requirement will increase to over 2,000,000 tpa, the bulk (63%) of which will be for Category I (Rigids).

The management and enforcement of the PWM and EPR guidelines is through the Central Pollution Control Board (CPCB).⁴⁰ The CPCB establishes waste management guidelines and standards and fosters stakeholder collaboration. The State Pollution Control Board (SPCB)⁴¹ is a state-level body responsible for monitoring state-level actions per the PWM regulations 2016.



⁴⁰ CPCB Central Pollution Control Board CPCB | Central Pollution Control Board

⁴¹ CPCB Central Pollution Control Board CPCB | Central Pollution Control Board



International Cooperation

Collaboration on scientific research between UK and India is well established in many sectors with multiple initiatives led by UKRI, Innovate UK, universities and institutes. In the field of sustainable plastics and circularity, the notable recent projects relevant to the GEM include:

The India Plastics Pact technical insight projects.

As part of establishing the India Plastics Pact, UKRI India supported the development of a series of insight reports into key issues that are central to a greater appreciation of the interventions needed to achieve a circular economy for plastics in India and achieve the Pact targets, namely (1) Material Flow of PET packaging applications in India⁴² (2) Food Grade rPET in India: business opportunities⁴³ (3) Design Guidance for food contact PET bottles⁴⁴ was developed (4) Small Formats & Sachets⁴⁵ and (4) Informal Waste Sector :The role of the informal waste sector in the Indian waste plastics system (pending publication July 2023).

The International Circular Plastics Flagship Projects Competition⁴⁶

Funded by UKRI and managed by WRAP, the competition funded five collaborative technical projects across India, South Africa, Kenya and Chile to advance key challenges that relate to achieving the Plastics Pact targets in the country in question. For India, two projects have recently been completed (publication due July 2023).

UK- India Twin Cities Marine Litter Partnership⁴⁷

The Twin Cities Marine Litter Partnership is a virtual community platform where members can exchange best practices and form networks to address plastic pollution and reduce marine litter at a city-to-city level. Aberystwyth, Wales and Puducherry are two of the participating cities.

⁴² India Plastics Pact (2022) Material Flow of PET Used in Packaging Applications in India: for the year 2021-22 (indiaplasticspact.org)

⁴³ India Plastics Pact (2022) Food grade rPET in India business opportunities report (indiaplasticspact.org)

⁴⁴ India Plastics Pact (2022) IPP PET Design Guidance Report (indiaplasticspact.org)

⁴⁵ India Plastics Pact (2022) India Plastics Pact Small Formats and Sachets Report

⁴⁶ WRAP 2022 International Circular Plastics Flagship Competition | WRAP

⁴⁷ UK Gov.uk (2022) UK and India sign landmark research agreement - GOV.UK (www.gov.uk)

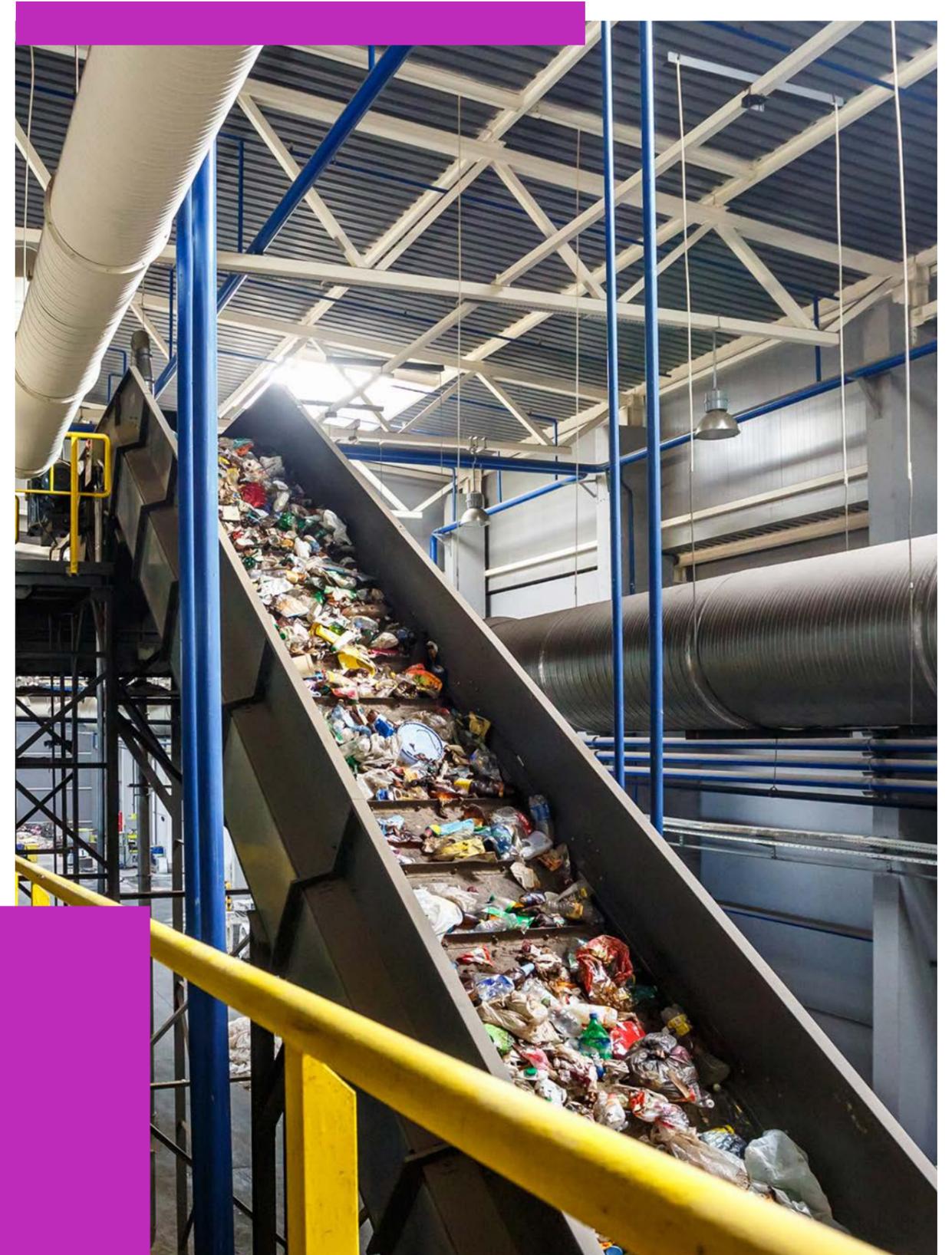
In addition, India has several research collaborations with the United Nations and Australia on sustainable plastics and circularity.

United Nations Development Programme (UNDP)

India and the United Nations Development Programme (UNDP) have collaborated to launch an “Inclusive Circular Economy” initiative, which focuses on the end-to-end management of plastic waste. The project aims to promote the segregation of waste at the source, collection of the segregated waste, and the establishment of Material Recovery Facilities (MRFs) for recycling all types of plastic waste along the value chain. In addition, the initiative aims to support the social inclusion of 20,000 waste-pickers, also known as Safai Saathis, across the country, by providing them with access to government welfare schemes and linkages.⁴⁸

Australia

India and Australia have joined forces to develop an industry and technology roadmap for a circular economy of plastics. This partnership aims to unlock future opportunities in plastic recycling, as well as industrial redesign and the creation of new materials, products, processes, and business models that promote circularity. The roadmap is set to launch in 2023 and is led by CSIRO, Australia’s national science agency, with support from the Australian Department of Foreign Affairs and Trade (DFAT) and India’s Department of Science and Technology (DST).⁴⁹



⁴⁸ <https://www.undp.org/india/press-releases/undp-india-and-hul-announce-partnership-drive-circularity-plastics>

⁴⁹ <https://www.csiro.au/en/research/natural-environment/circular-economy/ind-aus-reduce-plastics-waste>

06. Summary of Stakeholder Meetings

The GEM brought together a number of key stakeholders working in the sustainable plastics sector with support from WRAP and CII. It consisted of a week of meetings, site visits and workshops in the Mumbai and Gujarat region of western India. With a hotspot of activity in plastic recycling and processing in the region, it provided an opportunity to engage with key organisations in the sector to appreciate the complexities and systems at play in the Indian plastics value chain. The meetings offered deep insights into the downstream stages of collection, sorting and separation which is very different from the UK system as it revolves around the participation of the informal waste sector.

Understanding the Indian waste sector is critical for potential innovators and investors as it dictates the availability of waste plastic feedstock – critical for recyclers and processors. To investigate this further, the GEM organised a number of engagements during the visit. This includes:

- Appreciation of waste collection/ feedstock supply by visiting a number of waste collection, sorting and separation sites (including MRFs) and meeting with the operators.
- Visit to two major plastics recyclers (covering PET rigids and Polyolefin flexibles) to get an appreciation of the stage of mechanical recycling that is occurring in India (albeit in the advanced sector).
- A **Circular Plastics Innovation** workshop. The workshop to showcase the UK leading innovations to a wider Indian audience and for the UK delegation to discuss the current opportunities and challenges with a range of industry representatives and organisations.
- A series of in-depth 1-to-1 meetings with key businesses and organisations to better understand some specific topics and explore collaborative innovation opportunities.

Downstream Waste Collection and Sorting

Stree Mukti Sanghatana.⁵⁰ Swachhta Kendras are material recovery facility where dry waste is collected, segregated, and recovered before it is sent to recyclers. Such sites are also called Material Recycling Facilities (MRFs). While they perform a similar function as MRFs in the UK, they are very different in scale, automation and processes employed.

SMS is a women-only consortium (NGO) that supports female waste pickers. Once sorted, rigid plastics and flexible PE or PP films are sold on to recyclers. All sorting is done by hand.

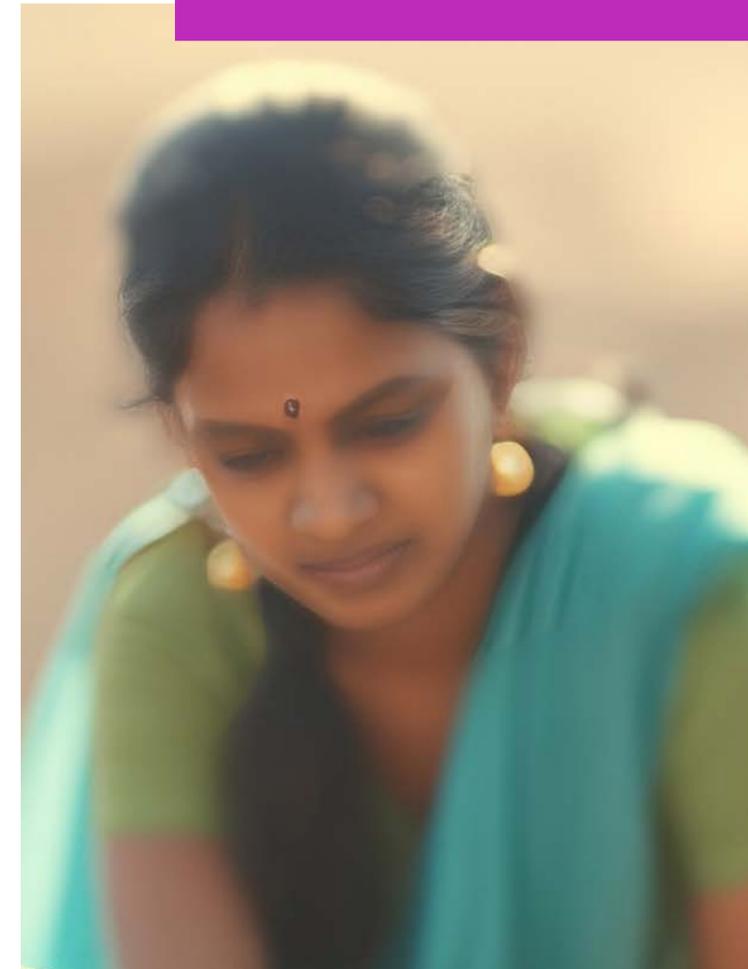


Mahalaxmi MRF is operated by **Dalmia Polypro.**⁵¹ Dalmia is predominantly a PET plastics recycler but also operates two MRFs in Mumbai. The plastics processed at the MRFs go on for recycling or onward processing. A small proportion of Dalmia's total PET feedstock for their recycling business comes from their own MRFs.

The Dalmia MRF was in a more urban location in a very restricted space.

AASRA Welfare Association MRF visit in Bandra, Mumbai

AASRA MRF is a more sophisticated MRF operation with three levels of sorting of plastics so different polymers and fractions. They received their input material for three main sources (a) direct from household collections (b) from IWS workers who operate the municipal collection services in housing associations and who collect some waste for themselves to sell on (c) purchased from roadside sweepers and collectors.



⁵⁰ www.streemukthisanghatana.org

⁵¹ www.dalmiapolypro.in

Downstream Plastics Recyclers



Dalmia Polypro Industries⁵² site visit. Vapi, Gujarat.

Dalmia Polypro is a well-established recycler. Its PET recycling business recycles approx. 70% of all PET bottles are collected in Mumbai. The PET flake output is mostly sold for textile fibres. The polyolefin output is sold to packaging converters and manufacturers as recycled plastic pellets to displace virgin plastic.

Impact Lucro⁵³ site visit. Vankas, Gujarat

Lucro is a polyolefin film recycler and operates an integrated business - operating wash plants, recycling plants and plastics conversion/manufacturing sites.

They take in sorted, washed films from their own sorting plant and produce two main outputs – 50% goes to the film conversion plant to be made into bags/rigid packaging, and 50% is sold as pellets to external converters.

Circular Plastics Innovation Workshop Mumbai

The workshop had approx. 50 attendees from a wide spectrum of the Indian plastics value chain including many who were signed up to the India Plastics Pact, including:

- Plastic resin producers
- Packaging converters
- Brand owners
- Recyclers
- Trade associations from the plastics sector
- NGOs
- Investors
- Research institutes
- Waste management organisation / informal waste sector bodies
- UKRI India

See Annex 2 for a full list of workshop panellists and delegates.



The workshop included presentations and panel discussions on a wide range of topics, including the outlook for chemical and dissolution recycling technologies in India, opportunities in integrated data management, innovations to facilitate incorporating recycled plastic and digital solutions to advance positive behaviour change.

The workshop enabled open discussions between Indian and UK participants, and this was appreciated by the Indian audience, who expressed that such open discussions rarely happen at conferences and events. The feedback included such statements as:

Upstream Plastics producers & converters

‘Incredibly well thought thorough event. The diverse set of participants in the audience and speakers and panellists enriched the conversations’.

SHELL INDIA

⁵² www.dalmiapolypro.in

⁵³ www.lucro.in

EPL Global⁵⁴ EPL are a leading packaging manufacturer globally with a major presence in India. They manufacture plastic tubes, laminated and closures. They sell approx. 17,000T of plastic tubes to the Indian market across oral care, beauty, and healthcare sectors. As a major producer (end customer), the discussions were focused on innovations to accommodate recycled plastic into EPL packaging, new materials, barrier layers, design for recycling and drivers for plastics elimination/reduction.

Shell⁵⁵ As a major resin producer (albeit not in India currently) the discussions with Shell revolved around their plans and insights relating to the future outlook for chemical recycling in India and the wider region.

Investment related organisations

Invest India⁵⁶ Invest India is the primary Indian government agency to encourage inward investment.

The UK GEM delegates explored the support available for UK businesses looking to partner with India including such topics as: Intellectual property (IP) protection, legal aspects of investing, locations, events, or support services available.

Circulate Capital⁵⁷ As a major investor in the Indian plastics sector in recent years, the discussions with Circulate Capital focused on their investment strategy, priority areas and processes. Their four key areas are (a) disruptive innovations (b) increased collection (c) deploying upcycling technologies (d) digitisation.

Circulate Capital has invested heavily in the mechanical recycling sector in India but is seeking opportunities to help advance the recycling of MLP and complex packaging.



⁵⁴ www.eplglobal.com

⁵⁵ www.shell.in

⁵⁶ www.investindia.org.in

⁵⁷ www.circulatecapital.com

07. Collaboration Opportunities

There are many opportunities for the UK and India to promote innovation by strengthening their collaboration in areas such as plastic recycling and circular economy. UKRI-funded IPP can be used as a strong leverage to extend the bilateral partnership as it provides a trusted and knowledgeable channel to major brands, recyclers, and organisations that have committed to targets.

During the GEM, several potential areas of collaboration were identified, including:

:

Opportunities in chemical recycling largely remain untapped in India

There is an opportunity to work with India on non-mechanical and dissolution recycling, an area that has not been explored extensively in India. This is despite the availability of feedstocks and the presence of naphtha crackers in the country. The shortage of current solutions to large waste category MLP could provide an opportunity for non-mechanical recycling technologies.

Supporting India's informal recycling sector

The majority of India's PE/PP mechanical recyclers are in the informal recycling sector. These are low tech and low capex machinery with an average capacity of 4 tonnes/day (c.1,300 tonnes per annum). There is an opportunity for the UK to work closely with material recycling facilities (MRF) to introduce new equipment and technologies to increase bulk density (e.g. shredders and compactors) which would improve throughput and the economics.



Opportunity for the UK to trial film sorting technology in India

Recent advances in mechanical sorting and separation of post-consumer film and flexible packaging in the UK could be adapted and trialled in India as the need to recycle more films grows. While the quality of film separation and sorting currently done manually by the IWS is extremely high, the proportion of film being recycled is low. Therefore, mechanical solutions could complement manual sorting and allow for greater volumes to be processed.

There is an opportunity for the UK to work with India in designing packaging for recyclability

Moving from problematic, unrecyclable poly-Alu and multi-layer plastic packaging to more recyclable plastic substrates (e.g., mono-material, multilayer films) is advancing rapidly in the UK and Europe. The experience and expertise from UK organisations could benefit Indian businesses and help accelerate sustainable packaging.

Collection and reporting of packaging data is still in its infancy in India

Packaging data across the plastics value chain is still in its infancy as until recently there was no mandatory requirement to report this. With the advent of new EPR regulations, businesses in India are required to report packaging data to a central reporting portal. While the system is rudimentary, it's a step in the right direction for India. The UK's experience and expertise in data reporting and analysis presents an opportunity to work closely with Indian organisations for an integrated data management system that would make decision making more efficient.



08. Barriers to Collaboration

A number of challenges and barriers to greater UK-India collaboration in the fields covered by the Mission were identified as the following:

Price sensitivity, ROI and access to funds hinder development of advanced recycling technologies

The Indian market is price-sensitive and new technologies need to compete with existing processes. Brands prioritize ROI and are unwilling to pay a premium for innovative solutions. While access to finance is not a barrier for established technologies, government grants and incentives are lacking for chemical recycling and less established models.

Traceability, costs and quality of feedstocks need to improve

The collection system is not transparent, and there are no national standards in operation to trace waste plastic feedstock. In addition, the price of the feedstock is relatively high, which limits the ROI for recycling. Furthermore, some waste plastics are contaminated with oils/fats due to poor separation at the source and the prevalence of oily/fatty foods in many food products.

The adoption of EPR in India could delay future investments

The success of many innovation investment decisions depends on the effective and timely implementation of the EPR legislation. There are concerns of delays and amendments to the legislation which will likely impact investment decisions and innovation.

Administrative, cultural and societal differences can make it difficult for UK businesses

Navigating the complex (and potentially) bureaucratic systems in India to operate effectively could be a deterrent to investment and this is why an effective partnership with an Indian business is seen as crucial. This includes such areas as business etiquette, taxation, employment, health and safety, permitting, state / federal laws etc. The need to invest time in India and understand the opportunities and challenges is important.



Transitioning to a circular economy for plastics – especially plastics packaging – is a global and national challenge.



09. Conclusions

Transitioning to a circular economy for plastics – especially plastics packaging – is a global and national challenge. Efforts are underway to tackle plastic pollution in the marine and terrestrial environment, conserve resources, reduce greenhouse gas emissions and develop livelihoods and jobs for those working in the waste sector.

This Innovate UK Global Expert Mission (GEM) provided insights into the complexities of the Indian plastics packaging market from a circular economy perspective. It illustrated the scale of the problem and the many challenges but also the great progress being made by some pioneering organisations and businesses. It also illustrated where the experiences and progress being made in the UK plastics sector align and also differ from the Indian context.

From an innovation perspective, the Mission highlighted the appetite and willingness for UK-Indian bilateral collaboration between the two countries. There are opportunities throughout the plastics value chain under the umbrella of implementing the circular economy for plastics – both upstream and downstream.

The appetite for innovation exchange and collaboration from leading plastic packaging consumer businesses (FMCG brands) and recyclers appears very strong. Driven by corporate commitments and initiatives, such as the India Plastics Pact, businesses are seeking solutions to advance circular economy solutions to the various waste plastic challenges.

The policy landscape and ambitions of the Government of India is also very favourable as regards to the relatively new EPR guidelines and targets. However, until the policies are fully established, there is significant uncertainty in the private sector as to how, and at what rate, the policies will be implemented and enforced. This implementation phase is likely to persist for many months which could act as a short-term delay to advancing bilateral collaborations.

The UK has a number of highly innovative businesses and technologies working on innovative solutions, and the Mission successfully identified several areas where collaborative innovation exchange would provide social, environmental, and economic benefits to the UK and India.

10. Annex 1 – List of UK Participants

UK Companies attending the GEM were:

ReVentas www.reventas.co.uk

Plastic Energy www.plasticenergy.com

Kellogg, Brown & Root (KBR) Inc / Mura Technologies Ltd www.muratechnology.com

Interface Polymers www.interfacepolymers.com

LitterLotto www.litterlotto.com

Dsposal www.dsposal.uk

WRAP also accompanied the GEM in their role as supporting the India Plastics Pact and as Technical Report writers.

Confederation of Indian Industries (CII) attended the GEM for the time in India.

www.sustainabledevelopment.in



11. Annex 2 – List of Circular Plastics Workshop Participants

Panellists

Confederation of Indian Industry
 Smart Sustainable Plastics Packaging Challenge, UKRI
 Indian Oil
 WRAP

Workshop delegates

AIPMA	Landbell GreenForest Solutions
AIWP	Marico Ltd.
AVI Global Plast Pvt. Ltd.	Mondelez International
Banyan Nation	Nouryon Chemicals
BASF	Pidilite Industries Ltd.
Beiersdorf	PolyCycl
BlackForest Solutions	PrintWeek and WhatPackaging? Magazines
Circulate Capital	Qualys
Coca-Cola India	Re Sustainability Limited
Dalmia Polypro Industries Pvt Ltd	Reckitt Benckiser India Pvt. Ltd.
Dow Chemical International Ltd.	Reliance Industries Ltd.
Dow Inc.	Saahas Zero Waste
EPL Ltd.	Shakti Plastic Industries
Filatex India Limited Dahej	Shell
Godrej & Boyce Mfg. Co. Ltd.	Social Lab
GreenWorms	SWaCH
Indian Oil Corporation Ltd.	The Lubrizol Corporation
Indian Plastics Institute (IPI)	The Shakti Plastic Industries
Interface Polymers Ltd.	UK Science and Innovation Network (SIN),
IPP Catalogue	British Deputy High Commission Mumbai
ITC Ltd.	WEF
JNTL Pvt. Ltd. (Part of J&J)	WRAP
Karo Sambhav	
Kellogg India Pvt Ltd.	
Kenvue (Part of J&J)	



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We fund business and research collaborations to accelerate innovation and drive business investment into R&D. Our support is available to businesses across all economic sectors, value chains and UK regions.

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