



CPI ROADMAP 2023

ROAD TO ZERO PLASTIC

ACKNOWLEDGEMENTS

This roadmap was developed under the guidance of Shiza Aslam, Research lead at the Circular Plastic Institute (CPI), as well as contribution from Wali Hassan, research associate at CPI. Those from academia, industry, and non-profit sector who made considerable contributions through participation in online surveys, virtual roundtable, in-person meetings, are acknowledged in Appendix B of this report.

Circular Plastic Institute

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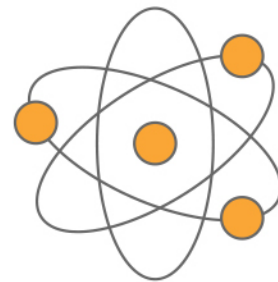
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EXECUTIVE SUMMARY

It is estimated that around 3,000 kilotons of plastic (including domestic produce and import both) is consumed annually in Pakistan. Plastics in Pakistan are predominantly used for manufacturing in the packaging, automobile, and construction sectors. With an approximate composition of PET (7.32%); PVC (9.6%); LDPE (10.3%); HDPE (8%); PP (18.7%); PS (3.71%); Polyester (12.5%); Rubber (17.18%); other (12.8%). Currently, Pakistan's plastic economy is highly linear such that due to a limited understanding of the recyclability of products and materials among upstream stakeholders, lack of waste management and recycling infrastructure, low market of various plastic polymers, and subsequent contamination rates, only a moderate share of the total plastic consumed is recycled in Pakistan while remaining either in stock (e.g., plastic in building and construction sector) or/ and ending up being openly burned, dumped, and leaked to water bodies. With improved infrastructure, enhanced understanding of the status and needs of the sectors, standards for products and (re)processing, improved material (re)manufacturing processes, and enabling environment can create considerable positive synergies and socio-environmental and economic impact including but not limited to reduced green house gas emissions, reduced water and energy demand/utility, new/expansion in employment opportunities, material circularity, sustainable production and consumption, and reduced demand for primary raw materials. To help realize these potentials and benefitting from positive synergies, CPI is established by Karachi School of Business and Leadership (KSBL).

This roadmap outlines the challenges and barriers that need to be addressed to achieve plastic circularity in Pakistan. The stakeholders across the value chain and wider enabling environment need to work together to overcome these challenges, including insufficient data, limited understanding of individual polymer behavior and data-driven product circularity, and the lack of standards and infrastructure to support circularity. Furthermore, the absence of a business and socio-economic case for interventions and the lack of incentives, financial support, and technological resources hinders the progress towards a circular future. CPI is committed to investing in research and capacity building to overcome these challenges and drive progress towards a more circular future. Their coordinated strategy focuses on prioritizing research activities and collaborating on important research priorities effectively. By overcoming these challenges, stakeholders can foster an ecosystem for plastic circularity in Pakistan and realize the vision for a circular economy.

We are actively seeking funding to generate data, evidence, and promote dialogues on the opportunities, barriers, and challenges in the plastic circularity ecosystem, and to identify and promote best practices.

ABOUT

Circular Plastic Institute

KSBL Circular Plastic Institute (CPI) aims to establish a holistic ecosystem to advance knowledge and catalyze the transition to plastic circularity in Pakistan. Based on the academic side of the academic practitioner ecosystem, CPI seeks to reduce the environmental impact of manufacturing, reprocessing, and plastic use leveraging technology, digitalization and institutional knowledge base. We aim to propel this agenda through collaboration, research, awareness creation and implementation.



Our Vision



"Our vision is to be the global leader in driving a sustainable manufacturing, reprocessing, and plastic use economy, where resources are conserved, waste is minimized, and a circular economy is promoted."

Our Mission



To create a collaborative platform and bring together industry, government, and academia to drive innovation and up-taking of evidence-based planning that reduces the environmental impact of manufacturing and reprocessing, while encouraging the responsible use, treatment, and disposal of plastic to facilitate circularity while dealing with plastics in Pakistan and to protect our planet.

Circular Plastic Institute is dedicated to promoting the circular economy, which aims preserve resources while minimizing waste. We work with businesses, governments, and individuals to help them transition to a more circular, sustainable model of economic activity.

ROADMAP 2023

Circular Plastic Institute

The development of the CPI research agenda and roadmap 2023 was informed by a variety of stakeholders across the polymer value chain through one-one meetings, online surveys, and a virtual roundtable held on January 19th, 2023. A detailed discussion of the entire roadmap development process together with active modes of collaboration and contributions are summarized in Figure 1 below, details can be found in Appendix A: Development of the Circular Plastic Institute Roadmap.

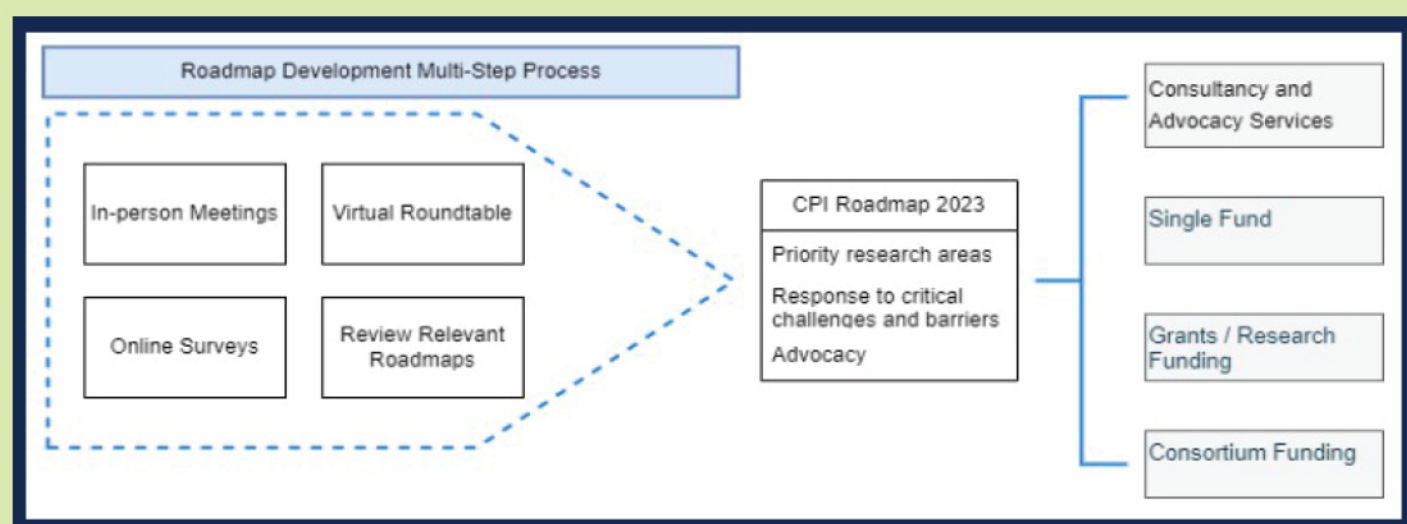


FIGURE 1: ROADMAP DEVELOPMENT PROCESS AND MODES OF COLLABORATION AND CONTRIBUTIONS

TECHNICAL AND ECONOMIC CHALLENGES AND ASSOCIATED KNOWLEDGE GAPS: STAKEHOLDER PERSPECTIVE ANALYSIS

Based on the collective input from stakeholders following multi-step process, key barriers and challenges that are preventing plastic circularity were identified (see Figure 2), against which priority research areas were set for CPI under its research agenda 2023. The assessment of barriers and challenges highlights the current state of materials and products manufacturing and reprocessing processes, status of downstream industry, current landscape of end-of-life management options and fate for polymer material and products, and opportunities and needs for a prospect circular plastic future.

Drivers and Barriers to Plastic Circularity in Pakistan: Stakeholder Perspective



Figure 2: Heatmap, presenting identified key barriers and challenges that are preventing plastic circularity

To realize the desired future state for plastic circularity, stakeholders across the value chain and wider enabling environment must work to overcome the following barriers and challenges and address the associated policy, regularity, knowledge, and infrastructure gaps:



INSUFFICIENT, UNRELIABLE, OR INADEQUATE DATA

- Limited understanding of secondary material markets (supply chain and flows)
- There is no reliable, accurate, and accessible database available on polymers in Pakistan
- Lack of transparency and transability across the value chain – resulting in disincentivizing CE motivation and prospect
- Limited data on informal sector and understanding therein
- Limited understanding of individual polymer behavior and data driven product circularity



SYSTEM INTERACTIONS AND SECTORAL NEEDS ARE NOT CONSIDERED

- The trade-off impacts that material choices may have across many sectors are not well understood.
- There is limited understanding on the potential of circular economy and material circularity at sectoral and sub-sectoral level
- Limited understanding on the needs of sector to manufacture complex and hard to recycle plastic
- Lack of understanding, incentives, and viable solutions to opt out of hard to recycle plastic use in material and products
- Lack of motivation to pursue sustainable and commercially viable packaging solutions



BUSINESS AND SOCIO-ECONOMIC CASE OF INTERVENTIONS ARE NOT CONSIDERED

- Need of the first tier of supply chain, particularly waste pickers are not well understood
- Lack of understanding of socio-economic needs and social protect network established by the informal sector, critical to their well-being and positive synergy
- Need to explore market indicator and viable supply chain and business strategies since many polymers and products remain commercially hard to capture and recycle, despite technical solutions being available
- Lack of financial & Technological support
- Lack of understanding of true cost of circular plastics
- Lack of index to support formal enterprises and supply chain over informal ones
- Lack of incentives to sort
- Lack of recognition given to recycling sector not recognized as green industry



MATERIAL PROPERTY DATA IS NOT AVAILABLE

- Secondary feedstock material property and material quality standards are frequently not accessible.
- There are no well-defined methods for adjusting material property and material quality standards to obtain equal performance for secondary feedstocks.
- Lack of product formulation & processing data

LACK OF INFRASTRUCTURE AND MANDATE TO SUPPORT CIRCULARITY

- Current collection infrastructure and mechanisms are unable to capture all plastics
- Ambiguity in the roles & responsibility of authorities
- Lack of targets & commitment in the industry
- Lack of awareness and incentives for consumers, businesses, and industries to realize sustainable consumption and support circular business
- Lack of incentives for industries to develop industrial symbiosis to cater their industrial waste through formal routes
- Lack of policies including Extended Producer Responsibility (EPR) to support the CE ecosystem



CPI recognizes these challenges and is committed to investing in research and capacity building to address them and drive progress towards a more circular future.

CPI HIGH PRIORITY ACTIVITIES:

The Institute has a coordinated strategy in place to contribute to CE sphere in Pakistan and realize the vision we have set. this strategy involves identifying and giving priority to research activities that address significant challenges and achieve the desired state of the industry and foster ecosystem for plastic circularity in Pakistan. The roadmap focuses on a specific area and includes a vision for the future, obstacles that need to be overcome, milestones to measure progress, and a detailed list of research activities needed to achieve those milestones.

The roadmap development benefits from the cross-cutting themes because they provide a useful framework to identify key research priorities. This enables parallel work without any duplication of effort. Even though research activities will be organized separately, the cross-cutting themes provide a structure to collaborate on important research priorities effectively.

Figure 2 illustrates how the Technical Areas identified based on the assessment of barriers and challenges for plastic circularity in Pakistan (see Figure 1) relate to the Cross-Cutting Themes. The research activities listed under each Technical Area represent the high-priority research themes. Table 1 shows narrowed research priorities for 2023 and Table 2 shows the ongoing CPI projects as its progress against the identified technical areas, cross cutting themes, and narrowed research priorities.



Technical Areas

	Characterization and Quantification Helps in understanding quantities and composition	Simulation and Analysis Tools Help in modeling and analyzing complex systems	Value Chain Analysis Identifies opportunities for improvement and optimization within a supply chain	Capacity Building Training and educating young professionals, aspirants, industrial workers
Developing Assessment Frameworks	<ul style="list-style-type: none"> • Data reliability index • City level and national data extrapolation criteria 	<ul style="list-style-type: none"> • Circularity measure index • Organization readiness for CE assessment • System thinking 	<ul style="list-style-type: none"> • Product design circularity matrix • Feasibility assessment e.g., Extended producer responsibility • Product standards 	<ul style="list-style-type: none"> • Training, courses, and activities relevant
Social Assessment	<ul style="list-style-type: none"> • Mapping waste pickers landscape 	<ul style="list-style-type: none"> • Just transition and market reforms 	<ul style="list-style-type: none"> • Informal waste sector investigation • Best practices • Social life cycle assessment • Incentive and intervention database 	
System Thinking & Analysis	<ul style="list-style-type: none"> • Waste audits • Safe CE transition • Phase out hazardous compositions 	<ul style="list-style-type: none"> • Lifecycle assessment (LCA) tools and databases 	<ul style="list-style-type: none"> • Material flow analyses (MFA) & scenarios • Techno-economic analysis of secondary material markets • Technical performance metrics • Project impact calculation 	<ul style="list-style-type: none"> • Repository of organizations in CE sphere • Collaborative Action • Assessing CE potential
Recycling & Recovery		<ul style="list-style-type: none"> • Waste logistics models 	<ul style="list-style-type: none"> • Material flow analyses (MFA) & scenarios • Techno-economic analysis of secondary material markets • Technical performance metrics • Project impact calculation 	



CROSS-CUTTING THEMES

Characterization and Quantification	Simulation and Analysis Too	Value Chain Analysis	Capacity Building
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FIGURE 2: RELATIONSHIP BETWEEN PRIORITY TECHNICAL AREAS AND CROSS-CUTTING THEME

TABLE 1: RESEARCH PRIORITY AREAS 2023	
	Value chain and technological study: Identify barriers and challenges to plastic circularity, including polymer or product specific material flow and market analysis Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners
	Baseline and composition studies, waste audits, and scenario modelling Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Social-Lifecycle assessments (S-LCA) of products and interventions, including scenario modelling Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Business case studies and waste/circular economics of circular initiatives and startups Potential Partners: Enterprises and businesses (for profit and non-profit) in CE sphere
	Develop models to phase out hazardous chemicals and additives in plastic Potential Partners: Government and public entities, academia, practitioners, and value chain actors
	Factsheets: Mapping landscape of polymers and products; developing circularity matrix and index Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Investigating material behavior and product circularity Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Recycling of plastic waste after upgradation for similar application (Circularity) Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Assessing planning and implementation process of Extended Producer Responsibility: Learnings and best practices Potential Partners: Government and public entities, academia, practitioners, and value chain actors
	Identify and promote best practices Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia
	Generate data, evidence, and promote dialogues on the opportunities, barriers, and challenges Potential Partners: Producers, manufactures, recyclers reprocessors, practitioners, academia, Government and public entities, and value chain actors

CPI IMPACT THUS FAR	
	Value chain mapping and capacity building of Pakistani governmental stakeholders to implement Basel convention's amendments to enhance control of the transboundary movements of plastic waste. Partners: COMSATS University Islamabad, Engro Foundation, and Engro Polymer Funded by: Asia-Pacific Network (APN) for Global Change Research
	Scoping Study for Waste Assessment along the Coast of Karachi Funded by: Worldwide Fund (WWF) Pakistan
	Mapping the Landscape of Waste Pickers in Pakistan: Challenges, Opportunities, and Organizational Strategies Partners: Ouroboros Waste Management (OWM) Funded by: Women in Informal Employment: Globalizing and Organizing (WIEGO)
	Lifecycle assessment (LCA) of four major groups of vinyl products manufactured in Pakistan namely, (a) pipes and fitting; (b) rigid film and packaging; (c) foam boards; and (d) profile Partners: Engro Polymer Funded by: Asia Pacific Vinyl Network (APVN)
	Mapping of Open Burning of Municipal Waste in Pakistan and Identification of Underlying Factors and Key Drivers Partners: NED University; Indus Valley school of art and architecture, COMSATS University Islamabad, and Engro Foundation, Ouroboros Waste Management (OWM) Funded by: Engineering X

DEVELOPMENT OF THE Circular Plastic Institute

The Circular Plastic Institute's research agenda and roadmap for 2023 is developed following a multi-step process. Different formal meet-up were arranged with representatives from various sectors such as industry, academia, practitioners, and other relevant stakeholders, related with the polymers (upstream and downstream actors and entities both). A virtual roundtable on Drivers and Barriers to Plastic Circularity in Pakistan was organized to identify key challenges preventing plastic circularity within the scope of discussing current situation, vision for future state, unpacking existing challenges and knowledge gaps, and mapping key areas of priority for research and development to support CE in Pakistan. The outcomes of the roundtable were combined with feedback from surveys, one-on-one meetings with subject matter experts, and other relevant sources like existing roadmaps.

INDUSTRY-WIDE ONLINE SURVEYS AND ONE-ONE MEETINGS

The Circular Plastic Institute carried out strategy expansions surveys (online) and in-person meetings to map current research and need gap perceived by relevant stakeholders to Support Plastics Circularity in Pakistan. Through online survey and one-one meetings, participants were asked to identify key challenges preventing plastic circularity in Pakistan, key barriers (technical, regulatory, social) impacting the industry from their point of operation and impact, data needs, key highlights and trends in the polymer sphere, and suggestions for CPI to focus and contribute to.

ROUNDTABLE ON DRIVERS AND BARRIERS TO PLASTIC CIRCULARITY IN PAKISTAN

The roundtable was held on 19th January 2023, virtually, in collaboration with other professionals from industry and academia are organizing a discussions and roundtables to identify key challenges preventing plastic circularity in Pakistan. Participants were asked in share their and their organization's view and learning following a semi-structured interview style dialogue. To cover the spectrum of issues and themes critical to support CE and developing roadmap for CPI, a sub-thematic discussion was posed to each participant, subjecting them to brainstorm pertinent to the issues of waste economy, enabling environment, sector specific potential of the circularity, critical skillset required, and barriers posed to different actors across the value chain, and behavior aspects necessary to be catered to ensure roadmap content encompassed the needs of polymer sector.

APPENDIX B

ROADMAP

Contributors

NAME	ORGANIZATION
Aatekah Mir Khan	Senior Manager, Public Affairs and Sustainability, Nestle
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Aneeq Ahmed	V.C Supply Chain, Engro Polymers
Asif Sarwar	CEO, Binex International and Chairperson, Polymer Waste Importers & Recyclers Association
Bilal Khalid	Founder, Urban Nerves (NGO, think tank)
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Dr. Asif Ali Qaiser	Professor, UET Lahore
Dr. Ata-Ul-Haq	Ex MD LWMC, Gujranwala
Dr. Atif Mustafa	Chairman, Department of Environmental Engineering, NED
Dr. Farhan Anwar	Associate Professor, Habib University
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Dr. Fatima Hafsa	Postdoc Fellow, Arizona State University
Dr. Fazal Noor	Chairman, Sir Syed University, Department of Architecture
Dr. Hamid Iqbal	M.D, Rawalpindi Waste Management, RDA
Dr Jabir	Comsat University
Dr Mansoor Ali	Consultant, Visiting faculty EU-Uk
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Dr Suneela Ahmed	Associate Professor, NED
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Zahid Farooq	Social activist/ Joint Director Urban Resource Centre
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