THE ROLE OF CIRCULAR ECONOMY PRINCIPLES IN INDIA'S CLIMATE CHANGE LEGISLATION

Dissertation submitted to the National University of Advanced Legal Studies, Kochi in partial fulfilment of the requirements for the award of LL.M. Degree in International Trade Law

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DECLARATION

I, Akhil R, do hereby declare that this LL.M. Dissertation titled **"THE ROLE OF CIRCULAR ECONOMY PRINCIPLES IN INDIA'S CLIMATE CHANGE LEGISLATION",** researched and submitted by me to the National University of Advanced Legal Studies, Kochi in partial fulfillment of the requirement for the award of Degree "Master of Laws in International Trade Law", under the guidance and supervision of Dr. Athira P.S., is an original, bona-fide and legitimate work and it has been pursued for an academic interest. This work or any type thereof has not been submitted by me or anyone else for the award of another degree of either this University or any other University.

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PREFACE

This dissertation is made in partial fulfilment of the requirements for the award of the Degree of Master of Laws in International Trade Law to the National University of Advanced Legal Studies, Kochi.

This dissertation primarily examines the concept of the Circular Economy and its crucial role in the domain of climate. The global discourse around the Circular Economy has been there for some time, but the implementation of this principle is aggressively taking place in many countries. With the looming challenge of Climate Change, there needs to be a drastic restructuring of the production process and the consequent waste generation and management. The lessons from the incorporation of the Circular Economy in many countries provide valuable insights on the breadth and depth of this principle within the municipal law of a country. The incorporation and implementation of Circular Economy principles are not free of challenges, the unique geographical and cultural diversity of India poses a multifarious challenge to the implementation of this principle within the Indian legal framework.

This thesis explores the concept and origin of Circular Economy principles and the incorporation of this principle at the International, Regional and National levels across the world and also sheds light on the element of Circular Economy already in place in the Indian legal framework. Additionally, the dissertation proposes various recommendations to consider while incorporating the circular economy framework in the Indian scenario.

I would also like to endlessly thank all the people who have immensely helped me in the completion of this dissertation. I would especially like to show gratitude to my guide and teacher, Dr. Athira PS, for her enormous encouragement, support and valuable input.

LIST OF ABBREVIATIONS USED

ALMM	Approved List of Manufactures and Models
CE	Circular Economy
CO2	Carbon Dioxide
CEAP	Circular Economy Action Plan
CEPL	Circular Economy Promotion Law
CPCB	Central Pollution Control Board
ENEC	Brazil's National Circular Economy Strategy Change
EPR	Extender Producer Responsibility
GCF	Green Climate Fund
GPA	Government Procurement Agreement
GST	Goods and Service Tax
IRP	International Resource Panel
KrWG	Kreislaufwirtschaftsgesetz
LiFE	Lifestyle for Environment
MOEFCC	Ministry of Environment, Forest and Climate Change
NAPCC	National Action Plan on Climate Change
NDC	Nationally Determined Contribution
NREP	National Resource Efficiency Policy
PACE	Partnership for Action on Computing Equipment
UK	United Kingdom
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WEEE	Waste Electrical and Electronic Equipment
WTO	World Trade Organisation
ZED	Zero Defect Zero Effect
ISO	International Organisation for Standardisation

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION 10
1.1 INTRODUCTION 10
1.2 RESEARCH QUESTION: 10
1.3 RATIONALE AND SIGNIFICANCE OF THE STUDY: 10
1.4 SCOPE AND DELIMITATION: 10
1.5 CITATION STYLE: 11
1.6 LITERATURE REVIEW 11
1.7 CONTRIBUTION TO THE LITERATURE: 12
1.8 RESEARCH OBJECTIVES: 12
1.9 HYPOTHESIS 12
1.10 RESEARCH METHODOLOGY 13
1.10.1 LEGAL RESEARCH METHODS: 13
1.10.2 SOURCES OF DATA: 13
1.11 STRUCTURE OF THE DISSERTATION 13
CHAPTER 2: CIRCULAR ECONOMY: THE CONCEPT AND ITS DIMENSIONS 14
2.1 INTRODUCTION 14
2.2 DEFINITIONS OF CIRCULAR ECONOMY 17
2.3 KEY PRINCIPLES OF A CIRCULAR ECONOMY 18
2.3.1 STAGES IN THE BIOLOGICAL CYCLE 19
2.3.2 STAGES OF TECHNICAL CYCLE 20
2.4 DIFFERENCE BETWEEN LINEAR ECONOMY AND CIRCULAR ECONOMY 22
2.5 3R to 9R strategy 26
2.5.1 FOUNDATIONS OF THE 9R STRATEGY 26
2.5.2 KALUNDBORG SYMBIOSIS AND 9R STRATEGY 29
2.5.3 ECONOMIC AND ENVIRONMENTAL SYNERGY 30
2.5.4 CHALLENGES IN IMPLEMENTING THE 9R STRATEGY. 30
2.6 THE KAMIKATSU STORY 30
2.7 THE SIGNIFICANCE OF THE CIRCULAR ECONOMY IN 21ST-CENTURY LEGAL FRAMEWORKS 32
2.8 CONCLUSION 34
CHAPTER 3: INTERNATIONAL LEGAL FRAMEWORK PERTAINING TO CIRCULAR ECONOMY 35

3.1 INTRODUCTION....35
3.2 LEGAL AND POLICY FRAMEWORK AS BACKBONE....35
3.2.1 REGULATORY INSTRUMENTS....36
3.2.2 ECONOMIC INSTRUMENTS....36
3.2.3 INFORMATION BACKED INSTRUMENTS....36
3.3 NEED FOR MULTILEVEL GOVERNANCE....37
3.4 INTERNATIONAL LEGAL AND POLICY FRAMEWORK....37
3.4.1 UN SUSTAINABLE DEVELOPMENT GOALS AND THEIR CONNECTION TO CIRCULAR ECONOMY....37
3.4.2 PARIS CLIMATE AGREEMENT AND CIRCULAR ECONOMY....43
3.4.3 WTO GOVERNMENT PROCUREMENT AGREEMENT....47
3.4.4 BASEL CONVENTION....49
3.4.5 THE UNITED NATIONS ENVIRONMENT PROGRAMME AND THE CIRCULAR ECONOMY....52
3.5 REGIONAL LEGAL FRAMEWORKS....55
3.5.1 EU CIRCULAR ECONOMY ACTION PLAN....55
3.5.2 WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT AND CIRCULAR ECONOMY....59
3.5.3 RIGHT TO REPAIR: EMPOWERING CONSUMERS AND PROMOTING SUSTAINABILITY....61
3.5.4 EXTENDED PRODUCER RESPONSIBILITY....63
3.6 NATIONAL LEGAL FRAMEWORKS....65
3.6.1 GERMANY'S CLOSED SUBSTANCE CYCLE ACT....65
3.6.2 CHINESE LEGISLATION ON CIRCULAR ECONOMY....67
3.6.3 BRAZIL'S NATIONAL CIRCULAR ECONOMY STRATEGY....69
3.7 CONCLUSION....71
CHAPTER 4: THE INCORPORATION OF CONCEPTS OF CIRCULAR ECONOMY WITHIN THE INDIAN LEGAL FRAMEWORK: AN ANALYSIS....73
4.1 INTRODUCTION....73
4.2 NATIONAL ACTION PLAN ON CLIMATE CHANGE....75
4.3 RIGHT TO REPAIR IN INDIA....78
4.4 EXTENDED PRODUCER RESPONSIBILITY REFLECTED IN INDIAN LEGAL FRAMEWORK....81
4.4.1 E-WASTE MANAGEMENT RULES OF 2016....81
4.4.2 PLASTIC WASTE MANAGEMENT RULES, 2016....82
4.5 NATIONAL RESOURCE EFFICIENCY POLICY OF INDIA....83

4.6 ZERO DEFECT ZERO EFFECT PROGRAMME....85
4.7 CHALLENGES....86
4.8 CONCLUSION....88
CHAPTER 5: CONCLUSION AND RECOMMENDATIONS....90
5.1 ENHANCEMENT OF THE INDIAN LEGAL FRAMEWORK TO BETTER SUPPORT THE ADOPTION OF CIRCULAR ECONOMY PRACTICES THROUGH CLIMATE CHANGE STRATEGIES....90
5.2 ADDRESSING THE BARRIERS TO SCALING UP CIRCULAR ECONOMY PRACTICES IN INDIA'S PRODUCTION PROCESS....91
5.3 POLICY AND LEGAL RECOMMENDATIONS....93
BIBLIOGRAPHY....96

CHAPTER 1: INTRODUCTION

THE ROLE OF CIRCULAR ECONOMY PRINCIPLES IN INDIA'S CLIMATE CHANGE LEGISLATION

1.1 INTRODUCTION

The circular economy is a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting. The circular economy tackles climate change and other global challenges, like biodiversity loss, waste, and pollution, by decoupling economic activity from the consumption of finite resources. This dissertation aims to shed light on the potential of incorporating Circular Economy principles in the legal framework to address Climate change concerns.

1.2 RESEARCH QUESTION:

1. How can India's legal framework be enhanced to better support the adoption of circular economy practices as a strategy for climate change mitigation?
2. What are the barriers to scaling up circular economy practices in India's production process and how can legislation address these challenges?

1.3 RATIONALE AND SIGNIFICANCE OF THE STUDY:

The research is aimed at encouraging the adoption of circular economy as an important principle within the climate legislations of India by providing logical reasons and evidence from various countries who have successfully adopted these principles. This study will provide positive inputs specific to the legal systems to achieve sustainable development.

1.4 SCOPE AND DELIMITATION:

The study focuses on

- Legislative framework of India pertaining to climate change
- Comparative analysis of countries that have incorporated Circular economy principles
- Incorporating the best practices across nations to be incorporated into Indian climate legislations.

1.5 CITATION STYLE:

Bluebook 21st Edition is adhered to in preparing this dissertation.

1.6 LITERATURE REVIEW

i. **Siminică, M., Avram, M., Popescu, L. and Avram,R.L., 2020. The Adoption of National Green Procurement Plans from the Perspective of Circular Economy. Amfiteatru Economic, 22(53), pp. 15-27.**

The impact of climate change influenced by reckless economic activities have put the world into a precarious position. The reorientation of economic activities especially focussed on increased green share of Gross Domestic Product supplemented by public procurement process which is driven by Circular Economy principles was studied by the Author. The illustration on European Union incorporating these principles in their procurement process has influenced many nations to adopt these into their municipal law.

ii. **Ashootosh Mandpe et al., Circular Economy Approach for Sustainable Solid Waste Management: A Developing Economy Perspective, 41 Waste Management & Research 499 - 511 (2023).**

Solid Waste Management is picked up by the author to discuss the potential of economic activities shaped by Circular Economy principles, having the potential to unlock employment opportunities and promote a development that has sustainability at its core. The study focussed on the existing challenges associated with waste management and the innovative solutions available with the incorporation of greener technology.

iii. Hongcheng Shen & Yi Liu, Can Circular Economy Legislation Promote Pollution Reduction? Evidence From Urban Mining Pilot Cities in China, 14 Sustainability 14700 (2022).

The author discusses the concept of urban mining which is finding relevance within the ambit of Circular Economy Promotion Law in place in China. The deep dive into Urban Mining Pilot City program which emphasises on the significance of circular economy principles incorporate scheme have had a significant impact on reduction of pollution in environment degradation triggered by to fore the multiple opportunities that are associated with circular economy when it is incorporated in urban planning.

iv. Brindha Ramasubramanian et al., *Recent Advances in Extended Producer Responsibility Initiatives for Plastic Waste Management in Germany and UK*, 5 Materials Circular Economy. 6 (2023)

The article discusses the potential of Extended Producer Responsibility(EPR) as a game changer in the plastic waste management practices in German and UK. The awareness creation efforts have trickled down into consumers owning up to the waste generator responsibility and the sharing of this responsibility along with producers have altered the plastic waste management industry. The circularity principles have played a role in nudging the consumers and producers to understand the potential benefits of incorporating them.

Various authors have discussed the principles and application of Circular Economy at different parts of the World, however there exists a lacunae when it comes to applying this principle in the Indian scenario. This study aims to address the challenge of how the existing circular economy can be better tailored to suit the urgent challenge of climate change and the associated economic gain in Indian perspective.

1.7 CONTRIBUTION TO THE LITERATURE:

This dissertation work will focus on the potential of circular economy as an important mitigating factor in climate change and ensure that the legal framework encourages the adoption of circular economy principles with special emphasis on a bottom-up approach.

1.8 RESEARCH OBJECTIVES:

To analyse existing Indian legal and policy frameworks related to climate change and circular economy.

To identify key barriers and opportunities for integrating circular economy principles into India's climate laws.

To propose legal reforms or new mechanisms that could incentivize the adoption of circular economy models to achieve climate goals.

To assess how circular economy principles from other countries can be better adopted to India's climate targets, both domestically and internationally.

1.9 HYPOTHESIS

“India’s existing climate legislation inadequately integrates circular economy principles, limiting the potential for these practices to significantly contribute to climate change mitigation; a more robust legal framework that explicitly incorporates circular economy models can enhance the country’s ability to meet its climate goals,”

1.10 RESEARCH METHODOLOGY

1.10.1 LEGAL RESEARCH METHODS:

Research will employ doctrinal research methods, comparative analysis and analysis of various case laws and statutes to understand the legal framework concerning climate legislations and potential of incorporating Circular economy into it.

1.10.2 SOURCES OF DATA:

Both primary and secondary sources of information will be relied upon. As primary sources, legislative enactments, judicial pronouncements, international agreements, etc., will be analysed. Apart from these, various secondary sources, such as books, journal articles, news reports, guidelines, online databases, etc., will be used for the research.

1.11 STRUCTURE OF THE DISSERTATION

The work is divided into following chapters:-

Chapter 1: Introduction- provides a brief outline of the research methodology and questions to which answers are sought.

Chapter 2: Circular concept and its dimensions: Delving into the existing literature on Circular Economy and its multiple perspectives.

Chapter 3: International Legal Framework pertaining to circular Economy– A detailed study of the legal framework pertaining to Climate change in India

Chapter 4: The incorporation of concepts of circular economy within the Indian legal framework – exploring the Indian climate legislations for elements of Circular Economic concepts

Chapter 5: Conclusion and Recommendations: Summarising findings, presenting conclusions, and suggesting future research or legal reforms.

CHAPTER 2: CIRCULAR ECONOMY: THE CONCEPT AND ITS DIMENSIONS

2.1 INTRODUCTION

The traditional economic model is often described as the linear economic model, which starts with 'take-make-dispose' referring to the sourcing of resources from nature, encompassing a value addition element with the aid of anthropogenic elements; use involves the utilisation of the particular product for its life span and at the end of its utility, disposing of it.[1]

This model has been in vogue for many years primarily due to the convenience and cheaper costs associated with such an economic model. However, the waste generated from the conventional economic model often proved detrimental to the environment and the health of human beings. This paves the way for the discourse on Circular economy.

Circular economy as a concept has been widely discussed in the last phase of the 20th century.[2] Circular economy traces back its origin to the work of Kenneth Boulding, namely an important treatise called 'The Economics of the Coming Spaceship Earth'.[3] In this work, Boulding discusses the journey of a spaceship pursuing a long journey. The fuel for this journey may be derived from an extrinsic element like Solar energy.[4] The spacemen's survival depends upon the resources stored in the vessel, which may be depleted with the passage of time.[5] To counter the limited resources challenge, recycling of materials, including water and the means to generate their own food within the spaceship must be discovered.[6]

Such a spaceship may be considered as an analogy for Earth and the discussions initiated by Boulding was to highlight the significance of identifying Earth as a closed

[1] Milan Novović & Paun Lučanovi, Circular Economy: A New Business Model of Sustainability in Rural Tourism (Int'l Sci. Agri-Bus. Conf. "Agro Mak" 2025 171,172 (Dragan Cvetkovic ed.)
[2] Walter R. Stahel, *The Circular Economy*, 531 Nature 435 (2016),(10th April 2025) https://www.nature.com/news/the-circular-economy-1.19594.
[3] Kenneth E. Boulding, *The Economics of the Coming Spaceship Earth*, in *Environmental Quality in a Growing Economy* 3, 8 (H. Jarrett ed., Johns Hopkins Univ. Press 1966).
[4] id at 9
[5] id at 9
[6] id at 10

economic system where the economy and environment should be ideally linked by a circular relationship unlike the often cited linear interlinkage.[7]

Further tracing the evolution of the Circular economy, the idea of Regenerative Design was discussed by John T. Lyle.[8] While working as a professor, Lyle gave a challenge to his students to bring out ideas for a society that centred around the daily activities being limited to renewable resources and focusing more on the value of living within such limits and consequently not endangering the environment.[9] Thus emerged the concept of regenerative design wherein all systems, ranging from agricultural production could be schematised in a regenerative way. This can be witnessed in all its glory in the Centre for Regenerative Studies, named after John T. Lyle, portraying how regenerative principles can be applied to create sustainable communities aimed at preserving the delicate ecological equilibrium.[10]

Walter Stahel, primarily an architect and industrial analyst, had brought out the concept of Performance Economy. This was discussed in his research report prepared along with Genevieve Reday submitted to the European Commission.[11] Stahel discussed the future of the economy in loops and the related impact it will have on the aspects of employment opportunities, competition in market, optimum utilisation of resources and minimising waste. Stahel discusses the idea of 'functional service economy' which emphasises on sale of service rather than sale of goods, which forms the core idea of Performance economy.[12] The important principles of Performance economy are Product's life extension, long-life goods, reconditioning activities and waste prevention.[13]

Michael Braungart, a German Chemist, along with an American architect Bill McDonough, materialised the idea of Cradle to Cradle.[14] Today, it also serves as a

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[7]David W. Pearce & R. Kerry Turner, *Economics of Natural Resources and the Environment* 37 (JHU Press 1990).

[8] Anna Francesca Macesar, *The History of Regeneration and Regenerative Sustainability*, THE SUSTAINABLE AGENCY (Apr. 26, 2023), https://thesustainableagency.com/blog/the-history-of-regeneration-and-regenerative-sustainability/

[9] Cal. State Polytechnic Univ., Pomona, History, Lyle Ctr. for Regenerative Studies, https://www.cpp.edu/env/lyle/about/history.shtml (last visited Apr. 18, 2025)

[10] id

[11] Cradle to Cradle, Product-Life Institute, http://www.product-life.org/en/cradle-to-cradle (last visited Apr. 15, 2025).

12 Walter R. Stahel, The Performance Economy 2 (2d ed. 2010).

13 Id. at 86

14 William McDonough, Cradle to Cradle, MCDONOUGH INNOVATION, https://mcdonough.com/cradle-to-cradle/ (last visited Apr. 20, 2025)

certification process.[15] At the core of this philosophy, is the idea that all the materials linked to industrial or commercial processes are considered as nutrients which may be further categorised into technical and biological. Taking a cue from the biological metabolism, which has attributes of safety and productive processes, the Cradle-to-Cradle design emulates this to conceptualise the 'technical metabolism'.[16] Much like how organic material returns back to the environment, the techno nutrients comprising synthetic materials should ideally be recycled infinitely and reused. The second important component of Cradle to Cradle lies in the use of clean and renewable energy thus focusing on carbon neutrality, while the last focus relies on the celebration of diversity which aims to encourage utilisation of locally available materials and indigenous knowledge.

Industrial Ecology refers to the study of the material and flow of energy through the production process.[17] Roland Clift, a professor at the Centre for Environmental Strategy at University of Surrey heads the discourse on Industrial Ecology.[18] The creation of closed-loop systems wherein waste serves as a vital input which can be materialised by the targeting link between operators within the system.[19] This model incorporates a multi-disciplinary approach aimed at designing a system with local constraints at the forefront while not losing sight of the larger impact such designs have at the global level.

Janine Benyus, an American science writer and innovator has championed the cause of Biomimicry. Biomimicry takes inspiration from and mimics the processes adopted by living organisms to address the challenges that they face.[20] Taking a leaf out of this problem solving, Biomimicry prods human beings to look at nature to solve the problems faced by individuals and communities.[21] In the process of translating the plans of nature into design, Biomimicry proposes three essential elements to be kept in mind.

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15 Cradle to Cradle Certified®, The Standard, https://c2ccertified.org/the-standard (last visited Apr. 20, 2025).

16 W.K. Chong & Christopher Hermreck, *Understanding Transportation Energy and Technical Metabolism of Construction Waste Recycling*, 54 Res., Conservation & Recycling 579 (2010).

17 Graedel, T. E. & R. J. Lifset, Industrial Ecology's First Decade, in Taking Stock of Industrial Ecology 6 (Roland Clift & Angela Druckman eds., 2016).

18 Subhas K. Sikdar, *An E-Conversation with Prof. Roland Clift*, 16 CLEAN TECHN ENVIRON POLICY 3 (2014), http://link.springer.com/10.1007/s10098-013-0702-7 (last visited Apr 20, 2025).

19 Supra n 14 at 35

20 The Biomimicry Institute, What is Biomimicry?, https://biomimicry.org/inspiration/what-is-biomimicry/ (last visited Apr. 20, 2025).

21 Id. at https://biomimicry.org/inspiration/what-is-biomimicry/ (last visited Apr. 20, 2025).

Emulation – The careful exercise of learning from the forms and processes which are widely seen in nature to guide anthropogenic designs and regenerative solutions.[22]
Ethical framework – Reflects a responsibility to conserve and take adequate care of the resource and the associated processes from which human beings learn from.[23]
(Re)connection – recognition of the fact that humans and intertwined with nature and that anthropogenic actions have an impact on the environment and other interconnected systems.[24]

2.2 DEFINITIONS OF CIRCULAR ECONOMY

According to the Ellen MacArthur Foundation, Circular economy refers to the modern economy, which is restoration-oriented by intentional design.[25] Such a system focuses on enabling flux of material, energy, labour and information so as to rebuild natural and social capital.[26] The pursuit of such actions can significantly reduce the per unit utilisation of energy for the generation of unit output and give a fillip to quicker adoption of renewable energy with the underlying rationale that everything in an economy constitutes a valuable resource
The European Commission defines the circular economy as a model of creation and consumption which is supplemented by sharing, leasing, reusing, repairing, refurbishing and recycling the once-used materials and goods as long as possible.[27]The European Commission conceptualised the Circular economy with longevity and value retention of materials.
The OECD (Organisation for Economic Co-operation and Development) defines Circular economy as an economic strategy which is focussed on annihilating waste and sustained use of resource by closing material loops attained through long lasting design followed by maintenance, repair, reuse, remanufacturing, refurbishing and recycling.[28]

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[22] Id. at https://biomimicry.org/inspiration/what-is-biomimicry/ (last visited Apr. 20, 2025).
[23] Id. at https://biomimicry.org/inspiration/what-is-biomimicry/ (last visited Apr. 20, 2025).

[24] Supra note. 20 at https://biomimicry.org/inspiration/what-is-biomimicry/ (last visited Apr. 20, 2025).
[25] Ellen MacArthur Foundation, *Towards the Circular Economy Vol. 1: Economic and Business Rationale for an Accelerated Transition* 7 (2013)
[26] Supra n 24
[27] European Commission, *Circular Economy Action Plan: For a Cleaner and More Competitive Europe* 4 (2020), https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0001.02/DOC_1&format=PDF.
[28] OECD, THE CIRCULAR ECONOMY IN CITIES AND REGIONS: SYNTHESIS REPORT (2020), https://www.oecd.org/en/publications/the-circular-economy-in-cities-and-regions_10ac6ae4-en.html (last visited Apr 20, 2025).

According to scholar Walter R Stahel, the Circular economy proposes to replace the idea of 'end of life' with suitable restoration with cleaner energy being derived from renewable sources that will result in the production of superior design of materials, products, systems and economic models.[29]

According to the Waste and Resource Action Plan, a Circular economy is an alternative model to the outdated linear economy so to keep resources in utility for as long as possible with the aim to derive the maximum value from these resources, recover and regenerate products and materials till the end of their life.[30]

2.3 KEY PRINCIPLES OF A CIRCULAR ECONOMY

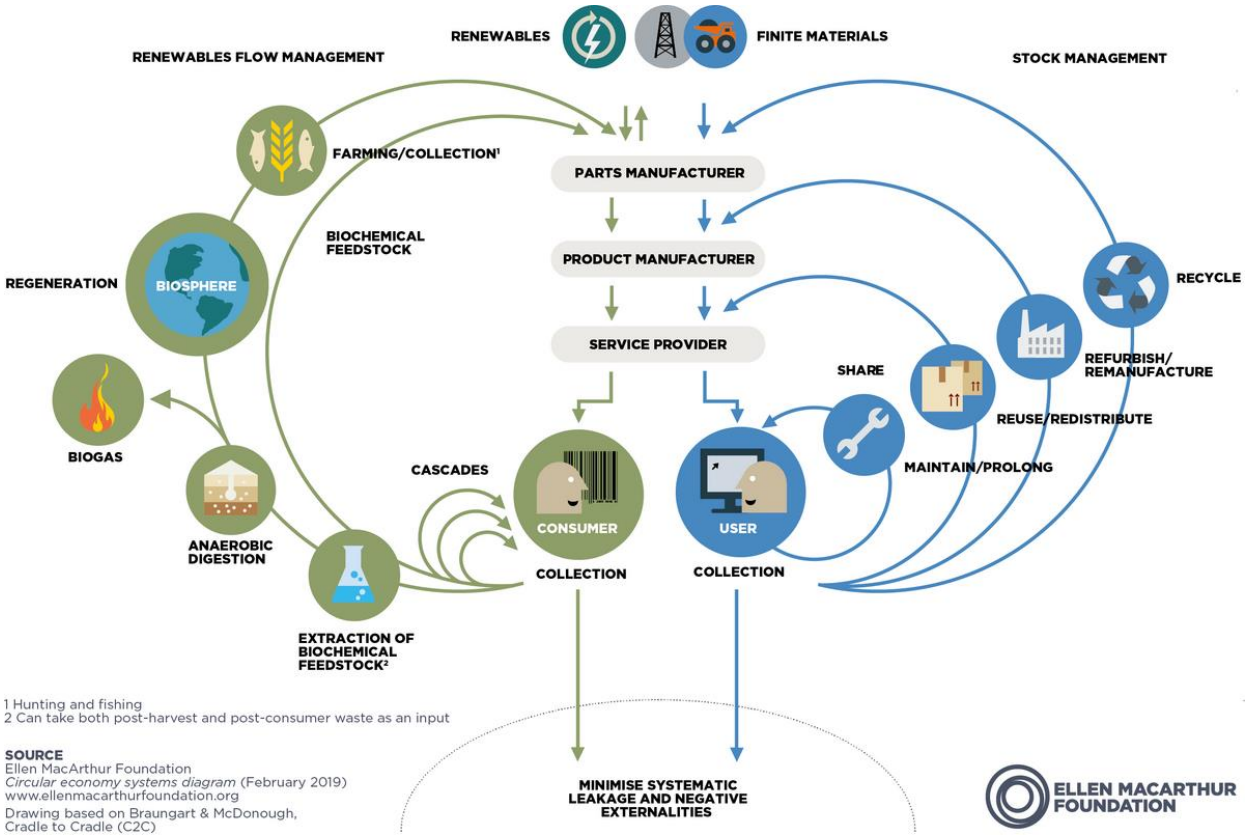

Fig 1. Schematic of Circular Economy[31]

[29] Walter R. Stahel, The Circular Economy, 531 Nature 435 (2016), https://www.nature.com/news/the-circular-economy-1.19594.
[30] WRAP, Circular Economy, https://www.wrap.ngo/taking-action/climate-change/circular-economy (last visited Apr. 20, 2025).
[31] Ellen MacArthur Foundation, Circular Economy System Diagram, https://www.ellenmacarthurfoundation.org/circular-economy-diagram (last visited Apr. 20, 2025).

The butterfly figure diagram provides an overview of the circular economy which comprises two important cycles namely the Biological cycle and the Technical cycle.[32]

2.3.1 STAGES IN THE BIOLOGICAL CYCLE

REGENERATION

The biological cycle represented in the left side of the above 'butterfly diagram' has Regeneration at its Core. This cycle is more concerned with the returning of nutrients to the soil, thus promoting the recovery of natural systems.[33] Unlike the linear model of economic activities, where the depletion of natural resources happens at an alarming rate, the circular model restores and improves nature. Incorporation of farming and food systems that give back organic materials to soil eventually arrest the harm inflicted and enhance the environmental health[34].

FARMING

Farmers can adopt innovative mechanisms like regenerative agriculture, agroecology, agroforestry, restorative aquaculture, and conservation agriculture to reach the regenerative outcomes. Restoration of degraded ecosystems, increased farm resilience and a fillip to biodiversity are promoted by the adoption of such sustainable farming practices.[35]

COMPOSTING

Post harvest and consumption, organic waste nutrients can be recovered and returned to the soil through the process of anaerobic digestion or composting. This process involves the use of microorganisms and oxygen to break down organic matter, producing compost that enriches the soil and reduces reliance on synthetic fertilizers. Anaerobic digestion, which occurs in the absence of oxygen, generates biogas which can be utilised as a renewable source of energy and the digestate, can be used as manure. Together, these processes close the nutrient loop, enhancing soil health and renewable energy generation, and form an integral part of the circular economy.[36]

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[32] Id.

[33] Ellen MacArthur Foundation, The biological cycle of the butterfly diagram (May 23, 2022), https://www.ellenmacarthurfoundation.org/articles/the-biological-cycle-of-the-butterfly-diagram (last visited Apr. 10, 2025).

[34] Ellen MacArthur Foundation, The biological cycle of the butterfly diagram (May 23, 2022), https://www.ellenmacarthurfoundation.org/articles/the-biological-cycle-of-the-butterfly-diagram (last visited Apr. 10, 2025).

[35] Id.

[36] Compost and Circular Economy, https://ic-ce.com/article-compost-and-circular-economy/ (last visited Apr. 20, 2025).

CASCADING

Cascading use of Materials is another important function of the biological cycle which can be illustrated by the use of food by-products being transformed into new material including textile from orange peels. Once a material cannot be further reused, they are shifted to the outer loops of the biological cycle and given back to the soil. [37]

2.3.2 STAGES OF TECHNICAL CYCLE

The right hand side of the diagram elaborates on the technical cycle of a circular economy which is characterised by products undergoing a series of value-retaining strategies referred to as 'loops'.[38] These loops are arranged from inner to outer layers.[39] The inner loops are reflective of the most efficient retention of a product's embedded value, thus as long as the product stays nearer to its original form, more is the value that is preserved.[40] The outer loops pertaining to processes such as manufacturing and recycling involve breaking down products, which results in a loss of embedded value. While recycling is an important facet of this process, it is considered as a last resort, as it reduces the products to raw materials, sacrificing the energy and craftsmanship already invested in it.[41]

Various aspects of the Technical Cycle are as follows.

1. Sharing

It involves the maximisation of product use without attributing significance to the need of ownership. Share access can vastly improve the life span of certain entities while reducing the cost and the detrimental impact on the environment.[42] Platforms like tool libraries, car sharing by aggregators, or homestay service providers like Airbnb are prominent examples of this concept.

2. Maintaining

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[37] Borregaard, Circular Economy and Cascading Use of Biomass, https://www.borregaard.com/sustainability/planet/circular-economy-and-cascading-use-of-biomass (last visited Apr. 20, 2025).
[38] The Technical Cycle of the Butterfly Diagram, Ellen MacArthur Foundation, https://www.ellenmacarthurfoundation.org/articles/the-technical-cycle-of-the-butterfly-diagram (last visited Apr. 20, 2025).
[39] The Technical Cycle of the Butterfly Diagram, Ellen MacArthur Foundation, https://www.ellenmacarthurfoundation.org/articles/the-technical-cycle-of-the-butterfly-diagram (last visited Apr. 20, 2025).
[40] Id.
[41] Id
[42] The Circular Economy Basics Series – The Technical Cycle, Circular Innovation Lab, https://www.circularinnovationlab.com/post/the-circular-economy-basics-series-the-technical-cycle (last visited Apr. 20, 2025).

Proper care and maintenance of a product can improve the lifespan of a product and ensures that the product remains functional and safe.[43] A periodic car service or cleaning of filters in an Air conditioner, maintenance can reduce premature wastage and sustain the utility of the product over time.

3. Reusing

A product may be kept in its original form and intended purpose by promoting reuse of the product. It includes second-hand markets, particularly in the fashion and packaging sectors.[44] The surge of reusable packaging solutions and resale platforms are indicators of nudge towards sustainability by reducing the need for production from scratch.

4. Redistributing

Redistribution involves reorienting the excess or unused goods to fresh users or markets.[45] The sale of unsold stock by retailers across markets spread over a vast geography, food delivery applications redirecting surplus meals to those requiring it, and in the process avoiding waste and retaining product utility are illustrations of the same.

5. Refurbishing

Refurbishment is considered a subset of the Right to Repair movement which champions the cause for design standards that enable the consumers to fix their own products and thus promoting durability and longevity of products.[46] Refurbishment essentially brings the product to a better utility stage by repairing and updating. The predominant application of refurbished products are observed in the technology domain with discounted rates applied to refurbished products across E-commerce platforms.[47]

6. Remanufacturing

Remanufacturing entails disassembling and overhauling the product to a mint condition. Unlike refurbishment, remanufacturing is more complex and often

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[43] Mirka Kans, Maintenance – a Crucial Factor for Achieving Circularity, Maintworld, https://www.maintworld.com/HSE/Maintenance-a-crucial-factor-for-achieving-circularity (last visited Apr. 20, 2025).

[44] Zicheng Zhu et al., *Packaging Design for the Circular Economy: A Systematic Review*, 32 SUSTAINABLE PRODUCTION AND CONSUMPTION 817 (2022), https://linkinghub.elsevier.com/retrieve/pii/S235255092200152X (last visited Apr 20, 2025).

[45] Supra n 38

[46] Right to repair: Making repair easier and more appealing to consumers, European Parliament News, https://www.europarl.europa.eu/news/en/press-room/20240419IPR20590/right-to-repair-making-repair-easier-and-more-appealing-to-consumers (last visited Apr. 20, 2025)

[47] Supra n 38

necessitates need for specialised equipment and skilled personnel, but it ensures that valuable components re-enter the economy.[48]

7. Recycling

Often considered as the ultimate stage where the product can no longer be used, repaired or remanufactured.[49] Recycling converts products into raw materials which may be utilised to create new items. The trade off associated with recycling is the embedded value which is lost while preserving the material value of the product.[50] Thus recycling is more suited for single-use products or when other loops are no longer viable.[51]

Design for Multiple Loops

The effective implementation of a circular system involves the design of products which support multiple loops. Multiple loops refer to the incorporation of attributes like durability, repairability, modularity, and ultimately recyclable items.[52] A product which has undergone sound design might support a circular economic system through sharing, periodic maintenance, reusage, and if needed, remanufactured or recycled thus keeping the wastage to a minimum and at the same time providing for maximal value extraction.

2.4 DIFFERENCE BETWEEN LINEAR ECONOMY AND CIRCULAR ECONOMY

The "take-make-dispose" model is the characteristic of a linear economy, where resources are extracted, used to manufacture products, and then discarded as waste, with little regard for environmental consequences or resource depletion.[53] The long-term adoption of this approach since the Industrial Revolution, had fuelled economic growth but it slowly resulted in significant environmental degradation, including pollution, biodiversity loss, and the depletion of natural resources.[54]

The linear economic model is characterised by products being designed for a short lifespan, with overemphasis on profit and mass consumption over durability or

[48] Remanufacturing, SCIENCEDIRECT, https://www.sciencedirect.com/topics/engineering/remanufacturing (last visited Apr. 20, 2025).
[49] Ragossnig & Schneider, Circular economy, recycling and end-of-waste, 37 WASTE MANAG. & RES. 109 (2019)
[50] Supra n 38
[51] Id.
[52] Supra n 38
[53] What is the Linear Economy, Ellen MacArthur Foundation, https://www.ellenmacarthurfoundation.org/what-is-the-linear-economy (last visited Apr. 19, 2025).
[54] E. Sakthivelmurugan, G. Senthilkumar & K.N. Karthick, *Analysis of the Impact of Circular Economy over Linear Economy in the Paper Processing Industry*, 66 MATERIALS TODAY: PROCEEDINGS 1446 (2022), https://linkinghub.elsevier.com/retrieve/pii/S2214785322037683 (last visited Apr 19, 2025).

repairability. The discussions over 'Planned obsolescence' were widely debated, especially in industries like electronics and fast fashion, where products are deliberately produced to be replaced within short intervals, thus generating more waste and driving continuous demand for virgin materials.[55]

The environmental impact of the linear economy is far-reaching. The rampant resource extraction for linear production is one of the major culprits of global biodiversity loss and greenhouse gas emissions. The dependence on Landfills have led to overflow of non-biodegradable waste, and incineration techniques release harmful pollutants, further accelerating climate change and degradation of ecosystems.[56]

The Circular Economy is structured around the fundamental idea of designing out waste and pollution, ensuring products and materials are in use for as long as possible, and regeneration of natural systems. The emphasis is on continuous cycles of reuse, repair, remanufacturing, and recycling, rather than the single-use trajectory of linear systems. In the Circular economy, products are designed keeping in mind the objectives of longevity, modularity, and ease of disassembly, allowing for repairs, upgrades, and eventual recycling of components. The shift in Business models from selling products outright to offering services as seen in leasing or the concept of product-as-a-service and consequently incentivising companies to create durable, high-quality goods and maintain their commitment for the lifecycle of the product.[57]

The Resource management itself is fundamentally different between the two systems. While the linear economy relies heavily on the extraction of pristine raw materials, the Circular Economy seeks to minimize this dependence by maximizing the reuse of existing materials and treating waste as a valuable resource. The reduced pressure on natural ecosystems and the minimal footprint of economic activity on the overall environment is the major advantage.

Waste management is another area where the two models diverge sharply. The linear economy ultimately result in waste as the inevitable endpoint and reliance on landfilling or incineration is required.[58] The circular economy, however, views waste as a design

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[55] GreenMatch, Environmental Impact of a Circular Economy: Statistics, Trends , https://www.greenmatch.co.uk/environmental-impact-of-a-circular-economy (last visited Apr. 19, 2025).

[56] Purbashree Sarmah et al., *Leaching Behavior of Inert Waste Landfills*, 182 WASTE MANAGEMENT 32 (2024), https://linkinghub.elsevier.com/retrieve/pii/S0956053X24002022 (last visited Apr 19, 2025).

[57] Ion Ionaşcu & Mihaela Ionaşcu, *Business Models for Circular Economy and Sustainable Development: The Case of Lease Transactions*, 20 Amfiteatru Econ. 48, 356 (2018).

[58] Supra n 15.

flaw and aims to eliminate it by creating closed-loop systems involving the cycling back of materials continuously into production, thereby reducing the need for new resource extraction and minimizing environmental harm.[59]

The linear model is built on the assumption of infinite resources and continuous consumption, which is increasingly unsustainable as resource scarcity and environmental limits become more apparent.[60] The circular economy, on the other hand, decouples economic growth from resource use by promoting efficiency, innovation, and the regeneration of natural capital, leading to more resilient and adaptable economic systems.[61]

Innovation in linear systems has traditionally aimed at optimising the extraction and manufacturing efficiency rather than sustainability, this is achieved through planned obsolescence where the products are designed with predetermined lifespans to drive perpetual consumption. Consequently, this approach leads to a vicious cycle of resource exploitation, with usage of global resources projected to double by 2060.[62],

The circular economy on the other hand restructures the whole production and consumption framework through closed-loop systems that gives primacy to longevity, reuse, and regeneration. By designing products keeping in mind disassembly, repair, and recycling, circular models extend material utility and minimise waste. Moreover the EU led studies point to the potential of adoption of the Circular economy creating nearly 700,000 jobs and boosting the GDP by 0.5% by 2030.[63]

Policy frameworks are increasingly supporting the shift to circularity. Governments and international organizations are implementing regulations that encourage eco-design, extended producer responsibility, and the development of secondary material markets.[64] These measures aim to create a level playing field for circular business models and accelerate the transition away from the unsustainable practices of the linear economy.

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[59] Kai Bethke & Stephan Sicars, *Circular Economy: A Question of Design* (Feb. 21, 2021), UNIDO, https://www.unido.org/stories/circular-economy-question-design (last visited Apr. 19, 2025).
[60] Julian Kirchherr et al., Conceptualizing the Circular Economy (Revisited): An Analysis of 221 Definitions, 194 Resources, Conservation and Recycling 107001 (2023), https://linkinghub.elsevier.com/retrieve/pii/S0921344923001374 (last visited Apr 19, 2025).
[61] Id.
[62] OECD, GLOBAL MATERIAL RESOURCES OUTLOOK TO 2060: ECONOMIC DRIVERS AND ENVIRONMENTAL CONSEQUENCES (2019), https://www.oecd.org/en/publications/global-material-resources-outlook-to-2060_9789264307452-en.html (last visited Apr 20, 2025).
[63] European Commission, Questions and Answers: Digital Services Act, EUR. COMM'N PRESS CORNER, https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_419 (last visited Apr. 20, 2025).
[64] Id.

The consumer behaviour associated with linear economy points to the prevalence of a passive consumption wherein consumers act as mere purchasers who discard the products after use and thus encouraging a throwaway culture.[65] The convenience-driven design aimed at short term use provides for no incentive to the producer to think about repair or reuse and thus disposal is the default option since the linear economic model works on the underlying principle of ease rather than sustainability. Waste management is compartmentalised and the consumer thinks of this process as a responsibility of other stakeholders.

In the case of Circular economy the apt terminology would be prosumers rather than consumers since this stakeholder is consciously selecting durable, repairable products and they make a deliberate decision to perform recycling or resale.[66] The responsible consumption from the part of the prosumer focuses on the extension of product life through repair, refurbishment which may be materialised through economic models involving leasing or take-back programs.[67] The cultural value driving this behaviour is rooted in collaborative value and choices that are value driven.[68] Such actions require teamwork among multiple stakeholders including business, government and consumers to normalise using goods which are reused and keeping resource efficiency at the heart of such decisions. The sustainability driven production process strives for transparency along with eco-friendly design targeting waste reduction.

Ultimately, the difference between the circular and linear economies is not just a matter of technical design or resource management, but a fundamental reimagining of humanity's relationship with the environment. The circular model recognises the limits of the planet and seeks to harmonise economic activity with ecological sustainability, offering a pathway to long-term prosperity that does not come at the expense of future generations.

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[65] Frank Figge et al., *Does the Circular Economy Fuel the Throwaway Society? The Role of Opportunity Costs for Products That Lose Value over Time*, 368 JOURNAL OF CLEANER PRODUCTION 133207 (2022), https://linkinghub.elsevier.com/retrieve/pii/S0959652622027949 (last visited Apr 20, 2025).

[66] Uygar Özesmi, The Prosumer Economy: Being Like a Forest, Radical Ecological Democracy (2019), https://radicalecologicaldemocracy.org/the-prosumer-economy-being

[67] Circular Economy Guide, RTS, https://www.rts.com/resources/guides/circular-economy/ (last visited Apr. 20, 2025).

[68] Christophe Beaurain, Chedrak Chembessi & Juste Rajaonson, *Investigating the Cultural Dimension of Circular Economy: A Pragmatist Perspective*, 417 JOURNAL OF CLEANER PRODUCTION 138012 (2023), https://linkinghub.elsevier.com/retrieve/pii/S0959652623021704 (last visited Apr 20, 2025).

2.5 3R to 9R strategy

At the core of the circular economic framework lies the 9 R strategies which is a structured model acting as a guideline for business enterprises, policy drafters, consumers which if adhered to will lead to sustainable development.

Initially the concept of Reduce- Reuse-Recycle which was commonly referred to as 3R was in vogue. Conceived in the 1970s it originated as a simple solution to address the waste management concerns.[69] The 3R framework suffered from serious challenges due to its limited strategies which did not address systemic inefficiencies in design of products, consumption trends, recovery of used materials.[70]

By the turn of 2010, Jacqueline Cramer improved upon the 3R model and enhanced it to the 9R framework incorporating strategies aimed at covering the lifespan of a product, from design phase to consumption phase.[71] This shift in focus from reactive waste management to being a champion of proactive resources in tune with the Circular Economy Action Plan and national strategies proved to be a game changer.

2.5.1 FOUNDATIONS OF THE 9R STRATEGY

The 9R strategy emerged as an improvement of earlier waste management models, such as the "3R" principle to address the modern-day challenges associated with resource management. This strategy provides a calculated approach to retain the value of materials across their lifecycle, giving focus to prevention, innovation, and recovery.[72]

The strategy is organised into three levels:[73]

Intelligent Product Use and Production (R0–R2): targeting on reducing the resource extraction and waste generation at the stage of design.

Product Lifecycle Extension (R3–R7): objective is to stretch the usability of products through repair, refurbishment, and repurposing.

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[69] What are the 3Rs? Reduce, Reuse, Recycle, GWP Group, https://www.gwp.co.uk/guides/what-are-the-3rs/ (last visited Apr. 20, 2025).

[70] L S Ng et al, *Constraints to 3R Construction Waste Reduction among Contractors in Penang*, 140 IOP CONF. SER.: EARTH ENVIRON. SCI. 012103 (2018), https://iopscience.iop.org/article/10.1088/1755-1315/140/1/012103 (last visited Apr 20, 2025).

[71] J. Cramer ,How Network Governance powers the Circular Economy: Ten Guiding Principles for building a Circular Economy, Based on Dutch Experience, 27 (2020).

[72] Circularise, R-Strategies for a Circular Economy, Circularise Blog (2024), https://www.circularise.com/blogs/r-strategies-for-a-circular-economy (last visited Apr. 20, 2025)

[73] Sfridoo, Quali sono i pilastri dell'economia circolare?, Sfridoo Blog (2024), https://www.sfridoo.com/en/blog/quali-sono-i-pilastri-delleconomia-circolare/ (last visited Apr. 20, 2025).

Material Recovery (R8–R9): The materials recovered are reintegrated into production cycles or converted into energy.

The 9 R Strategies in the Circular Economy can be further analysed as follows.

R0: Refuse

The basic idea over here involves the rejection of excess and environmentally detrimental products. By adhering to the principle of refusing to produce or utilise such non-essential goods, individuals and economic enterprises can bring down the demand for virgin materials which are limited in availability.[74]

An illustration for this can be considered from the corporate apparel maker Patagonia which put out a "Don't buy this Jacket" advertisement to discourage overconsumption by promoting durable goods over fast fashion.[75]

R1: Rethink

Rethink promotes the redesigning with emphasis on enhanced durability, modularity and recyclability as the ground rules.[76] Fairphone is an example of modular smartphone which has been developed with the aforementioned principles in mind while designing.[77] The replacement of each component being made available to the consumer has had a positive impact on the cases of full disposal of the device.

R2: Reduce

The reduction in the usage of material and energy as prerequisites for the manufacturing process has significantly reduced the environmental footprint.[78] Tesla's Gigafactories incorporated energy-efficient strategies to optimize the resource use in the production of batteries for electric vehicles.[79]

R3: Reuse

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[74] R-Strategies for a Circular Economy, Circularise Blog (2024), https://www.circularise.com/blogs/r-strategies-for-a-circular-economy (last visited Apr. 20, 2025).

[75] Patagonia, Don't Buy This Jacket, Black Friday and the New York Times, Patagonia Stories, https://www.patagonia.com/stories/dont-buy-this-jacket-black-friday-and-the-new-york-times/story-18615.html (last visited Apr. 20, 2025).

[76] Supra n 74

[77] Fairphone, Long-Lasting Design, Fairphone, https://www.fairphone.com/en/impact/long-lasting-design/ (last visited Apr. 20, 2025).

[78] Tom Hunger, et al, *Circular Value Chain Blind Spot – A Scoping Review of the 9R Framework in Consumption*, 440 JOURNAL OF CLEANER PRODUCTION (2024), https://linkinghub.elsevier.com/retrieve/pii/S0959652624003007 (last visited Apr 20, 2025).

[79] Tesla Mag, Tesla Gigafactories: Pioneering the Future of Sustainable Manufacturing, Tesla Mag (2024), https://www.tesla-mag.com/en/tesla-gigafactories-pioneering-the-future-of-sustainable-manufacturing/ (last visited Apr. 20, 2025).

The conscious decision of extending product life through reuse can prevent wastage. For instance a second hand clothing platform by the name of ThredUp, has been successful in diverting a considerable amount of garments from ending in landfills annually by encouraging their resale.[80]

R4: Repair

Repairing of damaged goods can restore the functionality of a product and subsequently extend the life of the product. iFixit provides an illustration of this concept, wherein they provide repair guides and kits, empowering consumers to fix electronic equipment independently.[81]

R5: Refurbish

Refurbishment involves the enhancement of parts or restoring back the products to a better and usable state. Apple's certified refurbished program provides a trust on the consumer on the extended lifespan of devices by replacing damaged components.[82]

R6: Remanufacture

Remanufacturing involves the disassembly of used products and parts to create new products. Caterpillar's Reman program salvages 85% of returned machinery parts, reducing reliance on raw materials.[83]

R7: Repurpose

Repurposing provides new functions to the often-discarded materials and the rebirth of such products can help reduce the unwarranted exploitation of the environment. Terracycle embarked on the ambitious project of repurposing plastic waste into park benches and playground equipment, thus saving large quantities of plastic from being dumped into landfills.[84]

R8: Recycle

[80] thredUP, Our Environmental Impact, thredUP, https://www.thredup.com/cleanout/impact (last visited Apr. 20, 2025).
[81] iFixit, Gold Standard of Repair, iFixit, https://www.ifixit.com/repairability/gold-standard (last visited Apr. 20, 2025).
[82] Apple, Apple Certified Refurbished Products, https://store.apple.com/Catalog/irl/Images/apple_certified.html (last visited Apr. 20, 2025).
[83] Cat, Sustainability – Cat® Reman, https://www.cat.com/en_IN/products/new/parts/reman/sustainability.html (last visited Apr. 20, 2025).
[84] TerraCycle, Recycled Products, TerraCycle, https://www.terracycle.com/en-NZ/pages/recycled-products (last visited Apr. 20, 2025).

Recycling is often associated with the process of recovery of materials for reprocessing the recovered materials. Alcoa's closed-loop aluminium recycling system saves 95% of the energy required for primary production.[85]

R9: Recover

The recovery of energy from waste that cannot be recycled mitigates landfill use. As the saying goes "one man's waste is another man's treasure", Sweden has materialised this intro reality with their waste-to-energy incinerators supplying heat to 1.2 million households annually.[86]

2.5.2 KALUNDBORG SYMBIOSIS AND 9R STRATEGY

The Kalundborg Symbiosis held in Denmark, exemplifies the 9R strategy in action. Since 1972 this initiative had been promoting the concept of Circularity in the production process.[87] The mission undertaken by Kalundborg symbiosis is to promote Industrial symbiosis wherein the by-products from one industry are routed as be the input for another.[88]

Systemic Rethink and Collaboration

The symbiosis materialised organically through Rethink-oriented partnerships across firms, where by-products became valuable assets. The illustration of how yeast residues arising from pharmaceutical production are reused as feed for animals, while the sludge from a fish farm transform into fertilizer are positive instances emerging out of this symbiosis.[89] The positive outcome of collaboration has triggered annual savings of 635,000 tons of CO_2, 3.6 million m^3 of water, and cost of €24 million by way of operational costs.[90]

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[85] Aluminum Association, Recycling, https://www.aluminum.org/Recycling (last visited Apr. 20, 2025).
[86] Blue Ocean Strategy, Turning Waste to Energy: Sweden's Recycling Revolution, Blue Ocean Strategy Blog, https://www.blueoceanstrategy.com/blog/turning-waste-energy-sweden-recycling-revolution/ (last visited Apr. 20, 2025).
[87] Kalundborg Symbiosis, 50 Years of Circular Production, https://www.symbiosis.dk/en/50-years-of-circular-production/ (last visited Apr. 20, 2025).
[88] Kalundborg Symbiosis, Strategy, https://www.symbiosis.dk/en/strategi/ (last visited Apr. 25, 2025).
[89] Kalundborg Symbiosis, D6.1: Kalundborg-Symbiosis: Successful case and role in ValueWaste 14 (2019), https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/37085554/80fb8989-69e5-4e3a-9b8e-a648a9027b7c/Attachment_0.pdf (last visited Apr. 20, 2025).
[90] JinHyo Joseph Yun et al., *Theme Issue: Open Innovation and 'Catch-up': Globalist or Localist?*, 31 EUROPEAN PLANNING STUDIES 845 (2023), https://www.tandfonline.com/doi/full/10.1080/09654313.2022.2146942 (last visited Apr 21, 2025).

2.5.3 ECONOMIC AND ENVIRONMENTAL SYNERGY

Kalundborg's success is due to its alignment of economic incentives with environmental goals.[91] By refuting linear waste models and remanufacturing materials, this network was able to demonstrate how industrial ecosystems can strive towards achieving circularity. The symbiosis also highlights the role of policy and innovation in promoting the robust 9R strategy, and in the process offering a blueprint for global sustainability efforts.[92]

2.5.4 CHALLENGES IN IMPLEMENTING THE 9R STRATEGY.

The application of 9R strategies in manufacturing processes face certain barriers like Economic Barriers which may be due to the high capital costs associated with the revamping of the infrastructure for circular processes.

From a Consumer perspective the reluctance to prioritise sustainability over convenience can hamper the programs promoting repair or reuse.

Extended producer responsibility is a policy framework that puts the onus for a product on the producer. The producer is responsible for the product's entire lifespan.[93] The rationale for such a responsibility is that it helps achieve environmental goals including targets of recycling along with fund generation from producers to aid the collection ,sorting and recycling of waste products and providing detailed information on its method of treatment.[94] However the regulatory framework often overlooks this responsibility and it can lead to inconsistencies in adhering to the 9R framework.

2.6 THE KAMIKATSU STORY

Kamikatsu, is a small town in the Shikoku Island of Japan, which boasts of achieving the status of first municipality to declare a zero-waste policy in 2003.[95] The nudge for such an ambitious goal was the concerns over pollution and unsustainable waste

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[91] Industrial Symbiosis and Wastewater: Exploring the Success of Kalundborg Eco-Industrial Park, Medium (Apr. 21, 2025, 12:35 AM IST), https://medium.com/mark-and-focus/industrial-symbiosis-and-wastewater-exploring-the-success-of-kalundborg-eco-industrial-park-631329cf86df.

[92] Id.

[93] Organisation for Economic Co-operation and Development, Extended Producer Responsibility and Economic Instruments, OECD, https://www.oecd.org/en/topics/sub-issues/extended-producer-responsibility-and-economic-instruments.html (last visited Apr. 21, 2025).

[94] Id.

[95] Justin McCurry, 'No-waste' Japanese village is a peek into carbon-neutral future, THE GUARDIAN (Mar. 20, 2020), https://www.theguardian.com/world/2020/mar/20/no-waste-japanese-village-is-a-peek-into-carbon-neutral-future

management, which prompted the authorities to phase out incinerators and incorporate strict waste separation and recycling procedures.[96]

The Kamikatsu town was able to achieve this status due to the following initiatives.

Extensive Waste Sorting practice by the residents who separate waste into 45 categories at the town's Zero Waste Centre, and in the course overtook the national average for recycling.[97]

No Kerbside Collection pushed the locals to bring their sorted waste to the centralised collection centre themselves, creating a personal responsibility and encouraging community participation.[98]

Composting was also encouraged which led to composting of organic waste generated at home, which was supported by subsidies for composting equipment.[99]

Reuse Initiatives including the "Kurukuru Shop" which allows residents to exchange used items for free, thus promoting concepts of reuse and reducing total waste.[100]

Business Engagement by roping in entrepreneurs and local economic tie ups have led to a zero-waste accreditation system that encourages them to adopt sustainable practices.[101]

The Kamikatsu's model achieved fruitful results due to its community centered approach supplemented by a strict waste separation practice, thus making it a global model for sustainable waste management and circular economy practices.

The 10R strategy provides a robust roadmap for transitioning to a circular economy, balancing ecological preservation with economic growth. By integrating these principles, stakeholders can decouple resource use from environmental degradation, fostering resilience and innovation.

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[96] Id.

[97] Introducing Japan's First Zero-Waste Town, ATMOS, https://atmos.earth/introducing-japans-first-zero-waste-town/ (last visited Apr. 21, 2025).

[98] Id.

[99] The Art of Zero-Waste Living in Japan, A SUSTAINABLE CLOSET, https://www.asustainablecloset.com/home/the-art-of-zero-waste-living-in-japan (last visited Apr. 21, 2025).

[100] Simon Denyer & Julia Mio Inuma, Postcards from Kamikatsu, Japan's 'zero-waste' town, WASH. POST (Apr. 27, 2022), https://www.washingtonpost.com/climate-solutions/interactive/2022/japan-zero-carbon-village-climate/.

[101] CAG, Small town, big impact: Japan's Kamikatsu zero-waste journey, (Apr. 21, 2025), https://www.cag.org.in/blogs/small-town-big-impact-japans-kamikatsu-zero-waste-journey.

2.7 THE SIGNIFICANCE OF THE CIRCULAR ECONOMY IN 21ST-CENTURY LEGAL FRAMEWORKS

The emergence of the Circular Economy as a transformative economic and legal instrument has been vouched for by the adoption of elements of this concept by various stakeholders, which was further accelerated due to the climate change challenges. Circular Economy principles are restructuring environmental law, corporate governance, and international trade systems.

The incorporation of Circular economy principles acts as a boost to reduce the greenhouse gas emissions primarily by reducing the material demand hence bringing down the demand for natural resources and the pollution associated with manufacturing processes associated with transforming such materials. The emphasis on durability, modularity and recyclability has promoted a shift towards a sustainable economic model which helps to bring down the rise in global temperatures to less than 1.5° Celsius.[102]

Circular Economy also acts as a conduit to support the Clean Energy Transitions which are rooted in waste management and recycling of critical materials used in batteries and fuel cells.[103] The effective incorporation of circular economy principles in the supply chain complemented by scientific handling of decommissioned clean energy equipment can go a long way in reducing the requirement for new extraction processes and aid in the transition to cleaner energy sources.

Resource Efficiency and Conservation is another important consequence of adoption of circular economy principles. The reduced dependence on landfill and to address population requires out of the box thinking and improved efficiency as discussed in the example of the Kamikatsu town of Japan.[104]

Regeneration of Nature and improving carbon sequestration is another important area where the circular economy can play an important role. The composting of organic

[102] 1.5°C: what it means and why it matters, UNITED NATIONS, https://www.un.org/en/climatechange/science/climate-issues/degrees-matter (last visited Apr. 21, 2025).
[103] Ellen MacArthur Foundation, A Circular Economy for Batteries to Underpin Renewable Energy Growth, (Apr. 21, 2025), https://www.ellenmacarthurfoundation.org/articles/a-circular-economy-for-batteries-to-underpin-renewable-energy-growth.
[104] Supra n 93 at https://www.oecd.org/en/topics/sub-issues/extended-producer-responsibility-and-economic-instruments.html

waste, regenerative farming practices, restoring soil health, sequestering carbon through technique dry cast concrete can support climate adaptation and resilience.[105]

The economic potential and social cost associated with circular economy as discussed earlier in the context of European Union provides a vista of opportunities for the emerging and developing economies to emulate this model which can have a multiplier effect on the economic growth as well as the employment opportunities brought in by the adoption of principles of circular economy.[106]

The incorporation of circular economy principles can aid the achievement of Sustainable Development Goals (SDGs). The circular economy principles can contribute to attaining at least 12 of the 17 SDGs, with particularly strong linkages to SDG 12 pertaining to Responsible Consumption and Production and SDG 13 related to Climate Action.[107] The adoption of a circular economy is estimated to bring down the greenhouse gas emissions by 39% by 2032 which can be achieved through efficient material utilisation in high impact sectors including construction, food industry, and plastic.[108]

The adoption of closed-loop water systems in textile manufacturing can reduce freshwater extraction drastically while recycling dye contaminants and thereby focus on SDG 6 connected to clean water. [109] The remanufacturing industries are major game changer in the effective utilisation of discarded products which can help to achieve SDG 8 which focusses on Decent work and Economic growth.[110]

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[105] Kelsea Schumacher et al ., *Fostering a Circular Economy and Carbon Sequestration for Construction Materials Workshop Report: A Focus on Concrete*, NIST SP 1500 (2023), https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1500-21.pdf (last visited Apr 21, 2025).

[106] Supra n 62 at https://www.oecd.org/en/publications/global-material-resources-outlook-to-2060_9789264307452-en.html (last visited Apr 20, 2025).

[107] Cris Garcia-Saravia Ortiz-de-Montellano et al, *How Can the Circular Economy Support the Advancement of the Sustainable Development Goals (SDGs)? A Comprehensive Analysis*, 40 SUSTAINABLE PRODUCTION AND CONSUMPTION 352 (2023), https://linkinghub.elsevier.com/retrieve/pii/S2352550923001598 (last visited Apr 21, 2025).

[108] Circular economy strategies can cut global emissions by 39%, CIRCLE ECONOMY (Jan. 26, 2021), https://www.circle-economy.com/news/circular-economy-strategies-can-cut-global-emissions-by-39 (last visited Apr. 21, 2025).

[109] Maria L. Catarino, et al, *Sustainable Wet Processing Technologies for the Textile Industry: A Comprehensive Review*, 17 SUSTAINABILITY 3041 (2025), https://www.mdpi.com/2071-1050/17/7/3041 (last visited Apr 21, 2025).

[110] Hasith Gunasekara et al, *Remanufacture for Sustainability: Barriers and Solutions to Promote Automotive Remanufacturing*, 43 PROCEDIA MANUFACTURING 606 (2020), https://linkinghub.elsevier.com/retrieve/pii/S2351978920307265 (last visited Apr 21, 2025).

2.8 CONCLUSION

The Circular Economy goes well beyond the recycling initiative and aims at a comprehensive and dynamic framework that questions the existing consumption patterns and consequently reshapes the value creation process and is sustained. Rooted in the fundamentals such as waste elimination, product longevity, regenerative design, renewable energy use, and systems-level innovation, the concept of circular economy offers a feasible roadmap toward sustainable development. The continuous improvement through constant research and policy refinement further enhances the adaptability and utility of the circular economy as the building block for a greener economic model. The circular economy framework is not limited to an environmental model**,** but it can act as a socio-economic transformative tool that works toward resilient, inclusive societies that stay relevant in this era of flux.

While the Circular Economy concept adoption brings with it a range of advantages, the wholesale adoption of a circular economy needs more than local entrepreneurship or business initiatives or business sustainability strategies. It needs solid legal and institutional designs at the national, regional, and international levels to propel and maintain this systemic transition. The law and policy establish the role of secondary raw material markets, eco-design rules, public procurement regulations, and extended producer responsibility, which are all powerful levers in helping to drive the transition. As we have seen the history of development, principles, and applications to industry of the circular economy, the following chapter will explore global legal frameworks enabling circular economy principles, examining multilateral environmental agreements, regional approaches like the European Union's Circular Economy Action Plan, and domestic legislation legislated in industrialized and developing nations. It will investigate how such legal tools overlap or diverge in encouraging circularity, the setbacks of harmonization across legal jurisdictions, and the power of collective policy intervention to drive a global circular economy. Familiarity with the following legal steps in the coming years is needed so that the circular economy can expand beyond visionary imagination to be legally binding and widely adopted sustainable development paradigm.

CHAPTER 3: INTERNATIONAL LEGAL FRAMEWORK PERTAINING TO CIRCULAR ECONOMY

3.1 INTRODUCTION

The metamorphosis from a linear "take-make-dispose" model to circular economic model is reflective of a core transition of how societies optimize utilisation of resources, design products and manage waste. Such a transition need not materialise organically, solely led by the market forces. A meaningful transition and adoption of circular economic principles requires a robust legal and policy framework that involves a participatory approach involving stakeholders from different tiers of the government and the governed.

3.2 LEGAL AND POLICY FRAMEWORK AS BACKBONE

A comprehensive legal framework supplemented by a strategic policy for advancing circular economic transitions should provide for an ecosystem which has infrastructural support, incentives and regulations to orient economic activities to a circular path. The absence of systematically planned interventions, businesses and end users may be reluctant to let go of deep-rooted linear practices that prove costly in environmental terms.[111]

The challenges faced during the implementation of circular economy through the means of law and policy include uncertain boundaries and scale, simplistic visualisation of goals, inertia to change associated with the status quo and latent elements including unintended consequences. A robust policy framework should accommodate these challenges which can be done through putting out clear definitions, goal setting with holistic outlook and incorporating the justice dimensions.

Regulatory frameworks provide a necessary "command and control signals" to mould the market with when these regulations are well designed and executed meticulously.[112] The generation of an ecosystem that enables circular businesses to thrive by providing a level playing field with regulatory certainty and addressing the environmental

[111] Katrien Steenmans & Feja Lesniewska, *Limitations of the Circular Economy Concept in Law and Policy*, 4 FRONT. SUSTAIN. 1154059 (2023), https://www.frontiersin.org/articles/10.3389/frsus.2023.1154059/full (last visited Apr 26, 2025).

[112] INTOSAI Working Group on Environmental Auditing, Market Based Instruments for Environmental Protection and Management 17 (2016), available at https://www.environmental-auditing.org/media/5370/wgea-instrument-protection-and-management_isbn-ok.pdf.(last visited Apr 26,2025)

challenges that market machinery fails to capture can enhance the shift from linear to circular models.[113]

Governments across the world employ a wide range of policy mechanisms to effect a change in the market as discussed below.

3.2.1 REGULATORY INSTRUMENTS

The involvement of Government in establishing mandatory regulatory requirements restructure market activities.[114] Extended Producer Responsibility (EPR) frameworks are illustrative of this exercise. EPR as a policy approach raises revenue streams and provides financial encouragement for the collection and recovery of material after the consumer stage of product lifecycle.[115] The onus is placed on the producer in implementing EPR mechanism failing which penal measures may be attracted.

3.2.2 ECONOMIC INSTRUMENTS

The nudges of the government may be oriented towards the adoption of certain practices by the market and the application of resource taxation which adds to the cost of virgin raw materials due to added layer of tax encourages the market players to look for better technology to extract useful resources from waste rather than exploit fresh resources.[116] Or the incentive to corporates that create products that has attributes of longevity, repairability and reuse enshrined in them can boost the adoption of such economic activities by more players.

3.2.3 INFORMATION BACKED INSTRUMENTS

Information asymmetry is often a major hindrance to the better adoption of technology or applications.[117] The enhanced consumer awareness championed by public policy

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[113] Oscar Rodríguez-Espíndola et al., *The Role of Circular Economy Principles and Sustainable-Oriented Innovation to Enhance Social, Economic and Environmental Performance: Evidence from Mexican SMEs*, 248 International Journal of Production Economics 108495, 5 (2022),

[114] OECD, OECD REGULATORY POLICY OUTLOOK 2021 (2021), https://www.oecd.org/en/publications/oecd-regulatory-policy-outlook-2021_38b0fdb1-en.html (last visited Apr 26, 2025).

[115] Organisation for Economic Co-operation and Development, *Extended Producer Responsibility: A Guidance Document for Policymakers* 5 (2024), https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/extended-producer-responsibility_4274765d/67587b0b-en.pdf.(last visited Apr 26, 2025)

[116] Mark Egan, An Analysis of Richard H. Thaler and Cass R. Sunstein's Nudge: Improving Decisions about Health, Wealth and Happiness 3 (2017).

[117] Qingyang Wu et al., *Empowering Local Governments: How Environmental Fiscal Federalism Affects Greenhouse Gas Emissions in China?*, 376 JOURNAL OF ENVIRONMENTAL MANAGEMENT 3 (2025), https://linkinghub.elsevier.com/retrieve/pii/S0301479725004256 (last visited Apr 26, 2025).

aided by other stakeholders can drastically improve the adoption of such practices by the consumers and encourage informed decision making from the part of the consumer.

3.3 NEED FOR MULTILEVEL GOVERNANCE

The effective implementation of the circular economy warrants coordination across governance levels, ranging from international bodies to the grassroots level municipalities, contributing specific capabilities and visions to form a coherent whole. The further analysis will span across the international bodies, supra-national bodies, National initiatives as various stakeholders putting across valuable policies and principles which can be emulated to better achieve Circular economy.

3.4 INTERNATIONAL LEGAL AND POLICY FRAMEWORK

The evolution of the Circular Economy from a theoretical economic model to an important pillar of global discourse on sustainability governance. At the International scale, Circular economic principles are being incorporated into sustainable development guidelines which aims to strike an even balance between economic growth and environmental challenges. The incorporation of circular economic principles into the international framework can be seen as discussed ahead.

3.4.1 UN SUSTAINABLE DEVELOPMENT GOALS AND THEIR CONNECTION TO CIRCULAR ECONOMY

United Nations Sustainable Development Goals (SDGs) aim to provide an integrated plan of action toward the eradication of interrelated social, economic, and environmental problems by the year 2030. The concept of the circular economy has especially become renowned for the potential it possesses in solving multiple SDGs at once, since it revolutionises production and consumption structures fundamentally.[118] Essentially, the circular economy tries to redefine economic activity to avoid waste and pollution, retain products and materials in use, and maximise natural systems ideas, whose direct applicability is for most SDG targets, while having realistic channels of implementation.

[118] Patrick Schröder & Jack Barrie, *How the Circular Economy Can Revive the Sustainable Development Goals: Priorities for Immediate Global Action, and a Policy Blueprint for the Transition to 2050*, Chatham House 9 (Sept. 2024).

SUSTAINABLE DEVELOPMENT GOAL 12

SDG 12, guaranteeing sustainable consumption and production patterns, is the most straightforward and broadest link with circular economy thinking.[119] Targets for SDG 12 form a resource efficiency scheme that can be addressed directly through circular measures. Target 12.2 requires sustainable utilisation and management of resources, and this is made possible by circular economy interventions through product design for durability, recyclability, and reuse; product use maximisation business models; and closed material loops that minimise the extraction of primary resources.[120] Studies conducted by the International Resource Panel indicate that circular economy interventions will cut global resource utilisation significantly and enable economic growth, demonstrating that absolute decoupling of economic growth and resource usage is achievable.[121]

Food systems are also among the principal areas wherein circular economy strategies promote SDG accomplishment, specifically Target 12.3, by reducing by half global per capita food waste in retail and consumer levels and food loss during production and supply chains.[122] Circular concepts in the sector involve prevention of food loss via improved inventory management and consumer education, valorisation of unavoidable food loss via biorefining activities, and nutrient recycling from organic waste for land rehabilitation. The Ellen MacArthur Foundation's Cities and Circular Economy for Food initiative has shown that redesigning urban food systems around the principles of circular can tackle food waste and cut back on nutrition while replenishing natural systems.[123]

Circular strategies find relevance in the larger issue of chemical pollution handled by Target 12.4, which is to control chemicals and wastes in their entire life cycle in an environmentally sustainable manner. Circular economy policies advance this target

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[119] United Nations, Goal 12: Ensure Sustainable Consumption and Production Patterns, UN Sustainable Development Goals, https://www.un.org/sustainabledevelopment/sustainable-consumption-production/ (last visited May 17, 2025

[120] Id at https://www.un.org/sustainabledevelopment/sustainable-consumption-production/ (last visited May 17, 2025

[121] International Resource Panel, *Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future 124* (Edgar Hertwich et al. eds., UNEP 2020).

[122] G.A. Res. 70/1, U.N. GAOR, 70th Sess., Agenda Item 15, U.N. Doc. A/RES/70/1 (Oct. 21, 2015), 22 https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf.

[123] Ellen MacArthur Foundation, Cities and Circular Economy for Food (2019), 13-17 https://ellenmacarthurfoundation.org/cities-and-circular-economy-for-food.

through non-toxic material cycles that abate toxic chemicals, product disassembly design for safely managing waste, and symbiotic industrial networks established to transform waste streams into useful resources. Current Basel Convention modifications regarding plastic waste reflect increasing integration of circular economy principles into world chemical and waste regulation law.[124]

Waste management is also one of the areas where principles of circular economy directly enable the implementation of SDGs. Target 12.5 specifically calls for significantly reducing the generation of waste through prevention, reduction, recycling, and reuse, which is aligned with the principles of the circular economy, focusing on the segregation of waste.[125] Prioritising prevention of waste from the initial design of products, then opportunities to stretch the life of products, and ultimately, material recycling, circular methods adopt the desired sequence of managing waste promoted in this target. The European Union's Circular Economy Action Plan established quantitative objectives of waste reduction as a metric for tracking progress toward Target 12.5, exemplifying how regional policy structures can incorporate global ambitions into meaningful action.[126]

The private sector also has a contribution to make towards developing circular economy strategies that promote the SDGs, notably Target 12.6, which requires businesses to adopt sustainable practices. Circular business models are specific action plans for this target in the form of product-as-service systems with retained producer ownership and responsibility, reverse logistics networks for recovering products, and remanufacturing plants that restore used products to a newer state. Corporate acceptance of circular economy principles has picked up pace in recent years, with more than 200 leading companies supporting the Ellen MacArthur Foundation's New Plastics Economy Global Commitment and setting concrete commitments to introduce circular solutions to managing plastic packaging.[127]

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[124] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Mar. 22, 1989, 1673 U.N.T.S. 57, 8, https://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf.

[125] Supra note 11 at 25 https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf.

[126] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A New Circular Economy Action Plan for a Cleaner and More Competitive Europe, COM (2020) 98 final (Mar. 11, 2020).

[127] Ellen MacArthur Foundation. & U.N. Environment Programme, The Global Commitment 2020 Progress Report 4 (2020).

Public procurement is a strong instrument for driving the transition to the circular economy and promoting Target 12.7 for advancing sustainable public procurement. Procurement methods in the circular economy involve measuring the cost of products on a life cycle basis instead of calculating the costs of acquisition alone, creating performance-based specifications that allow innovative solutions, and demanding design features that allow disassembly and recyclability. The Netherlands has led the way in circular procurement strategies by incorporating circular procurement as a strategy which focusses on the utility of a product at the end of its life and it further embarks on an ambitious journey to work with multiple public authorities to offset 1 megaton of CO2 through this initiative.[128] These actions directly serve the goal while generating market demand for circular goods and services, demonstrating how government purchasing power can systematically address climate change.

SUSTAINABLE DEVELOPMENT GOAL 13

The 13th goal of the SDG demands immediate action to mitigate climate change and its impacts. Moves towards a circular economy have great potential for climate mitigation through various avenues, such as material efficiency measures, minimising industrial emissions, food system transitions, minimising agricultural emissions, and urban planning strategies, minimising transport demands. The application of circular economy activities key material systems including cement, steel, aluminium, plastics, food would avoid 9.3 billion tonnes CO2e of greenhouse gas emissions by 2050, which is equivalent to reducing all transport emissions worldwide.[129] The potential for abatement is in support of Target 13.2, where mainstreaming climate change actions into national plans, policies, and strategies is needed.

Circular economy also facilitates awareness on climate action and capacity-building components of Target 13.3, which involves enhancing education and climate change mitigation awareness. Circular economy education programs enhance systems thinking and lifecycle effects understanding, circular design and business model innovation skills, and climate effects of consumption awareness.

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https://content.ellenmacarthurfoundation.org/m/64e0598fa6fb1d8b/original/The-Global-Commitment-2020-Progress-Report.pdf (last visited on 17 May 2025)

[128] Government of the Netherlands, Accelerating the Transition to a Circular Economy, GOV'T.NL, https://www.government.nl/topics/circular-economy/accelerating-the-transition-to-a-circular-economy (last visited May 17, 2025).

[129] Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change* 8 (2019), https://ellenmacarthurfoundation.org/completing-the-picture (last visited May 17, 2025).

OTHER SUSTAINABLE DEVELOPMENT GOALS

Circular economy strategies support many other 2030 Agenda goals, including Circular water systems, which drive SDG 6 (Clean Water and Sanitation) targets by recycling and reusing water in industry, recovering energy and nutrients from wastewater, and watershed protection through regenerative agriculture. Target 6.3 alone directs improving water quality by decreasing pollution, avoiding dumping and reducing release of harmful chemicals and materials by half and doubling recycling and safe reuse worldwide, which is a clarion call for circular thinking in the water sector.

The move to renewable energy through SDG 7 (Affordable and Clean Energy) is supported by circular strategies through design for renewable energy compatibility of products and systems, energy reuse from non-recyclable materials, and low energy demand through material efficiency.[130] The circular economy has been identified by the International Renewable Energy Agency as one of the enablers of sustainable renewable energy value chains, especially in the context of critical materials required in renewable technologies.[131] This link illustrates how circular strategies can overcome potential resource bottlenecks that otherwise risk constraining clean energy deployment.

The economic aspects of the circular economy complement SDG 8, dealing with Decent Work and Economic Growth, have circular business models as pivotal elements to generate new jobs for repair, remanufacturing, and recycling; enable new service-based business models; and promote local value creation through decentralised production. Based on an International Labour Organisation estimate, the transition to the circular economy can generate a net additional 6 million jobs worldwide by 2030 and demonstrates the job potential of this economic shift.[132]

Industrial innovation anchored in circular economy principles enables SDG 9 pertaining to Industry, Innovation and Infrastructure via the advancement of eco-design strategies for material efficiency, digital tools for sharing and monitoring, and biologically inspired material innovations. SDG 9.4 specifically requests the upgrading and retrofitting of infrastructure to make industry sustainable and to "increase resource-

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[130] Ellen MacArthur Foundation, *Universal Circular Economy Policy Goals: Enabling the Transition to Scale* 7 (2021), https://ellenmacarthurfoundation.org/universal-circular-economy-policy-goals. (last visited May 17, 2025).

[131] Gielen Dolf & Lyons Martina, IRENA, *Critical Materials for the Energy Transition: Rare Earth Elements*. 7 (2022)

[132] International Labour Office, *World Employment and Social Outlook 2018: Greening with Jobs* 52 (2018), https://www.ilo.org/global/publications/WCMS_628654/lang--en/index.htm. (last visited May 17, 2025).

use efficiency and expand the use of clean and environmentally friendly technologies", which aligns with fundamental circular economy principles that reimagine industrial systems.

Urban circular economy responses enable SDG 11 on Sustainable Cities and Communities by adaptive reuse and building and infrastructure adaptation, urban mining capacity building, and constructing efficient mobility systems with reduced urban sprawl. UN-Habitat New Urban Agenda integrates circular economy values as integral strategies for sustainable urbanisation by acknowledging the specific value of circularity in rapid urbanising environments.[133]

Marine conservation actions under SDG 14, dealing with “Life Below Water”, are supported by circular strategies emphasising reduced plastic pollution in the form of packaging leakage into oceans, fishing gear recovery and recycling system design, and implementation of microplastic alternatives for consumer goods.[134] The particular Target 14.1 also seeks to "prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities," which circular economy efforts particularly accomplish by altering product design and material flow to avoid wasting in marine ecosystems.

Land ecosystem conservation under SDG 15 (Life on Land) is promoted by circular regenerative economy practices that improve soil health through composting and nutrient cycling, mitigate land use pressure through resource use efficiency, and adopt sustainable forest utilisation with cascade utilisation of wood products.32 The United Nations Convention to Combat Desertification has integrated elements of the circular economy into its land degradation neutrality approach, acknowledging the possibilities of circular practices in the restoration of degraded land.33

The cross-linkages between the circular economy and other SDGs require coherence in the policies to be implemented. National planning systems that integrate, for instance, with direct linkage of circular economy approaches to SDG implementation; cross-sectoral coordination systems focused on potential trade-offs among the SDG targets in achieving co-maximum benefits; and harmonised measurement systems, monitoring

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[133] G.A. Res. 71/256, Annex, New Urban Agenda 71–77, U.N. GAOR, 71st Sess., U.N. Doc. A/RES/71/256 (Jan. 25, 2017), https://habitat3.org/the-new-urban-agenda/. (last visited May 17, 2025).

[134] United Nations Development Programme, *Combatting Plastic Pollution for Sustainable Development: A Snapshot of UNDP’s Work in 12 Countries* 14 (2024), https://www.undp.org/publications/combatting-plastic-pollution-sustainable-development. (last visited May 17, 2025).

circular economy performance and SDG targets, are some of the approaches that can make this convergence possible. As countries accelerate towards the 2030 Agenda for Sustainable Development, embracing circular economy thinking in SDG planning has the potential to accelerate a number of goals concurrently and encourage policy harmony. It is a systems-approach to sustainable development to address underlying drivers of environmental decline and unlock opportunities for inclusive prosperity.

3.4.2 PARIS CLIMATE AGREEMENT AND CIRCULAR ECONOMY

The Paris Agreement on Climate Change, signed in December 2015 at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), is a watershed moment towards the global promise towards climate change mitigation. The agreement sets out to cap global warming at well below 2°C above pre-industrial levels and make every effort to cap warming at 1.5°C.[135] Instrumental in meeting these challenging targets is the commitment by countries to submit Nationally Determined Contributions (NDCs) setting out their plans for climate change mitigation, reviewed and improved in a five-year cycle of ambition.

The regenerative approach associated with the Circular Economy seeks to address the estimated 45% of global greenhouse gas emissions that arise from material extraction, processing, and production of goods.[136] By reducing the use of resources and associated emissions through value chains, circular economy approaches complement energy-oriented mitigation strategies and offer potential pathways for the realisation of the Paris Agreement goals while avoiding other environmental hazards such as biodiversity loss and depletion of resources.

The Paris Agreement arose out of global climate negotiations within the UNFCCC structure, whereas circular economy thinking developed largely from waste policy, resource productivity, and sustainable production policy. However, the expanding awareness of consumption patterns and emissions from economic activities has revealed the narrowness of climate policy that is production-oriented and triggered more integration of climate and resource governance systems.[137] Integrating the two

[135] Paris Agreement art. 3, Dec. 12, 2015, T.I.A.S. No. 16-1104, https://unfccc.int/sites/default/files/english_paris_agreement.pd (last visited May 17, 2025).
[136] Circle Economy, *The Circularity Gap Report 2021: A Global Circular Economy Roadmap* 38 (2021), https://www.circularity-gap.world/2021. (last visited May 17, 2025).
[137] Intergovernmental Panel on Climate Change, *Summary for Policymakers*, in *Climate Change 2023: Synthesis Report* 24 (Hoesung Lee & José Romero eds., IPCC 2023), https://www.ipcc.ch/report/sixth-assessment-report-synthesis-report/. (last visited May 17, 2025).

systems offers new options for more system-level approaches to environmental sustainability that bind together both the energy and material sides of the climate problem.

Circular economy principles provide especially lucrative sources of climate mitigation potential in high-material sectors such as construction, transport, electronics, and food systems. In the built environment, measures like building lifetime extension, material efficiency, and design for deconstruction can, in theory, curb emissions by as much as 35-40% by 2050.[138] Circular mobility solutions ranging from vehicle lightweighting, shared mobility services, to remanufacturing enable electrification options to tackle embedded emissions in transport equipment and infrastructure.[139] These opportunities in sectors illustrate how circular interventions can tackle emissions sources not explicitly tackled by energy-centred decarbonisation options.

Financing facilities put in place under the Paris Agreement platform can potentially drive circular economy adoption in developing nations. The Green Climate Fund (GCF), established to finance climate action in developing countries, has started seeing circular methods as appropriate for climate finance where there are clear climate emission reduction gains.[140] Article 6 of the Paris Agreement sets up arrangements for cooperation among parties in carbon markets and presents possible avenues for the financing of circular economy initiatives with measurable mitigation impacts.[141] But for such opportunities to be achieved, there must be enhanced accounting, reporting, and verification methodologies for emissions reduction of circular interventions.

Apart from mitigation, circular economy measures are critical to climate adaptation goals articulated in the Paris Agreement. Resource-effective systems that reduce water, mineral, and biomass extractions increase community resilience to climate effects by taking pressure off stressed ecosystems that are exposed to extreme weather conditions.[142] In addition, circular economy design aspects like modularity, reparability,

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[138] Supra note. 10 at 56

[139] UN-Habitat & Urban Electric Mobility Initiative, *The Role of Electric Mobility for Low-Carbon and Sustainable Cities* 4 (2021), https://unhabitat.org/the-role-of-electric-mobility-for-low-carbon-and-sustainable-cities (last visited May 17, 2025).

[140] Green Climate Fund, *GCF: Catalysing Finance for Climate Solutions* 5 (2023), https://www.greenclimate.fund. (last visited May 17, 2025).

[141] ndrei Marcu, *International Cooperation Under Article 6 of the Paris Agreement: Reflections before SB 44* 4 (Int'l Ctr. for Trade & Sustainable Dev. 2016), https://www.ictsd.org. (last visited May 17, 2025).

[142] United Nations Environment Programme, *Adaptation Gap Report 2024: Come Hell and High Water* 31 (2024)

and flexibility increase infrastructure resilience against weather-related hazards. These adaptive advantages are especially useful in susceptible areas where resource limitations intersect with the effects of climate to undermine prospects for sustainable development.

Transition to circular economy systems conforms to the Paris Agreement principle of "common but differentiated responsibilities and respective capabilities," acknowledging varied implementation capacities among nations.[143] Less developed nations can establish circular development paths that skip resource-intensive industrialisation stages while meeting rising material needs. At the same time, developed nations with high levels of consumption have a special role to play in curbing embedded emissions in imported goods by circular mechanisms, minimising material footprints. This differentiated approach acknowledges historical accountability for emissions but provides regionally relevant directions to manage resources sustainably.[144]

The COVID-19 pandemic and the consequent economic stimulus packages have brought challenges along with opportunities to develop climate-circular alignment.[145] Whereas pandemic recovery began focusing on short-term health interventions at the expense of sustainability agendas, recovery programs in the majority of places have embedded green stimulus with circular features.[146] The COVID-19 recovery plan of the European Union is significantly invested in circular economy actions within broader climate commitments, and such recovery programs illustrate that crisis management has the capability to drive the transition toward sustainability transitions if appropriately aligned with long-term environmental agendas.

Information and communication technologies become increasingly vital to facilitate climate-circular synergies within economic production. Internet of Things uses optimised tracking and utilisation of resources throughout product life cycles, as digital

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[143] Supra note. 24 at https://unfccc.int/sites/default/files/english_paris_agreement.pd (last visited May 17, 2025).

[144] Pieter Pauw et al., *Different Perspectives on Differentiated Responsibilities: A State-of-the-Art Review of the Notion of Common but Differentiated Responsibilities in International Negotiations* 21 Discussion Paper 6/2014, https://www.die-gdi.de/en/discussion-paper/article/different-perspectives-on-differentiated-responsibilities/. (last visited May 17, 2025).

[145] Ariana Alva Ferrari et al., "The COVID-19 Pandemic as a Window of Opportunity for More Sustainable and Circular Supply Chains." 7 Cleaner Logistics & Supply Chain (2023)

[146] Organisation for Economic Co-operation and Development, *Building Back Better: A Sustainable, Resilient Recovery after COVID-19* 6 (2020), https://www.oecd.org/coronavirus/policy-responses/building-back-better-a-sustainable-resilient-recovery-after-covid-19-52b869f5/.

platforms enable sharing economy mechanisms with very high utilisation rates of durable products.[147] Blockchain technologies deliver supply chain transparency and certification of environmental properties, eliminating monitoring challenges that have rendered circular approaches incompatible with climate frameworks.[148] These digital enablers, however, need to be designed according to circularity principles in order to keep their own environmental impact as low as possible.

In the next few years, the Global Stocktake process under the Paris Agreement provides a strategic forum for strengthening climate-circular economy interlinkages. This joint report of progress towards overall achievement of the Agreement's objectives, to be delivered by 2023, sets out a basis for tracking not only decarbonisation of the energy sector but also material-related emission reductions.[149] Adding circular economy indicators to this report would greatly increase transparency on consumption-based emissions and could identify where alternatives in terms of resource efficiency can contribute to climate action.[150]

Capacity building and education are the main pillars for executing climate-circular programmes in different sectors of the economy. Shifting to converged sustainability methods needs capabilities in the labour force from technical consciousness to systems thinking to cooperative problem-solving.[151] Training and education organisations at all levels have initiated adding such capacities into learning packages, whereas industry associations and professional associations develop specialist training modules. This shift in skills must address both the reskilling needs in carbon-intensive industries and prepare for new green jobs that incorporate climate and circular economy factors.[152]

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[147] Abderahman Rejeb et al., *The Internet of Things and the Circular Economy: A Systematic Literature Review and Research Agenda*, 350 Journal of Cleaner Production, 3 (2022)

[148] Oliver O. Apeh & Nnamdi I. Nwulu, *Improving Traceability and Sustainability in the Agri-Food Industry through Blockchain Technology: A Bibliometric Approach, Benefits and Challenges*, 17 Energy Nexus 3 (2025)

[149] Supra note 24 at at https://unfccc.int/sites/default/files/english_paris_agreement.pd (last visited May 17, 2025).

[150] Tommaso Calzolari et al., *Circular Economy Indicators for Supply Chains: A Systematic Literature Review*, 13 Env't & Sustainability Indicators , 13 (2022)

[151] Stefan Bringezu et al., *Assessing Global Resource Use: A Systems Approach to Resource Efficiency and Pollution Reduction*, International Resource Panel, U.N. Environment Programme (2017), 10 https://www.resourcepanel.org/sites/default/files/documents/document/media/assessing_global_resource_use_amended_130318.pdf

[152] Olga Strietska-Ilina & Tahmina Mahmud eds., *Skills for a Greener Future: A Global View*, Int'l Lab. Off. 52 (2019), https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_emp/documents/publication/wcms_732214.pdf

As the Paris Agreement is being implemented throughout the world, the circular economy concept continues to gain momentum as a viable model for resource sustainable management and opportunities for enhanced interlinkages between these policies will continue to emerge. The shared goals of decarbonisation and resource efficiency offer various dimensions of sustainability challenges and opportunities towards a common direction of economic systems operating within planetary boundaries.[153]

3.4.3 WTO GOVERNMENT PROCUREMENT AGREEMENT

The Government Procurement Agreement (GPA) of the World Trade Organisation is one of the most robust global instruments that oversee members' government procurement policies. With growing global awareness of the decline in the environment and natural resource shortages, the integration of circular economy values in the agreement becomes a priority. The alignment is not only an environmental virtue but is a critical economic element that influences international trade relations and national buying policy.[154]

The GPA, which came into effect in 1996 and later revised in 2012, had mainly targeted the liberalisation and regulation of government procurement markets. The initial emphasis was on non-discrimination, openness, and procedural justice, the revised agreement witnessed a major shift in focus towards addressing environmental concerns in its policy.[155] Article X:6 enshrined that "technical specifications designed to promote the conservation of natural resources or safeguard the environment" could be properly included in the procurement process.[156] The explicit recognition of a procurement process with due regard to environmental effects beyond slender cost factors champion the cause of circular economy.

The application of circular economy principles has evolved through various mechanisms. Most immediately, the "technical specifications" clause in Article X

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[153] Stockholm Resilience Centre, *Planetary Boundaries*, https://www.stockholmresilience.org/research/planetary-boundaries.html (last visited May 21, 2025).
[154] World Trade Organization, *The Plurilateral Agreement on Government Procurement (GPA)*, https://www.wto.org/english/tratop_e/gproc_e/gp_gpa_e.htm (last visited May 21, 2025).
[155] Robert D. Anderson & Anna Caroline Müller, *The Revised WTO Agreement on Government Procurement (GPA): Key Design Features and Significance for Global Trade and Development*, WTO Staff Working Paper ERSD-2017-04, at 11 (Jan. 2017), https://www.wto.org/english/res_e/reser_e/ersd201704_e.pdf
[156] Agreement on Government Procurement, Mar. 30, 2012, WTO Doc. GPA/113, https://www.wto.org/english/docs_e/legal_e/downloads_e/GPA12_en.pdf. (last visited May 21, 2025).

allows procurement agencies to set requirements for products with certain environmentally beneficial characteristics like recyclability, repairability, durability, or being made with recycled materials.[157] The relaxation expounded by this article excluded mandating products that are made on the principle of circularity without necessarily contravening the agreement's fundamental provision of non-discrimination among prospective suppliers from different member states.

Apart from technical requirements, provisions for award criteria in the new GPA have also presented a chance for integrating circular economy aspects. Article XV:5 allows governments to award contracts on the basis of the "most advantageous" bid, rather than solely on lowest price, and to include environmental benefits as a term.[158] This helps procuring agencies to consider product durability, reuse, and overall lifecycle costs that are beneficial to circular economy values but may not be accounted for in up-front purchase costs.

The GPA's provisions on exceptions further support circular economy integration as can be seen in Article III which provides that nothing in the agreement shall prevent parties from adopting measures "necessary to protect human, animal or plant life or health" or "relating to the conservation of naturally rare resources," as long as the measures are not arbitrary discrimination or a disguised trade restriction.[159]The provisions for accommodating resource conservation and waste avoidance procurement policies reflect the key features of circular economy thinking.

Even with these facilitating provisions, the operational integration of circular economy principles in GPA-compliant procurement is subject to various challenges. The anti-discrimination requirement of the contract entails that any environmental specifications have to be used uniformly across suppliers from various member states, which can prove to be challenging in light of divergence in national circular economy requirements and certification regimes.

To overcome such challenges, most GPA signatories have developed innovative solutions. The European Union, as one of the largest GPA parties, has significantly mainstreamed circular procurement values in its Public Procurement Directives that now openly allow for life-cycle costing practices, functional specifications with a

[157] Supra note. 43 at https://www.wto.org/english/tratop_e/gproc_e/gp_gpa_e.htm (last visited May 21, 2025).
[158] Supra note. 44 at https://www.wto.org/english/res_e/reser_e/ersd201704_e.pdf (last visited May 21, 2025).
[159] Id at https://www.wto.org/english/res_e/reser_e/ersd201704_e.pdf

performance-based system in lieu of the use of certain materials, and pre-commercial procurement practices promoting innovation.[160] Likewise, Japan has enacted Green Procurement legislation focusing on environmentally friendly products while maintaining coherence with its GPA commitments through well-designed specifications.[161]

Incorporating circular economy principles into the WTO Government Procurement Agreement is an essential field to advance international trade regulation. As resource constraints intensify and environmental imperatives become more pressing, this integration offers a pathway to harness the substantial economic power of government procurement toward more sustainable systems of production and consumption. Through careful attention to both the legal requirements of the GPA and the transformative potential of circular economy thinking, procurement officials have increasing opportunities to advance sustainability goals while maintaining the open, fair, and transparent markets that the agreement was designed to encourage.[162]

3.4.4 BASEL CONVENTION

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and the circular economy model are two systems, which although created in isolation, have become increasingly integrated in solving issues of waste management across the world. As the global economies strive to circularise consumption and production, the law that regulates movements of waste across boundary lines is now at the core of enabling circular economy change.

The Basel Convention, which came into force in 1992, was created following challenges surrounding hazardous waste exports of industrial countries to developing countries.[163] It presents an international norm of prior informed consent for

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[160] European Commission, *Public Procurement for a Circular Economy: Good Practice and Guidance*, 6 (Oct. 2017), https://circulareconomy.europa.eu/platform/sites/default/files/knowledge_-_public_procurement_circular_economy_brochure.pdf.

[161] Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities, Act No. 100 of 2000 (Japan), https://www.iea.org/policies/684-law-on-promoting-green-purchasing-law-concerning-the-promotion-of-procurement-of-eco-friendly-goods-and-services-by-the-state-and-other-entities

[162] Steve Charnovitz, *Deploying the WTO Agreement on Government Procurement (GPA) to Promote Sustainable Procurement Practices*, 47 Geo. Wash. Int'l L. Rev. 235, 236 (2015), https://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=2951&context=faculty_publications.

[163] Basel Convention Secretariat, *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal: Protocol on Liability and Compensation – Texts and Annexes*

transboundary movements of hazardous wastes, prohibition of waste flows between parties and non-parties except under compatible arrangements, and prohibition on waste exports to Antarctica.[164] The Basel Convention ultimately aims to prevent the transfer of environmental and human health risks related to hazardous waste from industrial to developing countries, raising ethical concerns of environmental justice that can be addressed by resorting to circular economy concepts.

The most straightforward convergence between the Basel Convention and circular economy practices occurs in the field of secondary material streams.[165] To operate effectively, circular economy policies require materials to remanufacture and recycle not only within but also among national economies so that recycling and remanufacturing industry specialists can be established at a cost-effective.[166] However, the controls provided by the Basel Convention sometimes hinder this sort of recycling when materials are defined by its definitions as hazardous wastes, subjecting their transport to notification and permission procedures with increased cost, time, and complexity to a transaction.[167]

Such conflict emerged especially in the e-waste industry, where rejected equipment holds both harmful content and valuable content that can act as inputs to recycling or remanufacturing. Bans placed on e-waste flows by the Basel Convention, aimed at avoiding inappropriate dumping, sometimes distracted true recovery efforts by placing additional regulatory burden on shipping material to facilities for environmentally sound recycling.[168] A situation like this exemplifies how regulatory mechanisms implemented primarily to solve waste management problems need to be redirected to facilitate circular economy goals.

(Revised in 2023), UNEP/BRS/2023/10 (2023), https://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf.

[164] Secretariat of the Basel Convention, *Overview*, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, https://www.basel.int/theconvention/overview/tabid/1271/default.aspx (last visited May 21, 2025).

[165] Rita Remeikienė et al., *Secondary Raw Materials in the Circular Economy: A Multi-Perspective Study*, at 92 2024.

[166] Tomohiko Sakao et al., *Implementing Circular Economy Activities in Manufacturing for Environmental Sustainability*, 73 CIRP Annals – Manufacturing Technology 462 (2024),

[167] Josh Lepawsky, *The Changing Geography of Global Trade in Electronic Discards: Time to Rethink the E-Waste Problem*, 181 Geographical J. 152 (2015)

[168] Karin Lundgren, *The Global Impact of E-waste: Addressing the Challenge*, Int'l Lab. Off., at 33 (2012), https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_204065.pdf.

Aware of such challenges, the Basel Convention Parties have been increasingly concerned with circular economy ideas in their negotiations. The Convention's 2019 plastic waste amendments are a step in the right direction.[169] By subjecting most plastic waste to the control measures of the Convention, the amendments aim towards lowering plastic pollution while at the same time establishing incentives for the development of domestic recycling capacities and product recyclability, aligning with the core values of the circular economy.[170] Moreover, through the creation of the Partnership for Action on Computing Equipment (PACE) under the Convention, environmentally sound management strategies for computer equipment, such as refurbishment and recycling practices that extend product lifecycles, have now been considered.[171]

The Basel Convention regulatory approach has also evolved in ways that better match legitimate material recovery and recycling procedures. Formulation of technical guidelines to different streams of waste has assisted in elucidating when products should be addressed as "waste" or "non-waste" or "hazardous" or "non-hazardous," bringing greater clarity to circular economy companies.[172] Secondly, the structure of the Convention contains provisions for arrangements or agreements between Parties concerning transboundary movements of hazardous wastes, presenting a possible mechanism for easing movement of materials between countries with identical environmental protection needs.[173]

The European Union's Circular Economy Action Plan openly acknowledges the desire to "facilitate shipments of waste for recycling within the EU" while restricting the export of waste to third countries," demonstrating responsiveness to both circular economy needs and Basel Convention requirements.[174] The pandemic of COVID-19

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[169] Basel Convention Secretariat, *Plastic Waste Amendments Overview*, Basel Convention, https://www.basel.int/implementation/plasticwaste/amendments/overview/tabid/8426/default.aspx (last visited May 21, 2025).

[170] World Customs Organization, *Transition to a Circular Economy and Implications for Customs Administrations*, at 31 (2023), https://www.wcoomd.org/-/media/wco/public/global/pdf/topics/research/report/circular-economy-report-en.pdf.

[171] Basel Convention Secretariat, *Partnership for Action on Computing Equipment (PACE) Overview*, Basel Convention, https://www.basel.int/Implementation/TechnicalAssistance/Partnerships/PACEII/PACE/Overview/tabid/3243/Default.aspx (last visited May 21, 2025).

[172] Secretariat of the Basel Convention, *Technical Guidelines for the Environmentally Sound Management of Waste Lead-Acid Batteries*, Basel Convention Series/SBC No. 2003/9, U.N. Doc. UNEP/CHW.7/8/Add.1 (2003), https://www.basel.int/Portals/4/Basel%20Convention/docs/pub/techguid/tech-wasteacid.pdf.Basel Convention

[173] Supra note. 52 at https://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf.

[174] Supra note. 15 at 14

brought different aspects of this relationship into the limelight, as supply chain disruption highlighted the frailties in international material-based systems.[175] This was an impetus for some proponents of the circular economy to focus on material circulation in more localised systems and alleviating tensions with the Basel Convention prohibition on transboundary movement. But it has also reaffirmed the value of solid global value chains for certain material streams and recognised ongoing demand for cross-border cooperation in terms of waste classification and transit.[176]

The convergence of circular economy targets and the regulatory framework of the Basel Convention is a key aspect of sustainable development management. In a more globalised world geared toward more circular modes of production and consumption, the regulatory order governing material flows across borders will determine the success and equity of such transitions. Through balancing the tensions and capitalising on cooperation among such frameworks, policymakers are best placed to establish systems for resource flow that support strong environmental protection.

3.4.5 THE UNITED NATIONS ENVIRONMENT PROGRAMME AND THE CIRCULAR ECONOMY

The United Nations Environment Programme (UNEP) has become a pioneer organisation in advocating for circular economy values around the world. It was created in 1972 after the Stockholm Conference on the Human Environment, and it is the lead environmental agency of the United Nations system.[177] Created in the first place to tackle pollution control and environmental protection, the mandate of UNEP has expanded hugely to help meet the core sustainability challenges facing linear production and consumption economies. The convergence to circular economy is triggered by an increasing realisation that environmental degradation can no longer be effectively addressed without transforming the root economic systems that drive depletion of resources and generation of waste.[178]

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[175] Supra note. 34 at 2

[176] Sofía Martínez, *Circular Economy: A Catalyst for a Just and Green Transformation*, Green Econ. Coal. 4 (Dec. 2024), https://www.greeneconomycoalition.org/assets/reports/GEC-Reports/2024-Sofia-GEC-circular-economy-just-transition-4-FINAL.pdf.

[177] United Nations Environment Programme, *About Us*, UNEP, https://www.unep.org/who-we-are/about-us (last visited May 21, 2025).

[178] Julian Kirchherr et al., *Conceptualizing the Circular Economy (Revisited): An Analysis of 221 Definitions*, 194 Res., Conservation & Recycling 107001, 6 (2023),

UNEP activity on circular economy policy gained momentum in the wake of the 2012 United Nations Conference on Sustainable Development (Rio+20), which launched the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP) with UNEP as its secretariat.[179] The institutional mandate has supported UNEP's efforts towards enhancing resource efficiency in the economic sectors and laying down principles of sustainable lifecycle management.

UNEP has provided reliable scientific reports proving the necessity and feasibility of circular transitions through its International Resource Panel (IRP), which it founded in 2007. The IRP's review illustrates how manufacturing and material processing account for roughly half of all greenhouse gas emissions and more than 90% of biodiversity loss, highlighting the climate and environmental value of circular strategies.[180] These reports have been supporting economic arguments for circularity as well as revealing structural impediments that stand in the way of implementation across various regional and sectoral backgrounds.

UNEP's circular economy activity exhibits substantial regional diversity, an indicator of the organisation's recognition that implementation strategies must remain responsive to different socioeconomic conditions. In industrialised countries, UNEP activity is directed toward transforming fixed production-consumption patterns by regulatory innovation, green public procurement, and business action.[181] Strategies there tend to be aimed at the high-consumption sectors such as electronics, plastics, and buildings where circular strategies can have large resource efficiency benefits and environmental benefits.

Circular economy initiatives in such settings tend to leverage existing circular economic activities within informal economies and aim to improve environmental performance and working conditions, alongside maintaining jobs. For instance, waste management efforts of UNEP in some African cities have helped waste picker cooperatives and boosted the level of recovery of resources and minimised environmental pollution.[182]

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[179] United Nations Conference on Sustainable Development, *The Future We Want*, U.N. Doc. A/CONF.216/L.1 (June 19, 2012), https://sustainabledevelopment.un.org/futurewewant.html

[180] Supra note.10 at 128

[181] United Nations Environment Programme, *Sustainable Consumption and Production Policies*, UNEP, https://www.unep.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies (last visited May 21, 2025).

[182] United Nations Environment Programme, *Africa's Private Sector Supports Fight Against Plastic Pollution*, UNEP (June 1, 2023), https://www.unep.org/news-and-stories/story/africas-private-sector-supports-fight-against-plastic-pollution.

The Global Partnership on Marine Litter is a case in point of UNEP's problem-led strategy for developing circularity by addressing plastic pollution with interventions at production, consumption, and waste management practices.[183]The success of the partnership shows how the principles of circular economy can be communicated effectively when coupled with certain green issues that resonate with the public and policymakers.

UNEP has also established complete policy frameworks that translate circular economy principles into practical guidance for governments. UNEP's "Circularity Platform" offers a single-stop information hub of policy instruments, business models, financing instruments, and technologies to facilitate circular transitions in different contexts.[184]

Recognising that circular economy change requires collective actions at governance levels and sectors, UNEP has built diverse partnerships to mobilise key actors and enhance implementation capability. Collaborations with bodies such as the Ellen MacArthur Foundation leverage complementary institutional strengths, where the non-state institution is more likely to drive innovation and business engagement, while UNEP provides policy expertise, convening ability, and implementation capacity in varied national contexts.[185] These collaborations are representative of UNEP's catalytic role in global environmental governance, inasmuch as it exercises influence through normative development, knowledge generation, and mobilisation of stakeholders, rather than through regulatory authority.

UNEP's Medium-Term Strategy 2022-2025 brings circular economy values to unprecedented stature in the organisation's strategic design.[186] This organisational focus is an indicator of mounting recognition that circular solutions provide holistic solutions to interlinked environmental issues across climate change, biodiversity loss, pollution, and resource extraction. In framing circular economy as a cross-cutting theme instead

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[183] United Nations Environment Programme, *Global Partnership on Plastic Pollution and Marine Litter*, UNEP, https://www.unep.org/explore-topics/oceans-seas/global-partnership-plastic-pollution-and-marine-litter (last visited May 21, 2025).

[184] United Nations Environment Programme, *Circularity*, UNEP, https://www.unep.org/circularity (last visited May 21, 2025).

[185] United Nations Environment Programme, *UN Environment and Ellen MacArthur Foundation Sign New Agreement*, UNEP (Jan. 26, 2018), https://www.unep.org/news-and-stories/press-release/un-environment-and-ellen-macarthur-foundation-sign-new-agreement.

[186] United Nations Environment Programme, *For People and Planet: The UNEP Strategy for 2022–2025*, at 9, U.N. Doc. UNEP/EA.5/17 (2022), https://wedocs.unep.org/bitstream/handle/20.500.11822/42683/medium_term_strategy_2022.pdf?sequence=1&isAllowed=y

of an independent program area, UNEP recognises circularity's application across various environmental areas and economic sectors.

As the principles of circular economy become increasingly popular in sustainable development platforms, UNEP has both opportunities and challenges to reinforce its catalytic function. Specific strategic priorities are to drive policy coherence between international regimes impacting resource management, build implementation capacity within developing nations, enhance circularity indicators, and tackle social aspects of circular transitions.[187] By pushing these priorities forward, UNEP can assist in ensuring that circular economy strategies achieve their potential of improving environmental sustainability, economic resilience, and social well-being together in various global settings.

3.5 REGIONAL LEGAL FRAMEWORKS

3.5.1 EU CIRCULAR ECONOMY ACTION PLAN

The European Union's Circular Economy Action Plan (CEAP) is among the world's most far-reaching policy platforms for transitioning beyond linear economic practices and toward circular economies that reduce waste and conserve resources. Championed by the EU in March 2020 as part of the European Green Deal, the CEAP is a backbone of the EU's strategy for going climate neutral by 2050.[188] The CEAP policy acknowledges that consumption patterns of materials must be tackled as an integral part of climate change mitigation, considering the estimated 45% of global greenhouse gas emissions resulting from processes of production and land use linked to consumer products and food production.[189] The CEAP strategy to reduce those emissions by applying circularity principles is a significant step forward for climate policy, stretching beyond energy and transport the usual policy domains to the embodied carbon in materials and products.

CEAP's contribution directly to reducing climate change is through lowering emissions associated with the production and processing of materials. By building systems for extended product lives, rising rates of recycling, and greater use of secondary raw materials, the plan seeks to dramatically reduce virgin material extraction and

[187] United Nations Environment Programme, *Resource Efficiency for Sustainable Development: Key Messages for the Group of 20*, at 33 (2018), https://www.resourcepanel.org/reports/resource-efficiency.
[188] Supra note. 15 at 5
[189] Supra note. 18 at https://ellenmacarthurfoundation.org/completing-the-picture

processing often linked with energy-intensive carbon costs.[190] In the case of aluminium production from recycled products, there is around 95% reduction in energy requirements than from bauxite ore and therefore lower greenhouse gas emissions.[191] The CEAP's sectoral plans for electronics, batteries, cars, packaging, plastics, clothing, building, and food specifically target high-carbon embodied materials and place the plan as a bold instrument for emission reduction beyond conventional climate policy sectors.

Apart from materials production, the CEAP supports climate mitigation through waste reduction measures. The strategy imposes the EU Waste Framework Directive and sets stricter recycling targets while setting up measures to reduce landfilling.[192] The strategy further focuses on prevention of food waste which contributes to an even bigger climate footprint as food waste alone generates about 8-10% of all global greenhouse gas emissions.[193]

The CEAP's product policy strategy also leads to other climate effects in creating environmentally design standards that include carbon footprint considerations. The strategy extends the Ecodesign Directive to energy-relevant products and other products, and adds requirements for product durability, reparability, recyclability, and recycled content to improve the life cycle.[194] Facilitating actions such as digital product passports and the Green Claims Initiative further increase product transparency regarding environmental characteristics, including climate footprints which pave way for consumers and institutional purchasers to make more environmentally friendly purchase decisions, establishing market incentives for the procurement of lower-carbon

[190] Julian Kirchherr, Denise Reike & Marko Hekkert, *Conceptualizing the Circular Economy: An Analysis of 114 Definitions*, 127 Res., Conservation & Recycling 226 (2017)
[191] International Aluminium Institute & Organisation of European Aluminium Refiners and Remelters, *Global Aluminium Recycling: A Cornerstone of Sustainable Development*, at 28 (2009), https://www.world-aluminium.org/media/filer_public/2013/01/15/fl0000181.pdf.
[192] European Commission, *Waste Framework Directive*, https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en (last visited May 21, 2025).
[193] Monica Crippa et al., *Food Systems Are Responsible for a Third of Global Anthropogenic GHG Emissions*, 2 Nature Food 198 (2021)
[194] Regulation 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive 2020/1828 and Regulation 2023/1542, and repealing Directive 2009/125/EC, 2024 O.J. (L 1781) 1, https://data.europa.eu/eli/reg/2024/1781/oj.

goods.[195][196] The CEAP's focus on sustainable product policy thus employs market forces in support of climate goals by encouraging producers to reduce embodied carbon. In the building construction industry, responsible for approximately 36% of EU emissions when operational and embodied carbon are taken cumulatively, the CEAP brings notably important climate interventions. The Sustainable Built Environment Strategy covers the whole building life cycle, encouraging circularity concepts in construction and renovation processes leading to the Renovation Wave for better building energy efficiency. Through placement of recovery targets for construction and demolition waste, encouraging carbon assessment of buildings, and exploring possible carbon sequestration through use of bio-based materials, the CEAP provides operations and embodied carbon frameworks for the built environment. This systems-level perspective acknowledges that being climate neutral involves being mindful of all emissions from buildings, not just operational energy usage.[197]

The CEAP implementation has an impact in climate change, supplementing the EU Industrial Strategy by supporting circular industrial conduct. The policy promotes industrial cooperation so that by-products or waste from a particular industry are utilised as inputs for another and consequently minimising the use of material as well as related emissions. Moreover, by promoting the development of lead markets for climate-neutral and circular goods, through public procurement initiatives and sectoral initiatives, the CEAP creates economic incentives for industrial decarbonisation. Such alignment of circularity principles and industrial policy is one of the key developments in climate governance, acknowledging that industrial competitiveness and climate mitigation can be complementary goals if pursued under the prism of a circular economy.[198]

The CEAP's International nature further affects International climate action by addressing the problem of carbon leakage. While EU production gets cleaner and resource-friendly using circular methods, the strategy recognises that environmental effects can only be reallocated outside of the EU by means of trade. To avoid this from

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[195] EU's Digital Product Passport: Advancing Transparency and Sustainability, data.europa.eu (Sept. 27, 2024), https://data.europa.eu/en/news-events/news/eus-digital-product-passport-advancing-transparency-and-sustainability.

[196] European Commission, Green Claims, Environment, https://environment.ec.europa.eu/topics/circular-economy/green-claims_en.

[197] European Commission, *In Focus: Energy Efficiency in Buildings* (Feb. 17, 2020), https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-performance-of-buildings.

[198] Varsha Gopalakrishnan & Bhavik R. Bakshi, *Including Nature in Engineering Decisions for Sustainability*, in 1 Encyclopedia of Sustainable Technologies 109 (Martin A. Abraham ed., 2017)

occurring, the CEAP engages with the EU Carbon Border Adjustment Mechanism and free trade agreement provisions to ensure imported products share the same environmental circumstances, including climatic effects. Resorting to such practices helps in arresting the avoidance of climate objectives by offshoring carbon-intensive production, and potentially encourages trading partners to do away with carbon-intensive technology.[199]

CEAP research and innovation activities strengthen climate mitigation potential by overcoming technology and knowledge barriers to the advancement of the circular economy. The plan allocates Horizon Europe funding to advance low-carbon materials, advance recycling technologies, and create circular product design with innovations that can lower embodied carbon while generating economic value. The skills agenda of the plan also tackles human capital needs for circular economy transition, framing workforce readiness for circularity and climate-supporting jobs. This cross-cutting innovation support acknowledges that innovation in technology and society is necessary in an attempt to realise the complete climate potential of circular economy strategies.[200]

Even though these are reassuring climate contributions, the CEAP has been subject to criticism pertaining to identified limitations to its climate-integration strategy. Other critics propose that the plan must clearly estimate the savings of greenhouse gases due to the circular economy and put in place measures to track these climate effects alongside other environmental actions. Researchers also pointed out the plan's emphasis on growth, which could be at odds with more essential needs, compromising on existing consumption in achieving deep decarbonisation. Both critiques recognise tensions between economic growth targets and absolute environmental limits that remain even in circular economy models, and that further consumption-reducing actions will be needed to achieve climate neutrality.[201]

In the future, the CEAP's climate effects will mainly be influenced by implementation quality throughout EU member states, which exercise considerable latitude in converting EU directives into domestic policy. Success with the plan also relies upon

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[199] European Commission, *Carbon Border Adjustment Mechanism*, Taxation and Customs Union, https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.

[200] Voicu D. Dragomir & Mădălina Dumitru, *The State of the Research on Circular Economy in the European Union: A Bibliometric Review*, 7 Cleaner Waste System , 2 (2024)

[201] Patrick Schröder, *Promoting a Just Transition to an Inclusive Circular Economy*, at 25, Chatham House (Apr. 2020), https://www.chathamhouse.org/sites/default/files/2020-04/2020-04-01-inclusive-circular-economy-schroder.pdf. (last visited May 21, 2025).

securing adequate investment to drive circular economy transformation, estimated at around €160 billion a year throughout the EU by the European Investment Bank. EU recovery package and Multiannual Financial Framework make funds available to finance circular economy action, but private sector investment on top of this will be needed if it is to deliver transformative climate action.[202]

The EU Circular Economy Action Plan is a landmark step in the field of climate policy to treat emissions that are embedded in material consumption and use patterns. Through its frameworks that make products last longer, enhance material efficiency, minimise waste, and create markets for secondary materials, the plan complements existing climate policies for energy systems and direct emissions. The more the implementation ploughs ahead, the more the CEAP will be able to contribute to climate targets based not just on policy formulation but also on successful mobilisation of economic actors along value chains.[203]

3.5.2 WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT AND CIRCULAR ECONOMY

Waste Electrical and Electronic Equipment (WEEE) or e-waste is among the world's fastest-growing waste streams, with about 53.6 million metric tons of e-waste produced in 2019 and estimates that it can reach as high as 74.7 million tons in 2030. Technology innovation that fuels substitution patterns, common global access to electronic products, and obsolescence built into product design are the reasons for this rapid growth. The health and environmental effects of such expansion are prominent, as electronic devices have intricate mixtures of chemicals that include precious materials like gold, silver, copper, and rare earth and toxic chemicals like lead, mercury, cadmium which inflict tremendous damage on human health and the environment in the form of soil contamination, water pollution, and air emissions.[204]

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[202] European Investment Bank, *How the EU Bank Makes Energy Greener*, EIB.org, https://www.eib.org/en/stories/carbon-neutral-energy (last visited May 21, 2025).

[203] World Business Council for Sustainable Development, *Circular Economy Action Plan 2020: Summary for Business – Implications and Next Steps*, at 9 (2020), https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Resources/Circular-Economy-Action-Plan-2020-Summary-for-business. (last visited May 21, 2025).

[204] Vanessa Forti et al., *The Global E-waste Monitor 2020: Quantities, Flows, and the Circular Economy Potential*, at 9, United Nations Univ. (UNU), Int'l Telecomm. Union (ITU) & Int'l Solid Waste Ass'n (ISWA), Bonn/Geneva/Rotterdam (2020), https://www.globalewaste.org.(last visited May 21, 2025).

The European Union has led the way in policy approaches to WEEE by circular economy design, setting global policy making precedent. The EU WEEE Directive, adopted initially in 2003 and later amended in 2012, established Extended Producer Responsibility (EPR) concepts that impose financial liability for managing waste on manufacturers and importers. The EU strengthened the efforts in their Circular Economy Action Plan, which mandates "right to repair" standards, mandatory recyclability levels, and undertaking product-as-service options on electronic products. These policy paradigms are combined to show the way by which WEEE management can move away from specialised waste governance to broader resource governance systems for production, consumption, and end-of-life managing phases at the same level.[205]

The technical processes involved in circular management of electronics encompass multiple value retention options aligned with resource efficiency principles. At the highest level of the waste hierarchy, lifetime extension strategies, including repair, refurbishment, and remanufacturing, maintain product integrity while reducing virgin material demand and waste generation. When products reach true end-of-life, advanced recycling processes can recover materials through techniques including mechanical processing, pyrometallurgical recovery, hydrometallurgical methods, and bio-metallurgical approaches.10 However, current global recycling rates for electronics remain suboptimal, with only 17.4% of e-waste formally documented as collected and recycled in 2019, highlighting substantial implementation gaps between theoretical potential and practical reality.[206]

Urban mining, or the systematic retrieval of materials from discarded electronics, is an illustration of the circular thinking applied to achieving waste management and resource security objectives. Studies have shown that levels of precious metals in WEEE are higher than in natural ores, with a ton of mobile phones containing about 100 times more gold content than a ton of gold ore. Proper urban mining approaches ensure the recovery of these "anthropogenic deposits" can minimise environmental costs of primary extraction while lowering reliance on volatile global commodity markets and geopolitically focused material supplies. Urban areas have become optimal

[205] OECD, *Extended Producer Responsibility: Basic Facts and Key Principles*, OECD Environment Policy Paper No. 41, at 6 (Apr. 2024), https://www.oecd.org/env/tools-evaluation/extended-producer-responsibility.htm. (last visited May 21, 2025).

[206] Peeranart Kiddee et al., *Handbook of Electronic Waste Management: International Best Practices and Case Studies*, at 28 (Majeti Narasimha Vara Prasad et al. eds., Elsevier 2020),

arenas for the implementation of such approaches, with municipal governments increasingly adopting holistic systems that integrate accessible collection points, awareness raising, and cooperation with recycling facilities optimised for high-value material recovery.[207]

3.5.3 RIGHT TO REPAIR: EMPOWERING CONSUMERS AND PROMOTING SUSTAINABILITY

The "right to repair" is an important consumer rights because that was gathering pace over the past several years. Simply put, the campaign protects the consumers' right to repair and customise their bought items, mostly electronic products, according to their desire, without the involvement of manufacturers.[208]

The right to repair paradigm developed in agriculture, where farmers used to fix their machines themselves. With the evolution of technology, businesses began to use other types of barriers that kept consumers from fixing their own products. These ranged from proprietary tools to restricted spare part availability, software locks, and warranty policies that deterred self-fixing. The contemporary right to repair movement was born out of these growing control mechanisms, especially within the electronics sector. With advanced technological progress and the growing convergence of devices, producers took advantage of the argument that repairing them needed special knowledge and tools and essentially established repair monopolies. This development revolutionized the classical model of property ownership wherein buying a product once meant having total mastery over its use and upkeep.[209]

Right to repair legislation generally obliges manufacturers to make tools, parts, and information available to consumers and independent repair businesses in order to repair products. The movement has generated significant legislative activity in many jurisdictions. In the U.S., Massachusetts led the way in automotive right to repair law in 2012 by mandating automobile manufacturers to supply independent repair shops with the same diagnostic data as authorized dealerships More than 30 states have since

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[207] Markus Fahlbusch, *Urban Mining and E-Waste Exports: Overview and Recent Initiatives*, IPIS Briefing (Oct. 5, 2022), https://ipisresearch.be/weekly-briefing/urban-mining-and-e-waste-exports-overview-and-recent-initiatives/.(last visited May 21, 2025).

[208] Irene Calboli, *The Right to Repair: Recent Developments in the USA*, WIPO Magazine (Aug. 1, 2023), https://www.wipo.int/web/wipo-magazine/articles/the-right-to-repair-recent-developments-in-the-usa-56378.(last visited May 21, 2025).

[209] Aaron Perzanowski & Jason Schultz, *The End of Ownership: Personal Property in the Digital Economy*, at 145 (MIT Press 2016).

introduced some type of right to repair bill, although most bills have been strongly resisted by industry associations. A similar federal bill was introduced in 2021 as the Fair Repair Act and called for federal repair access standards across the country[210]

The economic justification for the right to repair is consumer choice and market competition. By maintaining control over the repair, manufacturers can price at high levels without the pressure of competition. Independent repair gets people on the job, enables small businesses, and gives consumers greater economic choice. Research indicates that open repair markets potentially save consumers billions of dollars a year in replacement and repair expenses.[211]

Environmentally, the right to repair addresses the increasing issue of electronic waste (e-waste). Extending the lives of products through repair instead of replacement saves significantly on resources and generation of waste. Globally e-waste in 2019 amounted to an estimated 53.6 million metric tons, with only a miniscule 17.4% recycled in a responsible fashion. Supporting repairs, right to repair legislation promotes circular economy strategies and moves towards sustainable objectives.[212]

The right to repair movement is a manifestation of core questions regarding ownership, sustainability, and consumer rights in the digital economy, wherein technology has become ubiquitous in everyday products, fixing products by oneself is both an economical and an exercise of agency on the part of the consumer.[213] The impact of the legislative push to include the right to repair within the ambit of the statutory framework will cast consumer-producer relationships for centuries to come with profound implications for the global market's environmental integrity and economic justice.[214]

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[210] DLA Piper, *The Right to Repair – What's at Stake, and What's Happening*, at 3 (2023), https://www.dlapiper.com.(last visited May 21, 2025).

[211] Anna Elin Seidel, *Right to Repair: Revolutionising Throwaway Culture*, Deloitte Insights, https://www2.deloitte.com/us/en/insights/industry/retail-distribution/from-throw-away-culture-to-repair-revolution.html.(last visited May 21, 2025).

[212] Vanessa Forti et al., *The Global E-waste Monitor 2020: Quantities, Flows, and the Circular Economy Potential*, at 23, United Nations University (UNU), United Nations Institute for Training & Research. (UNITAR), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA) (2020) https://www.globalewaste.org.(last visited May 21, 2025).

[213] Selcen Ozturkcan, *The Right-to-Repair Movement: Sustainability and Consumer Rights*, 0 J. Info. Tech. Teaching Cases 1, 2 (2023),

[214] Dunia Zongwe, Mahantesh GS & Mamatha R, *The Economics of Repair: Fixing Planned Obsolescence by Activating the Right to Repair in India*, 11 International Journal on Consumer Law & Practice 105 (2023), https://repository.nls.ac.in/ijclp/vol11/iss1/6.(last visited May 21, 2025).

3.5.4 EXTENDED PRODUCER RESPONSIBILITY

Extended Producer Responsibility (EPR) is an innovative policy solution wherein the onus for managing waste is transferred from municipal governments and taxpayers to manufacturers and producers of products. The environmental policy tool relies on the argument that the manufacturers and producers of products must be responsible for the financial and operational responsibility of managing their products in all stages of their life cycle, from manufacturing to disposal and recycling at the end-of-life. The idea developed during the 1990s when governments and environmentalists realized that conventional waste management systems were insufficient and in need of new solutions to deal with increasing environmental challenges.[215]

The theoretical foundation of EPR is built on the economic principle of internalising externalities, wherein the environmental damage once incurred by society is internalised as part of the market price of the product. Producers are incentivized in this manner to produce products that are more mindful of their environmental consequences, as they will bear direct responsibility for managing the wastes generated by their products. The responsibility can be seen in different dimensions, ranging from physical responsibility through collection and recycling, financial responsibility through sponsoring waste management facilities, to informational responsibility through giving information to consumers about how to properly dispose of them.[216]

The adoption of EPR schemes has received wider acceptance over many product ranges and regulatory regions worldwide, one of the most universal being the packaging waste. The European Union has provided leadership in this market with the implementation of a full set of EPR regulations on packaging material that obliges producers to specify recycling and recovery measures undertaken.[217] The electronic waste EPR schemes are another domain in addressing the difficult problem of recycling end-of-life computers, cell phones, and other electronic products with both useful and toxic materials. EPR

[215] Organisation for Economic Co-operation and Development (OECD), *Extended Producer Responsibility: A Guidance Manual for Governments* 10 (2001), https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm (last visited May 21, 2025).
[216] Yamini Gupt & Samraj Sahay, *Review of Extended Producer Responsibility: A Case Study Approach*, 33 Waste Management & Research 597(2015)
[217] European Environment Agency (EEA), *Managing Municipal Solid Waste—A Review of Achievements in 32 European Countries* 12 (EEA Rep. No. 2/2013), https://www.eea.europa.eu/publications/managing-municipal-solid-waste.(last visited May 21, 2025).

schemes for electronics generally require electronics manufacturers to create collection infrastructures and ensure the responsible recycling of their products.[218]

The environmental advantages of EPR go far beyond mere diversion away from landfills and incinerators. The levy of an additional cost component on manufacturers, these programs introduce market-based incentives for environmentally friendly design, encouraging manufacturers to create products that are more durable, repairable, and recyclable. Adopting such a change in product design nudges towards sustainability and can conserve other resources, reduce the usage of harmful materials, and make material streams more productive in the economy. Apart from that, EPR programs boast greater recycling rates compared to standard municipal waste management systems as they have access to committed funds and specialized facilities.[219]

The economic effects of EPR trickle down through the entire value chain, influencing producers, retailers, consumers, and waste management service providers. As producers incur higher waste management mandate expenses, these expenses can induce innovation and efficiency gains that lead to lower system-wide costs. Consumers pay more as producers pass-through costs induced by EPR but reap efficiency in product design and lowering municipal waste management expenses from general taxation. The waste management sector frequently experiences vast overhaul as EPR programs develop new business models in markets while potentially trashing current business models.[220]

The future looks promising for EPR as it is adapting to meet new challenges including waste streams and environmental issues. Textiles, upholsteries, and building materials are increasingly being targeted by EPR programs as governments shift to managing the environmental footprint of these industries.[221] Implementation of digital technologies, such as blockchain and IoT sensors, holds promise for enhancing tracking and transparency of EPR systems that may help tackle some of the enforcement issues that

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[218] Andrew Brown, Frithjof Laubinger & Peter Börkey, *New Aspects of EPR: Extending Producer Responsibility to Additional Product Groups and Challenges Throughout the Product Lifecycle*, OECD Env't Working Paper No. 225, at 45 (2023), https://www.oecd.org/environment/workingpapers.htm.(last visited May 21, 2025).

[219] Brindha Ramasubramanian et al., *Recent Advances in Extended Producer Responsibility Initiatives for Plastic Waste Management in Germany and UK*, 5 Materials Circular Economy 6 (2023)

[220] Johann Jose Israel Manas, *How EPR Law Contributes to the Economy?*, Plastic Bank Blog (Sept. 14, 2023), https://plasticbank.com/blog/how-epr-law-contributes-to-the-economy/.(last visited May 21, 2025).

[221] Ellen MacArthur Foundation, *Pushing the Boundaries of EPR Policy for Textiles* 11 (2024), https://ellenmacarthurfoundation.org/pushing-the-boundaries-of-epr-policy-for-textiles. (last visited May 21, 2025).

have capped program effectiveness in the past. The definition of EPR is also beginning to be broadened beyond traditional waste management issues to include wider sustainability considerations such as carbon emissions and resource efficiency.[222]

3.6 NATIONAL LEGAL FRAMEWORKS

3.6.1 GERMANY'S CLOSED SUBSTANCE CYCLE ACT

Germany enacted the Closed Substance Cycle and Waste Management Act (Kreislaufwirtschaftsgesetz or KrWG) which is the most ambitious policy package in Europe for sustainable resource management. Initially enacted in 1996 and later revised to incorporate contemporary changes in 2012 and 2020, the Act fundamentally re-moulded Germany's material management strategy by creating a waste-handling hierarchy of prevention, reuse, and recycling, each prioritised over disposal. This legislation has placed Germany as a global leader in circular economy practice and paved the way for the country's pursuit of climate protection objectives by engaging in diverse mechanisms.[223]

The underlying philosophy of the Act rests on the pillar of Extended Producer Responsibility, where waste management is transferred upstream to the producers and distributors rather than municipalities or consumers. This legislation has spurred German industry to adopt eco-design solutions by encouraging companies to redefine products and packaging to reduce the environmental load across the product's lifecycle. By putting the cost of end-of-life treatment onto the producers' shoulders, the law creates strong economic incentives that counterbalance corporate interests with resource conservation and protection.[224]

Perhaps the most important climate effect of the KrWG is its effect on diversion from landfill. The Act succeeded in prohibiting landfilling of untreated urban waste in 2005, diverting organic waste from landfill sites where it would produce the methane which is a major greenhouse gas having a global warming potential of 28. The adoption of this

[222] Ezekiel O. Udeh et al., *The Role of IoT in Boosting Supply Chain Transparency and Efficiency*, 11 Magna Scientia Advanced Research & Review 179 (2024),
[223] European Environment Agency (EEA), *Early Warning Assessment Related to the 2025 Targets for Municipal Waste and Packaging Waste – Germany* 4 (2022), https://www.eea.europa.eu/publications/early-warning-report-2022.(last visited May 21, 2025).
[224] German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), *Fundamentals for the Process of Transforming to a Circular Economy – The National Circular Economy Strategy* 7 (Apr. 2023), https://www.bmuv.de.(last visited May 21, 2025).

policy move has avoided releasing about 20 million tonnes of CO_2-equivalent emissions each year, or close to 2% of Germany's overall greenhouse gas emissions in 1990.[225]

Other than emissions in landfills, the Closed Substance Cycle Act has facilitated enormous energy savings through recovery of materials. When goods are recycled instead of being produced using virgin raw materials, energy embedded in extraction and primary processing is saved. Germany's recycling rates have risen steadily under the Act's regime to some 67% for municipal waste by 2020, compared with an average rate of 48% in the EU. These trends in material recovery translate immediately into climate benefits since each tonne of aluminium recycled, for example, avoids up to 14 tonnes of CO_2-equivalent emissions compared with production from primary metal.[226]

The Act has also spurred innovations in waste-to-energy technology, specifically for non-recyclable residual waste streams. Advanced German incinerators feature strict emissions controls and highly efficient heat recovery systems that displace fossil fuel combustion in district heating systems and industrial applications. More environmentally taxing than prevention or recycling, these second-generation thermal treatment facilities have displaced coal combustion-based power generation in most municipalities with a lower-carbon option for disposing of non-recyclable waste.[227]

From a systems point of view, the KrWG has effectively changed material flows within the German economy. The Act, through the creation of independent collecting networks for different streams of waste, has produced unadulterated, homogeneous recovery routes that optimise material quality and recycling efficiency. This physical infrastructure allows for the substitution of secondary materials for primary resources in manufacturing sectors, mitigating climate loads connected with raw material production, processing, and transportation.[228]

The Closed Substance Cycle Act takes Germany a step closer to even more ambitious climate objectives. Newly amended, the link between waste management and climate protection has been made stronger by proactively declaring greenhouse gas emissions reduction as an aim in the framework of the hierarchy of waste. It is a recognition of

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[225] Rie Watanabe & Lutz Mez, *The Development of Climate Change Policy in Germany*, 5 International Review for Environment Strategies 109-110 (2004).

[226] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), *Climate Action in Figures: Facts, Trends and Incentives for German Climate Policy* 8 (2019), https://www.bmu.de/en/publications. (last visited May 21, 2025).

[227] Xenia Malcher et al., *Decarbonization of District Heating: A Systematic Review of Carbon Footprint and Key Mitigation Strategies*, 215 Renewable & Sustainable Energy Reviews 5 (2025),

[228] Sarah Schmidt & David Laner, *Reducing the Climate Impact of Residual Waste Treatment: A German Case Study on Carbon Management Strategies*, 198 Waste Management 138 (2025),

growing awareness that circular economy solutions are the most economically efficient way of meeting Germany's 2045 climate neutrality pledge. [229]

3.6.2 CHINESE LEGISLATION ON CIRCULAR ECONOMY

China's Circular Economy Promotion Law (CEPL) of August 29, 2008, as of January 1, 2009, is a milestone legislation in the environmental governance system of the nation. CEPL boasts China's first comprehensive law specifically designed to drive circular economy development. The statute was enacted against a backdrop of accelerated industrialisation, dangerous environmental pollution, and impending resource crunch. The CEPL established a legislative template for the transition of China from traditional linear economic models to more sustainable patterns of consumption and production.[230] The CEPL consists of seven chapters with 58 articles that together build the institutional structure for China's development of a circular economy.[231] The law tried to define circular economy as "activities of reduction, reuse and recycling carried out in the course of production, circulation and consumption."[232] This "3R concept" is the theory-based pillar of the legislation, focusing on the efficiency of resources throughout the entire economic system rather than end-of-pipe treatment of waste.[233]

A prominent feature of CEPL is its hierarchical model of circular economy implementation. At the macro level, the law requires the creation of regional eco-industrial networks and pilot zones of the circular economy. At the regional level, it encourages eco-industrial parks where corporations can adopt industrial symbiosis. The micro level imposes on individual firms to use cleaner production technology and improved resource efficiency. The top-to-bottom integration of circular economy

[229] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, *Climate Change Act: Climate Neutrality by 2045*, Bundesregierung (June 25, 2021), https://www.bundesregierung.de/breg-en/service/archive/climate-change-act-2021-1936846 (last visited May 21, 2025).

[230] Ru Chen, *China's Circular Economy Policies: Review and Reflection* 5 (Sophia Vlieger de Oliveira & Claire Mahut eds., Circular Innovation Lab 2023).

[231] Environmental Protection Law of the People's Republic of China (promulgated by the Standing Comm. Nat'l People's Cong., Apr. 24, 2014, effective Jan. 1, 2015), Ministry of Ecology & Environment of the People's Republic of China, https://english.mee.gov.cn/Resources/laws/envir_elatedlaws/201712/t20171212_427823.shtml (last visited May 21, 2025).

[232] Id at https://english.mee.gov.cn/Resources/laws/envir_elatedlaws/201712/t20171212_427823.shtml (last visited May 21, 2025).

[233] Raimund Bleischwitz et al., *The Circular Economy in China: Achievements, Challenges and Potential Implications for Decarbonisation*, 183 Resource Conservation & Recycling, 3 (2022),

principles becomes fruitful when complemented by coordination among various levels of economic organisation.[234]

Economic tools play a pivotal role in the CEPL strategy for inducing circular habits. The statute has incorporated provisions for tax credits, subsidising funds, and favourable pricing policies for firms implementing circular economy technologies. It also includes preferential buying by the government for products produced under circular economy circumstances, using state purchasing power as a tool to induce market demand for green products.[235]

The CEPL imposes numerous regulatory requirements on companies in industrial parks to develop eco-circular implementation plans and construct joint facilities for waste treatment and resource recovery. The initiatives are designed to promote industrial symbiosis agreements in which companies' waste product turns into a productive material for another company, creating closed material loops within industrial areas.6 It has also been shown to be extremely effective in those sectors that consume large quantities of resources such as chemicals, steel, and cement production.[236]

For individual firms, the CEPL sets some of the requirements for higher resource productivity. Companies have to adopt prudent technology and equipment that achieve optimum utilisation of energy, water resources and land utilisation, which in turn will eliminate wasteful production processes generating excessive waste. The legislation also imposes on some industries the recovery and reuse systems for the products and packages they manufacture after being consumed by the customers, setting an early basis for extended producer responsibility in China.[237]

Consumer provisions in the CEPL aim to influence consumption patterns by fostering sustainable living. Public awareness about conserving resources is encouraged under the law, and government agencies must integrate circular economy principles into

[234] Thiago A. C. de Melo et al., *Circular Economy Public Policies: A Systematic Literature Review*, 204 Procedia Computer Science. 655 (2022)

[235] We Li & Wenting Lin, *Circular Economy Policies in China*, in *Towards a Circular Economy: Corporate Management and Policy Pathways* 95, 103 (Venkatachalam Anbumozhi & Jayanthakumaran Kim eds., ERIA Research Project Report No. 2014-44, 2016).

[236] Etienne Kechichian et al., *Circular Economy in Industrial Parks: Technologies for Competitiveness* 99 (World Bank Grp. 2021), https://openknowledge.worldbank.org/handle/10986/36658.

[237] Khairun Tumu et al., *Global Plastic Waste Recycling and Extended Producer Responsibility Laws*, 348 Environment Management , 4 (2023)

school education. The law also aims for labelled disclosure of information about resource usage on packages to enable consumers to make informed decisions.[238]

Critical examination of the CEPL reveals China's legislative method toward circular economy is both strong and weak. Its strength lies in the all-around extent of the law, touching on circular principles in various industries and phases of the economic cycle. As opposed to more narrowly focused waste management policy in most countries, the CEPL articulates a vision of systemic transformation of production and consumption systems. Such a systemic vision perceives circular economy as requiring system change rather than incremental re-orientation of current economic thinking.[239]

The CEPL's top-down, administrative governance style is reflective of China's general approach to government, which may suppress bottom-up creativity. The legislation imposes greater emphasis on government planning and directive interventions than on market mechanisms, which may suppress the spontaneity of circular business models unfolding under the pressure of entrepreneurial drive. Top-down regulation causes problems of implementation in a country that has very uneven regional variations of economic development and variations in local government capacity.[240]

The CEPL has many limitations, but despite those challenges, it has set China to be an early leader in circular economy law, guiding future policy action within and outside the country. It created a baseline that China has added to through its follow-up actions, such as the 2013 Circular Economy Development Strategy and the follow-up focus on circular economy. These policy developments demonstrate China's ambition of achieving global power, which is in alignment with its Nationally Determined Contributions and work towards global environmental justice principles.[241]

3.6.3 BRAZIL'S NATIONAL CIRCULAR ECONOMY STRATEGY

Brazil's National Circular Economy Strategy (ENEC) defines "circular economy" as an economic system aimed at maintaining circular resource flows and integrating economic activity with resource recovery, grounded in principles of waste prevention,

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[238] Feiyue Li et al., *On Regulating Chinese Consumer Environmental Behaviour to Reduce Global Warming: Some Reflections*, 53 Environment Policy & Law 247, 252 (2023)

[239] Robert Knothe, *Circular Economy Policies in China and the EU: A Comparative Analysis with the Extended Policy Mix Concept* 37 (Chalmers Univ. of Tech. Dep't of Tech. Mgmt. & Econ., 2023).

[240] Id. At 44

[241] Circular Economy (CE) in China, a Scoping Study, at 19 (Oeko-Institut & China Council for International Cooperation on Environment and Development [CCICED], 2024), https://www.bmuv.de/en/download/sino-german-action-plan-on-circular-economy-and-resource-efficiency. (last visited May 21, 2025)

material circulation, and environmental protection. The strategy's overarching goal is to shift Brazil from a linear, finite resource-based model toward a circular model that promotes efficient use of natural resources and sustainable production practices across value chains.[242]

ENEC outlines key policy objectives or guidelines, prioritising the elimination of pollution and waste, preservation of material value through reuse and recycling, environmental rehabilitation, reduced reliance on virgin natural resources, sustainable production and consumption, extended product/material lifecycles, and ensuring a fair, inclusive transition that addresses social disparities. The objectives enshrined in ENEC converge with the Circular Economy principles aimed at designing out waste, encouraging materials in use, and regenerating natural capital.[243]

The ENEC framework provides for a dedicated governance framework to implement and oversee the strategy. The strategy involves multi-stakeholder involvement by envisaging a consultative body charged with advising, monitoring, and evaluating ENEC's implementation, this forum promotes a federal approach of discussing with federal agencies, states and municipal authorities to ensure coherent action nationwide. Such institutional coordination is critical given that ENEC's agenda cuts across sectors and government levels. The forum is expected to guide the development of more detailed action plans.[244]

The ENEC strategy is largely based on the successful earlier legislation like the National Solid Waste Policy, which had elements of circular economy manifested in concepts of waste management and shared responsibility. The explicit recognition of a policy towards Circular Economy concept largely projects the orientation of policy makers towards a sound and robust policy which needs to be internalised by the systems and citizens alike to address the growing climate change menace.[245]

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[242] Guillaume Decaix et al., Greener Shores: Brazil's $100 Billion Decarbonization Opportunity, McKinsey & Co. (Oct. 22, 2024), https://www.mckinsey.com/capabilities/sustainability/our-insights/greener-shores-brazils-100-billion-decarbonization-opportunity. (last visited May 21, 2025)

[243] Ellen MacArthur Foundation, *Brazil Establishes First National Circular Economy Strategy*, Ellen MacArthur Found. (July 11, 2024), https://www.ellenmacarthurfoundation.org/news/brazil-establishes-first-national-circular-economy-strategy. (last visited May 21, 2025)

[244] Trench Rossi Watanabe, Brazilian Federal Government Establishes the National Circular Economy Strategy, TRENCH ROSSI WATANABE (July 31, 2023), https://www.trenchrossi.com/en/legal-alerts/brazilian-federal-government-establishes-the-national-circular-economy-strategy/.(last visited May 21, 2025)

[245] Omar Ouro-Salim et al, Unlocking Value: Circular Economy in NGOs' Food Waste Reduction Efforts in Brazil and Togo, 2 Discover Environment 46 (2024),

3.7 CONCLUSION

The transition to global circular economic trends is a paradigm shift for the manner in which societies produce, consume, and use resources. As discussed in this chapter, the circular economy is more than merely a target of sustainability but an influential, multi-prong approach linking environmental justice to economic resilience and social equity. Its incorporation into international, regional, and national law and policy regimes shows its requirement and feasibility to drive the transition away from the linear economic model.

At the global level, frameworks like the Sustainable Development Goals (SDGs) and the Paris Agreement demonstrate how circular approaches such as reducing waste, increasing resource efficiency, and thinking in terms of life cycles are associated with global goals. SDG 12 (responsible production and consumption) and SDG 13 (climate action) especially portray how circularity can impact environmental and economic outcomes. The Paris Agreement has set the ball rolling on discourse on material-based emissions, particularly those in sectors such as buildings, food, and transportation, providing governments with systemic pathways to address climate issues more comprehensively.

Legal tools such as the WTO's Government Procurement Agreement (GPA) and the Basel Convention also reflect the change. The GPA now promotes environmental procurement, and the Basel Convention has been extended to include circular approaches such as waste valorisation and environmentally sound transboundary movement. Such changes are signals of increasing synergy between economic regulation and environmental goals.

Regionally, the EU Circular Economy Action Plan (CEAP) is a holistic model founded on product design, sustainable consumption, and industry transformation. In addressing emissions locked in materials and promoting recycling, reuse, and green procurement, the CEAP promotes the European Green Deal vision of climate neutrality.

At the national level, Germany, China, and Brazil have each pioneered distinct legislative approaches to advancing circular economy principles. Germany’s **Closed Substance Cycle Act (KrWG)** emphasizes extended producer responsibility, landfill diversion, and high recycling rates, positioning the country as a global leader. China’s **Circular Economy Promotion Law (CEPL)** adopts a systemic 3R-based model through top-down planning, integrating circularity into production, consumption, and

industrial symbiosis. Brazil's **National Circular Economy Strategy (ENEC)** builds on prior waste policies to promote inclusive, resource-efficient practices nationwide. Together, these frameworks reflect varying legal traditions but share a common goal: aligning environmental sustainability with economic and social development.

Extended Producer Responsibility (EPR), e-waste regulation, and the Right to Repair are examples of how circularity can be made operational through purpose-specific legal measures. These not only guarantee longer lifecycles for products but also empower consumers and minimize ecological damage.

The Circular economy shifts are technologically feasible and economically profitable. But their full potential hinges on strong, multilevel policy and legislative institutions. Integrating circularity into government institutions is not only an environmental need but also a systemic necessity to construct a sustainable, equitable, and climate-resilient world economy.

CHAPTER 4: THE INCORPORATION OF CONCEPTS OF CIRCULAR ECONOMY WITHIN THE INDIAN LEGAL FRAMEWORK: AN ANALYSIS

4.1 INTRODUCTION

The Constitutional basis for climate law in India can be derived from the nature of the country's fundamental laws, which include environmental protection as a Directive Principle of State Policy and a citizen's fundamental duty. Article 48A of the Indian Constitution places the onus on the State to protect and enhance the environment quality, while Article 51A inscribes it as a fundamental duty on the part of every citizen to protect and improve the natural environment.[246] [247] These Constitutional provisions have been the foundation for significant environmental as well as climate-focused legislationS, establishing a template that lists the protection of the environment as a governmental duty as well as a civic duty. The Supreme Court of India has also expanded this foundation through landmark decisions that have grafted the right over a clean environment within the fundamental right to life under Article 21.[248]

India's climate regulatory regime has come a long way since the nation achieved independence, with early environmental legislation having a tendency to concentrate largely on pollution control and natural resource conservation before broadening further to include wider climate change considerations.[249] The Water (Prevention and Control of Pollution) Act of 1974 and the Air (Prevention and Control of Pollution) Act of 1981 established the early environment rule-making model for protection, while the Environment (Protection) Act of 1986 gave general powers of regulation of the environment in the backdrop of the Bhopal industrial disaster.[250] These foundation laws set out the institutional framework and jurisprudence that would eventually enable further advanced climate-specific policies and legislation and policy tools.

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[246] India Const. art. 48A.

[247] India Const. art. 51A.

[248] Aman Sharma, Environmental Protection as a Fundamental Duty: Constitutional Mandate and Ground Reality, 7 International Journal of Legal Science & Innovation 312, 313 (2025)

[249] Sayanangshu Modak, *The Imperatives of India's Climate Response*, Observer Research Foundation (2021), https://www.orfonline.org/research/the-imperatives-of-indias-climate-response (last visited May 22, 2025).

[250] Edward Broughton, The Bhopal Disaster and Its Aftermath: A Review, 4 Environment Health 6, 4 (2005),

The global aspects of India's climate law reveal the interactive engagement of India with international climate governing processes as well as its membership in multilateral environmental initiatives. India joining the United Nations Framework Convention on Climate Change in 1993 and the Paris Agreement in 2016 has had a direct impact on domestic legislative evolution, producing commitments to be translated into national policy and legislation. India's Paris Agreement nationally determined contributions, such as expanding renewable capacity and enhancing energy efficiency, have led to the emergence of particular legislative tools and regulatory systems aimed at fulfilling these global obligations. This spill over from international commitments to domestic legislation is a shining example of how global climate governance is influencing the legal frameworks of developing nations.[251]

The Institutional setting for India's climate policy includes various levels of government and specialist agencies, which mirror the federal structure of the Indian state and the overlapping nature of climate change. The nodal agency of the central government for climate policy is the Ministry of Environment, Forest and Climate Change, while State governments enjoy immense powers in respect of the environment through the Indian Constitution's concurrent list entries. Specialised agencies like the Central Pollution Control Board, the National Disaster Management Authority, and sectoral regulators facilitate the implementation of climate legislation across sectors. Institutional variety in this context refers to the interconnectedness of climate issues as well as the necessity of coordination across levels of government and sectors.[252]

India's climate legislation addresses both mitigation and adaptation dimensions, recognising that the country must simultaneously cut down on greenhouse gas emissions while preparing for the inevitable consequences of climate change. Mitigation policies contain renewable energy policy, energy efficiency codes, and carbon market systems, while adaptation policies contain disaster risk reduction, water management, and climate-resilient agriculture policy. It is a two-track approach that rests on the assumption of scientific foresight that even powerful mitigation actions could not avoid all impacts of climate, especially for a country with extensive

[251] Sandeep Sengupta, India's Engagement in Global Climate Negotiations from Rio to Paris, in *India in a Warming World* 114, 115 (Navroz K. Dubash ed., Oxford Univ. Press 2019)
[252] Ministry of Environment, Forest & Climate Change, Government of India, *Annual Report 2024–25*, at 9 (2025)

coastlines, monsoon-based agriculture, and extensive populations in climate risk-prone areas.[253]

4.2 NATIONAL ACTION PLAN ON CLIMATE CHANGE

The National Action Plan on Climate Change (NAPCC), introduced in 2008, is a unique policy document that sets the tone for India's comprehensive strategy to climate change concerns with its development imperatives intact. The Plan was formulated at a crucial juncture when India was being pressed globally to commit to binding emission reductions, while at the same time having to bring millions of its citizens out of poverty and provide energy security for fast growth. The strategic value of the NAPCC also consists in its explicit recognition of climate action and sustainable development as complementary goals and not mutually exclusive alternatives, thus enabling developing nations to pursue robust climate policies without having to abandon their development goals.[254]

The philosophical basis of the NAPCC is the premise that the climate response of India should be based on sustainable development paths that are in tune with its mitigation and adaptation requirements, and accounting for the special case of the country as an emerging nation with high climate vulnerabilities. NAPCC unequivocally recognises that India's per capita greenhouse gas emissions continue to be much larger compared to developed nations yet stresses the country's commitment to ensuring that its per capita emissions would never become larger than those of developed nations. This moral position mirrors the awareness of the nation towards the principle of common but differentiated responsibilities in the international climate law and places the nation in a responsible global position by bestowing a right of the nation to develop and increase the living standards of its people.[255]

The NAPCC comprises eight National Missions, which target specific sectors or themes for India's climate action plan. The National Solar Mission is to make India a world leader in solar energy through the development and deployment of solar photovoltaic

[253] Ministry of Finance, Government of India, *Economic Survey 2024–25*, at 274 (2025)
[254] Department of Science & Technology, Government of India, *Climate Change Programme*, https://dst.gov.in/climate-change-programme. (last visited May 22, 2025).
[255] Ministry of Environment, Forest & Climate Change, Government of India, *Parliament Question: Climate Change Mitigation and Adaptation* (Mar. 27, 2025), https://www.pib.gov.in/PressReleasePage.aspx?PRID=2115837. (last visited May 22, 2025).

and other solar technologies.[256] The National Mission for Enhanced Energy Efficiency is to accelerate the transformation to energy-efficient appliances in targeted sectors using new policy instruments such as market instruments and regulatory devices.[257] The National Mission on Sustainable Habitat operates towards habitats being sustainable through reduction of energy consumption through improvement in energy efficiency of buildings, management of solid wastes, and modal shift to public transport.[258] All these missions represent an integrated approach attempting to counter supply-side and demand-side interventions in various domains of the economy.

The National Water Mission of NAPCC answers one of the most urgent climate adaptation issues in India by integrated management of water resources and enhanced efficiency in water use in all sectors.[259] Since agriculture is monsoon-dependent and water-scarce areas in India are at high climate risk, conservation, augmentation, and efficient use of water resources under this mission is a crucial adaptation strategy.[12] The focus of this mission on community participation and traditional water harvesting techniques depicts sensitivity to the fact that successful climate adaptation implies integration of modern technology with indigenous knowledge systems. Reference to water security issues in the climate policy indicates the integrated nature of NAPCC to deal with interlinked environment and developmental issues.[260]

The National Mission for Sustaining the Himalayan Ecosystem identifies the Himalayas' vital role in providing India's water security, conservation of biodiversity, and climate management. The mission identifies the special vulnerability of mountain ecosystems to the effects of climate change such as glacial cover melting, altered regimes of precipitation, and disruption of ecosystems. The mission's concern with biodiversity conservation, forest cover, and traditional livelihoods indicates an appreciation that climate adaptation is based on collaborative strategies from

[256] India Sci., Tech. & Innovation Portal, *Jawaharlal Nehru National Solar Mission (JNNSM)*, https://www.indiascienceandtechnology.gov.in/st-visions/national-mission/jawaharlal-nehru-national-solar-mission-jnnsm. (last visited May 22, 2025).
[257] Department of New & Renewable Energy, Government of Haryana, *National Mission on Enhanced Energy Efficiency*, https://hareda.gov.in/about-department/national-mission-on-enhanced-energy-efficiency/. (last visited May 22, 2025).
[258] Ministry of Housing & Urban Affairs, Government of India, *Decarbonise Existing Buildings* (Dec. 19, 2024), https://www.pib.gov.in/PressReleasePage.aspx?PRID=2086106 (last visited May 22, 2025).
[259] Ministry of Jal Shakti, Government of India, *About Mission – National Water Mission*, https://nwm.gov.in/about-mission. (last visited May 22, 2025).
[260] Ministry of Jal Shakti, Government of India, *New National Water Policy* (Dec. 16, 2021), https://www.pib.gov.in/PressReleasePage.aspx?PRID=1782283. (last visited May 22, 2025).

ecosystems that preserve natural mechanisms of resilience. The transboundary character of Himalayan ecosystems also indicates an appreciation by the mission that some of the climate concerns need regional coordination and cannot be pursued through purely national efforts.[261]

Green India Mission is designed to expand forest and tree cover to augment carbon sequestration while scaling up ecosystem services and livelihood security of forest-dwelling communities. The mission is the best example of NAPCC strategy to design climate interventions to yield multiple benefits, i.e., mitigation in the form of carbon sequestration, adaptation in the form of ecosystem services, and development in the form of livelihood improvement. The focus of the mission on people's participation and participatory forest management is an indication that in sustainable forest management, active participation of local communities whose livelihood is centred on forest products is a requirement. Convergence of biodiversity conservation goals with climate goals is a reflection of high-level realization of the linkages between ecosystem management and climate change.[262]

The National Mission for Sustainable Agriculture meets the climate vulnerability of the Indian agriculture sector, which employs approximately half of India's workforce and is still overdependent on monsoon rains. The mission targets climate-resilient crop development, improving risk management instruments such as crop insurance, and supporting sustainable agriculture methods that increase productivity while lessening environmental footprints. The priority accorded to traditional farming systems and indigenous crop varieties indicates awareness that climate adaptation in agriculture has to build on existing knowledge systems and marry modern scientific thought. The holistic nature of the mission's response to overcoming productivity, sustainability, and climate resilience concerns indicates awareness that change in agriculture has to involve holistic interventions across multiple fronts.[263]

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[261] Ministry of Science & Technology, Government of India, *National Mission for Sustaining the Himalayan Ecosystem: Mission Document*, at 16 (2010), https://dst.gov.in/. (last visited May 22, 2025).
[262] Ministry of Science & Technology, Government of India, *National Mission for Green India (GIM)*, India Sci. Tech. & Innovation Portal, https://www.indiascienceandtechnology.gov.in/st-visions/national-mission/national-mission-green-india-gim (last visited May 22, 2025).
[263] Ministry of Agriculture & Farmers Welfare, Government of India, *National Mission for Sustainable Agriculture (NMSA)*, https://nmsa.dac.gov.in/ (last visited May 22, 2025).

The National Mission on Strategic Knowledge for Climate Change is the NAPCC's expression of the fact that climate action must be underpinned by strong scientific understanding, technological innovation, and institutional capability. The mission is intended to comprise climate science research capacities, facilitate technology development and deployment, and equip human resources to execute climate action across sectors.[264] Emphasis on indigenous technology development and research collaborations is an expression of India's policy of developing domestic capabilities while resorting to foreign collaboration for sharing knowledge and technology acquisition. The mission's emphasis on generating networks of knowledge institutions is a suggestion that climate risks need cooperative processes that move beyond conventional institutional silos.

4.3 RIGHT TO REPAIR IN INDIA

The right to repair movement in India has picked up momentum with the rise in consumers demanding that they have the liberty of repairing their electronic goods and household appliances without approaching manufacturer-approved service centres for repairs. It is a paradigm change in how society perceives ownership rights, especially in the context of digital machinery and modern appliances that are part of everyday life.

India's strategy towards the right to repair has been influenced by international trends, specifically action in the European Union and some U.S. states that have passed or proposed broad right to repair acts.[265] The Government of India has started to appreciate that consumers ought to have the right to choose where and how their goods are repaired, as opposed to being tied into proprietary repair networks with exorbitant prices and which may not be easily available to all geographic locations.

The concept of Right to Repair has the underlying philosophy of LiFE which is Lifestyle for Environment Movement. Considered as ‘Jan Andolan’, this public movement encourages individuals to come together as ‘Pro-Planet People’. With the leverage of social networks, the LiFE movement aims to initiate a change in addressing the climate change challenge. The LiFE movement envisages the replacement of the

[264] Ministry of Science & Technology, Government of India, *National Mission on Strategic Knowledge for Climate Change: Mission Document*, at 33 (2010),
[265] “Protecting the Right to Repair: The U.S. vs. the EU,” Hofstra J. Int’l Bus. & L. (Mar. 2024), https://www.hofstrajibl.org/2024/03/protecting-the-right-to-repair-the-u-s-vs-the-eu/. (last visited May 22, 2025).

linear use-and-dispose mode of economy with a circular economy ecosystem which strengthens and incentivises climate-friendly actions from individuals.[266]

The Consumer Protection Act 2019 gives some fundamental backing to the right to repair by establishing more extensive consumer protection structures, but does not explicitly state that right to repair in the way its proponents advocate. Consequent to this principle the Ministry of Consumer affairs have brought out a Right to Repair framework which largely outlines the objectives to be complied with by producers of goods.[267]

Currently, the Right to Repair framework is applicable to four major sectors, namely Farming equipment. Automotive equipment, Mobiles and Data storage equipment and Consumer durables.[268] The agriculture industry has been a specific target of right to repair efforts in India, where farmers generally find it difficult to acquire and pay for repairs for new agricultural machinery. Farm tractors and other agricultural equipment increasingly have advanced electronic systems that need specialized diagnostic tools and access to software in order to keep them running efficiently. Farmers contended that they should not be required to use only dealer networks for repairs, particularly when the farming season is busy and downtime can mean huge economic losses.[269]

The automobile sector is a significant domain in need of right to repair implementation in India. New cars have several electronic microprocessor-based control units and need expert-level diagnostic equipment to allow quality repair. The Society of Indian Automobile Manufacturers has debated the issue of striking a balance between how to hold on to safety and security issues on the one hand and enabling consumer rights, which favour repair technicians, on the other hand.[270]

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[266] *Lifestyle For Environment (LiFE) Movement*, Right to Repair India, https://righttorepairindia.gov.in/life.php (last visited May 23, 2025).
[267] T.R. Subramanya & Nidhi Saroj, *Is Right to Repair One's Own Good a Consumer Right? An Analysis of the Changing Dimensions of Consumer Rights in India*, 11 **International Journal on Consumer Law & Practice** 183, 199 (2023), https://repository.nls.ac.in/ijclp/vol11/iss1/9.
[268] *Sectors Covered*, Right to Repair India, https://righttorepairindia.gov.in/sectors.php (last visited May 23, 2025).
[269] Rajesh Kumar & Vimal Kumar, *Farm Mechanisation: Status, Strategies and its Challenges in Indian Agriculture*, Vol. 3, Issue 7, July 2021, at 361, https://www.researchgate.net/publication/363134762. (last visited May 23, 2025).
[270] BRICS Competition Authorities, *A Study on Competition Issues in the Automotive Sector* 179 (Competition Comm'n of India 2022), https://www.cci.gov.in/images/publications/en/astudyoncompetitionissuesintheautomotivesector1667292295.pdf. (last visited May 23, 2025).

In the electronics and smartphone industry, India's wide consumer base has created special dynamics around repair rights. The cultural practice of repairing a product and national repair shops have stretched manufacturer limitations on access to original parts, diagnostic equipment, and repair manuals. Consumers and Corporations have constantly demanded regulations requiring manufacturers to make these materials available to independent repair professionals.[271] In a recent National Workshop pertaining to Mobile and Electronics domain by a Committee on Repairability, a 'Repairability Index Framework' was mooted to facilitate the consumer to make an informed decision while purchasing a mobile or Tablet, giving primacy to the Repairability attribute compared to other devices.[272]

Intellectual property issues are huge in the right to repair debate in India. Patents and trade secrets are generally quoted by the manufacturers as reasons for limiting repair know-how and access to components. Consumer organisations, on the other hand raise their concern regarding such intellectual property rights must be accommodative of the exceptions for purposes of repair which serve a greater goal of addressing wastage and the resultant climate change.[273]

The financial stakes for the right to repair framework in India are huge, as India has a large population and a rising middle class. Greater repair rights could spur growth in the aftermarket repair market, create employment, and lower consumers' device maintenance costs overall. The right to repair is aimed at promoting sustainable consumption and reduction of e-waste as major pillars of Atma Nirbhar Bharat or self-reliant India programme.[274]

The recent policy deliberations have shown that the Indian government is planning a more general right to repair law that would solve most of the challenges systematically.

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[271] Margot Möslinger et al., *Towards an Effective Right to Repair for Electronics: Overcoming Legal, Political and Supply Barriers to Contribute to Circular Electronics in the EU*, at 23, Joint Research Centre, European Commission (2022),

[272] Press Release, Ministry of Consumer Affairs, Food & Pub. Distribution, Govt. of India, *Report for Framework on Repairability Index (RI) in Mobile and Electronic Sector Submitted* (May 3, 2025), https://www.pib.gov.in/PressReleasePage.aspx?PRID=2126409.

[273] Avnip Sharma & Abhinav Mohan Goel, *Intellectual Property Rights v. Right to Repair*, The IP Law Post (Dec. 10, 2021), https://iplawpost.wordpress.com/2021/12/10/intellectual-property-rights-v-right-to-repair/.

[274] Press Release, Ministry of Consumer Affairs, Food & Pub. Distribution, Govt. of India, *Department of Consumer Affairs Sets Up Committee to Develop Comprehensive Framework on the Right to Repair* (July 14, 2022), https://www.pib.gov.in/PressReleasePage.aspx?PRID=1841403

The law has to strike a balance between consumer rights and legitimate manufacturer interests in safety, security, and protection of intellectual property.[10] Formulating these policies is an important step towards defining the line between ownership rights and technological innovation in India's rapidly changing digital economy.

4.4 EXTENDED PRODUCER RESPONSIBILITY REFLECTED IN INDIAN LEGAL FRAMEWORK

Extended Producer Responsibility (EPR), as discussed in the previous chapter, has found significance in the Indian legal framework too. The EPR model recognises the fact that stakeholders who benefit economically from the production and sale of goods should take responsibility for the environmental burden of their product's whole lifecycle, including post-consumer waste management. The EPR aspect can be observed in the following Indian initiatives

4.4.1 E-WASTE MANAGEMENT RULES OF 2016

The evolution of EPR in Indian e-waste regulation started with the E-Waste Management Rules of 2016, which was an important move towards setting up producer responsibility for electronic waste.[275] These rules brought in the innovative idea of collection targets, where producers were mandated to collect a minimum percentage of the electronic items they had put on the market in earlier years. The original design used a phased process, starting with low-level collection levels, which would step by step increase over the years, taking into account the necessity for industry adaptation and infrastructure growth.[276] This incremental implementation schedule reflected the government's acknowledgement of the complex logistics of setting up country-level collection and recycling systems.

The E-Waste Management Rules were further improved in the 2022 amendment wherein the EPR mechanism was made more robust with compliance mechanisms and clear cut responsibilities were pinned on the manufacturer, producer, recycler, refurbisher and bulk consumer.[277] Stakeholders under the new rules must register with

[275] Press Information Bureau, Ministry of Environment, Forest and Climate Change, Extended Producer Responsibility (July 18, 2022), https://www.pib.gov.in/PressReleasePage.aspx?PRID=1842627.
[276] Id.
[277] Press Information Bureau, Ministry of Environment, Forest and Climate Change, *Recycling of e-waste* (Dec. 8, 2022), https://www.pib.gov.in/PressReleasePage.aspx?PRID=1881761.

the Portal maintained by the Central Pollution Control Board and must prove compliance through channels of comprehensive reporting mechanisms that are updated with the volume of e-waste collected, processed, and recycled.[278] The legislation expanded the definition of producers to cover importers and owners of brands, so that the environmental liability of foreign producers of products distributed in India cannot be escaped by them.[279] The holistic strategy seeks to close a huge loophole which had earlier enabled some multinational firms to pass on the burden of waste disposal to Indian retailers and distributors.

4.4.2 PLASTIC WASTE MANAGEMENT RULES, 2016

India's plastic waste management act has also adopted EPR principles, to ensure that there is an element of accountability involved in generation of plastic waste. The Plastic Waste Management Rules, which were updated in 2022, include specific EPR requirements for producers, importers, and brand owners of plastic packaging.[280] While in the case of e-waste, products have fairly long life cycles, plastic packaging usually enters waste after consumption of the product, and thus requires diverse collection and processing systems.[281] The legislation reflects this distinction by setting collection targets annually against the plastic packaging that entered the market during the same year, not historic sales volumes.

The EPR plastic waste system specifically targets multi-layered plastic packaging whose recycling is rendered challenging by virtue of its layering. The multi-layered packaging since 2022 has been under strict restrictions, when manufacturers are compelled to render the packaging recyclable or compostable.[282] This move is in line with more scientific proof of the permanence of some plastic recipes in the environment and is a preventive move from spreading non-recyclable plastic waste.[283] Producers

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[278] Central Pollution Control Board, *E-Waste EPR Portal*, https://eprewastecpcb.in/#/ (last visited May 24, 2025).
[279] Central Pollution Control Board, *Frequently Asked Questions (FAQ) under E-Waste (Management) Rules, 2022* (Jan. 23, 2024), https://cpcb.nic.in/uploads/Projects/E-Waste/FAQ_ewaste_23012024.pdf
[280] Central Pollution Control Board, *Centralized EPR Portal for Plastic Packaging*, https://eprplastic.cpcb.gov.in/#/plastic/home (last visited May 24, 2025).
[281] Central Pollution Control Board, *FAQs – Centralized EPR Portal for Plastic Packaging*, https://eprplastic.cpcb.gov.in/plastic/downloads/FAQs.pdf (last visited May 24, 2025).
[282] Central Pollution Control Board**,** *FAQs – Centralized EPR Portal for Plastic Packaging*, https://eprplastic.cpcb.gov.in/plastic/downloads/FAQs.pdf (last visited May 24, 2025).
[283] Md. Golam Kibria et al**.,** *Plastic Waste: Challenges and Opportunities to Mitigate Pollution and Effective Management*, 17 *International Journal for Environment Research* 20 (2023),

must now carry out recyclability analysis and labelling to enable segregation and handling of waste.

In response to an unstarred question on the action plan on circular economy in the Rajya Sabha, the reply from the Minister of state in MOEFCC listed out the other domains in which Extended producer responsibility is incorporated which are mentioned as follows.[284]

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

ii. E-waste: E-waste (Management) Rules, 2022

iii. Tyre Waste: Extended Producer Responsibility (EPR) for Waste Tyre, 2022

iv. Construction and Demolition Waste: Construction and Demolition Waste Management Rules, 2016

v. Bio-medical waste: Bio-medical Waste Management Rules, 2016

vi. Battery waste: Battery Waste Management Rules, 2022

vii. Fly ash: Ash Utilisation Notification, 2021

The application of EPR principles to more integrated circular economy schemes is catching in India's environmental policy. Legislation increasingly focuses on waste reduction and reuse regimes in addition to the conventional recycling regime and makes producers invest in new business models like product-as-a-service products and take-backs.[285] This combined system acknowledges that sound waste management includes root transformation in production and consumption patterns, not better disposal and recycling technology.

4.5 NATIONAL RESOURCE EFFICIENCY POLICY OF INDIA

India's National Resource Efficiency Policy (NREP) is a comprehensive policy that seeks to address the rising challenges of resource use in the nation while promoting sustainable development. The draft NREP was developed based on the premise that economic growth and rampant urbanisation have imposed unprecedented demands on

[284] Rajya Sabha, Unstarred Question No. 3902, *Action Plan for Circular Economy* (Apr. 6, 2023), https://sansad.in/getFile/annex/259/AU3902.pdf?source=pqars.
[285] Utsav Bhadra & Prajna Paramita Mishra**,** *Extended Producer Responsibility in India: Evidence from Recykal, Hyderabad*, 10 *J. Urb. Mgmt.* 438 (2021)

the country's finite natural resources. The policy works on the principal objective of delinking economic growth from resource consumption and transforming the long-standing linear economic model to a more circular one with emphasis on efficient utilisation of resources supplemented by minimal wastage.[286]

The overarching aim of the policy focuses on enhancing the productivity of resources in different sectors of the Indian economy. This includes enhancing the material consumption efficiency, minimising waste generation, and encouraging the implementation of cleaner production technologies. Targeted resource-consumptive sectors such as manufacturing, construction, textiles, and agriculture, which contribute to a high percentage of India's material footprint, are identified by the policy and quantifiable reduction in resource intensity along with economic competitiveness and growth patterns are envisaged by the Policy.[287]

The policy encourages industries to adopt concepts like industrial symbiosis, where waste produced by one industry becomes the input for another and thereby develops closed-loop mechanisms, reducing wastage of resources. This concept is suited for the manufacturing industry of India, which has until now functioned on linear production models. It incorporates incentives to encourage firms to invest in effective technology and establishes systems for evaluating and monitoring resource efficiency progress in various industrial segments.[288]

The above policy framework also touches on the critical domain of national material flow analysis and resource accounting. India acknowledged the necessity of establishing integrated systems of data collection and monitoring to quantify resource flows, determine inefficiencies, and monitor progress towards achieving resource efficiency goals. This would entail establishing universal measurement for resource

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[286] Press Release, Ministry of Env't, Forest & Climate Change, Govt. of India, *Extension of Timeline for Public Consultation on Draft National Resource Efficiency Policy, 2019* (Aug. 26, 2019), https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=192825

[287] Amrita Goldar, *Material Efficiency Approach towards Reducing Emissions: G20 Experiences and Lessons for India*, Policy Brief No. 2, Indian Council for Research on Int'l Econ. Rels. (Apr. 2021), https://icrier.org/pdf/Policy_Brief_2_Material_Efficiency_Approach_towards_Reducing_Emissions.pdf

[288] Gokulram A. & Abhishek Kumar, *Industrial Symbiosis in India – Challenge or Opportunity? Learnings from a Study of Naroda Industrial Estate, Gujarat* 21 (Anant Nat'l Univ., Anant Ctr. for Sustainability 2021), https://anantup.in/wp-content/uploads/2022/12/Industrial-symbiosis-in-India-challenge-or-opportunity.pdf

utilization, generation of waste, and recycling rates across different sectors of the economy. The policy requires material intensity patterns to be reviewed periodically and resource efficiency performance monitoring of industries by adopting standardized reporting procedures.[289]

International cooperation and knowledge-sharing are an essential part of India's policy structure on resource efficiency. India is an active member of global institutions like the International Resource Panel and collaborates with other countries to exchange experience and best-practice resource efficiency technologies. International connections give access to leading-edge technologies, learning through other nations' success experience of implementation, and contributing inputs to global resource efficiency targets. Policy. framework also allows for technology transfer arrangements and collaborative research projects with overseas partners.[290]

The economic gains of India's policy on resource efficiency extend beyond the environment to include considerable cost savings and competitiveness. Through the use of materials and reduction of waste, industries can reduce significant costs while improving their environmental performance. The policy framework incorporates provisions for quantifying these economic benefits and provides enterprises with tools for quantifying the financial payback of resource efficiency investments. This economic factor is crucial to enable mass adoption of resource-conserving methodologies within India's diversified industrial sector.[291]

4.6 ZERO DEFECT ZERO EFFECT PROGRAMME

The scheme was initiated by the Ministry of Micro Small and Medium Enterprises (MSME) with the objective of creating accurate awareness in Micro Small Medium Enterprises about Zero Defect Zero Effect (ZED) manufacturing which nudges and facilitates such enterprises to obtain ZED certification. In pursuit of ZED, MSMEs can

[289] NITI Aayog, *Strategy Paper on Resource Efficiency* (2020), https://library.niti.gov.in/cgi-bin/koha/opac-retrieve-file.pl?id=224fbc6ba21eeab00b31e2eb3b836477. (last visited May 22, 2025)
[290] United Nations Environment Programme, *Global Resources Outlook 2024: Bend the Trend – Pathways to a Liveable Planet as Resource Use Spikes* 86 (International Resource Panel 2024), https://wedocs.unep.org/20.500.11822/44901 (last visited May 22, 2025).
[291] Souvik Bhattacharjya & Shilpi Kapur, *National Resource Efficiency Policy: Reference Report for India* 11 (TERI 2019), https://library.niti.gov.in/cgi-bin/koha/opac-retrieve-file.pl?id=224fbc6ba21eeab00b31e2eb3b836477. (last visited May 22, 2025).

cut down on wastages substantially, enhance productivity, widen their market, have more Intellectual Property Rights, encourage innovation in production-related processes and adopt a level of standardisation for their products, processes and systems that can boost global competitiveness.[292]

4.7 CHALLENGES

India's shift towards a circular economy, though in conformity with global sustainability goal ideas, is confronted with multi-faceted challenges based on structural, institutional, and socio-economic realities. Legal frameworks alone will not act as a panache to the challenge of environment pollution and climate change.

A major challenge associated with implementation of circular economy is lack of awareness and coordination among stakeholders . While the Right to Repair initiative, which was launched in 2022, seeks to empower consumers and check e-waste by mandating manufacturers to release repair data, its implementation remains uneven.[293] Producers also find it difficult to comply, based on logistical challenges and costs of revenues, while consumers continue to rely on informal repair networks because they have limited access to cheap official services.[294] EPR regulations in the Plastic Waste Management Rules (2016) bind producers to be accountable for post-consumer waste, but most companies, small and medium-sized firms in particular are unaware of their responsibility and some continue not to comply and fall back on linear approaches.[295]

Fragmentation of policy exacerbates the issue. Programs such as the National Resource Efficiency Policy (NREP) stresses on segregation and recycling, but absence of inter-agency coordination encourages overlapping functions and a paucity of enforcement.[296]

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[292] Ministry of Micro, Small & Medium Enterprises, *Operational Guidelines for Implementation of the Zero Defect Zero Effect (ZED) Scheme* (2020), https://dcmsme.gov.in/schemes/clcs-tus/Operational_Guidelines_ZED.pdf. (last visited May 22, 2025).

[293] Shreyash Sharma & Kris Hartley**,** *India's Circular Economy: Lofty Ambitions, Limited Progress*, Observer Research Found. (Mar. 26, 2025), https://www.orfonline.org/expert-speak/india-s-circular-economy-lofty-ambitions-limited-progress. (last visited May 22, 2025).

[294] Ministry of Consumer Affairs, Food & Public Distribution**,** *Department of Consumer Affairs Sets Up Committee to Develop Comprehensive Framework on the Right to Repair*, Press Information Bureau (July 14, 2022), https://www.pib.gov.in/PressReleasePage.aspx?PRID=1841403. (last visited May 22, 2025).

[295] LegalRaasta**,** *Challenges of Extended Producer Responsibility (EPR) for Plastic Waste Management*, LegalRaasta , https://www.legalraasta.com/blog/challenges-epr-plastic/. (last visited May 22, 2025).

[296] Sujit Jena et al., *How Can India Unlock Circular Economy for Wastewater and Agricultural Waste Management*, Council on Energy, Env't & Water (Dec. 16, 2024),

For instance, the environmental compensation mechanism of the Central Pollution Control Board (CPCB) holds producers accountable for EPR shortcomings, but lacking monitoring systems and nascent recycling infrastructure erode accountability.[297] India's informal waste management structure, serving almost 90% of India's recycling, has no formal incorporation into these systems and leaves room for unsafe practices such as landfill dumping.[298]

Downcycling refers to the process of recycling materials into products of lower utility and quality compared to the original material and thus makes it less conducive for reuse.[299] The plastic recycling industry in India is still in its early days, and downcycling is a frequently observed across the country due to the lack of proper infrastructure and technology which is burdened furthermore with higher level of contamination in waste for recycling plastic products.[300]

The economic feasibility is a major hiccup when it comes to Circular operations, like industrial symbiosis or high-tech recycling, involving huge capital investment upfront, making it out of bounds for many firms.[301] As per a recent study by The Energy Research Institute, the small and medium-sized enterprises with financial, as well as technological limitations, prefer smaller profits over revenue generation potential from transformation involving sustainability.[302] Moreover, markets for recycles are underdeveloped owing to quality-related and consumer trust-related concerns, which depress demand.[303]

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https://www.ceew.in/publications/how-can-india-unlock-circular-economy-for-wastewater-and-agricultural-waste-management. (last visited May 22, 2025).

[297] FICCI FMCG/Retail/E-Commerce Secretariat**,** *Plastic Waste Management Rules & Regulatory Compliance Challenges in India*, at 5 (2024), https://ficci.in/public/storage/SEDocument/20708/wvJXfJlTEGj1Mrh6nMNN0RNyY1gf1ZPXOSfOBify.pdf. (last visited May 22, 2025).

[298] Raghav Das, *India's Journey Toward a Circular Economy: Challenges and Opportunities*, Raghav Das (n.d.), https://raghavdas.in/indias-journey-toward-a-circular-economy-challenges-and-opportunities/. (last visited May 22, 2025).

[299] Shankar Prasad Sarma, Shalini Goyal Bhalla & Mausam Kumar**,** *India's Tryst with a Circular Economy*, EAC-PM Working Paper Series, EAC-PM/WP/17/2023, at 16 (2023), https://eacpm.gov.in/wp-content/uploads/2023/07/17-Indias-Tryst-with-a-Circular-Economy.pdf. (last visited May 22, 2025).

[300] Id. at 18

[301] Nitish Arora et al., *Circular Economy: A Business Imperative for India*, at 35 (2018), https://wsds.teriin.org/2018/files/teri-yesbank-circular-economy-report.pdf. (last visited May 22, 2025).

[302] Id at 43.

[303] The Shakti Plastic Industries, *Extended Producer Responsibility Rules in India*, Shakti Plastic Indus. (May 29, 2024), https://www.shaktiplasticinds.com/extended-producer-responsibility-rules-in-india/. (last visited May 22, 2025).

The behavioural inertia linked with policymaker and consumer slows cultural shifts toward circularity. While the Right to Repair can help reduce e-waste to some extent, established consumption habits and manufacturer refusal to share proprietary information limit its impact.[304] Once again, even as EPR laws mandate recycled content in packaging, weak penalties and incentives for compliance guarantee minimal adherence.[305]

These challenges can be addressed by integrated policy harmony, strong investment in infrastructure, and stakeholders' education. Improving the informal sector's input, improving monitoring mechanisms, and building public-private partnerships can help address the challenges to adoption of circular economy

4.8 CONCLUSION

The Indian climate and environmental policy has transformed enormously due to the pressures of constitutional directives, international agreements, and domestic interests. This transformation is all about bringing environment protection within the ambit of government obligation and public duty. The widely accepted Global agreements like the UNFCCC and Paris Agreement have necessitated national efforts such as India's Nationally Determined Contributions, which have translated into reforms in energy efficiency and renewable energy capacity of the country.

India's mission-based climate governance has been showcased through the National Action Plan on Climate Change (NAPCC), which aims to strike a balance of mitigation, adaptation, and development objectives. NAPCC missions like solar, energy efficiency, water, and agriculture have given an impetus to Institutional and sectoral innovation aimed to better tackle climate change.

The adoption of new concepts like the Right to Repair and Extended Producer Responsibility (EPR) in the repertoire of policy instruments by India reflects a transition towards circular economy approaches. These systems improve sustainability

[304] Supra note 22 at 186.

[305] FICCI FMCG/Retail/E-Commerce Secretariat, *Plastic Waste Management Rules & Regulatory Compliance Challenges in India*, FICCI (2024), https://ficci.in/public/storage/SEDocument/20708/wvJXfJlTEGj1Mrh6nMNN0RNyY1gf1ZPXOSfOBify.pdf.

throughout the product life cycle and nudge consumer behaviour to adopt sustainable practices, aided by behaviour change initiatives such as the LiFE movement.

India's transition to a circular economy faces hurdles, including structural, institutional, and socio-economic challenges, including lack of stakeholder awareness, poor enforcement, unutilised recycling infrastructure, isolation of the informal economy, excessive stress on Small and Medium Enterprises, and small markets for recyclable items. Added to this, Cultural resistance, violation of EPR and Right to Repair legislation, and lack of adequate support mechanisms is a disincentive to sustainable transition.

Each challenge provides an opportunity. The restructuring of policies and legal frameworks to incorporate inclusiveness, integrated and innovative governance, decentralisation of power to local communities, and broadening the financial and technological accessibility gap between policy intention and ground reality, is vital in addressing these challenges.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

The Circular Economy is a holistic approach that shapes economic activities to be centred around the idea of efficient utilisation of resources, going hand in hand with reducing wastage. Climate change, on the other hand, is a reality, and the global discourse is aligned with the concept of living with climate change and better adapting to the changed circumstances. Pursuant to mitigating efforts, the adoption of the Circular Economy offers a rational solution to this challenge.

The discussions on Circular Economy build on the basic recycling concept along with reuse and reduce but taking it forward with the technological support opens up vistas for efficient production and reusing of waste again as input and thereby improving the life of a product.

The legal framework plays an important role in promoting the adoption of Circular Economic principles by all stakeholders. When push comes to shove, the statutory framework can enable and coerce the adoption of climate-friendly mitigation measures into production processes. It is in the light of this discourse that the adoption of the Circular Economy in the Indian legal framework and the best practices from the adoption of the Circular Economy in other countries provide a valuable insight to Indian policymakers.

5.1 ENHANCEMENT OF THE INDIAN LEGAL FRAMEWORK TO BETTER SUPPORT THE ADOPTION OF CIRCULAR ECONOMY PRACTICES THROUGH CLIMATE CHANGE STRATEGIES

To enhance India's legal framework for Circular Economy integration, several measures are necessary. Firstly, a consolidated national legislation or Climate Change Act must be enacted, which defines the Circular Economy and enshrines it as a legally binding principle underpinning climate mitigation efforts. Such a statute should articulate goals such as lifecycle resource efficiency, waste minimisation, and sustainable product design. It must assign responsibilities to the Central and State governments and set sectoral Circular Economy targets.

Secondly, existing environmental statutes should be amended to reflect Circular Economy imperatives. The Environment Protection Act, 1986 can incorporate Circular Economy within its objectives, thus empowering regulatory authorities to impose

circularity mandates on industries. Sector-specific regulations and rules, such as the Construction and Demolition Waste Rules of 2016 and Battery Waste Management Rules of 2022, tracing their origin from the Environment Protection Act 1986, must expand their scope to incorporate circular design, reuse, and recovery obligations. The National Resource Efficiency Policy, still in draft form, should be finalised and given statutory status to provide operational clarity.[306]

Thirdly, fiscal and market-based instruments should be deployed to incentivise Circular Economy practices. These include green tax credits for refurbished goods, reduced GST rates for recycled materials, and viability gap funding for Circular Economy infrastructure like material recovery facilities. Public procurement policies must prioritise products adhering to the Circular Economy standards, creating a stable demand for circular goods.

Fourthly, capacity building is crucial. A nodal Circular Economy authority under the Ministry of Environment, Forest and Climate Change should be established to coordinate between ministries, enforce compliance, and facilitate knowledge exchange. Institutional reforms should also integrate Circular Economy curricula into legal and technical education to foster stakeholder awareness.

5.2 ADDRESSING THE BARRIERS TO SCALING UP CIRCULAR ECONOMY PRACTICES IN INDIA'S PRODUCTION PROCESS

Legal barriers primarily stem from the absence of binding the Circular Economy mandates and institutional fragmentation. Regulations lack enforceable circularity requirements, and overlapping jurisdictions between central, state, and local authorities hinder coordination. Moreover, definitions of waste, recyclables, and secondary raw materials are inconsistent across laws, creating ambiguity.

Economic barriers include high upfront costs for adopting circular technologies, limited access to credit, and underdeveloped secondary materials markets. Informal waste

[306] Supra note. 286 at https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=192825 (last visited May 22, 2025).

workers play a key role in recycling, but their exclusion from formal systems limits resource recovery efficiency and traceability.

Legislative solutions include harmonising waste definitions, extending EPR to more sectors, and mandating take-back schemes. The inclusion of informal sector actors through formal registration, skill development, and integration into municipal systems is vital. Additionally, mandatory lifecycle assessments for high-emission sectors like steel, cement, and textiles can promote design for durability and recyclability.

Based on an exhaustive review of statutory provisions, international models, policy instruments, and implementation mechanisms, the research clearly demonstrates that while India has made substantial climate commitments and initiated key policies, its legal infrastructure does not yet systemically embed the Circular Economy principles. Rather than treating circularity as a core pillar of its climate governance, India's approach remains fragmented, often focused on end-of-pipe solutions rather than lifecycle sustainability.

The findings indicate that Circular Economy principles are visible within the statutory landscape but there exists lacunae in a comprehensive Circular Economy Policy as seen in the European Union. Regulatory mechanisms such as the Environment Protection Act, 1986, and the Air and Water Acts primarily function within a linear paradigm, emphasising pollution control and resource regulation rather than regenerative production and consumption. Policies such as the National Action Plan on Climate Change (NAPCC) and its missions focus on renewable energy, energy efficiency, and sustainable habitats, but do not adopt the Circular Economy holistically.[307] While measures like Extended Producer Responsibility (EPR) under the E-Waste Management Rules, 2016, and Right to Repair frameworks have emerged, they are limited in scope and not embedded across sectors. Consequently, the central claim that existing legislation inadequately integrates CE principles is validated.[308]

This dissertation offers a novel legal perspective on Circular Economy integration within India's climate governance framework. While prior literature has examined the Circular Economy in policy and industrial contexts, this work foregrounds the legal

[307] Supra note. 254 at https://dst.gov.in/climate-change-programme. (last visited May 22, 2025).
[308] Supra 275 at https://www.pib.gov.in/PressReleasePage.aspx?PRID=1842627.

dimension, demonstrating how climate and environmental laws shape or constrain circular transitions. The comparative analysis with international frameworks, particularly the EU Circular Economy Action Plan and the Paris Agreement's targets, acts as a lodestar for Indian policymakers. The study contributes to a growing body of environmental jurisprudence advocating for systemic legal reform that bridges sustainability principles and enforceable rights.

The research enhances academic understanding by conceptualising the Circular Economy not merely as a technical or economic model, but as a constitutional and statutory obligation. It highlights the role of Articles 48A and 51A of the Indian Constitution in grounding the Circular Economy in fundamental environmental duties.[309] By doing so, it expands the normative foundation upon which climate-responsive legislation can be built.

5.3 POLICY AND LEGAL RECOMMENDATIONS

1. **ENACT A NATIONAL CIRCULAR ECONOMY AND CLIMATE CHANGE POLICY**:

   The Policy makers should chart a Policy which clearly defines Circular Economy principles, mandate life cycle assessments, enforce sector-specific targets, and promote institutionalisation focussed enhancing the awareness among stakeholders with a robust mechanism to monitor and regulate such activities.

2. **AMEND EXISTING ENVIRONMENTAL LEGISLATIONS**:

   There is a need to revamp the Environment Protection Act, 1986, and sectoral laws, including the Factories Act and Building Codes, to better accommodate the Circular Economy criteria, such as energy efficiency, recyclability, and modularity, which are currently scattered across legislations.

3. **FORMALISE AND STRENGTHEN EPR FRAMEWORKS**:

[309] Supra 246,247

EPR obligations must be extended to sectors like textiles, and packaging. Penalties for non-compliance should be stringent to promote a deterrent effect and the opportunities paved by EPR credits should be encouraged to improve market efficiency by competition.

4. **INTEGRATE INFORMAL SECTOR WORKERS**:

Informal workers form an important part of the Indian economy, and the legal recognition imparted, especially to informal waste workers through licensing, skill training, and access to public recycling infrastructure, will manifest in improved material recovery and social equity.

5. **ADOPT CIRCULAR PUBLIC PROCUREMENT POLICIES**:

The recent initiative of Approved List of Manufacturers and Models (ALLM) is a welcome initiative in public procurement process which mandates a preference for indigenously developed solar parts mandating recycled content in government tenders, rewarding Circular Economy innovation, and adopting lifecycle costing can mainstream Circular Economy in public infrastructure.

6. **ESTABLISH A CIRCULAR ECONOMY AUTHORITY**:

A centralised statutory body with enforcement, funding, and research capabilities can coordinate inter-ministerial efforts and monitor Circular Economy indicators.

7. **IMPLEMENT FISCAL INSTRUMENTS**: .

The carbon credit and trading mechanisms are widespread in global trade and the discussions around plastic credit is one such arena that the State can explore into and the idea of a differentiated GST structure with due credit being given to greener technology adoption with Circular Economy rebates, and investment-

linked tax deductions for Circular Economy compliant infrastructure can aid the faster adoption of this technology.[310]

8. **CAPACITY BUILDING AND EDUCATION**:

Legal education, vocational training, and public awareness campaigns should include Circular Economy principles so that they will encourage individuals to incorporate these into their daily lives, and the cumulative impact of these actions can help address the climate change challenge.

India stands at a critical juncture where its climate ambitions must be matched by transformative legal frameworks. The International Organisation for Standardisation (ISO) has published a ISO 59040:2025 standard which aims to achieve climate neutrality and integrate climate action in governance and management. With India championing environment-friendly technology and action plans, the awareness and compliance with this ISO standard can give a fillip to Indian made products in the International market and aid in better price discovery.

This dissertation reaffirms that circular economy principles, when properly integrated into climate legislation, offer a pathway to not only achieve emissions reduction but also enhance resource efficiency, equity, and resilience. The success of Circular Economy integration hinges on coordinated legal reforms, institutional innovation, and stakeholder commitment. By adhering to the constitutional duties and honouring global commitments by translating them into actionable statutory mandates, India can demonstrate climate leadership rooted in sustainable development.

[310] World Bank, *Product Overview: Plastic Credits*, THE DOCS (Nov. 2024), https://thedocs.worldbank.org/en/doc/411ebaec936068e4bb62a0e40ebce522-0320072024/original/Product-Overview-Plastic-Credits-FINAL.pdf. (last visited May 25, 2025).

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