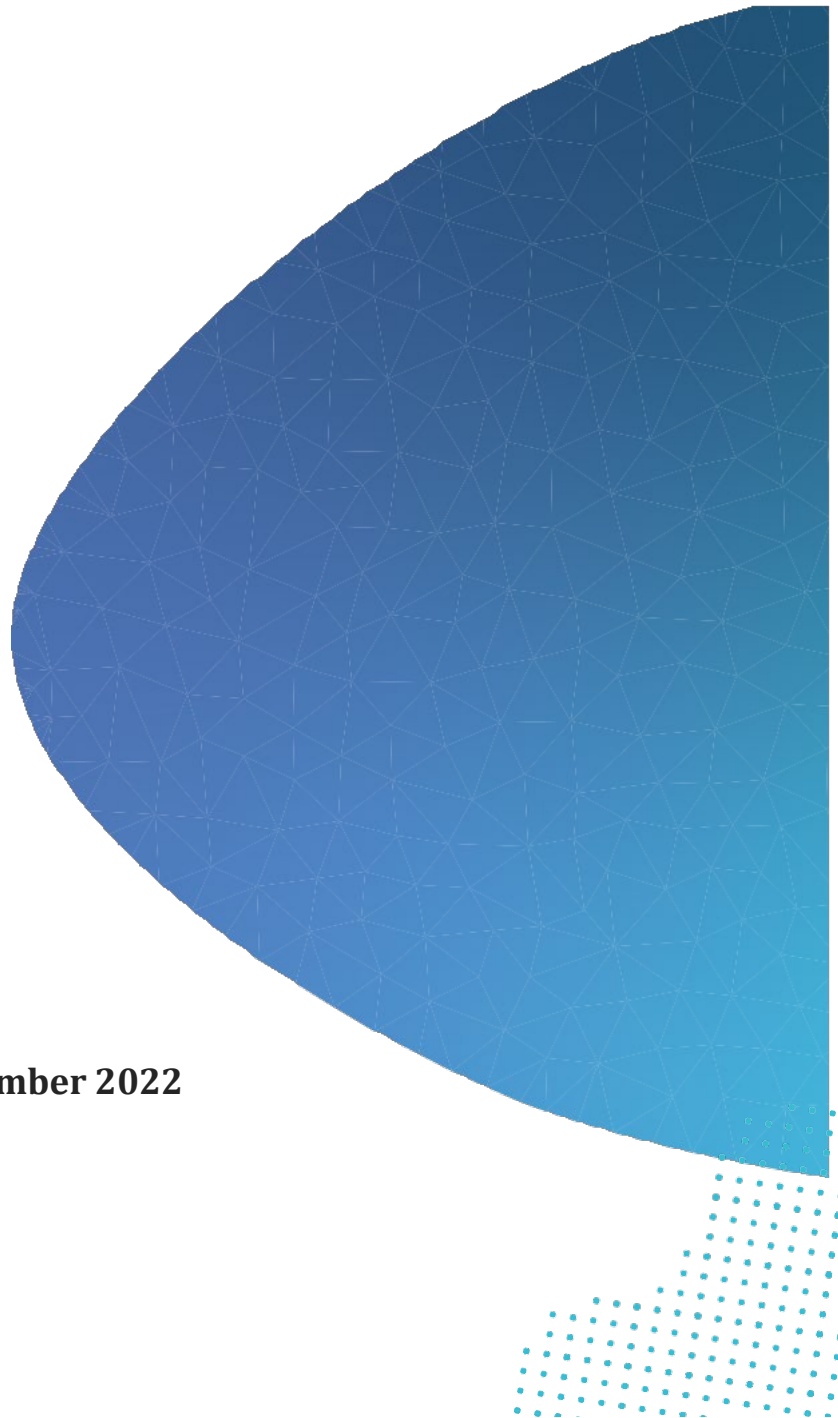


Investment Climate assessment for Circular Bioeconomy Sector in India: An assessment of the institutions, policies, regulations and financial environment

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Contents

Summary.....	1
1. Introduction.....	2
2. Overview of circular bioeconomy in India	3
3. Methodological approach.....	5
4. Results	6
4.1 Business Enablers	6
4.2 Policy and regulatory framework for circular bioeconomy	7
4.2.1 Regulatory environment.....	7
4.2.2 Policies and Programmes	8
4.2.3 Key Institutions in the Wastewater & Energy Sector	12
4.3 Market conditions for RRR products.....	13
4.4 Support services for circular bioeconomy.....	15
4.4.1 Financial assistance	15
5. Conclusion.....	18
References	20

Summary

To tackle overexploitation of resources, pollution and related health issues, there has been an increase in policies, laws, and programmes that emphasize the importance of treatment, recycling, and reuse over the years. Various attempts have been made at various scales for resources recovery and reuse (RRR) interventions with varying degrees of completion and success. With limitations of the public sector, engagement of the private parties is believed to enhance circular economic approaches in future.

This report is an attempt to assess the existing institutional, policy, regulatory and financial environment in which the RRR businesses operate in India. It begins with a brief introduction of India's take and position in terms of sustainability followed by an overview of the regulatory environment. The regulatory environment covers some of the important acts and rules concerning wastewater, energy and nutrients. The policies and programme section talks about some of the major policies that are being run by the central government in the country.

The subsequent section talks about the key institutions involved in the national level for the major sectors being covered in the report. This discussion is followed by description of the financial environment. The section describes the major government-run financial assistance and subsidies in the RRR domain. It also talks about the various monetary incentives offered by the government for the promotion of MSMEs in the country along with their general access to debt. The report also lists some of the key drivers that are involved in the RRR sectors differentiated by various parameters such as policy, regulatory and financials and others, followed by a conclusion.

1. Introduction

Realizing the resource potential and recovering nutrients, water and energy from waste is a new agenda towards attaining sustainable development. Developing countries are shifting their focus from disposal-oriented strategies towards business-oriented approach that emphasizes value creation and revenue generation (Murray and Buckley, 2010). Circular bioeconomy (CBE) is the production of recoverable biological (waste) resources and the conversion of these resources into high-value-added products, such as food, feed, bio-based products, and bioenergy (Gatto et al. 2021). CBE minimizes the depletion of resources, encourages regenerative practices, and stimulates reuse and recycling in a way that adds the highest possible value to the system (Muscat et al. 2021). It focuses on using waste and residues as a valuable resource (UNEP 2016; Stegmann et al. 2020). CBE fosters the sustainable processing of biomass into marketable products (Figure 1) such as organic fertilizers, or energy in the form of fuel, power or heat (Hetemäki et al. 2017; Temmes et al. 2020; Zabaniotou 2018; Stegmann et al. 2020).

India has been shifting gears to evolve into a viable economic nation treading along the pathway towards sustainability. Mounting into the global scenario of climate resilience, India is strengthening its internal strategy as expressed to UNFCCC at the 26th session of the Conference of the Parties (COP26) in UK through presenting the five nectar elements (*Panchamrit*) of India's climate action (GoI, 2022). Following Cop26, the COP27 meet brought to fore a circular economy's relevance in mitigating carbon emissions for India by ensuring responsible consumption and sustainable resource management. At the Climate Change Performance Index, India maintains its strong performance holding the eight position, rated high in the GHG Emissions, Energy Use, and Climate Policy categories, and medium in Renewable Energy. (Burck et al. 2022). India is presently driving towards introduction of a circular economy which is estimated to provide a yearly benefit of USD 624 billion by 2050 and a 44 percent reduction in greenhouse gas emissions (The Economic Times 2022). The government formulated the Battery Waste Management Rules 2022, Plastic Waste Management Rules as amended in 2022, e-Waste Management Rules 2022 in support of CE. Further the budget of 2022-23 also recognizes action plans to be formulated across sector like electronic waste, lithium-ion batteries, end-of-life vehicles, scrap metal, municipal solid waste (Thapyal et al. 2022).

It is perceived that the adoption of CE can unlock half a trillion dollars of economic value in India by the year 2030 (Mandpe et al. 2022). The circular bioeconomy is still emerging considering its high potential in India. Experiences across the globe shows that majority of the waste-reuse businesses are still at a nascent stage. Some of the businesses are either operating at a small scale or some are not self-sustaining in the long run and thus requiring proper investment channels, markets and business opportunities to foster their growth

(Otoo and Drechsel 2018). While policies and strategies are increasingly being oriented to harness the value from waste, there is a need for efficient business models. To achieve success in RRR sector, there is a need for private sector involvement along with the support of the governmental agencies that primarily act as the promoter of such markets and provide business support in the form of appropriate policies and infrastructure (Otoo and Drechsel 2018). This prompts the need for a deeper understanding of the business environment under which the waste reuse businesses are operating in different countries to foster entrepreneurship in waste-reuse sector.

The main objective of this study is assessment of investment climate (IC) by reviewing the national policies, strategies and regulations, financing mechanisms, and infrastructure and business environment in India. The study also identify main gaps in these areas affecting waste management, in general, and entrepreneur development in resource recovery and reuse in particular. The report introduces resource recovery in India followed by a review of the institutional framework (regulations, policies and programmes), critical examination of the financial environment towards circular bioeconomy, and existing market conditions.

2. Overview of circular bioeconomy in India

Indian economy is growing rapidly (at 8.7% annually)¹ and is likely to grow from USD 3.18 trillion to USD 5 trillion.² Along with the economic growth, increase in population, urbanization and change of consumption patterns will continuously increase the waste generation and pose a challenge to waste management in India. The urban population is growing rapidly and is estimated to be 46 million (UN population estimates 2018). The total quantity of solid waste generated in the country is 58 million tons with a collection efficiency of 95.4% (CPCB 2021). While the cities across the country treat 50% of waste collected and landfill around 18% of the waste, 31.7 % of the total waste generated remains un-accounted (CPCB 2021). It has been indicated that with absence of proper source segregation and the lack of awareness about bio-wastes as high-value resources, waste-derived circular bioeconomy is yet to be tapped fully (Awasthi et al. 2019, Venkata Mohan et al. 2018).

The organic component of solid waste varies between 40-60% across different cities in India. According to the Ministry of Urban Development, the entire potential of city compost plant in India is 0.71 MT per year, while the current production is 0.15 MT per year (MOC&F³ 2017). Recognizing the importance of converting the organic fraction of waste into compost for soil, Government of India (GoI) initiated different interventions. One of the policy was 'Promotion of city compost,' which entailed a development of marketing compost by providing a payment of INR 1,500 to fertilizer companies on the purchase and distribution of city-compost through the rural outlets of the

¹ Annual growth reported in 2021 (Source: <https://data.worldbank.org/country/india>)

²

http://economictimes.indiatimes.com/articleshow/56254240.cms?utm_source=contentofinterest%26utm_medium=text%26utm_campaign=cpst

³ Ministry of Chemicals and Fertilizers, Government of India

companies. Later other marketing entities marked by concerned state governments may also be involved with approval of the Department of Fertilizers. A fertilizer manufacturer was also allowed to co-market city compost with chemical fertilizers through their network in the market. The fertilizer companies could adopt villages to encourage city compost utilization. The compost generated would be procured by the government and public sectors in India will also promote the use of city compost for their gardens and horticulture, to the greatest possible extent. The policy involved the Ministry of Urban Development to look after installations of the compost plants across the state and Bureau of Indian Standards (BIS) to develop standards for eco-marking to ensure good quality of compost and so its acceptance among farmers. In 2017, the Market Development Assistance scheme was extended to compost manufacturers on bagged compost in the ratio of 1 bag of compost for 2 bags of chemical fertilizers.

However, in 2021, the Expenditure Finance Committee (EFG) chaired by Finance Secretary & Secretary (Expenditure) reviewed continuation of ongoing scheme of 'Policy on Promotion of City Compost' and observed that promotion of city compost is very small. There existed component for organic manure/compost under larger schemes of other Ministries viz. Department of Agriculture & Farmers' Welfare (DA & FW), Ministry of Agriculture and Farmers' Welfare and Ministry of Housing & Urban Affairs (MoHUA). The Expenditure Finance Committee (EFG) recommended that as there are similar schemes in other Departments with larger budget and better field presence, promotion of city compost scheme should be discontinued.⁴ Following the recommendation, the market development assistance was stopped. While the rationale to streamline policies towards circular bioeconomy is an essential step, the learning that engagement of the private fertilizer to market compost with incentives might not be viable. Marketing channels for other policies based on the different schemes run by the ministries need to be carefully planned for uptake of compost. Another evidence from the failure of the policy which might impede other policies and strategies on compost is the education of farmers in relation to use of compost by agricultural extension programmes.

Along with the city waste, agrowaste is another opportunity which has a potential to generate energy, soil ameliorant, food and consumer products. India being an agrarian economy has a very high agro-residue biomass potential (about 500 metric tons per year) (Bhuvaneshwari et al., 2019). The major quantity of solid waste generated from agricultural sources are sugarcane bagasse, paddy, wheat straw and husk and waste of vegetables are food products, tea, oil production, jute bres, groundnut shell, wooden mil waste, coconut husk and cotton stalk etc. (Maji et al. 2020, Ramesh et al. 2019). Two largest challenges for managing rural waste in India are underreporting and open burning (Chaudhary et al. 2021). Open burning of agrowastes, which is a common practice in India, accounts for a sizable fraction of India's GHG emissions, and the tremendous potential for conversion to biogas is being overlooked (Kapoor et al. 2020). Large scale intervention for conversion of agrowaste and replacing fossil fuels, would reduce GHG emissions from the energy sector. However, despite the benefits associated with biogas production, its potential is still underexplored due to issues pertaining to agri-waste supply chain, availability of cost-effective and simple pre-treatment

⁴<https://www.fert.nic.in/sites/default/files/2020-082021-09/Discontinuation-of-Scheme-%28City-Compost%29.pdf>

technologies, and viable business models to facilitate biogas production and utilization from agri-waste (Kapoor et al. 2020). Policy interventions and stronger collaboration between policymakers and potential biogas producers in the agricultural sector are needed to tide over technical, financial and regulatory barriers (Vilkè et al. 2020, Hildebrandt and Bezama 2019, Kapoor et al. 2020).

In this context, major impetus is being given to strengthen the backbone of economy majorly focusing on biotechnology for which the federal Government is coming up with major policies time to time. National Biofuel Policy was set up with the goal of using bio-fuels in 2009. 'The National Biotechnology Development Strategy 2015' was launched by the Ministry of Science and Technology with an aim to establish world-class bio-manufacturing hub and empowering human resources.⁵ In addition, Ministry also launched a 'National Mission on Bioeconomy' with the Institute of Bio-resources and Sustainable Development (IBSD) in order to boost rural economy by tapping bioresources, which when optimally utilized can create a large number of jobs at rural level.

3. Methodological approach

This study was based on review of literature, both peer reviewed and grey literature, from the national and global literature and existing policies/strategies for CE in India. To study the enabling environment for RRR options in India, expert opinions from various technical reports, research articles and statistical bulletins of state agencies were analysed and synthesized to prepare the sections on sanitation sector (Water Aid 2016, Ministry of Statistics 2016, Rohilla et al. 2017), Municipal Solid Waste (MSW, Kumar et al. 2017, Ahluwalia and Patel 2018), and wastewater treatment (Starkl et al. 2013, Ministry of Statistics 2016). Similar reports and papers provided information on composting (MCF 2017, Dilkara et al. 2016), biogas (Rao et al. 2010, Kaniyamparambil 2011, MNRE 2017, Mittal et al. 2018), and waste to energy plants in India (Kalyani and Pandey 2014, Ahluwalia and Patel 2018). Additional publications have been examined to get an insight into the socio-institutional aspects of the system such as demand for fertilizer (MAFW 2017, Dilkara et al. 2016), institutions and policies (Dilkara et al. 2016, Rohilla et al. 2017, Mittal et al. 2018), financing options (Chatri et al. 2012, Rohilla et al. 2017), and governance and business climate (World Bank 2017, 2018).

The enabling conditions for the businesses in the RRR sector were assessed based on the following indicators -

- Business enablers – cost and time to start a business, tax structure and incentives, access to electricity, water and other utilities, level of business satisfaction with governance and availability of infrastructure
- Policy and regulatory framework for circular bioeconomy – review of the institutional arrangements around RRR covering the various waste streams such as wastewater, MSW, Faecal sludge as well as the by-products of these wastes – composts and energy (biogas); discussion about stakeholders and the institutional arrangements that govern their action - government and non-government, formal and informal organizations and

⁵ <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134035>

individuals that have a part to play in elements of RRR and the written laws and policies that govern them as well as the informal arrangements that shape their modes of operation.

- Market conditions related to RRR products - demand for the product derived from RRR businesses and the constraints such as institutional or competition from substitutes faced by such products)
- Support services for the businesses in the RRR – institutional supports such as availability of national co-marketing directives, business incentives provided, incubators and accelerators or network associations.

4. Results

4.1 Business Enablers

India has recorded a jump of 37 positions against its rank of 100 in 2017 to be placed now at 63 among 190 countries assessed by the World Bank⁶. For the present study, four key parameters relevant for RRR businesses to start their business operations are being considered (as shown in Table 1). To start a business in 2020, it required about 6-7 months with an approximate expenditure of USD 13,000 in Delhi and Mumbai based on the study by World Bank (Table 1).

Table 1: Establishing a business in India – time taken and the associated costs				
Country	Activities	Number of procedures	Time to complete	Associated costs
India	Starting a business	10 (in Delhi) 10 (in Mumbai)	17 days (in Delhi) 18 days (in Mumbai)	USD 56.33-86.23 (in Delhi) USD 134.81-160.16 (in Mumbai)
	Dealing with construction permits	11 (in Delhi) 19 (in Mumbai)	113.5 days (in Delhi) 98 days (in Mumbai)	USD 2505.18 (in Delhi) USD 4914.86 (in Mumbai)
	Getting electricity	3 (in Delhi) 4 (in Mumbai)	27 days (in Delhi) 82 days (in Mumbai)	USD 838.78 (in Delhi) USD 155.07 (in Mumbai)
	Registering property	9 (in Delhi) 9 (in Mumbai)	49 days (in Delhi) 68 days (in Mumbai)	USD 7315.81 (in Delhi) – USD 6745.12 (in Mumbai)
	Paying taxes	11 (number)	252 hrs/year	Profit tax – 21.7%; Labour tax and contributions – 20.1%; Other taxes – 7.9%
Total cost of procedures for establishment of a business is approximately ~ USD 13,000				

As a result of continued efforts by the Government, India has improved its rank by 67 positions from 2016-20. However, high corruption rates are main issues which impede any policy or technological reforms. Openness and transparency is maintained at moderate level in India as reported by World Bank in their ‘Ease of doing business’ ranking. Some of the major reforms carried out by Government of India (GoI) which has boosted the ‘ease of doing business’ in India are – (i) registration process

⁶ The study by World Bank considers 11 areas of regulation affecting small and medium-size domestic firms in the largest business city of an economy. The areas of regulation considered are – (1) starting a business, (2) dealing with construction permits, (3) getting electricity, (4) registering property, (5) getting credit, (6) protecting minority investors, (7) paying taxes, (8) trading across borders, (9) enforcing contracts, (10) resolving insolvency, and (11) labour market regulation.

has been automated therefore time required for obtaining a trade license and to complete the tax and value added tax registration has been reduced; (ii) start-ups are made easier through elimination of stamps and enhancement of the online registration system; (iii) reduction in the property transfer tax to 6.7% of the property value, (iv) reduction in the corporate income tax and (v) application processing time has been reduced for access to electricity. However, cost of business registration has been increased, time required for filing the value-added tax and the corporate income tax has been made more complex and time taking and firms need to meet 7% of their electricity needs through solar energy (thus increasing the initial costs of installation) which has an impediment for the ranking.

4.2 Policy and regulatory framework for circular bioeconomy

4.2.1 Regulatory environment

This section elaborates on the regulatory ecosystem of India with respect to the Resource Recovery and Recycling components. There are multiple laws, rules and regulations in the country which are specifically related to waste management, environment and pollution control along with timely launched Missions with specific objectives. Also, the section specifies the policies framed by the nodal agencies/ ministries responsible for factors affecting the RRR components.

Acts and Rules

The Acts incorporated in the Indian Legislature, which provide a strong platform for the evolution of the RRR ecosystem in the country.

The Water (Prevention and Control of Pollution) Act, 1974

This act aims to prevent and control water pollution through the establishment of the Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB). It precisely imposes regulations on the treatment and disposal of sewage and industrial effluents.

The CPCB is responsible for creating water quality management plans that include, among other things, establishing water quality goals, monitoring water quality, controlling pollution, wastewater recycling and resource recovery, the use of clean technologies, and establishing wastewater discharge standards and residual pollution charges. The SPCBs, on the other hand, develop comprehensive water pollution prevention, control, and abatement programmes and ensure their implementation at the state level, as well as provide advice on matters relating to water pollution to the State Government. (MoEFCC GoI, 2022)

The Water (Prevention and Control of Pollution) Cess Act, 1977

The act aims to provide for the imposition and collection of a cess on water consumed by persons engaged in the industry segments and by local governments to supplement the resources of the Central Board and the State Boards established under the Water (Prevention and Control of Pollution) Act of 1974. (CPCB GoI, 2022)

The Environment (Protection) Act, 1986

The Environment (Protection) Agreement provides the Central Government with the authority to enact regulations to control environmental pollution.

The act was amended in 2017 wherein the standards for sewage treatment plant effluent discharge into water bodies and the land were clarified. The National Green Tribunal (NGT), however, scrapped these standards since the diluted and differential standards would increase pollution loads and further adversely affect a large section of the population. With its 2019 order, the NGT tightened the discharge standards for sewage and stressed that such standards will result in the effluent that can be reused for all non-potable purposes. As per that, each sewage water treatment plant should be used for reusing and recycling water to reduce droughts and climate change. (GoI, 2022)

The rules and regulations implemented by the Government of India with respect to waste management, in relation to the Circular Economy are provided in Table 2.

Table 2: Rules - Government of India

Year	Name of the Rule	Description
1989	Hazardous Wastes (Management and Handling) Rules (1989, amended January 2003, August 2010, April 2016)	Hazardous Waste Rules deal with resource recovery and disposal of hazardous waste in an environmentally sound manner.
1998	Biomedical Waste (Management and Handling) Rules (1998, amended September 2003, March 2016)	These rules apply to all who generate, collect, receive, store, transport, treat, dispose of, or handle biomedical waste in any form
2000	Municipal Solid Wastes (Management and Handling) Rules (2000, amended April 2016)	All the ULBs in the country are directed to manage MSW in a scientific way. These rules cover all the aspects of MSWM such as collection, segregation, recycling, treatment and disposal in an environmentally sound manner.
2016	Construction and Demolition Waste Management Rules	These rules addressed the indiscriminate disposal of C&D Waste and enable these wastes to be reused and recycled in a gainful manner

Source: Research Paper: Overview of Municipal Solid Waste Generation, Composition, and Management in India

The rules passed by the Ministry of Environment, Forests and Climate Change (MoEF&CC), GoI in the year 2016, have replaced the Municipal Solid Wastes (Management and Handling) Rules, 2000. The rules focused primarily on the aspects of segregation at source, collection, and disposal of sanitary waste, collect back scheme for packaging waste, user fees for collection, waste processing and treatment, promoting the use of compost, and promoting waste to energy.

4.2.2 Policies and Programmes

There are several policies launched by the Government of India in order to stabilize the waste management system of the country. The programmes mentioned are further additions to the initiatives taken by the government to emphasize the importance and urgency of the matters concerning to RRR.

Policies related to RRR

As per the Indian Constitution's 12th Schedule, the local government entities in cities and urban areas oversee the provisioning of fundamental civic services including sanitation facilities. However, this has never been enough as they face several challenges due to the shortage of funds, lack of full

coverage of services, poor delivery of services. The central and state government, consequently, are quite actively involved in the formulation of several policies and programmes that are involved in the promotion of sanitation facilities including faecal sludge management. While policies concerning environment and waste have always existed in the country, there has been an increase in the policies related to renewable energy including biogas and biomass, waste to energy, compost, and so on over the years.

National Environment Policy, 2006

Launched in 2006, this is a crucial policy in the history of India. Some of the aspects of the act focus on the treatment, and proper disposal of waste, along with recycling. (Policy, 2006)

National Urban Sanitation Policy, 2008

The Ministry of Urban Development of India launched the National Urban Sanitation Policy in 2008, emphasizing the importance of defining integrated city-wide sanitation plans that include institutional strengthening, awareness generation, behavioural changes, pro-poor approaches, and cost-effective technologies aimed at developing state sanitation strategies and city sanitation plans that should lead to open defecation-free cities, as well as sanitary and safe waste disposal. (India, 2008)

Service Level Benchmarks (SLBs), 2008

To introduce greater accountability among ULBs and improve urban services, the Ministry of Urban Development has prepared SLBs at the national level for performance monitoring and evaluation against agreed targets in four key sectors: water supply, MSWM, sewerage, and stormwater management. (Unnisa, 2013)

National Water Policy, 2012

Among the other objectives, the policy focuses on the incentivizing recycling and reuse of water in the RRR domain. However, the absence of any action plans or frameworks is the main issue that has creates a hindrance in the fulfilment of this objective.

The Ministry of Urban Development (now Ministry of Housing and Urban Affairs) promoted small scale Waste to Energy systems and nutrient recovery from onsite faecal sludge treatment systems (septic tanks and pit latrines) in its National Policy on Faecal Sludge and Septage Management (FSSM) in February 2017. (MINISTRY OF JAL SHAKTI DEPARTMENT OF WATER RESOURCES, 2022)

PPP Toolkit for Solid Waste Management, 2012

PPP Toolkit is an attempt by the Ministry of Urban Development to provide a comprehensive knowledge of SWM for implementers. It has been prepared to provide a step-by-step approach for identifying, evaluating, and implementing PPP projects in the SWM sector. (Kapil Dev Sharma, 2019)

National Policy on Faecal Sludge and Septage Management (FSSM), 2017

The Ministry of Urban Development (now Ministry of Housing and Urban Affairs) promoted small scale Waste to Energy systems and nutrient recovery from onsite faecal sludge treatment systems

(septic tanks and pit latrines) in its National Policy on Faecal Sludge and Septage Management (FSSM) in February 2017. (MoUD, 2017)

National Policy for Management of Crop Residues (NPMCR)

The policy was launched in 2014 to address the issue of the management of crop residue. It aims to promote in-situ management of crop residue in place of burning it as it leads to the degradation of the environment. Some of the other objectives include utilizing the crop residue for other purposes such as power generation, composting, production of bioethanol and so on; spreading awareness on its ill effects and capacity building; and introducing of several laws and policies to reduce the menace. (MoA GoI, 2014)

Programmes

The most recently launched programme are mentioned herewith in the report. It is to be noted that the Government is focusing on circulating the effort of each stakeholder involved in the waste management ecosystem to be brought under the overall development scenario of the country.

Jawaharlal Nehru National Urban Renewal Mission, 2005

To bridge investment gaps in urban infrastructure and implement reforms for better urban management, India launched the Jawaharlal Nehru National Urban Renewal Mission in 2005. Water supply, sewerage and drainage are some of the most crucial sectors under the programme that are focussed on. (JNNURM, 2005)

Swachh Bharat Mission, 2012

It is one of the biggest campaigns being run in the country since October 2, 2014, which aimed to make India clean and open defecation free by 2019. Under the programme, more than 10 crore toilets are built now. This campaign is now in its second phase and now aims to provide the required infrastructure for proper solid as well as waste management in the rural areas of the country. (GoI, Swachh Bharat Mission (Grameen), 2022).

Ganga Action Plan I, 1986; Ganga Action Plan II, 1993; Namami Ganga, 2014

Ganga Action Plan I

- This was introduced with the following objectives: curbing pollution by treating domestic waste as well as preventing of industrial waste from entering the river.
- The total cost sanctioned for the project was INR 462.04 crores. Out of this, around 433.3 crores were spent on 25 class-I towns of West Bengal, Bihar and Uttar Pradesh. The treatment capacity of about 868.69 MLD of sewage was created under the programme.

Ganga Action-II

- Under phase II, several activities were undertaken such as reviving of existing and laying of new sewerage systems and treatment plants.
- Till February 2014, around INR 3402.23 crores had been spent on this plan. The treatment capacity also expanded to 1757.23 MLD.

Namami Gange

- The major initiatives under this plan include the development of the riverfront, the construction of sewage treatment plants, the cleaning of the river, the conservation of biodiversity, afforestation, and public awareness among others. (TERI, 2020) The programme has been allocated INR 20000 crores.
- The treatment capacity of about 328 MLD of sewage was created under the programme as of 2019.

Waste to Energy Programme

Currently, a Waste to Energy Programme (WTE Programme) is being implemented to recover energy from industrial, agricultural, and municipal wastes/residues through bioCNG/ power/ biogas. Along with this, organic fertilisers are also produced by biogas plants as by-products which can be used for agricultural purposes.

Distilleries, paper and pulp solvent extraction, dairy, starch industries, sugar mills, pharmaceutical industries, and sewage treatment plants are among the industries where such projects are being implemented. (Energy, 2022)

Sustainable Alternative Towards Affordable Transportation (SATAT), which aims to establish 5000 CBG plants by 2023-24, with a production target of 15 MMT of BioCNG, is supported by the WTE programme through Central Financial Assistance provided by the Ministry of Petroleum and Natural Gas. Through the creation of new employment opportunities and increases in farmer income, it will help realize the vision of "Annadaata se Urjadaata". (MoPNG, 2022)

In addition to aligning itself with Swachh Bharat Mission, WTE utilizes Municipal Solid Waste (MSW) to generate electricity. At the end of January 2021, five Waste to Energy projects have been approved in principle by the Ministry for the grant of Central Financial Assistance (CFA) from the Waste to Energy programme. According to estimates, the projects will generate electricity from 6000 tons of MSW per day. (MNRE, 2021)

Biomass Power and Bagasse Co-generation Programme, 2011

The Government of India has been promoting this programme to generate energy through biomass using agricultural residues such as shells, husks, wood, and bagasse for power generation from dedicated energy plantations. On May 11, 2018, a scheme to promote biomass-based cogeneration in sugar mills and other industries was announced.

The objectives of the programme are:

- To promote the efficient and cost-effective use of surplus biomass for power generation.
- To maximize surplus energy production from sugar mills with improved technologies.
- To promote cogeneration technologies as a supplement to conventional power.

The power generation potential from agricultural and agro-industrial residues is estimated to be around 18,000 MW. The potential for surplus power generation through bagasse cogeneration in

sugar mills is estimated to be around 8,000 MW with progressive higher steam temperature and pressure and efficient project configuration in new sugar mills and modernization of existing ones. As a result, the total estimated potential for biomass power stands at approximately 26,000 MW.

The sugar industry has traditionally used biogasse as a fuel to meet the steam and power requirements of the sugar processing and sugar mill complex through incidental cogeneration. With advancements in boiler and turbine technologies for generating and utilising high temperature and pressure steam, the sugar industry has been producing steam and energy to fulfil its own needs while selling the excess electricity to the grid by optimally utilising bagasse. The sale of surplus power generated by optimal cogeneration contributes to the viability and stability of sugar mills, as well as the creation of additional power generation capacity across the country. (MNRE, 2021)

New National Biogas and Organic Manure Programme (NNBOMP)

The NNBOMP scheme, a central government scheme, aims to establish small biogas plants ranging in size from 1 M3 to 25 M3.

The objectives of the scheme are to provide green and clean renewable gaseous fuel for lighting, cooking and small power needs of potential farmers, cattle farmers/users, and individual households, as well as to facilitate the management and utilisation of biogas plant- produced slurry as an organic enriched Solid Biogas Fertilizer.

Biogas, as a clean cooking fuel produced from wastes available at the doorsteps of potential beneficiaries, along with the simultaneous production of organic nutrients enriched slurry, provides an opportunity to reduce costs/savings by '9,000 to '12,000 per year, based on plant sizes ranging from 1 to 4 M3. Efforts to establish biogas plants across the country are helping to double farmers' income. (MNRE, 2021)

4.2.3 Key Institutions in the Wastewater & Energy Sector

Institutions in the Wastewater Sector

1. Ministry of Jal Shakti: This is the nodal ministry that formulates and oversees the programmes and policies concerning the development and regulation of water resources in the country.
2. National Water Mission: Launched in 2011, its main objectives include water conservation, and management of water sources to ensure equal distribution and reduction of wastage.
3. Central Pollution Control Board (CPCBs) and State Pollution Control Board (SPCBs)
4. Programmes at the Central Level (TERI, 2020)

Institutions in the Energy Sector

1. In India, the Ministry of New and Renewable Energy (MNRE) oversees developing renewable energy policies for electricity, transportation, and heating. The MNRE includes the National Institute of Solar Energy and the National Institute of Wind Energy, which conduct research and development, testing, certification, standardisation, skill

development, resource assessment, and awareness activities. The MNRE also addresses bioenergy for electricity, such as EfW, and biogas.

2. Under the MNRE, the Indian Renewable Energy Development Agency (IREDA) operates as a non-banking financial institution, granting loans for renewable energy and energy efficiency projects.
3. The Solar Energy Corporation of India (SECI) oversees carrying out various MNRE subsidy schemes, including the solar park scheme and the grid-connected solar rooftop scheme.
4. SSS-NIRE is an autonomous institution of the MNRE, a developing R&D centre with a mission to focus on bioenergy and develop innovative renewables and biofuel technologies.
5. The Ministry of Power (MoP) governs India's electricity sector, which includes renewable energy generation. The Minister of Power is also in charge of the MNRE and renewable energy.
6. The Central Electricity Regulatory Commission (CERC) regulates generation and transmission utility tariffs and grants interstate transmission and trading licences.
7. The Ministry of Petroleum and Natural Gas (MoPNG) is the overall coordinating ministry for biofuel development and national biofuels policy implementation. It oversees biofuel marketing and distribution, blending levels, pricing and procurement policy, and capacity building.
8. The Ministry of Science and Technology is in charge of innovation, with a strong emphasis on bioenergy technology research.

4.3 Market conditions for RRR products

India produces most of the domestically consumed fertilizers. However, as of 2014, more than 25% of the consumption of nitrogen fertilizers and about 30% of phosphorus fertilizers are met through imports (FAO 2018). Thus, nutrient recovery from waste can help save substantial amounts of foreign exchange used for fertilizer imports. Despite the acknowledged benefits of waste-based organic fertilizers in both organic and conventional farming, compost use is not widespread among farmers in India (Dilkara et al. 2016). Crop residues are usually burned to prevent the transmission of diseases without regards of the possible damage to soil microflora which enhances soil fertility.

The most important barrier to the use of compost among the farmers is competition from chemical fertilizers although they are not substitutes. Chemical fertilizers are highly subsidized by the government and its availability and easy access at local retail agricultural input shops in rural areas make it more acceptable for the farmers. Another related barrier is the dissemination of information to farmers about the use of compost derived from the organic fraction of the solid waste. Although the use of aged farmyard manure is well-known, farmers have limited knowledge on municipal solid waste-based compost. It has been reported by farmers that the compost derived from organic solid waste is of low nutrient quality compared to farmyard manure, which lowers their preferences. Recently, government support programmes like Swacch Bharat Abhiyan are promoting waste segregation and utilization of organic fertilizer both from organic solid waste as well as fecal sludge

in the rural areas. The Ministry of Chemical and Fertilizers has issued a national co-directive that market development assistance in the form of INR 1500 per ton of city compost will be provided for scaling up production and consumption and the dealer's networks can be used for marketing composts (MCF, 2016). These measures are still in nascent stage and its success yet to be assessed in the future.

With an annual population growth rate of 1.58% energy demand in India is also on the rise which is being primarily met from fossil fuel. In rural India, 67% of the households still rely on firewood as a source of cooking fuel. Biogas a clean form of energy derived from animal waste, primarily cattle dung, poultry droppings, crop residue, kitchen waste, etc. can be a substitute for Liquid Petroleum Gas in rural areas. Although biogas has been promoted for over three decades now, there is still a potential for the expansion of the sector. The rate of biogas dissemination is low in rural areas and the share of biogas in the fuel mix in rural households is insignificant. Around five million family biogas plants (40%) have been installed under the biogas development program in view the total potential of 12 million domestic biogas gas plants estimated by the MNRE (CSO, 2014). In addition to family type biogas plants, 400 biogas off-grid power plants have been set up with a power generation capacity of about 5.5 MW (MNRE, 2015). The share of anaerobic digestion in biological waste treatment in urban areas is presently very low due to high capital cost and low revenue growth prospects compared to other competing waste treatment technologies. Currently, there are only 56 operational biogas-based power plants in India, the majority of them are located in three states, Maharashtra, Kerala, and Karnataka (CPCB, 2013).

The primary barriers of biogas technologies in rural areas are the following –

- Financial limitations – high installation cost and high level of bureaucracy and hence procedural delays in the accessing the financial support; Rao and Ravindranath (2002), Bansal et al. (2013), Kaniyamparambil (2011)
- Market – freely available fuelwood which is a cheaper option, Ravindranath and Balachandra (2009), Bansal et al. (2013)
- Social and cultural – lack of social acceptance for biogas like night soil, human excreta and low involvement of women in the decision-making process , Rupf et al. (2015)
- Technical and Infrastructural – this related to the inadequate supply of the feedstock – scattered dropping of cattle and low output for 2-3 months during winter and lack of skilled labour for the construction; , Rupf et al. (2015), Kaniyamparambil (2011), Bhat et al. (2001), Bansal et al. (2013)
- Lack of information - Poor dissemination of information regarding the technology and incentives given by the government Rao and Ravindranath (2002), Ravindranath and Balachandra (2009), Lack of awareness regarding substrates other than cattle dung for biogas generation Raha et. al. (2014).

In urban areas, biogas produced from municipal and industrial wastes is primarily considered for generating electricity or for transportation fuel. The primary barriers for biogas in urban areas are –

- (i) Financial barriers - high capital cost, unavailability of long term financing options, high interest rate and high-risk perception by financial institutions,

(ii) Competitiveness – operational costs of the biogas plants are higher than that of thermal power plants using coal or natural gas. Electricity derived from other renewable sources like solar, hydro and wind is cheaper than biogas; (iii) segregation of organic and non-organic waste is not done in urban households resulting in the low-quality organic feedstock; (iv) government incentives like feed-in tariffs, long-term financing, capital grants, viability gap funding & tipping fee for waste collection and handling are currently not in place (Mittal, 2018). Low economic viability of large scale projects discourage private investments in this sector (Ojha, 2010).

4.4 Support services for circular bioeconomy

4.4.1 Financial assistance

This section specifies the kind of financial assistance provided by the Government to the RRR initiatives in India. In India, traditionally, the Government of India (GoI) catered to major investments towards waste management (landfills, wastewater treatment plants, rural biogas programme etc.). An important national programme Jawaharlal Nehru National Urban Renewal Mission (JNNURM) to modernise cities and implemented through the MOUD started supporting PPPs in SWM and WSS projects (primarily through infrastructure projects) in 2005. Post 2014, there has been a paradigm shift in support of RRR businesses by the Government of India (GoI). The central government announced Smart Cities Mission (SCM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Swachh Bharat Mission (SBM). While all of the funding opportunities as mentioned under JNNURM still exist, the GoI has initiated “Promoting Innovative Smart Solutions” such that ULBs can avail matching funds under these schemes for public services. One of the major thrust areas is waste management including (i) waste to energy and fuel, (ii) waste to compost, (iii) treatment of wastewater, and (iv) recycling and reduction of construction and demolition waste. These missions focuses on making ULBs financially self-sustaining through promotion of user charges for the cost recovery and include private players to increase the service delivery. Thus, there is a boost towards startups and Small and Microenterprises (SMEs) in the RRR sector. A synopsis of the financial assistance provided through the different programmes is provided in Table 3.

Table 3: Financial Assistance provided by GoI

Initiative	Ministry	Period	What is financed	Available Funds
Swachh Bharat (Clean India) Mission	MoHUA/ MoDWS	2014-2019	Toilet construction in households, communities, and public spaces in all 4041 statutory towns	9 billion USD
AMRUT Mission	MoHUA	2015-2023	Water supply and sewerage connections, wastewater treatment facilities and septage management; and storm drainage systems (500 cities)	7 billion USD

Smart City Initiative	MoHUA	2017-2023	Sanitation and wastewater treatment management in 100 cities	7 billion USD
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MoHUA = Ministry of Housing and Urban Affairs, MoDWS = Ministry of Drinking Water and Sanitation

Central Financial Assistance for Biomass Power and Bagasse Co-generation Programme

To promote biogas-based cogeneration in industries especially sugar mills, financial assistance at the rate of Rs. 25 lacs/ MW is provided by the Central government. The assistance provided is based on the surplus exportable power but only for those projects that install new turbines as well as broilers. This assistance is a backward process and is usually released in a single instalment, without any advances.

The Ministry has launched the Bio-urja Portal to expedite the online submission of proposals and supporting documents for the scheme's Central Financial Assistance (CFA). (MNRE, 2021)

Central Financial Assistance for Waste to Energy Programmes

Central Financial Assistance (CFA) for projects of different categories is given in the form of capital subsidy to the promoters and in the form of Grants-in-Aid for other activities, as given below:

- a. Biogas generation: Rs.1.0 crore per 12000 cum/day (Maximum CFA-Rs.10 crore/project)
- b. Bio-CNG generation (including setting of Biogas plant): Rs.4.0 Crore per 4800Kg/day;
- c. Power generation based on Biogas (Maximum CFA- Rs.10 crore/project):
 - Gas engine/turbine route: Rs.3.0 Crore per MW
 - Boiler+Steam turbine route: Rs.1.5 crore / MW
- d. Power Generation (based on MSW/ RDF): Rs.5.0 crore /MW (Maximum CFA- Rs. 50 crore/project)
- e. Power (Based on BTG route): Rs.0.50 crore/MW (Maximum CFA - Rs.10 Crore/Project)
- f. Biomass Gasifier:
 - Rs. 2,500 per kWe with dual fuel engines for electrical application
 - Rs.15,000 per kWe with 100% gas engines for electrical application
 - Rs. 2 lakh per 300 kWth for thermal applications
 - Rs.10,000 per kWe for 100% producer gas engines with Gasifier system for electrical applications
 - Rs.8000 per kWe for 100% producer gas engine alone for electrical applications (MNRE, 2021)

Central Financial Assistance for New National Biogas and Organic Manure Programme

The Central Subsidy is provided under the NNBOMP for the installation of biogas plants of sizes 1 M3 to 25 M3, ranging from '7500 per plant of size 1 M3 to '35,000 per plant of size 20-25 M3. Apart from that, financial assistance is provided for turnkey job fees for construction, supervision, and so on. It also provides funding for a skill development programme for Biogas Mitras and BDTCs to hold

training courses. The amount of the subsidy is determined by the size of the installed biogas plant, the state or region, the beneficiary category, and the states of the North-eastern Region. Furthermore, administrative charges as well as training, publicity, and technical support are provided to the States/UTs implementing the scheme through Biogas Development and Training Centres (BDTCs). (MNRE, 2021)

Pradhan Mantri Mudra Yojana

Under the scheme, a non-banking financial company named Micro Units Development and Refinance Agency Ltd. (MUDRA) provides financial support to banks and microfinance institutions to provide support for the development of micro enterprise sectors in India. The loans provided are in three categories – Tarun, Kishore and Shishu varying with the requirement of the loan amount, age of the business and other parameters. No collateral is required and largely offered to traders, store owners, street vendors and others.

National Policy for Management of Crop Residues (NPMCR)

The policy was launched in 2014 to address the issue of management of crop residue. It aims to promote in-situ management of crop residue in place of burning it as it leads to degradation of the environment. Some of the other objectives include utilizing the crop residue for other purposes such as power generation, composting, production of bioethanol and so on; spreading awareness on its ill effects and capacity building; and introducing of several laws and policies to reduce the menace.

Single Point Registration Scheme

This scheme is managed by National Small Industries Corporation (NSIC) to support micro-enterprises in India. The main objective of the scheme is to enable business enterprises to become eligible in government purchases without the need for an earnest money deposit (EMD). Those having NSIC registration can avail of the benefit. Other benefits include free- cost tender, tender participation, and others.

High Risk and High Reward Research

Under this scheme, funding is provided for ideas and projects in the field of science and technology that can have a meaningful impact. There is no set budget for these projects, and the research grant must cover consumables, contingencies, equipment, and travel costs in addition to overhead grants. The funding is usually for three years and extendable up to five years in exceptional cases. (GoI, High Risk - High Reward Research, 2022)

General access to debt

To fund the growth, MSMEs require external financing (especially debt) since their internal resources are insufficient. MSMEs still rely primarily on banks for external financing, despite financial limitations. There are a variety of ways for MSME entrepreneurs to access external financing. The cash flow and investment needs of MSMEs are often met by straight debt.

Furthermore, MSME administrators often have difficulty securing new equity financing due to financial market constraints. MSMEs have access to a variety of funding sources, which means that

their access to finance differs. To create a supportive platform and promote MSMEs, governments and regulating agencies have extended incentives, grants, guided loans, and subsidized loans. The problem of financial connectivity persists, however. Accessing finance and selecting it properly has become a necessity because of the various difficulties. (Wasdani 2020)

The instances of bad loans are on the rise in the MSMEs, suggests the FSR report by RBI. The portfolios of both private as well as public sector banks suggest accumulation in non- performing categories and SMA 2. The percentage of NPA had risen sharply from 16.8 per cent in March to September 2021. The bank also mentioned that the chances of medium and low-risk borrowers in the MSME becoming high-risk borrowers were significantly high. (Ganguly 2022).

5. Conclusion

The present study focusses on assessing the enabling climate for RRR business opportunities in India. The study used four different criteria for the assessment – (i) business enablers for small and medium to initiate businesses; (ii) regulatory framework and polices related to waste management and whether these work towards promoting RRR opportunities; (iii) existing market and operations in the country which can be examples for promoting such businesses across the country; and (iv) access to finance and whether there exists any support services from the government to promote these activities.

India has improved its position in the worldwide ranking jumping 37 positions within two years to 63 among 190 economies. However, high corruption rates are main issues which impede any policy or technological reforms. Openness and transparency is maintained at moderate level in India as reported by World Bank. Therefore, although there exists legislations and policies, pertaining to waste and wastewater management along with the requisite quality standards for the permissible environmental restrictions, enforcement to achieve the means are not always easy.

It can be observed that although India is taking giant steps towards the improvement of handling waste and wastewater it still has a long way to go. The market development of the RRR businesses is still is scattered in some pockets of the country. While there are promotional activities like Ministry of Chemical and Fertilizers has issued a national co-directive that market development assistance in the form of INR 1500 (USD 21.5) per ton of city compost will be provided for scaling up production and consumption and that the dealer's networks can be used for marketing composts, the market for MSW compost is still undeveloped. Although India has standards for the compost they are not mandatory and therefore, nutrient recovery whether from waste or wastewater resources are in slow progress. In fact, there had been several experiments with MSW compost as well as faecal sludge compost, the market is still small and restricted to some pockets. While India is gradually progressing out from lower access to improved sanitation, the service chain will probably take some further time to develop. Some private involvement is being already noticed especially with the emptying facilities (of septic tanks) and establishment of Faecal Sludge Treatment Plants. With government programmes targeted towards city development, it is strongly felt that sanitation service chain as well as reuse business is going to develop further.

Along with the improvement in the business environment, Government of India is boosting an ecosystem to finance startup through different sources of funding (subsidies, venture capitalists into the sector, grants-in-aid, PPPs etc.). However, the bureaucratic mechanism often acts as a disincentive for the sector to avail the support from the government. To expedite the growth of the sector, the reforms towards enabling the environment that has been initiated should be promoted further.

The overall performance of India in creating enabling environment for the RRR sector across all the four indicators considered for the study shows a medium performance. While opportunities for the small and medium industries to initiate the business is made favorable along with the other institutional mechanism, the market potential has yet not developed particularly for the recovery of the nutrient which needs more awareness campaigns and regulations by the government. Implementing the CE concept in India in the waste management stream has various organizational, social and legislative constraints. These gaps are to be addressed immediately by the concerned authorities so that the sustainable and cost-saving option of CE can be applied at a broader scale in India. Although India has recognized circularity, the transition towards circular bioeconomy need effective implementation of Government policies. The GoI has introduced several policies in the recent past; however, none of the oriented policies proved to be a game changer. There is an urgent need to launch campaigns for organizing the sectors associated with solid waste recycling, thereby involving the rag pickers and other human scavengers, enhancing waste collection efficiency, and having positive social impacts. At the same time streamlining the existing policies with implementation agencies is required to effectively promote circular bioeconomy.

Absence of a common platform for interaction between entrepreneurs and global experts on various concepts of circular economy. To boost the implementation of the CE concept in India, there is a need to develop a suitable platform for proper interaction and exchange of ideas at national and international levels. Such a platform can aid in connecting the budding entrepreneurs and the experts, which may have positive impacts. The entrepreneurs need to be equipped with suitable technologies and business models such that they are adaptable or replicable on a wider scale in India. This should be backed by campaigning among citizens to provide them a better understanding of circularity. An increase in awareness among common masses might produce favourable results in adaption of circular economy approach.

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