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STRATEGY FOR FOSTERING RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GOA

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EU-REI
Creating a Resource Efficient India

STRATEGY FOR FOSTERING RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GOA

Prepared for
Directorate of Planning, Statistics and Evaluation (DPSE), Government of Goa

Prepared by
The Energy and Resources Institute (TERI)

With support from
European Union's Resource Efficiency Initiative (EU-REI)

DR. PRAMOD SAWANT,
CHIEF MINISTER,
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Foreword

Responsible and efficient management of natural resources holds the key to our future as not only our environment, but our people and economy depend on these resources. Significant improvements in resource efficiency will be necessary to meet the aspirations expressed in the Sustainable Development Goals (SDGs) and the Paris Agreement on climate change.

Government of India has been making serious efforts to push forward the agenda on resource efficiency and circular economy and has recently also drafted the National Resource Efficiency Policy for India. This policy recognizes the role that State governments can play in supporting the vision for efficient use of natural resources.

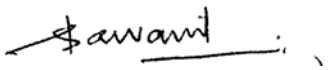
I feel proud to share with you that Goa is the first state to develop State strategy on Resource Efficiency (RE) and Circular Economy (CE) and this strategy is expected to enable the state's convergence with India's RE strategy and draft RE policy (GoI) and support in meeting many of the Sustainable Development Goals (SDGs). It was prepared with extensive consultation with government departments to seek their inputs and suggestions. Subject and sectoral experts, stakeholder groups including those representing the priority sectors of the state, have also shared their perspectives and suggestions which have been incorporated in the Strategy document.

The State of Goa has witnessed economic growth in recent times, largely driven by industries, mining, and tourism has put ever increasing pressures on the state's natural resources and environment. This strategy paper proposes a set of sectoral recommendations to foster RE&CE in the priority sectors of the state and also present an overall state-level action plan on mainstreaming RE&CE in Goa and fostering sustainable management of resources. In context of the growing need to conserve and sustainably manage the resources of coastal areas, this strategy will offer means to balance the competing demands of different users of the same resources and to manage the resources sustainably.

Goa 2035, a vision document for the state, highlights, “Goa should stand out globally as a model of development without destruction.” This is a laudable goal and illustrative of the recognition in Goa’s policy circles that there is a need for alternative development pathways to meet the sustainability challenge. This Strategy on Resource Efficiency (RE) and Circular Economy (CE) will help the state to transform itself as a role model for other states in India.

I hope that this strategy is able to initiate urgent policy action, fill some existing knowledge gaps, showcase good practices and potential for replicating and up-scaling these practices and help in the implementation of our agenda on efficient natural resource management.

I would also like to express my gratitude to Niti Aayog for encouraging the State of Goa to formulate the State strategy on Resource Efficiency (RE) and Circular Economy (CE) and would like to congratulate the Directorate of Planning, Statistics and Evaluation, Government of Goa for steering the development of this Strategy.



Dr. Pramod Sawant
Chief Minister,
Govt. Of Goa

H.E. Ugo Astuto
The EU Ambassador to India

Foreword

Resource Efficiency (RE) and Circular Economy (CE) are among the most crucial issues for the future development of societies in an increasingly resource-constrained world.

Without significant improvements in resource efficiency, it will be nearly impossible and substantially more expensive to keep global warming below 1.5-2° C and increasing material efficiency is a key opportunity to move towards the 1.5° C goal set by the Paris agreement.

Increasing resource efficiency is also key to secure growth and offers major economic opportunities by driving down costs and boosting competitiveness, as it helps in stimulating technological innovation, creating job opportunities, while opening new export markets and benefiting consumers through more sustainable products.

But for that to happen, we need to find new ways to improve the management of resource stocks, reduce inputs, optimise production processes and business methods, logistics, changing consumption patterns, and minimising waste. We need to develop new products and services. For this to materialise, comprehensive policy interventions are required to mainstream RE and acknowledge its contribution towards climate change mitigation.

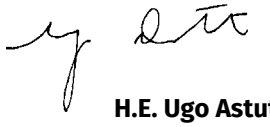
Europe is at the forefront of the global transition towards a low-carbon and circular economy. In 2015, the European Commission adopted an ambitious 'Circular Economy Package' which consists of an EU Action Plan containing concrete and ambitious programme of actions and sets out a timeline for measures that cover the entire product life cycle. In December 2019, the European Commission presented the European Green Deal, the most ambitious package of measures that will enable the EU to become the world's first climate-neutral continent by 2050. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases by 2050 and where economic growth is decoupled from resource use.

The European Union is in a unique position for bringing on board all relevant stakeholders, including policy makers and private businesses to share experiences on evolving models for Resource Efficiency and Circular Economy from the 27 European Member States, all of which have their key strengths, competencies and technologies.

The EU is very committed to strengthen the global transformation towards resource efficiency and climate neutrality. Since 2017, the European Union Delegation in Delhi partnered with India in the areas of resource efficiency and circular economy under the Resource Efficiency Initiative (EU-REI), implemented on behalf of the European Union by a consortium led by GIZ, TERI, CII and Adelphi. In the short duration of time of this initiative, the EU-REI has been able to create effective policy partnerships with NITI Aayog and MoEFCC at Central level and Goa and Telangana at state level. These partnerships have focussed on mainstreaming Resource Efficiency and & Circular Economy into the Indian economy. Concrete outputs have been the release of India's Resource Efficiency Strategy by NITI Aayog in November 2017, the Draft National Resource Efficiency Policy published by the by Ministry of Environment Forest and Climate Change in September 2019 and finally the present Strategy for Fostering Resource Efficiency and Circular Economy in Goa by the Government of Goa.

I would like to congratulate NITI Aayog and the Government of Goa for taking the lead in producing the very first state-level Resource Efficiency Strategy in India. I trust that this strategy will contribute to creating a more sustainable and resource-efficient future for Goa and will give a boost to the tourism sector. The focus of Goa's Resource Efficiency Strategy on tourism, marine litter and other related issues can contribute to the ambitious goal set by the Hon. Prime Minister of India to make tourism one of the key sectors to achieve $5-trillion economy.

I would like to re-iterate the strong commitment of the European Union to continue working with India to make it happen.



H.E. Ugo Astuto
The EU Ambassador to India

Acknowledgement

NITI Aayog along with European Union Delegation to India in November 2017 came out with the Resource Efficiency (RE) Strategy for India which included an Action plan. The strategy recognised the emergent need to use resources judiciously in order to sustain long-term development and well-being in the Indian society. The plan of action for implementation of the RE Strategy received due support from the European Union (EU) funded Resource Efficiency Initiative (EU-REI) led by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in consortium with The Energy and Resources Institute (TERI), Confederation of Indian Industry (CII) and adelphi.

The RE Strategy identified actions at state level as an important area for taking forward the resource efficiency agenda in India As a fast-growing state with construction and tourism as important sectors, and facing challenges of waste management and marine litter owing to it being a favourite tourist destination, Goa offers multiple opportunities for championing the cause of resource efficiency. The Goa State Strategy on Resource Efficiency is the first state strategy of its kind in India. This strategy provides a comprehensive roadmap for achieving the goals of sustainable development and resource efficiency and can be used as a best practice example for the rest of India.

This Strategy document is a result of the vision of Mr. Ratan P. Watal, Member Secretary, Prime Minister's Economic Advisory Council (PM-EAC), and the supportive effort of Mr. B.N. Satpathy, Senior Consultant, Office of Principal Scientific Advisor to Government of India. Government of Goa championed the cause and delegated the task of preparation of the strategy for the state in accordance with state priorities to Directorate of Planning, Statistics and Evaluation (DPSE). Notable efforts by Shri Daulat A. Hawaldar, IAS, Commissioner & Secretary (Finance), Government of Goa, Dr. Y. Durga Prasad, Director, DPSE, and Mr. Tolentino Furtado Deputy Director, DPSE drove the work forward. DPSE commissioned the work to The Energy and Resources Institute (TERI) team including Dr. Shilpi Kapur Bakshi, Ms. Ashwini Pai Panandiker, Mr. Souvik Bhattacharjya, Ms. Anoushka Khatri and Ms. Mehar Kaur. TERI team undertook the important task of research, analysis, and stakeholder consultations for the development of this strategy. Ms. Joanna Pyres of Circlewallas brought forth the inputs of stakeholders from grassroots. European Union Delegation (EUD) to India provided due support for the preparation of the state strategy through its Resource Efficiency Initiative (REI). Support of Ms. Henriette Faergemann, First Counsellor of Environment, Transport, Urbanisation, Energy & Climate Change, EUD, and Ms. Gabriella Soos, FPI Program Manager, EUD was key. The efforts of the REI team including Dr. Dieter Mutz, Dr. Rachna Arora, Mr. Pranav Sinha and Dr. Reva Prakash was crucial throughout the entire process.

Contents

1 About This Strategy Paper 13

2 Background 16

2.1 Historical and socio-economic background of Goa 16
2.2 Role of natural resources in economic development of the state and emerging challenges 19
2.3 State- and national-level policies and programmes –implications for resource use in Goa 28
2.4 Adopting a systems thinking approach 30

3 Prioritizing Sectors for Operationalizing Resource Efficiency and Circular Economy in Goa 39

3.1 Priority sectors 39
3.2 Tourism sector 40
3.3 Construction sector 46
3.4 Importance of RE&CE for promoting sustainable development in Goa 49

4 Improving Material Resource Efficiency and Enabling Circular Flow of Materials in Tourism Sector in Goa 52

4.1 RE&CE– relevance for tourism sector 52
4.2 Potential of material resource efficiency and circular economy in tourism sector in Goa 54
4.3 Tour operators– scope of influence and channels of intervention for fostering RE&CE in tourism sector in Goa 57
4.4 Social innovations and good practices 60
4.5 Enhancing material resource efficiency in tourism sector 64

5 Fostering Resource Efficiency in Construction Sector in Goa– Focus on Construction and Demolition Waste 67

5.1 Potential for material resources efficiency and circular economy in the construction sector in Goa 67
5.2 Social innovations and good practices 71
5.3 Enhancing resource efficiency in construction sector in Goa 74

6 Improving Resource Efficiency and Circularity of Material Flow to Combat Marine Litter 76

6.1 Presence of marine litter in Goa 76
6.2 Potential sources of marine litter in Goa 79
6.3 Managing marine litter–resource efficiency opportunities 80
6.4 Recommendations and suggested action 83
6.5 Stakeholder engagement 85

7 Operationalizing Resource Efficiency in Goa 88

7.1 Action plan 88
7.2 Creation of a demonstration village–potential pilot 94
7.3 Business models for fostering resource efficiency and circular economy in Goa– a few examples 95

Annexures 109
Annexure 1: Waste generation by hotels 110
Annexure 2: Green/ secondary building material 112
Annexure 3: Good Practices for managing marine litter 115
Annexure 4: Barriers and concerns linked to circular flow of selected materials 119

1 ABOUT THIS STRATEGY PAPER

Natural resources are critical for existence of life on the planet. The growing human aspirations and the consequent requirement of natural resources have made current consumption and production unsustainable. This is increasingly posing threat to the planet's ability to provide services to the humanity in future. 'Resources need to be managed more efficiently throughout their life cycle, from extraction, transport, transformation and consumption, to the disposal of waste' (EU 2011). There are, however, substantial gains that the society can enjoy through adoption of resource-efficient practices and circular economy, including creation of new business opportunities and jobs.

European Union (EU) and the Government of India have been working together on a number of areas of potential interest under the broader topic of natural resources and environment for quite some time. In recent years new areas of collaboration have been identified including Resource Efficiency and Circular Economy (RE&CE). In November 2017, EU Delegation and NITI Aayog, the policy think tank of the Government of India, launched the 'National Strategy on Resource Efficiency' that built up on the recommendations proposed by the Indian Resource Panel[1]. Under the core action plan of this strategy, three sub-national workshops for capacity building and awareness creation were successfully conducted in three Indian states (Odisha, Telangana, and Goa) during the period January–April 2018. The objective of these workshops was to motivate the states towards the development of State Resource Efficiency (RE) Status Paper and Action Plan. The two state governments, namely, Telangana and Goa decided to prepare the state strategies on RE, and The Energy and Resources Institute (TERI) was assigned by the Government of Goa to help them develop the strategy paper for Goa[2]. The nodal department in Goa identified in this context was the Directorate of Planning, Statistics and Evaluation (DPSE), which is also the nodal department at the state for the implementation of the sustainable development goals (SDGs).

The work on this strategy paper is supported by the partnership project of European Union (EU) and the Government of India–-Resource Efficiency Initiative (EU-REI)[3]–which is beingimplemented by a consortium led by GiZ and other members as The Energy and Resources Institute (TERI), Confederation of Indian Industry (CII) and adelphi.

Overall objective of this strategy paper is to mainstream (material) RE&CEin the priority sectors in Goa. This will also enable the state's convergence with India's RE strategy and help in meeting some of the SDGs. The strategy paper proposes a set of sectoral recommendations to foster RE&CE in the priority sectors of the state and also present an overall state-level action plan on mainstreaming RE&CE in Goa.

This strategy paper recognizes the emergent need to use resources judiciously across life-cycle stages[4] in order to sustain long-term development and well-being in the Goan society. The strategy has the potential to address resource security concerns such as resource depletion, supply constraints, and rapid degradation of natural resource base, particularly

1 PIB. 2017. NITI Aayog and EU delegation to India release the Strategy on Resource Efficiency (RE). Details available at http://pib.nic.in/newsite/PrintRelease.aspx?relid=174013, last accessed on January 20, 2020

2 Stakeholder engagement process was also undertaken at the grassroots level and through a participatory approach of different stakeholders, and for this, the EU–REI project collaborated with a local agency – Circlewallas for organizing discussions on local issues, gaps, challenges, and feasibility

3 At the national level, EU-REI through TERI is supporting the Resource Efficiency Cell housed at the Ministry of Environment Forests and Climate Change (MoEF&CC) in developing an integrated resource efficiency policy for India.

4 Life-cycle stages of any product are: extraction/mining, design, manufacturing/production, consumption, and end of life

by fostering the use of secondary raw materials. This has the potential to further augment the resource base and foster the development of the state. The implementation of RE measures in Goa will make it a leader in promoting RE&CE at the sub-national level in India and deriving gains across the domains of sustainability, which could also encourage other states to move on a similar path. Also, considering that Niti Aayog has highlighted the importance of competitive federalism[5] in getting the states to move forward in areas such as agriculture and tourism, the RE&CE strategy of Goa's focus on tourism as one of the sectors can help the state create that competitive edge in this sector over many other states of the country. Also the role of cooperative federalism is equally important in the context.

The focus of this strategy paper is on abiotic resources, specifically non-energy minerals (including construction minerals), given the current and projected explosive growth rates in material demand arising out of Goa's growth. However, this focus in no way reduces the importance of the concerns related to the inadequate access and inefficient management of 'the basics' of water, sewage networks, and electricity, which are also critical for a prosperous tourism business, functional buildings, and community well-being, which have been highlighted by the stakeholders[6]. The water requirement and electricity consumption in Goa have been increasing over the years due to additional demand by the floating population (tourists), raising concerns related to need for better resource management.

In the preparation of this strategy paper, consultations have been held with the key stakeholders including representation from both urban and rural contexts[7], and their inputs have been incorporated. Recognizing that involvement of stakeholders is imperative for making any RE&CE strategy effective, a bottom–up approach was used to develop this. For this, a broad range of stakeholders from tourism, construction, waste, and marine sectors as well as civil society and communities were invited to participate in two focused group consultations and one workshop. These events were designed to understand different perspectives and experiences of the existing systems and explore the potential for shifting to resource-efficient systems and models. The focused group consultations were designed and delivered using participatory methods based on a system awareness approach by Goa-based facilitators Circlewallas. In total, over 100 participants contributed with their ideas representing different stakeholder groups *(shown in Table 1)*.

Reflecting the complexity of situations that were presented to the participants during the discussions, many individuals associated themselves with more than one sector –such as construction and hospitality, waste and construction, civil society and construction, etc., often working in one and a passionate active citizen in another or working in multiple sectors. These participants thus contributed a wealth of knowledge about existing barriers, key materials requiring greater efficiency, and opportunities for greater RE and circularity. This information provided[8] background, scope, priorities, and opportunities suggested in the strategy paper.

5 Niti Aayog. 2018. A presentation on 'Eventful Years of Niti Aayog'. Details available at http://pibphoto.nic.in/documents/rlink/2018/jul/p20187303.pdf, last accessed on January 20, 2020.

6 Land was also raised as a key resource for tourism, construction, waste, and communities. It was discussed in terms of the interconnectedness with all the other natural systems needed for health, and review of land use policy from a resource efficiency angle was suggested as an important task

7 Discovering ways for villages to prosper through RE/CE will support local people, boost economy/industry, protect environmental assets, and help make headway on grass-root implementation of the sustainable development goals

8 In addition to informing the strategy, information collected during these discussions from the stakeholders can be made publicly available online to inspire and inform stakeholder action for RE&CE in Goa. Stakeholders can be invited to review the data and be inspired to take action towards RE&CE in Goa. As the strategy implementation process develops, stakeholders can also be invited to participate in collaborative action for RE&CE in Goa.

Table 1 Stakeholder groups from Goa who participated in the focused group discussions for the Strategy Paper

Tourism	Construction
• Five-star hotels • Mid-level hotels • Restaurants • Beach shacks • Tourism operators • Tourists and visitors	• Architects • Construction companies • Miners • Sanitation/solar providers • Construction suppliers/industrial estates
Civil society	**Waste**
• Youth and students including students of architecture • Civil society/community members • NGOs, Community based organizations (CBOs),and faith-based social workers • Educators • Senior citizens • Artists (for social change)	• Waste management entrepreneurs • Waste management officials • Waste management committee and panchayat • Up-cycling entrepreneurs • Researchers
Marine	**Business other**
• Fishing community • Marine researchers • Lifeguards	• Social entrepreneurs of eco-friendly/organic technologies and products • Information Technology and Artificial Intelligence professionals • Industrial designers

2 BACKGROUND

2.1 HISTORICAL AND SOCIO-ECONOMIC BACKGROUND OF GOA

Located on the western coast, Goa was a Portugal colony for more than 400 years and attained its statehood in 1987. It is one of the fastest growing states in India. Goa is a small, mostly rural, state comprising only 3702 km2. It is a network of 191 village panchayats, 13 municipal councils, and 1 municipal corporation. It is mostly surrounded by green spaces and a famous 105 km of coastal tourist belt. Goa has been blessed with rich natural environment. Known for its gentle coastline flecked with sheltered bays and long beaches, it also has coral reefs around an offshore archipelago, estuaries, and stunning diversity of riverine systems. There are river islands, mangroves, fertile Khazan fields, hills, forests, including the global biodiversity hotspot of the Western Ghats (Myers 2000), rich array of wildlife including schedule-1-protected species, and vibrant bird population in the state. Earlier, Goa used to have strong marine and fish diversity; however, pollution and overfishing have led to a dramatic drop in the population and degradation of the marine system.

The state has a unique relaxed culture, which attracts both domestic and international tourists. Visitors come to Goa to enjoy its 'susegad' (relaxed) quality of life, its exceptional welcoming and tolerant east-meets-west culture, picturesque villages, music, food and celebration as well as pleasant climate, open spaces, and sense of being carefree.

As per Economic Survey 2018–19 (DPSE, Government of Goa), the resident population of Goa is 14.58 lakhs constituting 0.12% of India's population. The projected population for 2019 is 15.48 lakhs. More than 62% of the population resides in urban areas. The sex ratio stands at 973 females per thousand males as against the national average of 933. The state has a high literacy rate of 89.57%, and 39.58% constitutes the workforce. The state also boasts of excellent health indicators with high life expectancy rate as compared to the national one. In Goa, current birth rate is 13.4 per thousand population and death rate is 8.49 per thousand population. It has the lowest poverty rate of 9.9% (Niti Aayog[9]). The state has relatively good infrastructure with all villages and towns electrified and having provisions for tap water connection, though shortages in supply of these exist at times. All the villages are also connected with all-weather roads.

Goa exhibits strong economic growth and is one of the fastest growing states in the country. It has the highest per capita net state domestic product (NSDP) in the country which is nearly four times the national average (DPSE 2018). As per the Economic Survey 2018–19, the gross state domestic product (GSDP) at constant (2011–12) prices for the year 2017–18 (Quick Estimates) reflected a growth of 6.23% as against 12.49% in 2016–17. In 2017, Goa had the highest GSDP of $6345 as against national average of $1750, but there are inequalities across the state with many people depending on remittances from family and relatives living/working elsewhere in India and abroad.

India's Public Affairs Index (PAI 2018) has been prepared by the Government of India, portraying performance of all the states. Goa has been categorized in the small state category wherein, the population is less than 2 crores. For preparation of

9 Niti Aayog. 2019. State statistics. Details available at https://niti.gov.in/state-statistics, last accessed on January 20, 2020

Table 2.1 Public Affairs Index and rank for Goa

PILLAR	NATURAL CAPITAL	HUMAN CAPITAL	SOCIAL CAPITAL	ECONOMIC CAPITAL
INDEX	0.498	0.408	0.438	0.536
RANK	8	7	9	1

Table 2.2 Goa's overall rank (Public Affairs Index)

THEME	ESSENTIAL INFRASTRUC-TURE	SUPPORT TO HUMAN DEVELOPMENT	SOCIAL PROTECTION	WOMEN AND CHILDREN
GOA (SMALL STATE STATUS) 2018	1	5	12	9
INDIA (2018)	1	6	30	20

THEME	CRIME LAW AND ORDER	DELIVERY OF JUSTICE	ENVIRONMENT	TRANSPARENCY & ACCOUNTABILITY
GOA (SMALL STATE STATUS) 2018	2	5	8	10
INDIA (2018)	3	14	18	27

THEME	FISCAL MANAGEMENT	ECONOMIC FREEDOM	AGGREGATE INDEX PAI SCORE
GOA (SMALL STATE STATUS) 2018	2	3	2
INDIA (2018)	6	11	10

PAI, ten themes have been considered and ranks have been assigned accordingly. Based on the four grand pillars, namely, natural, human, social, and economical capital, the rank that Goa has received is presented in Table 2.1. Further, the overall rank based on the themes has been presented in Table 2.2. These ranks indicate that the socio-economic condition in Goa is far better than other states. It must be noted that in order to achieve economic development, natural, human, and social capitals are crucial. The natural resources provide vital inputs that keep our life and our economy functioning.

If we look at Goa's economic performance and contribution of the different sectors[10] to the GSDP at constant prices, in 2017–18, the secondary sector had the largest share of 57.41%, followed by the tertiary sector with 35.60%, and the primary sector accounting for the lowest share of 6.99%.

Goa is traditionally known as a tourist paradise for its natural scenery, unique beaches, and cultural heritage. It attracted about 54.80 lakh tourists in 2018–19 upto October, comprising 48.76 lakh domestic and 6.04 lakh foreign tourists[11]. The state caters to a floating population (tourists) that is more than double of its resident population. Moreover, of late, the flash floods in the hill stations of north India have resulted in the increase in unseasonal tourism in Goa.[12] The total revenue earned through tourism-related activities (including hotels, events, travel agencies/tour operators, water sports activities, taxis, beach shacks– government and private, deck beds and umbrellas, touting, lease rents, photography, other fines) during the period April 2018–December 2018 was to the tune of INR

10 Under the primary sector, the sub-sectors include agriculture, forestry, fishing, mining, and quarrying. Under the secondary sector, the sub-sectors include manufacturing, electricity, gas, water supply, other utility services, and construction. The tertiary sector includes trade, repair, hotels, restaurants, transport, storage, communication services, transport other than railways, financial services, real estate, ownership of dwelling and professional services, public administration, and other services

11 Economic Survey 2018–19, Directorate of Planning Statistics and Evaluation (DPSE), Government of Goa

12 Tewari, M and R T Sharma. 2013. Monsoon effect: Tourists choosing non-hilly destinations as north hills face nature's fury. *The Economic Times*, June 22, 2013. Details available at https://economictimes.indiatimes.com/industry/services/travel/monsoon-effect-tourists-choosing-non-hilly-destinations-as-north-hills-face-natures-fury/articleshow/20708165.cms?from=mdr, last accessed on November 21, 2019

406.73 lakhs (Economic Survey 2018–19, DPSE). Construction owing to tourism has also risen in the state. Led by room aggregators such as OYO, many small operators are refurbishing their hotels/rooms for the tourism industry, leading to the generation of construction and demolition waste.

Agriculture in Goa comprises cultivation of crops like paddy, cashew, coconut, and seasonal vegetables and pulses, and provides livelihood support to nearly 12% of the population. Cashew processing has been a traditional industry in the state. Cashew apple is also used in the production of feni, local liquor, which has become internationally popular. During 2017–18, cashew nut production in the state was estimated at 34,259 metric tonnes with area under cultivation at 58,250 hectares[13].

Pharmaceutical is a major industry in the state. Out of the total medicines that are produced in India, 12% are manufactured in Goa (DPSE 2017–18).

Fishing is an important sector here, and is the only source of livelihood for a sizeable community of fishermen who have been contributing significantly to the fish production in the state. The marine fish production in Goa was recorded to be 89,266 tonnes while inland fish production was 4124 tonnes (up to October 2018)[14]. Goa has been witnessing investments in the fields of biotechnology and IT, and is emerging as a destination for knowledge-based industries.

Though, Goa is an example of high economic development, both its key drivers such as tourism and construction are resource intensive and thus needs attention for the overall sustainability. In addition, local people experience shortages of economic opportunities resulting in high emigration (brain drain), which calls for a need to create new economic activities that can provide increased value and prosperity for the local people and the state.

13 Directorate of Cashewnut and Cocoa Development. Area and production of cashew. Details available at https://dccd.gov.in/Content.aspx?mid=1075&tid=1, last accessed on January 20, 2020

14 Provisional estimates, DPSE, Government of Goa

2.2 ROLE OF NATURAL RESOURCES IN ECONOMIC DEVELOPMENT OF THE STATE AND EMERGING CHALLENGES

The natural capital or natural resources are vital for health and well-being. People rely on resources such as energy, water, biodiversity, ecosystem services, land, and clean air for their livelihood. Moreover, materials classified as biogenous (e.g., wood), minerals (e.g., metals), or energetic (e.g., fuels) are important for our existence. However, Goa has been witnessing an increase in demand for many of these resources in the past few years, owing to the rapid economic development, which has raised concerns over resource depletion. Material resources, in particular, have experienced substantial increase in demand by the growing sectors including construction and tourism.

If we look at the endowment of the state for the material resources, Goa has many mineral resources of economic importance, including iron ore, manganese, and bauxite. Besides, there are minor minerals like basalt, laterite stones, rubbles, river sand, and murrum that are in great demand as construction material. As per the data from Directorate of Mines and Geology, the exports of iron ore progressively increased from 0.44 million tonnes in 1951 to 35 million tonnes in 2008–09. Post that a public interest litigation (PIL) led the Supreme Court pass an order in October 2012 disallowing any mining activities. After addressing the illegalities and imposing a cap on extraction, around 38 mining leases were given permission to operate in 2016–17. These leases were again revoked in 2018 due to continuation of illegal activities. This led to drop in the percentage distribution of NSDP in case of mining from 5.91% in 2012–13 to 1.70% in 2017–18 (DPSE, Economic Survey 2018–19).

For overall development of tourism in Goa, reliable and regular electricity supply is also important. Currently, Goa has 100% village electrification. In 2016–17, the energy consumed per thousand population was 1,808,423 kWh while energy consumed per square kilometre was 973,127 kWh.[15]

Currently, like any other state in India, Goa has been mostly following the linear economy model that uses virgin raw material extracted from nature. Raw material or resource is defined as a substance or a mixture of substances that have not been subject to any treatment besides its detachment from its source. It is gathered because of its utility value and directly consumed or used in the production process (UBA 2012).[16] Goa has been experiencing rapid economic growth over the last two decades; however, this has been propelled by increased scale and intensity of resource use leading to manifold increase in demand for natural resources especially materials. Thus, concerns over resource depletion, constraints manifesting in resource supply, price shocks, and rapid degradation of natural resource base have become more pronounced.

Tourism, one of the most lucrative economic sectors in Goa,as an industry is a consumer of materials and resources, and does not manufacture resources. Heavy footprint of unplanned and unregulated growth in tourism and its allied activities such as construction is becoming detrimental to the sustainability of the sector itself.

Tourism sector in Goa generates significant amount of waste,[17] which has the potential to be used as secondary resources. In Table 2.3, waste generation by tourists in Goa has been estimated as on 2018.

Using the data on waste from 2015, which estimated the per capita waste generation to be approximately 0.45kg/day[18], the total waste generation by tourists estimated in the state will be 273,408 tonnes per year (or 749 tonnes per day [TPD]).The total waste generation by local population per year was estimated to be 250,645 tonnes(or 686 TPD).

Table 2.3 Estimates of waste generation by tourists in Goa

VARIABLE	POPULATION (ESTIMATED)	TOURISTS (ORGANIZED)	DOMESTIC TOURISTS	FOREIGN TOURISTS
NUMBER	1,526,000	8,953,547	6,895,234	890,459
STAY DAYS	365		5	9
PERSON DAYS	556,990,000		34,476,170	8,014,131

VARIABLE	DAY TOURISTS	WEEKEND TOURISTS	TOURISTS (UNORGANIZED)	TOTAL TOURISTS
NUMBER	1,167,854	689,523	2,238,387	1,191,934
STAY DAYS		2	3	
PERSON DAYS		1,379,047	6,715,160	607,574,508

VARIABLE	TOURIST PERSON DAYS AS PERCENTAGE OF LOCAL POPULATION PERSON DAYS	TOTAL WASTE GENERATION BY LOCAL POPULATION PER YEAR	TOTAL WASTE GENERATION BY TOURISTS PER YEAR
PERSON DAYS	1.09	250,645 TONNES (OR 686 TONNES PER DAY)	273,408 TONNES (OR 749 TONNES PER DAY)

15 Ministry of Power, Government of India. Consumption of power 1950–2018. Details available at https://www.indiastat.com/goa-state/06/power-data/26/consumption-and-sale/70/consumption-of-power-1950-2018/449667/stats.aspx, last accessed on January 20, 2020

16 German Federal Environment Agency (UBA, 2012): Glossar zum Ressourcenschutz

17 In a study (TERI DISHA) conducted in 2010–11, waste generation by hotel categories was estimated and projections done. According to the responses elicited in the survey done during this study, a category A hotel is estimated to generate approximately 1.49 kg per room per day (kg/room/day), category B, 1.25 kg/room/day, category C, 1.49 kg/ room/day, and category D, 1.28 kg/room/day. Based on this generation of waste, the projection of waste generated by the hotels across Goa in 2020 and 2030 was 17,194 and 22,788, respectively

18 Department of Tourism, Government of Goa

Nilkamal
MATERIAL HANDLING

LITTERING AT THE BEACHES OF GOA (PREVIOUS & FACING PAGE)

The Goa Vision 2035 notes the difference in waste generation rates across different types of hotels where the tourists' stay vary in kilogram per room per day from low budget hotels (0.58) to medium budget hotels (0.75) to high budget hotels (1) to luxury hotels (3).

A survey conducted by the Central Marine Fisheries Research Institute in 2018 estimates that beaches in Goa had the highest quantity of plastic debris in India with every metre of beach sand having an average 25.47g of plastics. Based on a random visit to few beaches in Goa (during April–May 2019), it was found that there is significant amount of littering still happening at the beaches by tourists. Waste material found included beer bottles, plastic, straws, cigarette buds, food waste, and clothing material (commonly left by tourists at the beaches). Minor shack owners also dump their waste of cooking oil into the sand by digging up pits and do not segregate waste. Anecdotal evidence from tourists also pointed towards Goa being considered as overly polluted and is becoming a less desirable destination.

The Goa Vision 2035 has suggested– the need to adopt participatory models of tourism that ensure greater 'tourist experience' for less material usage and no host stress.

Some efforts have been seen in the direction to encourage environmental and resource conservation in the state. With piling up of garbage on the beaches in the state, it has led to the appointment of a private agency– Drishti Marine – to keep the beaches clean and garbage-free. There are public notices at the beaches to encourage responsible behaviour including those discouraging littering on the beaches, but lack of adherence to these can be seen easily. One way to keep a check on littering at public beaches is to conduct stringent checks on licenses for commercial activities, shacks, and small resorts on the beaches, and monitor their activities.

Construction sector in Goa is an extremely resource intensive. Although a substantial demand is met from local supplies, additional materials are imported from nearby states. For example, as noted earlier, Goa has rich deposits of minor minerals like basalt, laterite stones, rubbles, river sand, murrum, etc., as reported by the Government of Goa, which are extensively used to meet local construction needs. However, clay bricks are not easily available in Goa and are sourced from neighbouring states like Karnataka and Maharashtra. The state is not a major producer of cement, although in recent years, cement manufacturing has been increased substantially in Goa and helping meet the local requirement. The demand for aggregate resources such as sand, gravel, and crushed stone has also been escalated with the expanding construction in Goa. Aggregate materials are high-bulk and low unit value commodities that derive much of their value from being located near the central market (Bates 1969). There have also been recent reported instances of illegal mining of sand in the state. In 2018, the Goa Bench of the Bombay High Court issued explicit directions to the Goa State Pollution Control Board and the River Navigation Department on the failure to control extensive looting of sand from river beds. In this context, the role of RE holds immense potential in improving self-sufficiency as well as reducing material footprint, arising from the extraction of primary materials from ecologically sensitive locations. For example, the research carried out by the University of Bath, UK and Goa Engineering College, has found that concrete made with an admixture of ground-up plastic bottles is almost as strong as traditional concrete mixtures.

The Revised City Development Plan of Panaji[19] has duly recognized that many sandy pockets having been taken over by developers and heavy construction activities are seen along the coastal hill slopes.

19 CCPGoa. 2015. Revised city development plan for Panaji, 2041. Details available at http://ccpgoa.com/images/Revised%20City%20Development%20Plan%20for%20Panaji%202041.pdf, last accessed on January 20, 2020

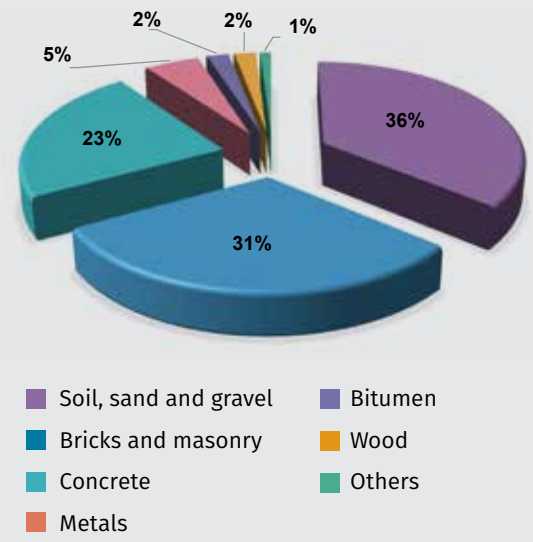


Figure 2.1 General composition of 'major' C&D waste in India[20] (2017–18)

Source: Resilient Energy India Pvt Ltd

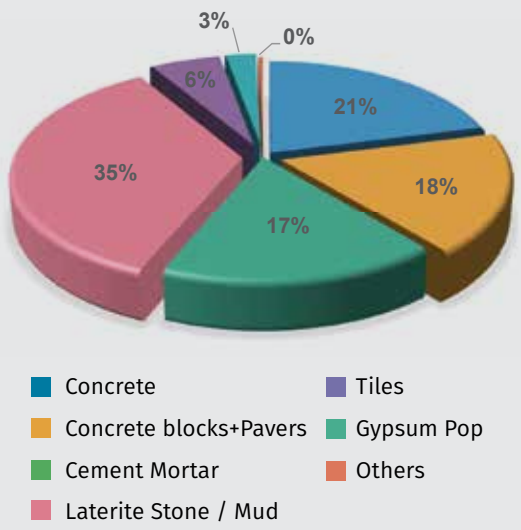


Figure 2.2 Composition of construction and demolition waste in Goa (2017–18)

Source: Resilient Energy India Pvt Ltd

Besides the demand for resources in the construction sector, there is also a growing issue of littering of construction and demolition (C&D) waste across different parts of the state resulting in wastage of resources, which could otherwise have been recycled. The detailed project report on solid waste management by the Corporation of the City of Panaji (2015) states that the city generated around 22TPD in 2013 and this is expected to increase to 54 TPD by 2040. The estimated increase in C&D waste generation is from 25 TPD to 35 TPD with the base yearas 2013 and the projected year as 2040. In light of the TDR (transfer of development rights) and Regional Plan 2021, where there are plans of adding lakhs of square meters of area, the state exhibits the problem of management of its garbage to curb the creation of Sonsodo dumps across Goa. The incessantly mounting piles of construction debris pose many problems.

Illegal dumping along roads and highways has led to mountains of untended waste causing air pollution. The government notified the public, in particular the debris generators, to dump the waste at the sites specified in the document with prior intimation to the concerned Assistant Engineer. The government has made available vacant spaces by the sides of national highways and state roads where land is available and has been acquired for road widening but has still not been utilized for such purpose. More than a dozen sites have been identified. However, illegal dumping continues, leading to local threat to the environment. Further, after the waste is dumped, there is very limited knowledge of the fate of construction debris apart from the open dumping. There is also not enough information available about recyclers of construction debris in Goa. There are reports of selective collection and reuse of C&D wastes, which are not properly documented. Often the debris ends up in agricultural fields.

Further, the massive construction projects are depriving Goa of its minerals and natural resources. The growing degradation/destruction of sand dunes of Goa largely due to construction of hotels/resorts/guesthouses has posed a big challenge. According to a report on the sand dunes of Goa by the National Institute of Oceanography, it has been observed that (i) construction of resorts and buildings, (ii) dune sand mining, and (iii) roads in sandy strips are the major factors responsible for the large-scale degradation and consequent elimination of sanddunes.

20 CDE. 2015. C&D waste processing in India, Delhi shows the way. Details available at https://www.cdeglobal.com/news/2015/december/cd-waste-processing-in-india-delhi-shows-the-way, last accessed on January 20, 2020

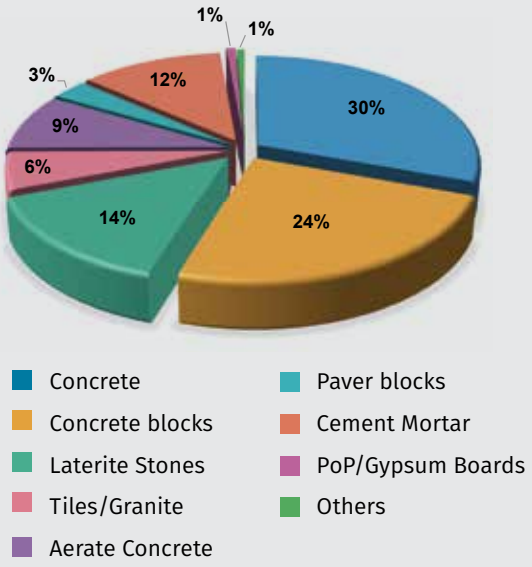


Figure 2.3 Configuration of construction waste generated in Goa (2017–18)

Source: Resilient Energy India Pvt Ltd

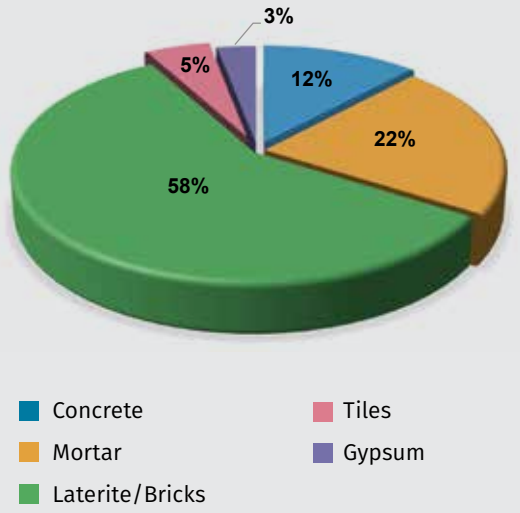


Figure 2.4 Demolition waste breakup (2017–18) of Goa

Source: Resilient Energy India Pvt Ltd

There is an emerging need for dune reclamation to fix approach roads to the beaches, for landscaping or beautification of frontal dunes and other tourist activities. In March 2019, the National Green Tribunal had taken serious note of the inability of the Government of Goa to install CCTV cameras to monitor sand extraction to identify illegal mining activities depriving the state of its silt.

The C&D wastes rules mandates that local authorities shall establish a database and update it once a year, device appropriate measures in consultation with expert institutions for the management of C&D waste generated including processing facility and for using the recycled products in the best possible manner. But there is no department that collects data on the quantum of such waste generated in the state. There is no knowledge and transparency about what happens to the construction waste after it has left the industrial estates. The presence of public notices is of no benefit as debris from demolition waste is dumped on the roadside and used for backfilling low lying areas. No debris management fee is charged and there is no effective plan of action for handling or disposing waste from demolition.

Goa Waste Management Corporation (GWMC) had appointed Resilient Energy India Pvt Ltd to conduct a preliminary assessment of quantum of C&D waste generated in Goa. The data collected were for the period of 1 year, which is 2017–18. Figure 2.1 presents the general composition of 'major' construction and demolition waste in India.

In juxtaposition, the composition of the total C&D waste in Goa consists majorly of laterite stone, concrete, and concrete blocks as evident from Figure 2.2.

The waste that is typically generated during the construction phase in Goa is presented in Figure 2.3. Construction waste (i.e., waste generated during the civil construction) in Goa comprises concrete and concrete blocks, while demolition waste majorly contributes towards laterite stone waste generation.

Stakeholders' interactions revealed that typically a 180 m2 building/construction structure will lead to around 400 MT of debris. This includes laterite stones/bricks: 65%, concrete: 3%, mortar: 24%, tiles: 5%, and gypsum/PoP: 3%. Further, it was noted that in general the average composition of construction and demolition waste generated in the state is laterite/blocks – 58%, mortar – 22%, concrete – 12%, gypsum – 3%, and tiles – 5%, as presented in Figure 2.4.

The northern region of Goa, specifically cities like Bardez and Tiswadi, witnesses considerable amount of waste piling up and requires utmost attention. The map of the quantum of C&D waste generated in totality in the state helps to recognize and set targets towards the major parts of Goa where maximum waste is produced (Refer Figure 2.5).

It is a common practice that the change in ownership of small and medium hotels generally results in renovation. Further, franchise of large hotel chains undergoes mandatory renovation in 5–7-year period. Refurbishment of hotel rooms is a significant contributor to the generation of demolition debris in Goa. It is seen that many small operators refurbish rooms for the tourism industry. Box 2.1 presents estimates of the renovation waste generated from hotels rooms in Goa.

Many villages have experienced unprecedented change in their built environment and demographics, as well as in the look and feel of their homes. Unplanned tourist infrastructure on a large scale has put a lot of pressure on both local communities and the environment. There is genuine concern about loss of fields, community, trees, forests, biodiversity, and culture as shown by the fact that 40% of NGT cases are filed from Goa, though the state only covers 0.12% of the national population. Ecological destruction, inefficient sewage disposal, and poor waste management generate local resistance to further growth of the industry in Goa. There is a rise in building mega scale (compared to the norm in Goa) properties/ projects. Stakeholders have highlighted that the construction activities are leading to a lot of extraction from the state's natural resources, such as construction material (laterite, sand), groundwater, land, etc., and create impact in terms of waste, space consumption, pollution, and overuse of natural and other resources.

Box 2.1:

Renovation waste generated from hotels rooms in Goa

Estimate based on preliminary assessment by Resilient Energy Group

Consider a 7-year cycle of renovation (other than small units) 26,000/7= 3715 rooms per annum*.

Waste generated @ 1MT/room for 3715 MT/ annum:

1. Cement mortar – 1860 MT – 5MT/day
2. Tiles and sanitary fittings – 820 MT –2.3 MT/day
3. Gypsum/PoP – 1040 MT – 2.85 MT/day

* Considering linear relation, not necessarily followed in practice, but works on a weighted average consideration

The Goa Tourism Development Corporation has plans to re-develop hotel units in north Goa coastline with new refurbishment projects of 1686 hotel units and 30,720 rooms. On an average, room renovation generates average 1 MT waste including 50% cement mortar, 22% tiles and bathroom fittings, and 28% PoP/gypsum.

These buildings often remain empty much of the year (investment properties/second homes) or do not comply with existing requirements for waste management or violate norms such as the Coastal Zone Regulation. Both tourism and construction sectors have issues of waste and marine litter management, which are putting constraint on sustained development.

There is also potential to increase the electricity generation from waste in Goa. The Goa State Solid Waste Management Cell[21] has set-up a bio-methanation-to-electricity plant to treat 40 tonnes of wet waste to produce 0.2–0.3 MW of electricity. The plant collects mixed waste from 25 coastal towns and villages, and sorts it using machineries. The plant's WTE technology is based on anaerobic digestion, where micro-organisms breakdown biodegradable material in the absence of oxygen. As per the data received from Goa Waste Management Corporation, in 2018, on average electricity generation was around 0.5 MW/100 tonnes of input biodegradable waste as received in the facility (in tonnes per day).

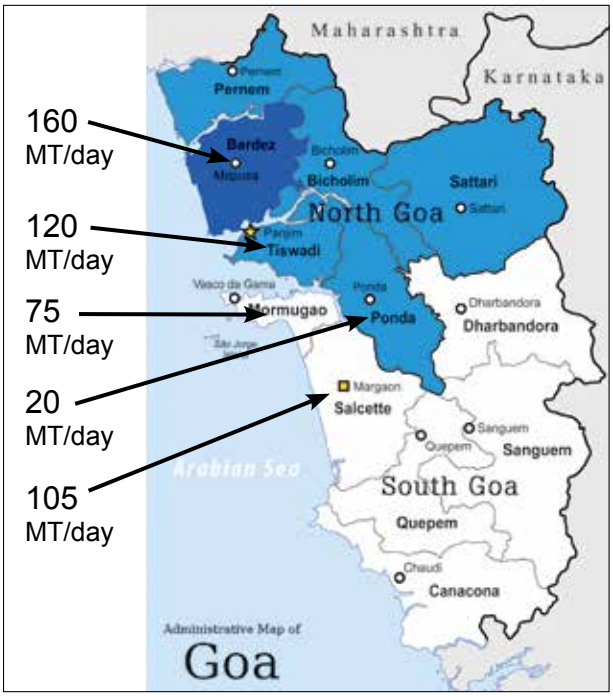


Figure 2.5 Waste generation per day across the districts of North Goa

21 The Cell, constituted under the Department of Science and Technology operates from the premises of the Goa State Pollution Control Board

2.3 STATE- AND NATIONAL-LEVEL POLICIES AND PROGRAMMES – IMPLICATIONS FOR RESOURCE USE IN GOA

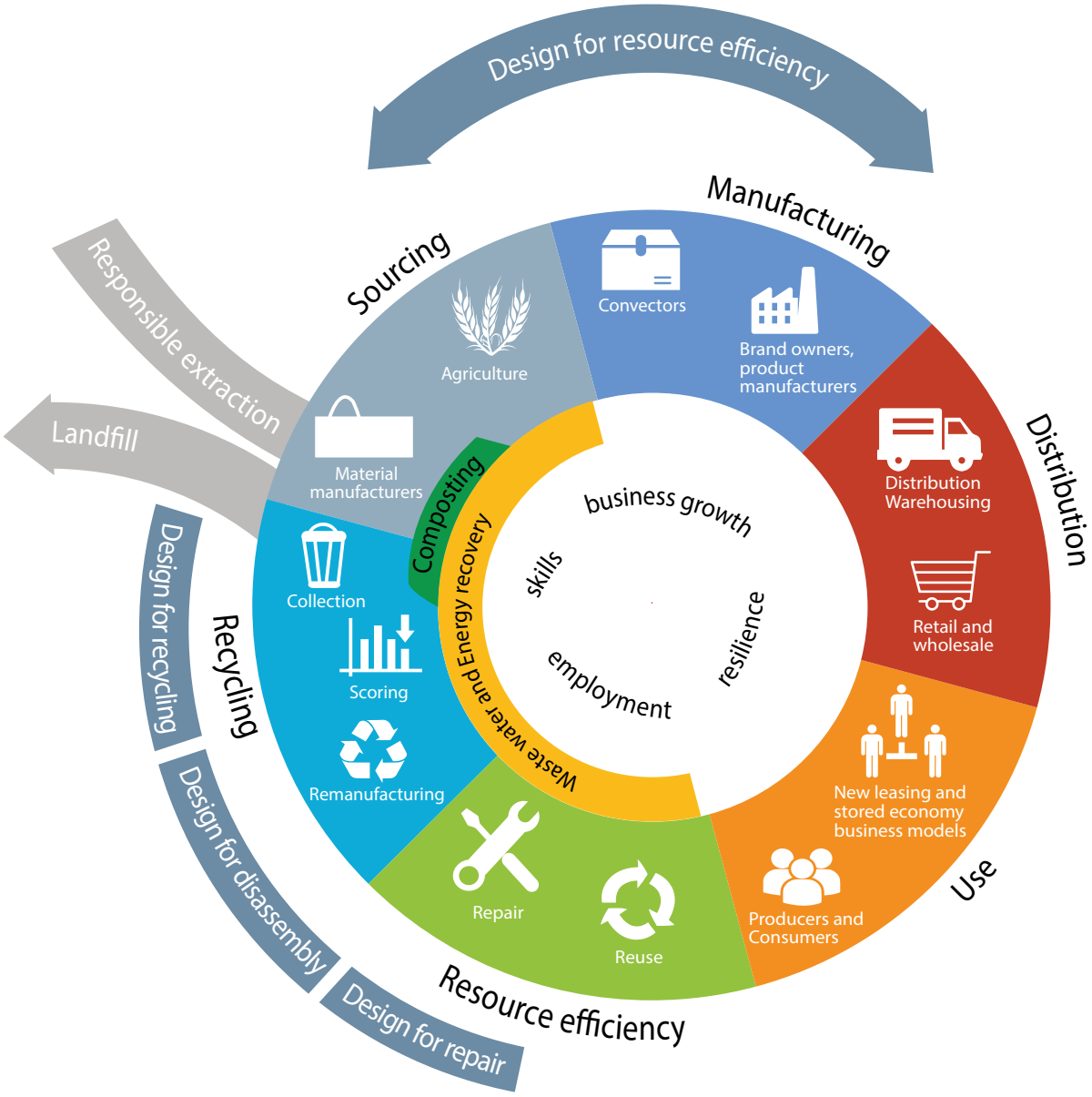


Figure 2.6 Circular economy model

The utilization of resources involves their flow from one life-cycle stage to another, beginning from mining to designing, followed by manufacturing, consumption, and ultimately end-of-life management (disposal or recycling). The life-cycle approach is also in line with the idea of closing the loops and reducing dependency on virgin raw material by creating alternate sources of resources through reuse and recycling.

The impact of each life-cycle stage can highlight the stages where maximum resource inefficiency occurs and then measures can be developed to enhance RE.

There are substantial gains that the society can enjoy through adoption of resource-efficient practices and circular economy (CE) principles. Enhancing RE and promoting the use of secondary raw materials have emerged as a strategy for ensuring that the potential trade-off between growth and environmental well-being can be minimized. This strategy has the potential to stabilize raw material supply for industry, which in turn translates into reduced price spikes due to supply constraints or disruptions resulting in substantial economic benefits. These include reduced costs linked to less extraction of virgin raw material, if secondary raw material is made available, and there is improved corporate performance and competitiveness. New industries can be created including those in the recycling sector as well as through innovative design and manufacturing.

In terms of social benefits, reduced extraction pressures due to adoption of resource-efficient strategies have the potential to reduce conflict and displacement in mining areas along with improving health and welfare of local communities. RE has enormous potential for job creation, not only in the recycling sectors, but also high skilled jobs in innovative design and manufacturing sectors. The resource-efficient strategies also contribute towards preserving resources for future generations. In addition, a life-cycle approach is not sector specific and it provides scope for initiatives across different sectors. Devising a state-level initiative for RE&CE in Goa must have scope for achieving the objectives across different stages of the lifecycle and ensure that all the stakeholders get involved at respective stages.

2.4 ADOPTING SYSTEMS THINKING APPROACH

RE in a biotic resources within tourism, construction, and waste sectors requires integration of RE into the existing operational structures of a wide range of stakeholders. A new resource-efficient 'system' cannot be designed or mandated by one stakeholder, or created through a strategy paper alone. It will require system-wide efforts and on-going collaborations, learning and prototyping new ways of doing across an ecosystem of stakeholders until RE is achieved over time. This can be achieved through a collaborative approach to operationalizing the RE&CE strategy.

Stakeholders from across Goan society including households, businesses, and institutions will need to adopt a circular mindset, efficient behaviours, and efficiency values. While these are Goan cultural norms, they are not the norms of consumer capitalism to which modern society currently aspires. A new model of 'efficiency or circular capitalism' is needed, which can take root and be an acceptable/desirable goal at the level of the entire system –and not just as a niche market with a limited impact.

Adopting a bottom–up participatory systems approach acknowledges the interconnection and dependencies between different stakeholders, industries, and materials within the system. There is a need for stakeholders to show leadership and work together across traditional divides to share information and see connections across the sectors (tourism, waste, and construction) and across the stakeholder groups such as business, civil society, government, and the research and education communities. Working together over time with an action-learning/prototyping approach, diverse stakeholders can share experiences and build understanding between different parts of the wider 'system'. By learning together they can bring new knowledge, insight, economic opportunities and innovation, and iterate a new RE system.

Further, a state-level initiative for RE&CE in Goa enables highlighting the relevant policies and facilitates stakeholders, particularly the government departments, to create an enabling policy environment for achieving RE. The approach also enables introducing consistency in the policies, targeting different life-cycle stages so that RE gains at one stage are not lost due to inefficiencies at other stages.

Table 2.4 Lists the national- and state-level policies, rules, programmes, and schemes having implications for RE&CE in Goa

	National		Goa state	
S.No.	**Policy/rules**	**Programme/scheme**	**Policy/rules**	**Programme/scheme**
I. The design stage				
1.	The National Design Policy	Awarding 'Indian Design Mark' or 'I-Mark'of Indian Design Council to products that satisfy key design criteria including eco-friendliness		
2.			The Goa (Regulation of Land Development and Building Construction) Act, 2008 (Goa Act 6 of 2008) and The Goa Land Development and Building Construction Regulations, 2010 (Incorporating Amendments upto September, 2018)	
3.			The tourism policy for erection of temporary seasonal structures, beach shack, huts, and others 2013–16 outlines terms and conditions for setting up of such structures	
4.	The Science, Technology and Innovation Policy, 2013	The Technology Development and Transfer Division of Department of Science and Technologies supporting research and development in 19 waste management technologies		
5.			Energy Conservation Building Code, 2006 of Bureau of Energy Efficiency (BEE) adopted for State of Goa as part of the Goa Land Development and Building Construction Regulation, 2010 requires providing minimum requirements for the energy-efficient design and construction of buildings	
6.		'Eco-Mark' of eco-labelling scheme from BIS. Eco-mark is a cradle-to-grave approach that looks at raw material extraction, production, and disposal of the product		
7.			The regulation of conservation as part of the Goa Land Development and Building Construction Regulation, 2010 requires to prepare/oversee the preparation of design guidelines for listed buildings/precincts/ conservation zones and suggest suitable designs adopting new materials for replacements keeping the old form intact as far as possible and with universally accepted conservation principles in specially sensitive areas identified by the committee	

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
8.		GRIHA (Green Rating for Integrated Habitat Assessment), a voluntary system, attempts to minimize a building's resource consumption, waste generation, and overall ecological impact to within certain nationally acceptable limits		
9.	The National Housing and Habitat Policy, 2007 aims to put in place the concept of 'green' and 'intelligent' buildings			
10.		Technology submission of Pradhan Mantri Awas Yojana (PMAY), 2015 is meant to coordinate with other agencies working in green and energy-efficient technologies, climate changes		
11.		ISO 14062:2002 describes concepts and current practices relating to the integration of environmental aspects into product design and development		
12.		IS/ISO 14001:2015 provides requirements for an environmental management system that an organization can use to enhance its environmental performance		
13.				Coastal tourism programme of the Department of Goa Tourism – Development of Eco Resorts will be facilitated by national and international brands
14.				Department of Goa Tourism: Coastal tourism programme: Development of Eco resorts will be facilitated by national and international brands
II. The manufacturing stage				
1.	National Manufacturing Policy of 2011 to create National Investment and Manufacturing Zones (NIMZs) that are clean and energy efficient	The 'Digital India'(promoting manufacturing, consumption of IT, and e-waste recognition), 'Make in India' programme, and 'Skill India'		
2.				Nature-based tourism – Facilitate development of river cruises in small vessels across Goa's inland waterways. Focus will be on eco-conscious boats
3.	National Policy on Electronics 2019 (NPE 2019and E-waste Rules, 2016 to allocate e-waste recycling park/zone	Sustainable e-waste management – Safe disposal, e-waste recycling industry, best practices adoption. E-waste Rules, 2016 to allocate e-waste recycling park/zone, which should promote industrial symbiosis		

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
4.		IS 455:2015 Portland Slag Cement – Specification (fifth revision) for the use of slag as raw material to compensate for lime. IS 1489 (Part 1): 2015 Portland Pozzolana Cement – Specification Part 1 Fly Ash Based (Fourth Revision) IS 3812: use of fly ash in cement IS 12894: use of fly ash in bricks IS 383: use of recycled C&D waste in concrete production	Encourage industries to convert existing and generated waste such as mining rejects, slag, etc., into useful products, which is one of the objectives under Industrial Policy of Goa, 2003	
5.	National Manufacturing Competitiveness Programme, 2014	Achieve 'zero effect, zero defect models' by aligning schemes for MSMEs such as Lean Manufacturing Competitiveness Scheme, Quality Management Standards (QMS) and Quality Technology Tools (QTT), Technology and Quality Upgradation (TEQUP) schemes, ISO9000/ISO 14001 certification reimbursement schemes, marketing support/assistance to MSMEs, entrepreneurial and managerial development of MSMEs through incubators		
6.		Charter on 'Corporate Responsibility for Environmental Protection (CREP)' 2016		
7.	National Steel Policy, 2017 emphasizing development that is environmentally friendly, with focus on resource conservation, product quality, and innovative transportation mechanism to reduce waste, pollutions, de-congest transport infrastructure in mining area			
8.			The Goa government aims to follow the Edible Oil Packaging Regulation Order 1998 under Food and Drugs Administration. According to which there shall be an efficient system and provision for treatment of refuse and effluents before disposal. The facilities shall conform to the requirements laid down by the local water control authority and the state pollution control board.	
9.			Department of Fisheries, Goa has a Blue Revolution Scheme under which financial assistance shall be granted to traditional fishermen for the procurement of fiber-reinforced plastic boats	
10.		Installation of bio-toilets by Indian Railways in passenger coaches in 2010 [22]		

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
11.		National programme for LED-based home and street lighting for promoting energy efficiency in 2015		
III. The consumption stage				
1.			Incentives for Consumption of Local Raw Material is one of the schemes under the Industrial Policy of Goa, 2003	
2.		Energy efficiency labelling– Star label for appliances by the BEE provides consumers with informed choice about purchase decisions thereby saving their electricity bills		
3.			Promotion of industries that do not indulge in wasteful consumption of resources is one of the objectives under the Industrial Policy of Goa, 2003	
4..	C&D Waste Management Rules 2016			
5.	Fly Ash Notification (S.O. 763 (E)), 2015			
6.	The National Environment Policy 2006 is aimed at the adoption of Environmental Management Systems through purchase preference for ISO 14000 goods and services.	Prime Minister's Council on Climate Change suggests Green Procurement and Purchasing (GPP) Guidelines; Consultation on GPP Guidelines; development of GPP guidelines by Ministry of Environment and Forest mandates CII-ITC Centre of Excellence for Sustainable Development		
7.		Guidelines on corporate social responsibility and sustainability for Central Public Sector Enterprises (CPSEs) urge the CPSEs to initiate and implement measures towards a GPP supply chain in 2013		
8.		Biofuel Programme 2009 –Focus on development and utilization of indigenous non-food feed stocks raised on degraded or waste lands, thrust on research and development on cultivation, processing, and production of biofuels		
9.	India's Electricity Act, 2003	Renewable Energy Certification, 2010 can be traded or exchanged with buyers in states deficient of renewable energy		

	National		Goa state	
S.No.	**Policy/rules**	**Programme/scheme**	**Policy/rules**	**Programme/scheme**
10.	National Mission on Enhanced Energy Efficiency (NMEEE)	GFR 2017 Rule 173 (xvii) on the procurement of energy-efficient electrical appliances urges the procuring entity to ensure electrical appliances procurements only with the notified BEE star rating. Perform Achieve Trade (PAT) scheme, 2012administered by BEE improves energy efficiency in industry by trading in energy efficiency certificates in energy-intensive sectors		
11.	Auto Fuel Policy, 2015 promoting fuel economy through differential tax on rough levy of differential tax on two wheelers and passenger cars/jeeps			
12..	National Electric Mobility Plan, 2015 envisages promoting electric vehicles about 6–7million units of electric/hybrids on Indian roads by 2020			
IV. The end-of-life stage				
1.	National Environment Policy (NEP), 2006		The tourism policy for erection of temporary seasonal structures, beach shack, huts, and others 2013–16 outlines the terms and conditions for setting up such structures. A beach shack allottee will maintain two dustbins, one for biodegradable waste with lid and one non-biodegradable	
2.	Construction and Demolition Waste Management Rules 2016		To obtain a municipal building license or a village panchayat building license, the Goa Land Development and Building Construction Regulation, 2010 requires that no material for construction or earth from excavation or any other construction material shall be stacked on public roads	
3.	Plastic Waste Management Rules 2016		Goa bans plastic below 50 microns[23] in June 2017	UNDP and Hindustan Coca-Cola Beverages collaborates launched comprehensive Plastic Recycling Programme in Goa in 2018[24]
4.	Solid Waste Management Rules 2016		For controlling plastic menace, the provisions of the Goa Non-Biodegradable Wastes Act and Rules are being implemented in all the urban areas	Plastic Garbage Scheme 2007 notification has been published on June 2, 2011
5.	E-waste Rules 2018 (Deposit Refund Scheme)	Extended producer responsibility authorization under the new e-waste rules makes producers responsible for safe treatment and disposal of post-consumer products		

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
6.	Hazardous Waste Rules 2016		Goa Pollution Control Board aims to follow the hazardous waste rules of working on handling, recycling, reprocessing or reusing hazardous waste, their import and export, and providing treatment, storage, and disposal facilities for hazardous waste	Project on making Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDFs)was initiated in Goa by Goa Industrial Development Corporation (GIDC) in 2006
7.	Batteries (Management and Handling) Amendment Rules, 2010			
8.		Reduction in GST on waste, 2017 – E-waste and plastic waste products	The Goa government has planned to set-up common facilities for solid waste management, industrial and hazardous waste, construction and demolition waste, e-waste, and effluent through Public Private Partnership (PPP) models under Goa Investment Policy 2014	
9.		CPWD Guidelines for Sustainable Habitat – Reuse and recycling of construction and demolition waste		
10.	Fly Ash Utilization Policy, 1999 such as in cement industry			
11.	Bio-Medical Waste Management Rules, 2016		Goa Pollution Control Board aims to follow the Bio-Medical Waste Management Rules, 2016, which include: 1. Working on the collection, segregation, processing, treatment, and disposal of the bio-medical wastes in an environmentally sound management, thereby, reducing the bio-medical waste generation and its impact on the environment 2. Ensure segregation of liquid chemical waste at the source, and ensure pre-treatment and neutralization prior to mixing with other effluent 3. Ensure treatment and disposal of liquid waste in accordance with the Water Act 1974.	
12.	Plastic Waste Management 2016		Goa Pollution Control Board aims to follow the Plastic Waste Management 2016, which includes the following: 1. Local bodies shall encourage the use of plastic waste for road construction as per Indian Roads Congress (IRC)guidelines or energy recovery or waste to oil 2. Recyclable plastic waste shall be channelled to an authorized plastic waste recycler and recycling of the waste shall conform to IS: 14534:1998 3. Every local body shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing, and disposal of plastic waste on its own or by affiliating with external agencies	

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
13.			Under the Nital Goem Nital Baim Scheme, Goa Government aims to repair and renovate existing wells to promote conjunctive use of water and maintain ground water structures	
14.			Under the Rain Waste Harvesting Scheme subsidies are provided for watershed purchase	
15.			Under the Water Resources Awareness programme, Goa Government is committed to disseminating information and sensitizing the general public to the conservation, preservation, and development of water resources	
16.	Environment (Protection) Rules, 1986 –Water (Prevention and Control) Act, 1974, and Air (Prevention and Control of Pollution) Act, 1981			The Director of Tourism, Department of Tourism, Panaji, the Chief Office, Panaji Municipal Council, Panaji, and the Chief Conservator of Forests, Forest Department, Panaji are directed to prohibit the carrying, use, and sale of non-biodegradable PET bottles and plastic carry bags in the tourism sites, gardens, and parks in Panaji[25]
17.			The Goa Non-Biodegradable Garbage (Control) Act, 1996 To levy tax on sale of items in non-biodegradable materials, which shall be used for solid waste management; provide segregated dustbins and provide for removal and recycling of contents; support research on reduce, reuse, and recycle; impose requirements on packaging for type, size, labelling, composition, degradability, and recyclability for proper disposal; impose penalties for contravening the rules[26]	
18.				Goa Government constituted a flying squad for periodic special 'drives/raids' to enforce the provisions of the Goa Non-Biodegradable Garbage (Control) Act, andtake necessary action against the violators[27]
19.			In 2010, the Goa High Court had directed all village panchayats to create composting facilities for bio-degradable wastes and arrange for weekly collection of non-biodegradable wastes. In 2012, the Goa State Pollution Control Board was mandated by the High Court to conduct inspections to ensure that these facilities had been implemented[28]	

	National		Goa state	
S.No.	Policy/rules	Programme/scheme	Policy/rules	Programme/scheme
20.				Goa Environment Department in June 2011 signed an MoU with ACC (Karnataka) for the disposal of plastic, thermocol tyres, and such other items. The state has to collect the waste and deliver it to ACC limited. The waste collection will be done through village panchayats[29]
21.	Single Use Plastic (SUP) Ban: From October 2nd 2019.The Central Government is set to ban single use plastic items. The list of items is expected to include plastic bags, straws, cups, small beverage bottles, decoration items, and some sachet variants. The Ministry of Environment, Forest and Climate Change has been asked to ensure and enforce the ban on SUPs by all the states and the union territories. The plan includes incentives such as international competition on innovations on plastic waste recycling by the Department of Industrial Policy and Promotion; award for the best plastic-free station by the Rail Ministry, and competition among tourist spots for plastic waste removal by the Tourism Ministry			The government of Goa from October 2, 2019 will discontinue single-use plastic water bottles in its offices, meetings, functions, and all departmental canteens, and instead use eco-friendly, reusable alternatives to provide water. In August 2019, legislators in Goa approved a bill setting fines from INR 2500 to INR 3 lakh, for manufacture, sale, and use of single-use plastic items and carry bags

**The first phase of a product's lifecycle, that is, mining has been excluded*

22 Installation of bio-toilets by Indian Railways in passenger coaches
23 Development of Eco-resorts will be facilitated by national and international brands
24 https://www.coca-colaindia.com/stories/sustainability/packaging-recycling/new-beginning-for-goa-with-comprehensive-plastic-recycling-progr, last accessed on January 20, 2020
25 Department of Science, Technology and Environment, Goa. 2013.Directions under Section 5 of the Environment (Protection) Act, 1986 regarding plastics. Details available at http://www.dstegoa.gov.in/GNBG/As%20amended_Directions.pdf, last accessed on January 20, 2020
26 Department of Science, Technology and Environment, Goa.2003. The Goa Non-Biodegradable Garbage (Control) Rules, 1997. Details available at http://www.dstegoa.gov.in/GNBG/As%20amended_GNBG%20RULES.pdf, last accessed on January 20, 2020
27 Department of Science, Technology and Environment, Goa. 2004. Order. Details available at http://www.dstegoa.gov.in/GNBG/(12).pdf, last accessed on January 20, 2020
28 Down To Earth. 2015. Are Goa's village panchayats following High Court orders on garbage disposal state pollution board to enquire. Details available at https://www.downtoearth.org.in/news/are-goas-village-panchayats-following-high-court-orders-on-garbage-disposal-state-pollution-board-to-enquire-38021, last accessed on January 20, 2020
29 TNN. 2011. MoU signed on plastic waste disposal in state. The Times of India, June 11, 2011. Details available at https://timesofindia.indiatimes.com/city/goa/MoU-signed-on-plastic-waste-disposal-in-state/articleshow/8808294.cms, last accessed on January 20, 2020

3 PRIORITIZING SECTORS FOR OPERATIONALIZING RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GOA

3.1 PRIORITY SECTORS

Resource productivity at a macroeconomic level depends on various factors. An economy with large resource-intensive sectors has usually lower resource productivity values in terms of DMI or RMI than an economy with large service and research sectors, which are, by and large, less resource intensive. The economic importance of a resource is determined on the basis of its application in key sectors of the economy, and the extent of its substitutability by other resources. In this chapter, we focus on the hotspot sectors of the Goa's economy– construction, tourism, and waste (with focus on marine litter) along the different life-cycle stages. These sectors[30] have high economic importance as well as are facing high consumption of materials, and are also interlinked in resource use and waste generation. This strategy paper also looks into the pharmaceutical industry in Goa, which is well established and has emerged as a major driver in the growth of the state. The sector contributes around 10% of India's pharmaceutical output and is also largely export driven.

30 As part of the work on this strategy paper, case study analysis was done for the pharmaceutical industry in Goa. The pharma industry in the state is well established and has emerged as a major driver in the growth of the state. The sector contributes around 10% of India's pharmaceutical output and is also largely export driven.

3.2 TOURISM SECTOR

Tourist arrival data

Goa with its right blend of history, culture, natural beauty, and climate has been an attraction to tourists since many decades and now the destination exists on both the international and national tourist map. Tourism in Goa is largely a coastal phenomenon and is dependent on the beaches and the sea. It has become a major industry in Goa and attracts domestic and foreign tourists from all over the globe for a fabulous peek into the complex heritage and natural spectacle of the state. An examination of tourist arrival data between 2012 and 2018, as presented in Figure 3.1, shows that the total number of tourists increased almost three times from 2,788,029 in 2012 to 7,785,693 in 2017. Data before this time period showed that between 1981 and 2012the total tourist arrivals increased from 439,000 in 1981 to 2,788,029 in 2013, which is almost seven-times growth.[31]

The share of foreign tourists in the total number of tourists in 2017 was 11.4%. The estimates for tourist arrival in Goa during the period 2018–19, but upto October 2018 was about 54.80 lakh, which comprised48.76 lakh domestic and 6.04 lakh foreign tourists.[32]

Origin data for the foreign tourists in Goa show that there has been an increase in the number of tourists from Russia as compared to the decreasing trend of tourists from other countries. Figure 3.1 presents the foreign tourist arrival in Goa statistics from top five origin countries.

There have been slight fluctuations in the growth of tourist arrivals as these are susceptible to several local and international factors. For instance, the growth of tourist arrivals post 1990s can be attributed to the depreciation of the rupee (TERI 2000) or decline in tourist arrivals in 2008 due to the terrorist attacks in Mumbai (GoG 2010). The recent years too have seen some decline in growth rate of tourist inflows to the state. The main reasons identified by the stakeholders for the same include littered land and beaches, widespread indiscipline among taxi operators and drivers, poor and corrupt policing, which have impacted Goa's image as a welcoming tourism destination. The pressure on the beaches of north Goa—most notably, Baga, Calangute, Candolim, Sinquerim, and Anjuna has been highlighted where basic infrastructure such as garbage clearance, sewage systems, and roads, is struggling to keep pace with the sheer pressure of arrivals. Also beach cleaning has been delayed due to infighting between government departments for years. As a result Japanese, Finnish, and Danish operators have pulled themselves out of Goa citing safety and health concerns.

The increasing tourist population has put pressure on the natural resources, and the most of the brunt of tourism is felt in Tiswadi, which houses the capital of Goa and is most popular with domestic tourists. There is also distinct seasonal variation in tourist arrivals, with over 80% of domestic and international tourist arrivals concentrated in the tourist season months. Data for taluka-wise number of tourists in 2017–18 are presented in Table 3.2.

The average duration of stay for tourists in the hotels in Goa has been identified to be 5 days for

31 The tourist arrivals data have been procured from the Department of Tourism. A separate statistical wing within the department compiles data on tourist arrivals based on monthly records received from immigration office, hotels and cruise ships, and information counters. A performa in which the data need to be sent monthly has been circulated by the department to various sources.

32 Source: Economic Survey 2018–19, Directorate of Planning Statistics and Evaluation (DPSE), Government of Goa

Table 3.1 Tourist arrival statistics for Goa during 2012–18

Year	Number of domestic tourists	Number of foreign tourists	Total number of tourists	Percentage increase
2012	2,337,499	450,530	2,788,029	4.38
2013	2,629,151	492,322	3,121,473	11.96
2014	3,544,634	513,592	4,058,226	30.01
2015	4,756,422	541,480	5,297,902	30.55
2016	5,650,061	680,683	6,330,744	19.50
2017	6,895,234	890,459	7,785,693	22.98
2018 (provisional)	7,081,559	933,841	8,015,400	2.95

Source: Department of Tourism, Government of Goa

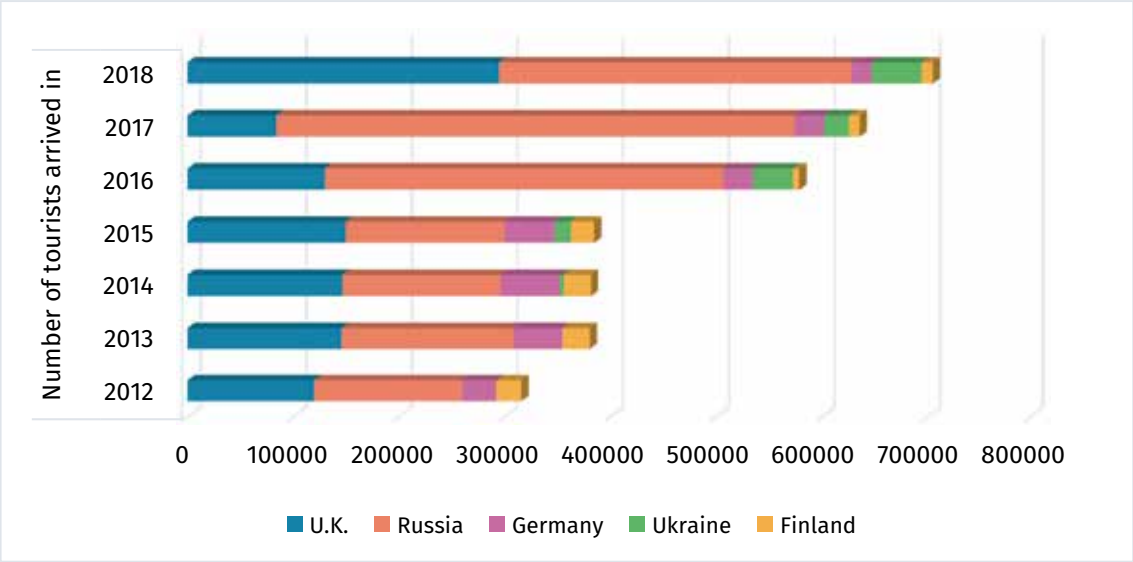


Figure 3.1 Foreign tourists in Goa from top five origin countries

Source: Department of Tourism, Goa. Statistics. Details available at http://www.goatourism.gov.in/statistics/247, last accessed on January 21, 2020

domestic tourists and 9 days for foreign tourists.[33]

The planning of sustainable tourism policy is complex and requires careful, extensive, and detailed study and understanding of the current status of tourism, its impact on environment, biodiversity, economy, and social and cultural life. The sustainable tourism plan should be merged with the main agenda of sustainable development to enhance socio-economic and environment benefits to all. It is important to mention here the Tourism Policy of Bhutan, which is founded on the

33 Department of Tourism, Goa. Statistics. Details available at http://www.goatourism.gov.in/statistics/227, last accessed on January 21, 2020

principle of sustainability, wherein, tourism must be environmentally and ecologically friendly, socially and culturally acceptable, and economically viable. Box 3.1 presents the details about the policy.

Growth of Tourism Infrastructure

The taluka-wise number of hotels and total bed capacity in 2017–18 are presented in Table 3.3. To cater to the increasing number of tourist arrivals in the state, the bed capacity too has increased over the years.

The distribution of hotels in the four different categories provided by the Department of Tourism is shown in Figure 3.2. The categorization of hotels is in terms of the quality of rooms, restaurant, swimming pool, and quality of amenities and services provided in each hotel. An examination of the type of hotels in different categories revealed that the distinction is very fluid. Further, this classification does not correspond to the star category as the star category hotels were mostly spread across category A, B, and C hotels. One reason for the same was that some hotels that did have good facilities, applied for a lower category as the excise rate that is levied in the bars and restaurants depends on the category of the hotel. Further, some of the older hotels, after upgrading and expanding their facilities, may have not upgraded their categories. The number of major hotels and resorts has increased by 170% from 42 in 2008 to 113 in 2018, according to the State Department of Tourism. In comparison, budget hotels grew 100% from 2142 in 2008 to 4286 in 2018, as can be seen in Figure 3.3.

Most of the star hotels have restaurants. In addition to these, there are several standalone restaurants offering a wide variety of local, national, and international dishes at reasonable prices. Besides these restaurants, there are shacks, which are typically built of temporary materials operating during the tourist season between October and February. Some of the five-star hotels have in-house recreational facilities, such as night bars,

Box 3.1:

'High Volume Low Impact' tourism policy in Bhutan

The Royal Government of Bhutan developed the 'High Volume, Low Impact' tourism policy for attracting tourists to create a unique and exclusive image package for promoting Bhutan. The main agenda of the policy is 'to foster a vibrant industry as a positive force in the conservation of environment, promotion of cultural heritage, safeguarding sovereign status of the nation for significantly contributing to gross national happiness'.

This policy forms the ground for the tourism sector to be sustainable, ecologically adaptive, culturally sensitive, economically beneficially as well as socially acceptable so that the local community is able to reap the benefits associated with tourism in a sustainable manner. The policy was earlier known as High Value, Low Volume Policy, which focused on regulating tourist inflow in the country so that there would be minimal impact on the environment and the resources of the country.

This policy helps to achieve the following three objectives mentioned in the National Tourism Policy:

i) Increase revenue especially foreign exchange;
ii) To enhance socio-economic development of the country via tourism, and
iii) To publicize Bhutan's culture, religion, and people to the world.

Under this new policy of 'High Volume and Low Impact', the Tour Operators charge US$250 per tourist per night as tariff rate, which is levied on international tourists only. This policy mandates the tour operators to keep the international tourists in three-star or above hotels. The tariff includes their accommodation, travel, food, entertainment, etc. Further, a part of this tariff, that is, US$65 is given to Tourism Council of Bhutan, which is then used for social welfare activities.

Table 3.2 Taluka-wise number of foreign and domestic tourists' arrival during 2017–18

District/taluka	Number of domestic tourists	Number of foreign tourists
North Goa	**5,479,852**	**578,815**
Tiswadi	2,259,707	230,093
Bardez	2,639,586	289,219
Pernem	560,426	51,258
Bicholim	17,137	7233
Sattari	2996	1012
South Goa	**1,552,445**	**373,186**
Sanguem	32,423	10,922
Ponda	14,057	1046
Dharbandora	14,217	9022
Canacona	47,344	29,697
Quepem	2338	545
Saleete	1,365,940	275,442
Mormugao	76,126	46,512

Source: Goa at a glance. Details available at http://goadpse.gov.in/Goa%20at%20a%20Glance%202018.pdf, last accessed on January 21, 2020

Table 3.3 Taluka-wise number of hotels, lodging houses including paying guest houses and bed capacity in 2017–18

State/ district/ taluka	Number of hotels, lodging houses including paying guest houses	Number of beds*
Goa	**4399**	**79,621**
North Goa	**3650**	**54,512**
Tiswadi	386	11,404
Bardez	2818	38,799
Pernem	431	2721
Bicholim	10	204
Sattari	5	53
South Goa	**749**	**22,859**
Sanguem	2	12
Ponda	7	249
Dharbandora	26	1330
Canacona	70	1434
Quepem	6	206
Salcete	554	17,164
Mormugao	84	2728

*The number of beds has been estimated using the average beds per hotel for 2016–17

Source: Goa at a glance. Details available at http://goadpse.gov.in/Goa%20at%20a%20Glance%202018.pdf, last accessed on January 21, 2020

discotheques, etc. Water sports like boating, water scooters, sailing, canoeing, water skiing, etc., are also available in a few starred hotels. Apart from these, water scooters and speed boats are also available at some of the beach stretches. There are a number of casinos– both offshore and onshore– at the tourist destinations. A number of mini golf courses have also sprung up in various hotels. In addition to these, the Department of Tourism is also regulating the number of beach beds that come up on the beaches. The increasing demand for recreational facilities will add additional pressure on the natural resource base of the state and local access to those resources.

Total number of hotels/paying guest house, rooms, and beds as on March 31, 2019 (including star category and heritage hotels)

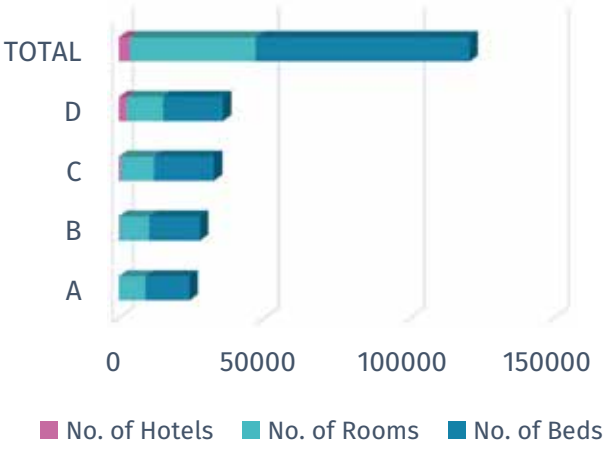


Figure 3.2 Category-wise distribution of hotels, rooms, and beds

Source: Department of Tourism, Goa. Statistics. Details available at http://www.goatourism.gov.in/statistics/230, last accessed on January 21, 2020

Luxury Hotels Increased 170% between 2008 and 2018 in Goa

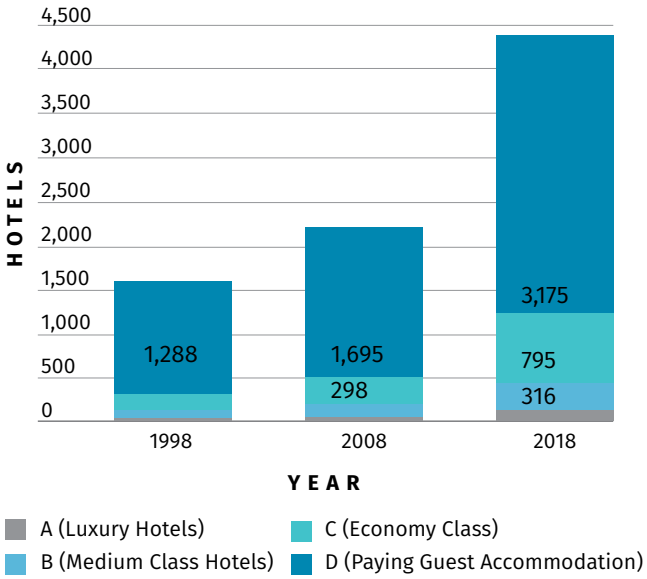


Figure 3.3 Category-wise hotel distribution in Goa

Source: Gokhale, N. 2018. In lush, prosperous Goa, the growth of luxury hotels – up 170% in 10 years – is sparking conflict. Details available at https://www.indiaspend.com/in-lush-prosperous-goa-the-growth-of-luxury-hotels-up-170-in-10-years-is-sparking-conflict/, last accessed on January 21, 2020

Table 3.4 Hotels, rooms, and beds for heritage hotels in Goa as of March 2019

No. of hotels	No. of rooms	No. of beds
2	24	38

Source: Details available at http://goatourism.gov.in/statistics/230/, last accessed on January 21, 2020

There is a sense from local stakeholders that investment in public infrastructure– water supply, electricity, and sewage management – has not been consistent with the increase in tourist rooms/numbers. Stakeholders highlighted the need for the government to focus on providing this public infrastructure to meet the demand of new rooms. They also noted that while conducting a carrying capacity study to better understand and forecast the limits the tourism industry needs to work within if the state is to preserve its natural environment, ecosystem services, wildlife, and cultural identity. Such a carrying capacity study can ensure that the needs of local people and ecosystems are also met as the industry expands (i.e., that expansion of the industry is sustainable for long term). There are some hotels that are using RE to measure and manage resource consumption, but this is not the norm.

3.3 CONSTRUCTION SECTOR

The construction sector in Goa has been one of the most vibrant industries in the Goan economy since its liberation in 1961. In particular, the last decade has witnessed rapid growth in the construction industry, and real-estate prices mostly for non-Goans, which is a matter of concern for locals Goa has been ranked the best-placed state for its infrastructure by the Eleventh Finance Commission and it also tops the best quality of life in India, as rated by the National Commission on Population. Every year large numbers of international and domestic tourists arrive in Goa to enjoy its white sand beaches, nightlife, cathedrals, and World Heritage-listed architecture. Owing to rapid urbanization and tourism bustle, this rich biodiversity hotspot has become susceptible to a growing need for construction activities. There exists a high potential for imminent growth in this sector, which shall then drive the demand for numerous construction and building materials.

The growth rate of the construction sector contribution to GSDP of Goa has been witnessing a fluctuating trend– it was -2.54% in 2014–15, increased to 29.88% in 2015–16, then again decreased to -9.48% in 2016–17 and increased to 25.52% in 2017–18 (Quick Estimate).

Figure 3.4 presents the apportionment of the total built-up area in Goa in square metre for 2017–18 (1.42 million m^2) into residential, commercial, and industry-occupied edifices.

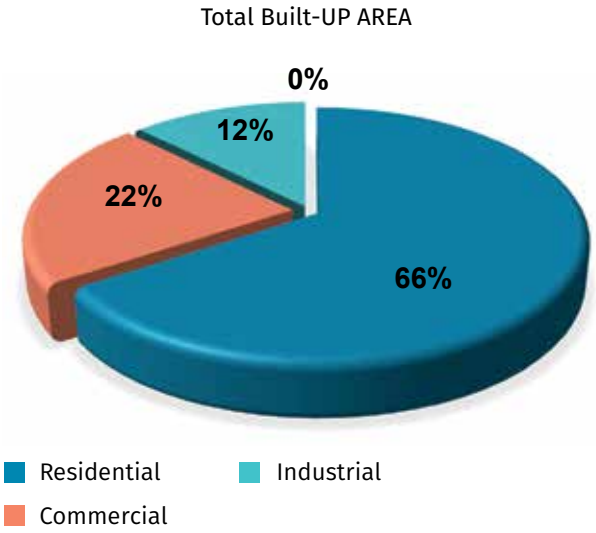


Figure 3.4 Total built-up area in Goa as notified by the Town and Country Planning Department and GIDC

Growth drivers in the construction sector in Goa

The state economy being heavily dependent on tourism activities has witnessed a rise in the construction and renovation of hotels. There has been a noted multiplication of the tourist accommodations – doubling every decade. This recent spurt has led to the number of hotels and lodging houses, including paying guest houses, mounting to 4399 in 2017–18 from 3506in 2016–17.

There is also upcoming a green-field airport at Mopa, which is expected to handle around 30 million passengers per annum. Goa ranked 19th in terms of ease of doing business as per the Business Reforms Action Plan 2017 prepared by the Commerce Ministry's Department of Industrial Policy and Promotion, in partnership with the World Bank Group. Goa requires public infrastructure development such as roads, sanitation, electricity, and water to enhance its tourism industry, besides investments to expand its mining and pharmaceutical sectors.

Further, the Goa Vision 2035 will lead to enhanced construction activities and the consequent consumption of related raw materials. The Government of Goa has approved a Panaji Smart City proposal amounting INR 981 crore (US$ 144.1 million). Moreover, there are nearly 700 projects in pipeline to be funded by the central and the state governments. The state is also in the process of developing the logistics sector in

Goa by forming a special logistics group. For this purpose several bridges will be built to address the existing deficiencies with regard to logistics and warehousing. Not long ago the Union Ministry of Home Affairs recognized five islands in Goa, namely, St George Island, Grande Island, Pequeno Island, Conco Island, and Bhindo Island to be holistically developed.

The unceasing construction activity in the state has experienced growing volume of generation of waste as well as uncontrolled and illegal dumping of waste along the highways. Of the total waste generated in Goa, construction debris accounts for 34%.

Local stakeholders are concerned that some of the construction are done based on speculation and investment opportunities in high real estate value, and were not planned for actual demand of visitors or to meet the needs of local people. Stakeholders also perceive that construction has been boomed but that many of the constructed establishments do not have occupancy (for most part or all year around). Stakeholders have mentioned that over 20% of buildings in Goa are empty. This does reflect lack of coordination in terms of planning between numbers of people arriving, needs of local people, and what is being constructed.

3.4 IMPORTANCE OF RE&CE FOR PROMOTING SUSTAINABLE DEVELOPMENT IN GOA

As per Niti Aayog,[34] in an increasingly resource-constrained world, a rapidly developing country like India will need to increase its overall resource consumption in the short-to-medium term in order to meet its developmental goals. Therefore, efficient use of resources is essential for India in order to achieve sustainable development and is an unavoidable policy priority.

The Goal 12 on Sustainable Consumption and Production emphasizes on 'doing more with less' thereby ensuring that the needs of the present generation are fulfilled without compromising the needs of the future generation. This goal, in particular, promotes RE, green economies, and sustainable infrastructure. It also focuses on reducing degradation and pollution and minimizing waste. The goal also calls for environmentally sound management of chemicals and all wastes throughout the life cycle, efficient use of natural resources, as well as ensuring spread of information and awareness on sustainable practices and lifestyles. Eight other SDGs (2,6,7,8,9,11,14, and 15)[35] also have a bearing on RE.

In case of Goa, adopting RE&CE would go a long way in addressing the resource use challenges that tourism and construction sector pose to the state while also creating new economic opportunities (jobs and industries) for the state and fostering responsible consumption and production. RE will help the state in achieving the sustainability goals particularly SDG 12 and contribute to the national developmental agenda. Goa, through its affluent rural set-ups, can explore what responsible production and consumption looks like in the

34 Niti Aayog. 2017. Strategy on Resource Efficiency

35 SDG2–Zero Hunger, SDG6– Clean Water and Sanitation, SDG7–Affordable and Clean Energy, SDG8–Decent Work and Economic Growth, SDG9–Industry, Innovation and Infrastructure, SDG11–Sustainable Cities and Communities, SDG14–Life Below Water, and SDG15–Life on Land

21st century villages. It can witness how modern aspirational village consumers, small-scale producers, and panchayat governance can support a shift towards sustainable consumer behaviour and business practices, as well as test how to make extended producer responsibility (EPR)-based logistics work at the state and national level, where production is not local.

Waste is being looked at as an important issue in the state with special focus given to the challenge of marine litter (plastic waste, generation, and end of life management). Though biotic resources such as water and land have not been included in this strategy paper, these resources are also critically important for Goa's tourism and construction sectors.

The sectoral recommendations and the state-level action plan for fostering RE&CE in the state made by this strategy paper will help empower the state government monitor and report towards SDGs, particularly the SDG 12. In context of the SDG Indicators and Monitoring Framework being used for monitoring SDG implementation along with data on the indicators that have been developed for the states, there are 11 targets for SDG 12–Ensure sustainable consumption and production patterns. A total of 17 indicators have been identified at national level to measure and monitor the progress of these targets. Specifically, Target 12.5,which states, by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse, is extremely relevant in the context of RE&CE. The progress against this target through the three specific indicators under the target (listed below) can be monitored and reported by the state. There could also be suggested refinement and[36] and localization of these indicators further where needed:

- Number of waste recycling plants installed (Indicator 12.5.1) *and operational*
- Number of municipal corporations *(and panchayats)* using waste segregation techniques(Indicator 12.5.2)
- Number of municipal corporations banning the use of plastic (Indicator 12.5.3)

Further, many other targets under SDG12 though have to be monitored at the national level, but the indicators for many of these can be assessed and monitored at the state level, which will then contribute to meeting the target at the national level. For example:

- Formulation of national Sustainable Consumption Production (SCP) framework and integration of SCP with national/state planning process (Indicator 12.1.1)
- Green public procurement policy developed and adopted by the central ministries/states/UTs *(numbers)* (Indicator 12.7.1)
- Number (and effectiveness) of sustainable tourism strategies or policies and action plans implemented with agreed monitoring and evaluation tools (Indicator 12.b.1)
- Encourage and promote effective public, public–private, and civil society partnerships, building on the experience and resourcing strategies of partnerships (Indicator 17.17)

36 See italicised text in the indicators list

The recommendations in this strategy paper will help assess the SDG indicators listed above and enable the state to report the progress along SDG 12 while also fostering new economic opportunities in line with the SDGs and providing new learning and data on modern village circularity (including but not limited to traditional village circularity).

Currently, in the reporting of the progress made by India's states and union territories towards implementing the 2030 SDG targets in a report[37] that was released by the Niti Aayog in December 2018, progress on SDGs 12 (and SDG 13 and 14 could not be measured[38] as relevant state/UT-level data were not available). However, Goa can become one of the first states to contribute to reporting on this goal. The state can also report on SDG 17–Partnership for the Goals, by piloting and reporting on how multi-disciplinary, multi-sectoral collaboration (partnership platform for RE/CE in Goa) can help in delivering SDG 12.

37 Niti Aayog. 2018. SDG India Index: Baseline report, 2018. Details available at https://niti.gov.in/writereaddata/files/SDX_Index_India_21.12.2018.pdf, last accessed on January 21, 2020

38 Also SDG 17 was left out as it focuses on international partnerships

4 IMPROVING MATERIAL RESOURCE EFFICIENCY AND ENABLING CIRCULAR FLOW OF MATERIALS IN TOURISM SECTOR IN GOA

4.1 RE&CE– RELEVANCE FOR TOURISM SECTOR

The quality of environment is essential to tourism for an appealing destination. The traditional tourism model reflects high consumption in the linear take-make-dispose model as it relies on large quantities of resources consumed not only by tourism operators but also by tourists themselves, and, at the same time, producing significant amounts of waste and generating pollution. Figure 4.1 depicts the linear model for tourism sector where sourcing of resources/raw material happens, followed by manufacture and provision of tourism-related products and services, and then consumption and use of these products and services. Wastages occur at all the stages.

Further, increased tourists inflow can have adverse environmental impacts, such as increased waste and waste water generation, as well as noise and air pollution. Acknowledging that the resources are limited and that the linear economic model will further contribute to scarcity of resources, the tourism industry has a heavy resource footprint and needs to support the transitioning towards a more circular tourism economy. Indeed, because of the scale of the tourism footprint, action towards RE&CE by the tourism sector in Goa would have a significant effect (including ripple effect) on the state economy and environment, and presents an opportunity for the sector leadership not only in Goa but for the whole country.

RE&CE aspects can be integrated into the tourism value chain at all stages of the value chain. The concept calls for not only resource-efficient manufacturing but also for RE after use in terms of extension of the product lifespan through reuse and repair. Products of every industry linked to the tourism sector, such as food industry, construction industry, textile industry or furniture industry have to be designed to allow repair, reuse, and recycling in order to extend life of the products and their proper recyclability. There is significant potential for the CE to change the existing value chain around the design, construction, operation, renewal, and repurposing of tourist facilities. Tourism businesses in Goa can support this through their supply chain choices, sector advocacy, and through R&D partnerships with suppliers. This is also an opportunity for the tourism industry to contribute further to economic, social, and environmental development in Goa by supporting/incubating/fostering local circular supply chains and new businesses within Goa.

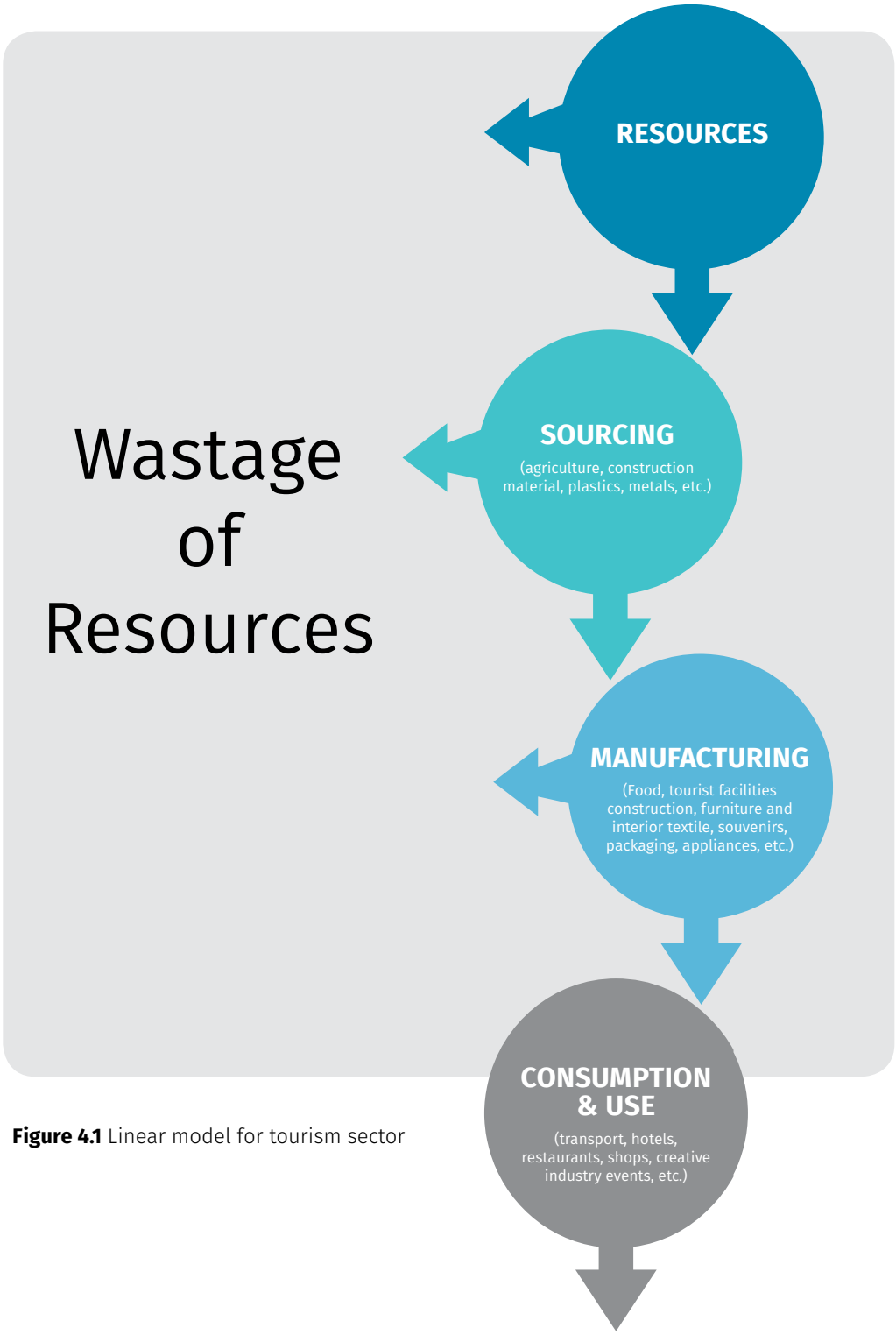


Figure 4.1 Linear model for tourism sector

4.2 POTENTIAL OF MATERIAL RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN TOURISM SECTOR IN GOA

Working towards a more resource-efficient and circular economy within the tourism sector involves many aspects and material flows along the different life-cycle stages. Table 4.1 summarizes these and highlights the potential opportunities.

However, stakeholders' discussions have highlighted a few concerns and barriers regarding tapping of some of the opportunities listed in the above Table. Annexure 4 presents these concerns and barriers that were highlighted by the stakeholders in context of circular flow of plastics.

There is relative scarcity of certified green/ resource-efficient materials in the state and this represents opportunities for creating new markets for such materials within Goa. Alternatives for plastic products such as straws and packaging material, which besides facing concerns linked to availability, also face issues related to buying of minimum quantities and prices. On a broader level, re-thinking on the need of straws should also be done. Do we actually need straws at all or we can just keep their use for essential purposes (such as drinking coconut water). Social innovators in Goa are working on developing bio-plastics but the sector needs start-up support.

In Goa, currently there is lack of needed focus on local sourcing of food. A few good practices exist, but overall stakeholders have specifically highlighted the need to go back to understand the local seasonal rhythms for food. This can also give a much needed boost to local agriculture, which is currently suffering due to shifting of people to the tourism sector for employment and high real estate value.

One of the existing initiatives that are trying to provide support to the hotels on environmental objectives including issues linked to RE is the Green Otels[39] (a member of the Global Sustainable Tourism Council). The mission of this initiative is to encourage the hospitality industry in general and Chief Engineers of the hotels in specific, to move towards a greener consciousness by tracking trends, by providing platforms for ideation and dialogues with thought leaders, by providing solutions through consultation and training tools, and by certifying and recognizing best practices. Travel and Tourism Association of Goa is one of the supporting associations of this initiative. However, it may require more effort and engagement for these initiatives to impact small and medium-sized hotels.

39 Details available at www.greenotels.com, last accessed on January 20, 2020

Table 4.1 Opportunities to promote resource efficiency and circular economy in the tourism sector

Life-cycle stage	Aspect	Material focus	Opportunities
Design stage and raw material use	Designing of hotels	Building and construction	• Use C&D waste • Use products that are made of recycled or renewable material • Use reclaimed products like salvaged wood floors or vintage furniture
	Sourcing of food[40]	Food	• Bulk buying from local suppliers • Demand reduced packaging • Buy seasonally
	Procurement for circular economy	Packaging	• Encourage suppliers to minimize packaging (or even do away with packaging[41] where possible) • Reuse packaging and use packaging with recycled content (except for food packaging) • Housekeeping cleaning supplies and chemicals can be purchased in concentrated form in reusable containers and can be used for different purposes • Bulk buying and arrangements with suppliers to return the packaging material for reuse
Construction of tourist facilities	Temporary structure construction for events[42]	Building and construction	• Use reusable material • Minimize waste during construction
	Refurbishing, furnishing, and decorating hotels	Building and construction	• Furnishing hotels from recycled/environmentally friendly materials designed to be easily dismantled and recycled (carpets, ceiling, etc.) • Have integrated take-back collection and recycling scheme for used furnishings • Reduce the raw materials used and favour locally produced natural options
	Local sourcing of material	Building and construction	• The Goa Vision 2035 Document has suggested that tourism infrastructure, particularly accommodation, should be encouraged to be eco-friendly, with careful use of locally available materials and incentives for the same need to be given in form of subsidies
Tourism service provision	Using secondary raw material/ alternative materials	Paper	• Purchase guest room products such as stationery, tissue papers, etc., made from recycle paper • Efforts on making paper-free environment through use of digital technology
	Using secondary raw material/ alternative materials	Paper, cloth, plastic, and chemicals	• Provision of laundry bags made of jute/linen instead of paper and plastic bags • Recycling cleaning agents in other hotel areas for cleaning purpose • Supplying water in guestrooms in returnable, hotel-filled branded glass bottles, or even a whole large water dispenser instead of plastic bottles • Using environmentally friendly versions of electronic devices such as sensor lights • Design a linen (both towels and sheets) reuse programme in all guest rooms • Do away with plastic straws and use alternatives such as bamboo straws • Use alternatives for plastic used in packed meals • Use reusable laundry bags made of cloth (for soiled linen) and cane (to deliver laundered clothes) instead of plastic

Life-cycle stage	Aspect	Material focus	Opportunities
	Minimizing use of raw material	Guest room amenities	• Reduce the use of bathroom amenities like soap and shampoo • Shift from small plastic bottles to refillable/ceramic or glass dispensers for soap and shampoos • Provide amenities like newspapers, shower caps, shoe shine, sewing kits on guest request • Keep bathroom amenities like dental kits, shaving kits, loofah pads, and shower caps as special amenities
End of life/ waste management	Managing end of life products	Furniture, linen, and mattress	• Remanufacture old mattresses • Re-dye the linen and carpet to match the room decor after refurbishment • Rotate the draperies periodically to increase the life span of the fabric • Tie ups with furniture and mattress recycling organizations • Old blankets and worn out furniture should be donated by the hotels[43]
		Food waste	• Set-up a food composting unit at the tourist facility itself in cooperation with municipal authority • Production of energy from food leftovers at a pyrolysis[45] plant • Store the excess heat generated by the pyrolysis onsite as hot water in a swimming pool, or repurposed as a thermal energy storage system • Recycle used cooking oil from restaurants into fuel by a local oil refinery or make soaps out of used cooking oil
		Other	• Garbage segregated at source of origin in all departments –such as kitchen, restaurant and bar, housekeeping, laundry, and maintenance • Targets set for waste disposal including recycling targets and amount of waste going to landfills

Source: Author's own compilation

40 The increase in greenhouse gases, pollution and ill health—all of these are intrinsically linked to our eating habit.
41 The case study on packaging is presented in Chapter 6 and discusses opportunities for use of recycled packaging and naked (no packaging) products.
42 Such as for destination wedding venues and premises for art and cultural events
43 Kurtagić, S M. 2018. Circular economy in tourism in south east Europe. Details available at https://open.unido.org/api/documents/13165892/download/Paper%20Circular%20Economy%20in%20Tourism%20SEE.PDF, last accessed on January 20, 2020
44 Pyrolysis process heats the waste, breaksit down to produce natural gas and char. A cyclone separates off the gas leaving biochar, which is valuable as an additive for the gardens. The gas is combusted and generates heat and electricity.

4.3 TOUR OPERATORS – SCOPE OF INFLUENCE AND CHANNELS OF INTERVENTION FOR FOSTERING RE&CE IN TOURISM SECTOR IN GOA

Tour operators play a central role in the tourism industry. As intermediaries between tourists and tourism service providers, tour operators can influence the choices of consumers, the practices of suppliers, and the development patterns of destinations. This unique role means that tour operators can make an important contribution to furthering the goals of sustainable tourism development and protecting the environmental and cultural resources on which the tourism industry depends for its survival and growth. Besides strengthening their brand values and reputations with consumers, integrating RE practices and CE principles into tour operators' business practices can also create better relationships with suppliers, staff, and local communities, increasing their respect as a partner in destinations and limiting the risk of problems or conflicts. A strong positive reputation and a low risk of conflict can lead to increased access to key resources such as capital, ability to develop products in an increasingly competitive market, and motivated and loyal staff. From a financial standpoint, resource-efficient practices can also increase revenue and shareholder's value, particularly through the generation of more repeat business, acquisition of new clients, cost savings, and increased operational efficiency. The Global Sustainable Tourism Council provides resources with actionable tips and advice for taking part in responsible travel. Tour operators can also become certified to show customers their compliance with the highest environmental and social sustainability standards. Figure 4.2 presents the various channels of influence for the tour operators.

Tour operators who sell Goan holidays to people outside of Goa can play a role in setting up of realistic prices to enable viability of resource-efficient products and services (incorporating the premium they would carry due to RE characteristics) and not trying to gain market share by offering cheap products, which may not be resource efficient.

PUBLIC TOILET & BATH
SABHANA TRUST BANGALORE
PAY & USE KEEP & CLEAN
ISMAIL 2

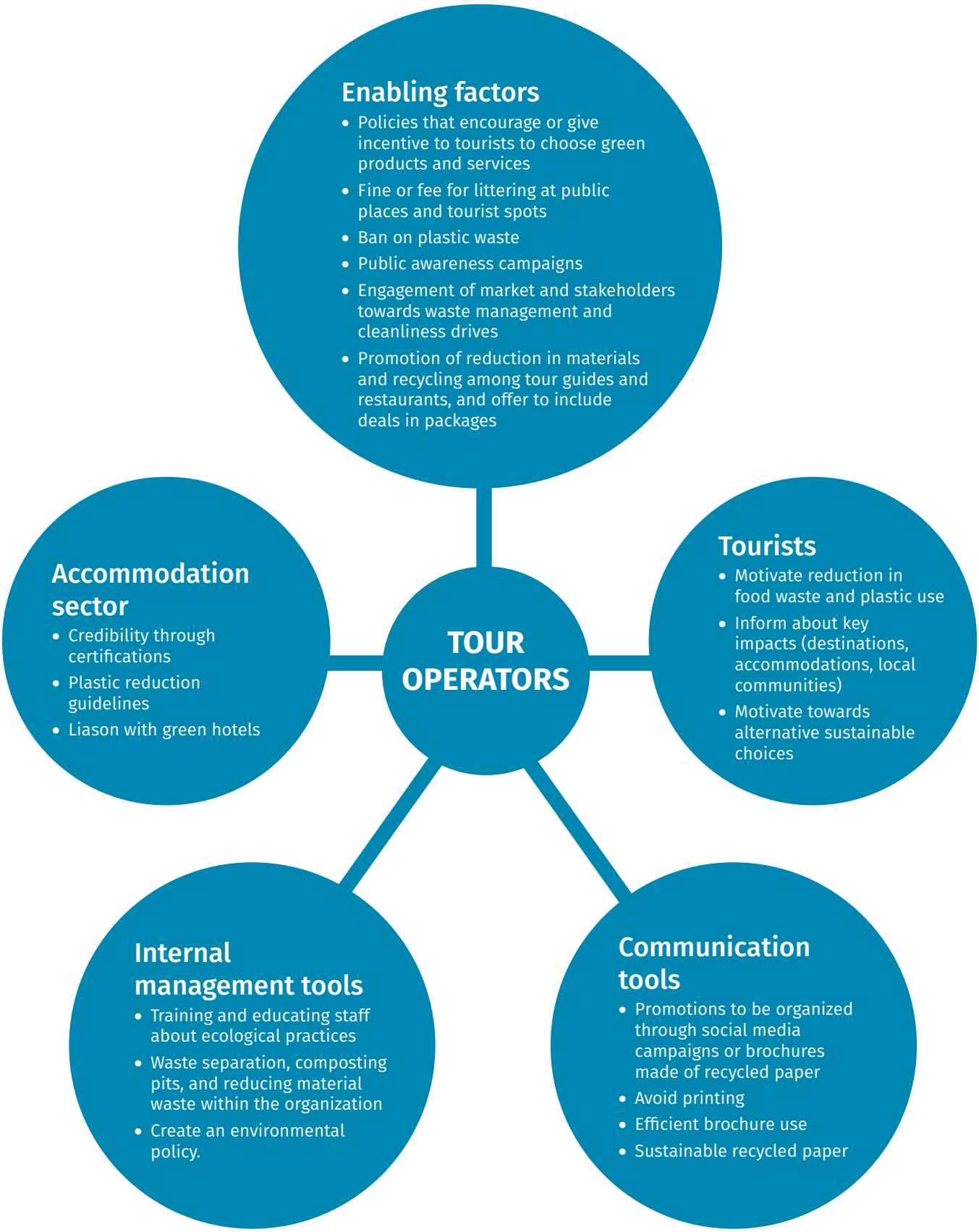


Figure 4.2 Channels of influence of tour operators and the related opportunities for fostering resource efficiency

4.4 SOCIAL INNOVATIONS AND GOOD PRACTICE

Goa is witnessing many social innovations and good practices ranging from collection of waste to using them as a resource and making new products out of them. 'Upscaling these social innovations' and replicating these good practices are the main concerns of all those dealing with the need to operate a transition towards a more resource-efficient and circular society. It is important to ensure that social innovations are maintained and do not fade in time, they are supported in their expansion, and how can they grow, get replicated but continue to learn from others without reinventing the wheel. There is also scope for bringing about newer innovations that could be expanded. Table 4.2 presents a summary of a few such innovations and good practices from Goa. Table 4.3 presents a few examples on innovative interventions to make selected material flows in tourism sector resource efficient.

Table 4.2 Social innovations/good practices focused on aspects of RE&CE with examples from Goa

Category of social innovation/ good practices	About the social innovation/good practices
Campaign to engage and create awareness about environment and conservation	Pilot run by Goa Institute of Management– tourists incentivized to collect waste in exchange for discounted coupons to local restaurants; collected waste segregated and recycled
	Pilot run– exchange 10 beer bottle caps or 20 used cigarette butts for a beer at a pop-up waste bar
	Waste bar initiative by Drishti Marine with CSR support from Gualia Closues –a hangout place where one could exchange segregated garbage for a drink
	Carpet of Joy– collectively, 150,000 plastic bottles of 1-litre capacity were repurposed to create this mammoth installation spanning 2000 m^2 in length, with a part of it climbing 12 metres into the sky, and a 9-metre-tall tree as a part of the installation
	#NoSUP campaign by Aranya Research, raising awareness with small operators about the need to say not to single use plastics including plastic straws
Resource efficiency in design and construction of hotels	Alila Diwa Goa–used primarily local materials, including the region's eco-friendly brick red laterite stone.[45]
	Yogamagic Eco Retreat–used local, sustainable materials like bamboo, mud, clay, and stone; furnished using reclaimed wood, natural coconut coir flooring, organic bamboo fibre, and khadi silk.
	Park Regis Goa– uses eco-friendly cleaning materials, recycles old building waste metal
	Beach Box Hotel, Goa is a boutique concept hotel crafted from recycled materials and shipping containers. Its motto is to recycle, repurpose, and reuse materials
	Anil Counto Enterprises Alcon Hospitality Group (O Coqueiro) –recycles water, treats cooking oil, and manage other resources efficiently

45 Alila Hotels. Sustainable tourism. Details available at https://www.alilahotels.com/diwagoa/sustainable-tourism, last accessed on January 20, 2020

Carpet of Joy

collectively, 150,000 plastic bottles of 1-litre capacity were repurposed to create this mammoth installation spanning 2000 m^2 in length, with a part of it climbing 12 metres into the sky, and a 9-metre-tall tree as a part of the installation

Category of social innovation/ good practices	About the social innovation/good practices
Local sourcing of food by hotels	Bomra–a Burmese restaurant in Candolim, serves freshly caught fish and locally obtained veggies from the villages nearby. Aangan Village stays operated by the Verlem Eoc-tourism Cooperative Society in Netravali Panchayat. The project is owned and operated by the rural community with various in-built sustainability principles such as waste management, carrying capacity, and model that promotes tourism as an additional income-generating activity to the main livelihood, which is agriculture
Use of alternative materials/ secondary materials	Park Regis uses eco-friendly cleaning materials, implements procedures for cutting down and managing food wastage, and cuts down on paper usage for business meetings by having everything available electronically. Carry Your Bottle and Ecoworld Goa–produces metal water bottles to replace the use of plastic PET bottles and in implementing a refill network and associated app.
Upcycling– make soap from used cooking oil and fat-based oil	Saahas Zero Waste operates in Goa collecting waste and produces products such as T-shirts, exercise books, etc. Currently, its production is outside Goa but looking for manufacturing suppliers in Goa The Sustainable Green Company–makes packaging from recycled cardboard, which replaces the need for thermocol and other plastic packaging. Currently supplying to the manufacturers – IFB and Siemens. Resora Soaps – a laundry detergent made by hand from used edible oil in Goa. The upcycling gets rid of any toxins, fragrances, or chemicals that would adversely affect the oceans where the oil would otherwise drain into in the absence of upcycling. The soap is completely biodegradable and the water left over from washing can be used in gardens or parks. Stakeholders have suggested setting up of village-based recovery and collection units for used cooking oil that could provide local women with cottage industry enterprise opportunities, which could in turn be sold back to hotels and restaurants, creating a more circular value chain.
Managing waste	Recycle provides waste collection services to more than 10,000 units scattered across many village panchayats and municipal councils in Goa and charges a user fees for these services. They support residents to manage organic waste on-site and collect dry waste segregated in as many as four or more categories–glass, paper, PET bottles, and metals. Sanitary waste is collected separately. Organic waste is managed on-site. For bulk generators, an additional service of supervising composting services is provided. They also have a tie up for sending recycled glass bottles to companies using glass bottles; one such being the Old Monk Alcohol factory. There is also an increasing use of upcycled goods for niche products.[46] Sustainable Designed Solutions–works with individual households, independent restaurants and hotels, and small businesses in Maharashtra and Goa, to deliver bacterial-based purification of kitchen waste from oil and grease. Tanks are set-up on the property. Kitchen waste is deposited along with a corresponding proportion of effective microorganisms culture. It takes approximately 24 h for the bacteria to breakdown the oil, an energy and labour-free process. The set-up is one tenth of the price of building and maintaining a chemical-based sewage treatment plant with water as a by product

46 Details available at https://www.iwasproducts.com/, last accessed on January 20, 2020

Category of social innovation/ good practices	About the social innovation/good practices
Recycle – converting used hotel soaps into new soap bars	Goa Waste Management Corporation in association with Sundara charitable trust, GCCI, and Travel and Tourism Association of Goa has started recycling old hotel soaps into new soap bars. These soap bars will then be sent to slums and villages to be distributed to their communities and help in not only promoting resource efficiency but also supporting the social objective of improved hygiene. This innovative solution on managing soap waste from the tourism sector delivers triple bottom line benefits by employing the special children from the new Dawn Ashadeep School of Special Children, Sada, Mormugao
Responsible tour operator	Terra Conscious is a conservation–social impact responsible travel enterprise based out of north Goa and offers responsible marine and coastal travel experiences conducted in partnership with local communities to enable informed and sensitive engagement for both the visitors and the local tourism operators. They work primarily with local community boat partners who are empowered to transform their practices into being more sustainable and ethical. They also support the tourist's travel experiences with complementary social impact programmes that focus on creating awareness, building capacity for various stakeholders to enable them to address marine and coastal conservation challenges and engage in grassroots action

Source: Authors compilation based on stakeholders inputs

Table 4.3 Innovative interventions to make selected material in tourism sector resource efficient– a few examples

Material	Intervention	Benefit	Enablers	Policy support
Cleaning amenities, shampoos, hand wash	Substitute liquid form with dehydrated powders (which can be converted into liquid by simply adding water at the use stage); Consistency is 90% water and 10% active material	• Monetary benefit, • save packaging material and space	Requirement of Demineralization (DM) water treatment plant, one-time investment in hotel/ accommodation facility depending upon occupancy and size of hotel	• Incentives to industries making such dehydrated powders for a certain number of years to phase out plastic. • Stringent restrictions on non-recyclable materials (considering economics of such restrictions). • Awareness, info-graphics, and education regarding such products and the benefits to use them to the tourism service providers and tourists
Plastic straws (single use)	Stalk of the papaya that is semi sun-dried (mainly for the papaya milk) becomes quite sturdy and does not bend easily and can be used as a straw	• Papaya farming can reap monetary benefits. • Inexpensive and biodegradable alternative to plastic straws	These are available in plenty in papaya farms usually. This is the stalk that bears the fruit and the leaves. Farmers usually keep trimming the leaves, so there is plenty of stem available	• Recognition and support to such initiatives
Used cooking oil	100% transformation to soap	• Soap recycling, • monetary benefits, • environment-friendly technique to dispose and utilize cooking oil	Three simple ingredients required and particulars according to formula Outsourcing– such waste can be fixed in grease traps, delivered to individuals or plants that recycle and utilize cooking oil	• Setting of oil recycling plants for such purposes. • Training and development for understanding recycling process. • Awareness and info-graphics required for hotels to adopt such practices

4.5 ENHANCING MATERIAL RESOURCE EFFICIENCY IN TOURISM SECTOR

Ratings, awards, and recognition

Develop a resource efficiency star rating that recognizes resource-efficient operators and gives conscious tourists the choice to reward conscious operators with their business. Awards and recognition help spread the news of the hotels and tour operators practicing RE&CE and attracts new clientele to these including corporations that need to conduct business with socially responsible companies. These ratings will not only help raise awareness and create visibility, but will also influence the peer operators and businesses to create conscious products and services.

Use of economic instruments

To incentivize tourists to not litter, there could be promotion of a separate collection system with deposit-refund elements, which will incentivize tourists to bring back their plastic waste to the vendors and not litter public places such as beaches and parks. Further, tourist environmental fees could be introduced, which can be gathered in a special fund for tackling waste management issues in the state.

Use of regulatory instruments

The boom in unregulated bed and breakfasts, homestays needs to be checked with compulsory registration of such facilities and frequent monitoring of their waste disposal practices. Further, there should be strengthening of enforcement of bans that have been imposed on littering and plastic use in the state.

Introduction of the environmental certification schemes for accommodation sector will benefit in bringing about quality improvements in the sector and also enable introducing of resource efficiency standards.

Tap into cultural knowledge of resource efficiency in the villages

Traditionally Goan society has shown many examples of resource-efficient ways and circularity, which is part of its local culture. The tourism sector can tap into this cultural knowledge and integrate them in the service provision of the tourism sector.

Capacity Development

Develop focussed capacity development programmes for hotels and tour operators to enable them to undertake and oversee RE&CE strategies in their operations and service provisions. Goa's many tourism management colleges/institutes should also be one of the target groups for these programmes as they can then imbibe the relevant learning to their students who could then act on ground to foster resource efficiency.

Good practices and examples from existing local leaders and from tourism sector across the world could be shared with them and suggestions made on the possible replication of these practices in the Goan set-up. Travel and Tourism Association of Goa (TTAG) should be looped in here to bring in participation by the tourism stakeholders and continuation of efforts based on learning from the capacity development programmes. It is also important to train the personnel involved in the tourism service provision process and those in designing procurement policies of the tourism companies about the efficient use of resources

and motivate/encourage them to adopt skills and knowledge in resource-efficient provision and procurement.

Information on good practices and models

There is a need to create a directory of people and companies that are engaged in good practices and business models in the tourism sector. This directory can be made available to tourism operators when they are initiating their businesses and seeking for licences and No Objection Certificates.

Stakeholder engagement

Industry partnerships

Identifying industry leaders and engaging them to push forward the RE&CE agenda for the industry by creating their ownership and engagement so that it can become an industry-led campaign/movement with businesses sharing, inspiring, and competing with each other to be most resource efficient.

In July 2018, UNDP India, Goa Waste Management Corporation, and Hindustan Coca-Cola Beverages joined hands to recycle plastic waste in the state. The collaboration of UNDP and Hindustan Coca-Cola Beverages seems to create a circular economy for plastic waste and to generate value out of used plastic, helping to reduce plastic litter.

With the launch of the official programme, waste pickers or *safaii mitras*, as they are being called, will be enrolled in a technology platform developed by Bengaluru-based Mindtree. Each *safaii mitra* will get an identity on the platform that will know what kind of waste each one of them is helping bring to the recycling centre. As each *safaii mitra* gets the waste to the recycling centre, he/she will get paid for the plastic and other waste. Since the *safaii mitras* are encouraged to regularly supply the processing centre with plastic, they will be incentivized to recycle the plastic.[47] Once brought to the recycling centre, the plastic is shredded and converted into flakes. The flakes are then used for the manufacture of a variety of products that are of everyday use, creating a new industry of recycling plastic waste. With the effort being put in by the *safaii mitras*, nearly 4–5 tonnes of plastic waste are expected to be collected in Goa every day. Their effort will help clean the tourist city by removing the plastic litter from public places.

Awareness generation for all

Locals, tourists, and the providers of tourism products and services need to be made aware of RE&CE. Promote garbage segregation and suppliers of resource-efficient packaging and other products, and services through directories circulated as part of licensing processes with the local panchayats. Guidelines for tourists on responsible use of resources need to be created and shared with tourists on their arrival.

Engaging tourists through use of behavioural nudges

Use feedback mechanisms to inform consumers about the environmental impact of their consumption. For example, provision of an aggregate scoring system for how the guest is doing in relation to resource use and reward guests either financially, with loyalty bonuses or simply with a good conscience, rather than designing hotel rooms as spaces of unlimited resource use.

Another opportunity to explore is to enable peer-based nudges. Social norms or customary forms of behaviour that regulate our interaction with others, have been shown to influence consumer behaviour, including making environmentally sustainable choices. Green nudges make use of the inclination towards imitating the behaviour of peers

47 Source: https://globalrec.org/2018/02/27/goa-setting-new-benchmarks-for-waste-management-india/

either through allowing for peer comparison (for example, through providing information on plastic consumption of peers) or through encouraging consumers to signal their green behaviour to others (Schubert 2016). Technology can support such approaches.

Creating business models

Circular business models that aim to use waste as a resource can promote cross-sector and cross-cycle links by creating demand and supply for secondary raw materials. Chapter 8 presents examples of a few business models including a model on managing waste of used cooking oil from tourist facilities and generating value.

5 FOSTERING RESOURCE EFFICIENCY IN CONSTRUCTION SECTOR IN GOA—FOCUS ON CONSTRUCTION AND DEMOLITION WASTE

5.1 POTENTIAL FOR MATERIAL RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR IN GOA

The use of products with high recycled content is essential to bring in resource efficiency in the construction sector. Natural resources are scarce and consumption of only virgin materials for manufacturing of products results in early depletion of natural resources. The construction and demolition (C&D) waste presents a vast opportunity for recycling and recovery to control landfilling and illegal dumping as the waste materials sent to landfills at the end of the life cycle stage leads to contamination of land and groundwater. Table 5.1 presents the potential uses of C&D waste. Table 5.2 presents the scope for resource efficiency-linked interventions across the various stages of the life cycle in the construction sector.

Table 5.1 C&D waste and its potential uses

Material	Process	End Use
Plain concrete	Crushed	Aggregate
Fresh concrete	Washed to remove cement and recover aggregate	Aggregate
Reinforced concrete	Crushed and steel bars removed steel recycled	Aggregate
Clay bricks & roof tiles	Cleaned Crushed Pulverized	Masonry Aggregate Building materials
Bricks	Cleaned and crushed	Aggregate and filling material

Source: *Training Manual on Construction and Demolition Waste Management in India for Cities and Towns*; GIZ 2017 [48]

48 Sekhar, A R, K Chandran, and V Rathi. 2017. Training manual on construction and demolition waste management in India for cities and towns. Details available at http://re.urban-industrial.in/live/hrdpmp/hrdpmaster/igep/content/e64918/e64922/e67075/e67087/GIZ_CD_eTrainingManual.pdf, last accessed on January 21, 2020.

Photo 5.1 Reduction of packaging waste during construction

Table 5.2 Scope for resource efficiency-linked interventions across the various stages of the life cycle in the construction sector

Life cycle stage	Aspect	Material/ activities	Opportunities
Pre-construction stage	Design and planning of construction	Building and construction	• Use materials that are made of recycled or renewable material • Reduce the use of non-renewable materials • Use C&D waste • Use durable materials that require less frequent replacement and reduce the landfill waste over the lifetime of a building
		Waste	• Designers and builders should be required to design a Waste Management Plan for each construction project.[49] • Minimize waste during construction
		Refurbishing	• Improve lifespan of materials • Use durable materials • Local sourcing of materials

Life cycle stage	Aspect	Material/ activities	Opportunities
Construction	Reduce packaging waste	Packaging material	• Use the waterproof bags in which the various building materials like cement, lime, waterproofing admixtures, etc., are packaged for earthbag construction
		Certified green products	• Certification[50] for alternative or local materials (like mud, bamboo, etc.)[51] – Organizations like Sahas are re-using some of the debris to make products and certification can help in promotion of such products – Certification will encourage similar initiatives to come up
End of life	Deconstruction	C&D waste	• Organizing material for redistribution in reusable form • Sweeping and/or removing debris or demolition materials from a work area and/or disposal into a roll-off container
			• Jobsite sorting: Use waste containers to effectively deal with construction waste • Picking: Construction materials should be handled with special equipment that is designed to support heavy loads and resist abrasion. A hydraulic excavator or a grapple is used to pick through the stockpile of materials • Establishing a system of connectivity between the specific segregated waste (that can be utilized) and potential users of this waste
			• Through harmonized procedures complemented by an intelligent tool and a supply chain tracking system for highly efficient sorting at source in demolition and refurbishment works; use of cutting-edge technologies for sorting and recycling for the production and automated quality valuation of high-purity raw materials from complex CDW need to be developed • Optimized building products (low embodied energy cements, green concretes, bricks, plasterboards and gypsum plasters, extruded composites) through the partial replacement of virgin raw materials by higher amounts recycling technologies can be injected into the market, directing towards achieving a cost-effective retrieval of secondary high-purity raw materials recovered from complex C&D waste • Formal set up to manage the construction debris; Goa has proposed the Integrated Solid Waste Management (ISWM) system for the year 2040, for a total capacity of 100 tonnes per day (TPD). If the planned system is implemented, out of the 100 TPD, around 33 TPD of construction debris could be processed. C&D waste could be collected separately, zone-wise, for transportation to ISWM facility for processing and landfilling.

Source: Authors compilation

Various concerns have been raised by the stakeholders during consultations regarding the way construction activities are taking place in Goa and the associated use of resources and management of C&D waste.

The replacement of traditional Goan construction materials with modern and imported materials poses various issues including those linked to compromise on durability and functionality which have often characterized the long-standing Goan buildings and the Goan heritage. For example, a contemporary material often used in construction is corrugated iron sheeting (tin roofs as they are popularly known in Goa), but the use of this metal as roofing material, instead of the traditional locally made Goan/Mangalore tiles, leads to more than normal heating up of buildings. This also hastens the rising damp and deterioration process, with disastrous effects for older buildings. Traditional local Goan building materials, unlike their modern counterparts, were identified and developed keeping in mind the state's climatic conditions. Additionally, the methods for the usage of these traditional materials have improved over many generations.

But there are also concerns linked to the use of local building materials. For example, excessive use of the local virgin materials in Goa can deplete the rich bio-hotspot of its resources. Sand and laterite are two of the most important local building materials specific to use in Goa. There is a high degree of awareness in Goa that sand and laterite are very important finite resources to conserve in the state and that its extraction has an impact on the environment and its ecosystem-services. In addition, there is a strong recognition that these two local resources cannot be seen in isolation of land reforms, the politics that surround the extraction and use of these two resources, and the policies and reforms around use of existing heritage and older buildings and livelihoods around extraction of these resources. Figure 2 in Annexure 4 presents the barriers that have been identified by the stakeholders that prevent a circular flow of sand and laterite in Goa. The figure also delves into the strategies identified for alternative materials that can be considered for construction in the state.

Further, it is recognized that there is not enough information (and its dissemination) and research available on alternative types of resources and materials that can be used in construction. While mud is used in Goa as an alternative resource for construction of homes and public infrastructure, inadequate research on its use limits the use, and unstructured use could lead to destruction of hillsides. Another important alternative material is the fly ash. The government of Goa has been trying to encourage the use of this. C'cure Building Solutions, which is based in Margao, is among the pioneer units in the state to bring in the concept of fly ash bricks and it manufactures bricks from crushed slag, fly ash, and cement (for binding). Fly ash bricks can be a good substitute for clay bricks. Clay is mainly extracted from the riverbanks, thus making the area prone to soil erosion. Fly ash bricks can also be leveraged as a good substitute to clay bricks due to round-the-year availability and better durability.

49 Akadiri, P O, A Chinyio Ezekiel, and Paul O Olomolaiye. 2012. Design of a sustainable building: a conceptual framework for implementing sustainability in the building sector. Details available at https:/ /www.mdpi.com/2075-5309/2/2/126/pdf, last accessed on January 21, 2020.

50 GreenPro, Indian Green Building Council, is a product certification that facilitates green building projects in selecting the right products and equipment. GreenPro follows a life cycle approach for certifying a product. The product is considered for certification right from the raw material extraction to the end of its useful life.
Green Pro certifications have been awarded to various manufacturers producing green building materials all over India. The main objective of the certification is to facilitate green product market transformation in India through product accreditation. The green product rating enables the transformation of the existing 'linear' – unsustainable process to a sustainable 'cyclic' process, thereby eliminates the quantity of disposal of wastes in landfills or through incineration.

51 Expertise available on the use of alternative materials has to match the aspirations of citizens from Goa. A clear cut channel of communication, a model of e-exchange and connectivity of unique and innovative techniques can be developed to move forward the digital dream of India.

5.2 SOCIAL INNOVATIONS AND GOOD PRACTICES

Interestingly, communities in Goa have already started demonstrating and executing projects in the construction sector that are based on RE &CE concepts. These (also green) building designs have successfully presented efficiency solutions and have set certain sustainability benchmarks that can be explored and promoted in the state of Goa. Table 5.3 presents a few examples of these social innovations and good practices.

Table 5.3 Social innovations/good practices focused on aspects of resource efficiency and circular economy in the construction sector – examples from Goa

Category of social innovation/good practices	About the social innovation/good practice
Resource-efficient construction	**Aldona, Goa**: The Indian Green Building Council (IGBC) awarded a newly built house in Aldona its first green home certification[52] for Goa, with its highest (gold) rating. The house was constructed based on principles of using local materials, recycling every scrap of waste, using minimal water and fuel, orienting everything to take advantage of daylight and breeze. These principles are nothing new to the Goan architecture, they have actually been a way of life for centuries.
	Utilization of waste rubble and pebbles to form pathways and seashells are also used for décor, and also for paving, like gravel.
	Waste rubble, river pebbles, flagstone, and shells are used to pave pathways as well as create steps in the landscape, build up plinths and terraces

Category of social innovation/good practices	About the social innovation/good practice
Recycle, upcycle, and repurpose	**The Beach Box Hotel, Goa:** This is a property developed majorly using shipping containers. The 16 rooms, the restaurant, the bar are all built from containers, and even the swimming pool has been built into one giant container. The idea is to recycle and reuse materials and yet provide a comfortable and an upscale experience. Seventy per cent of the property is made using the containers, thus reducing the use of construction material. Each of these containers is designed to hold up to 30 tonnes of weight and to be stacked up to 7 feet in height; that's almost 200 tonnes when fully loaded. The design of these containers is also strong enough to withstand earthquakes and sea salt for up to 25 years. Promoting such eco-friendly yet viable options among restaurants, shacks, hoteliers should be done.
Use of secondary/ sustainable raw materials	**Arjun tree One, Margao, Goa:** This is an illustration of eco elegance – combining function and form by using recycled bottles and flyash bricks as aesthetically pleasing features. This is a successful instance of procuring and putting to work recycled materials for building projects. Discarded plastic as a replacement of sand in structural concrete: The Goa Engineering College in association with the University of Bath, UK has demonstrated this. Bamboo House Goa is a hotel situated near Sal River with rooms built by using bamboo. Bamboo, a traditional building material, is gaining attention due to its capacity for tapping ecological potential in green construction and can be easily grown and harvested. **Photo 5.3.** Utilization of recycled bottles and fly ash bricks as building materials
	Saraya Ecostay in Sangolda has built an entire compound wall with discarded bottles in cob, and also utilized bottles for lighting in cob cottages. Goa's beer bottles, pet bottles, and coconut are massive resources and found in huge amounts as discards from restaurants and wandering tourists. Bottles can be effectively, creatively, and aesthetically used as a building resource. Not just as occasional inserts for lighting or effect, but even as building blocks like masonry units. An entire garden gateway in glass bottles Glass bottles in a cordwood wall Private homes built out of coconut wood as the only building material

Category of social innovation/good practices	About the social innovation/good practice
	Photo 5.5 Ar. Ini Chatterjee has built entire homes with coconut wood as the only building material.
Refurbishment	**Mitaroy Goa Hotel**, a 400-year-old Portuguese heritage bungalow, is a prime example of a successful building restoration project in Goa. The restoration project demonstrates how modern comforts can be accommodated into traditional Goan houses without detracting from the historic fabric and how restoration can be accomplished using traditional Goan materials and techniques that have been passed down from one generation to another among Goan artisans and craftsmen.
Knowledge sharing and scientific research	The International Conference on Environment Friendly Handling and Recovery of Construction and Demolition Waste was organized by the Goa Waste Management Corporation (GWMC) in collaboration with SINTEF, CPUD, and IL&FS Academy of Applied Development (IAAD). C&D waste was recognized as a kind of 'resource' and not 'waste'. Presently, the researchers at SINTEF, a Norwegian research institute, are trying to work on finding solutions to the useless construction debris that are haphazardly dumped in open spaces in Goa. A facility will be set up to handle the construction and demolition debris.

52 Green rating is very documentation-intensive. Key elements included using mostly local material with as little waste as possible, an organic root zone treatment system to recycle water, and low-flow plumbing fixtures. Other important aspects are rainwater harvesting (in this case, a 1 lakh-litre tank, and recharge pit that feeds the water table), designing the building around existing trees, and orienting living spaces to make the best use of daylight and natural breeze so that electricity use will remain at a minimum.

5.3 ENHANCING RESOURCE EFFICIENCY IN CONSTRUCTION SECTOR IN GOA

Estimation of C&D waste

The Construction and Demolition Waste Management Rules put emphasis on the efficient management of debris and for Goa to tackle its waste, it is necessary for the state to ensure compliance. The use of waste as raw materials for the construction sector will also help urban local bodies (ULBs) in abiding by the new rules. The quantum of C&D waste has to be estimated in an organized method and a detailed quantification and characterization study are required to plan the strategy. Transparent data sharing between the planning authority and (Goa Waste Management Corporation) GWMC must be mandated.The data for the construction debris including sand and laterite that can be reused (especially when it is mixed-material) must be organized.

C&D waste collection centres

Waste collection material centres could be set up at suitable locations across the state so that the waste generated at construction and demolition sites, which include concrete, steel, bricks/stones, doors, windows, flooring material, roofing tiles, etc., can be handed over and in exchange of suitable other resource-efficient materials and new materials such as aggregates that are produced from recycling.

Sustainable procurement

Construction, like tourism, is also a consumer of materials produced by several stakeholders (finished houses, infrastructure, and consequent waste). The public sector could procure resource-efficient construction materials including products made out of waste and thereby create a market for these products and incentivize the suppliers.

ULBs need to explore avenues on setting targets for the use of C&D waste. For example, there are opportunities for using this waste for construction of recreational places such as parks, for roads and pavements, and for filling of pits. There should also be material passports for public buildings.

Use of economic instruments

Waste during construction activities can be consumed to some extent within the project. Since construction waste is highly spread out, there is a need for the collection efficiency to be strengthened. Support to private sector through provision of land and other required infrastructure on concessional lease can be provided.

Tax incentives including reduction in infrastructure tax from using certified resource-efficient materials and products, and tax incentives on property taxes, and registration for houses and commercial establishments constructed using green materials, and through resource-efficient processes could be provided.

Guidelines, manuals, and information booklets

Guidelines on good practices and manuals for C&D waste management cycle need to be developed. Further, there should be easy-to-read and accessible information booklets on the certified resource-efficient products, which can be used as substitutes for construction activities and how they can be procured. Performance-related information about alternative materials or alternative construction should be readily available and it should also highlight the benefits. Some of these materials include bamboo and mud.

Awareness generation

Large-scale awareness, sensitization, and targeted campaigns could be organized through the help of industry associations for architects, contractors, and suppliers in the construction sector. Architecture schools have a huge role in spreading awareness of resource efficiency aspects and influencing builders and contractors to understand the life cycle of materials and implement material efficiency in their construction activities. The labour force in the construction sector too must be made aware of the needs and ways to minimize wastage of resources.

Awareness-generation workshops for the office bearers of the resident welfare associations (RWAs) and commercial establishment associations, builder associations could be organized.

Awareness also needs to be created for the alternative materials for construction that are locally available and how these could have benefits (or disadvantages if any) over materials that are being procured from outside.

Green construction

Rating systems such as GRIHA (Green Rating for Integrated Habitat Assessment) rating system for green buildings developed by The Energy and Resources Institute (TERI) and Indian Green Building Council (IGBC), initiated by the Confederation of Indian Industry (CII), can encourage conscious effort in design, construction, and operations of buildings to enhance environmental performance and facilitate the effective use of site resources, water conservation, energy efficiency, handling of waste, optimum material utilization and design for healthy, comfortable buildings.

Further, the use of catalogue for green products such as the GRIHA Product Catalogue should be promoted. These catalogues provide green building designers and clients with all the necessary information on green building products that can be used in order to make buildings compliant with the green building rating systems.

Rethinking construction to address risks and impacts linked to climate change

The construction sector faces the challenges of designing and constructing buildings and infrastructure that can withstand more stress from a changing climate. For this, developing innovative design strategies and techniques will help ensure safe building and infrastructure and also guarantee the safety of workers.

6 IMPROVING RESOURCE EFFICIENCY AND CIRCULARITY OF MATERIAL FLOW TO COMBAT MARINE LITTER

6.1 PRESENCE OF MARINE LITTER IN GOA

Marine litter is an economic, social, and environmental problem. Developing integrated approaches to reducing marine litter of all sorts is a key priority for the country and specifically coastal states. This involves not only the tourism industry, but also fishing and shipping, and management of the rivers and waterways that lead to the sea.

Beach debris

Goa is one of the tourist destinations with an international reputation. Beach tourism is predominant in the state. Greater dependence on beaches for tourism, socio-cultural, and religious activities has increased the littering in the beaches over the years. A study (Kaladharan, Vijaykumaran, Singh,et al. 2017)[53] was conducted to assess the quantity and composition of marine litter along various Indian beaches. As seen from Figure 6.1, amongst all the other states, Goa was found to be highest generator of beach debris with 40.9 kg/head. The composition of this litter has been shown in Figure 6.2. Single-use plastics that were considered for this assessment included carry bags, sachets (soft drinks, edible oils, detergents, and beverages), cases (cosmetics, toothpaste), PET bottles, and ice-cream containers. From the composition of the litter, it can be said that tourism (presence of shacks, water sports, and other activities on the beach) could be the main contributor to the litter on the beach. This beach litter eventually finds its way into the sea.

The stakeholder consultations held to gauge people's perception on the issue of marine litter highlighted the presence of sewage, plastic, oil, tar, fishing nets, glass bottles, cigarette butts, coal, and/or hazardous waste on the beaches of Goa. Further, it was opined that the Sagar Mala project of river-way industrialization shall add to the marine litter problem. There is a fear that further industrialization of the river systems will only increase the pollution at sea if waste management is not dealt with adequately and timely.

Microplastics

A study (D'Souza and Gaonkar 2017)[54] was conducted to examine the presence of microplastics[55] on the beaches of Goa and also in the sediments. The study confirms the presence of microplastics (Figures 6.3 and 6.4) in Goa. The presence of this contaminant is an emerging concern to the coastal environment.

53 Kaladharan, P, K Vijaykumaran, VV Singh, D Prema, PS Asha, B Sulochanan, P Hemasankari, L Loveson Edward, S Padua, SVeena, AAnasukoya, and HM Bhint. 2017. Prevalence of marine litter along the Indian beaches: A preliminary account of its status and composition. *Journal of Marine Biological Association of India* 59 (1).

54 D'souza, D, and S Goankar.2017. Microplastic pollution incoastal ecosystems – a serious threat to human health and marine ecosystems. *TerraGreen*. Details available at https://www.magzter.com/article/News/TerraGreen/Microplastic-Pollution-In-Coastal-Ecosystems-A-Serious-Threat-To-Human-Health-And-Marine-Ecosystems, last accessed on January 21, 2020.

55 Microplastics refer to minute fragments of plastic debris, which are widespread in the oceans. Microplastics are of two types: i) smaller than 5mm, and (ii) macroplastics are > 5mm. Typically, the microplastics that are less than 5 mm in size, may disintegrate to particles as small as 1–100 nm and interfere with the well-being of marine animals.

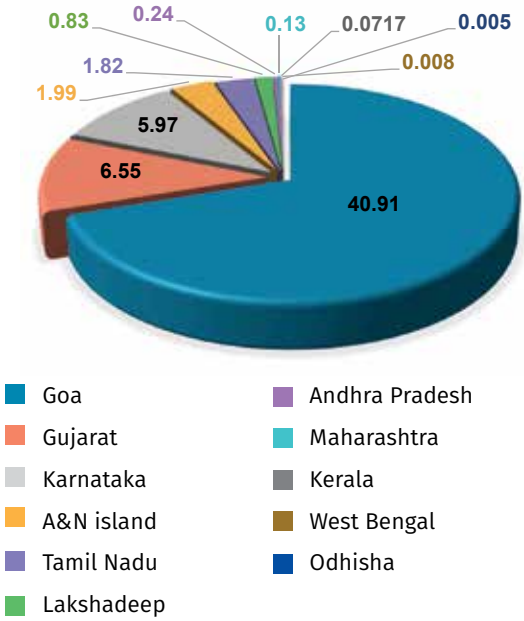


Figure 6.1 Per capita share of beach debris among coastal population of Indian coastline

Source: Kaladharan, Vijaykumaran, Singh,et al. 2017

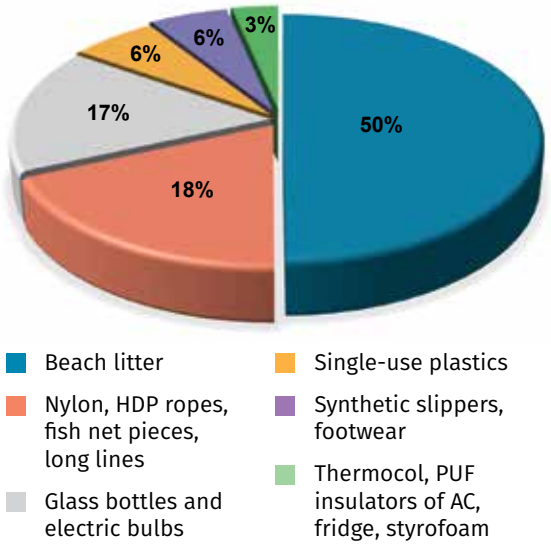


Figure 6.2 Composition of marine litter found on Goa's coast

Source: Malkarnekar, Gauree. 2018. With 41kg litter per head, Goa beaches are garbage dumps. The Times of India. Details available at https://timesofindia.indiatimes.com/city/goa/with-41kg-litter-per-head-goa-beaches-are-garbage-dumps/articleshow/64047651.cms, last accessed on January 21, 2020.

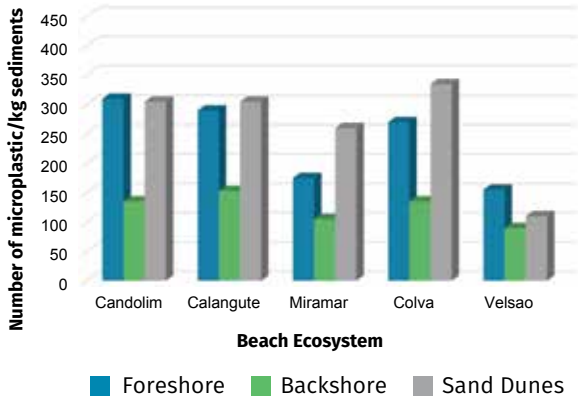


Figure 6.3 Abundance of microplastics in the foreshore, backshore, and sand dunes of the beach ecosystems in Goa

Source D'Souza and Gaonkar 2017

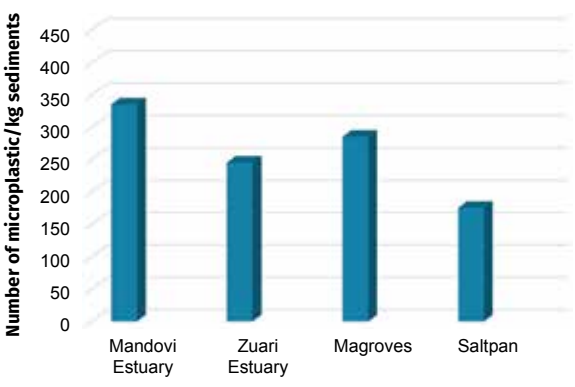


Figure 6.4 Microplastics abundance in the sediment obtained from different coastal ecosystems

Source D'Souza and Gaonkar 2017

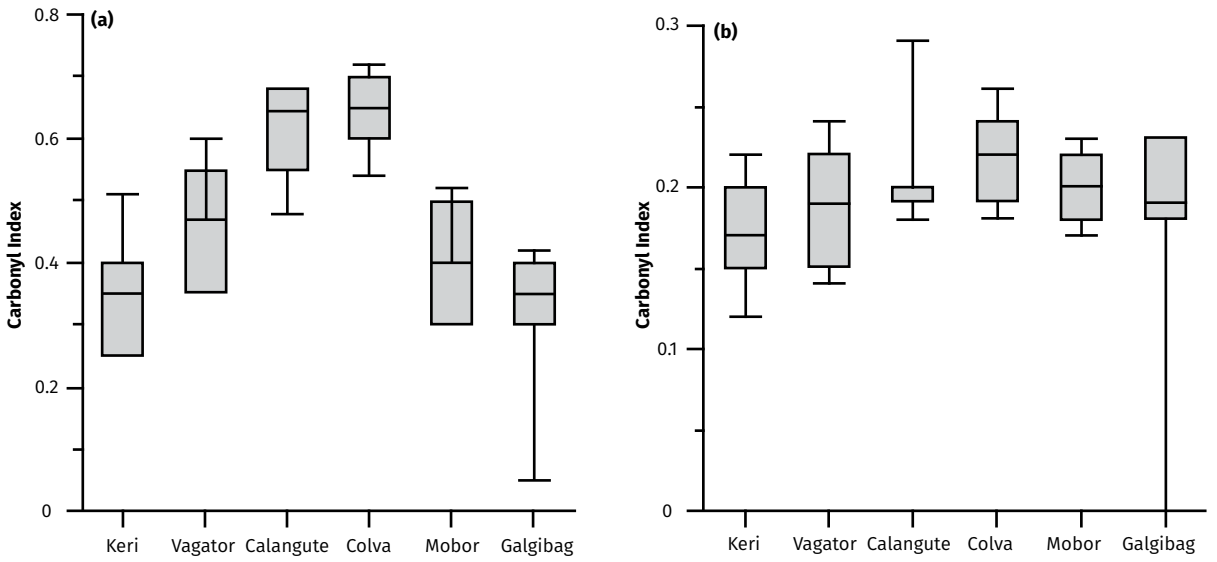


Figure 6.5 Carbonyl index values of polyethylene MPPs along the Goa coast during (a) NE monsoon and (b) SW monsoon. The horizontal bar in the box displays the median value and the ends of the whiskers are the maximum and minimum values.

Source: Veerasingam, Saha, Vethamony, et al. 2016

Microplastics pellets

Microplastic pellets (MPPs) are ubiquitous contaminants, recognized as a serious threat to the biota in coastal, estuarine, and marine environment. The distribution, abundance, weathering, and chemical characteristics of MPPs on the beaches of Goa, and their transport to the coast during the southwest (SW) monsoon were studied by (Veerasingam, Saha, Vethamony, et al. 2016).[56] White colour MPPs were the most abundant, and Polyethylene (PE) and Polypropylene (PP) were the dominant polymer types of MPPs deposited on all the beaches in Goa. The carbonyl index values of PE along the Goa coast are shown in Figure 6.5.

56 Veerasingam, S, MSaha, V Suneel, P Vethamony, A C Rodrigues, S Bhattacharyya, and BG Naik. 2016. Characteristics, seasonal distribution and surface degradation features of microplastic pellets along the Goa coast, India. Chemosphere 159: 496–505.

6.2 POTENTIAL SOURCES OF MARINE LITTER IN GOA

Marine litter is the outcome of inappropriate behaviour. Reasons for littering can be as diverse as lack of citizenship, lack of awareness or negligence towards the implications of littering, accidents, lack of (financial) incentives, failing collection systems, lack of proper infrastructure, landfill escapes, etc. The release of litter in sea/oceans is sometimes intentional, including negligence, and sometimes accidental.[57] The potential pathways can be direct (on-site dumping) or diffuse (sewage) or diffuse (inland waterways and rivers). The potential sources of marine litter have been presented in Table 6.1.

Table 6.1 Potential sources of marine litter

Sources
Land-based
Tourism and costal recreation (littering on streets, parks, beaches)
Household and general littering of single-use plastics
Garbage disposal in rivers and stormwater drains
Toilet and sewer overflow
Construction and demolition waste dumped near the waterbodies
Sea-based
Shipping sector
Fishing (professional and recreational); aquaculture installations
Port activities
Other off-shore activities
Casinos and cruises in Mandovi River close to Miramar beach

Most relevant loopholes in plastic packaging
Lack of measures to reduce the production of plastic packaging (e.g. bags, bottles, EPS fish boxes)
Production and consumption patterns based on single-use/disposable items rather than reduce and reuse
Inadequate research in enhancing the production of bio-plastics
Inappropriate behaviour when disposing litter (e.g. during activities along the coast, particularly impact related to tourism)
Lack of awareness or incentives to separate waste for recycling
Decoupling between design/production and recycling – products are designed without their whole lifecycle in view
Inappropriate behaviour on waste management in industries and retailers (losses of material, etc.)
Deficient separate collection infrastructure for plastic packaging waste
Inappropriate waste collection and separation facilities (e.g. bins without lids in windy areas)
Insufficient collection coverage of municipal waste

57 VanAcoleyen, M , I Laureysens, S Lambert, L Raport, Cvan Sluis, B Kater, E van Onselen, J Veiga (EUCC), M Ferreira (EUCC). Marine litter study to support the establishment of an initial quantitative headline reduction target – SFRA0025. Details available at https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/final_report.pdf, last accessed on January 21, 2020.

6.3 MANAGING MARINE LITTER – RESOURCE EFFICIENCY OPPORTUNITIES

With an objective to tackle the marine pollution across India's 7500-km coastline, the Union Ministry of Earth Sciences is planning on a comprehensive study to identify the source of litter, especially the plastic waste that flows into India's coastal waters. The exercise is the first step towards framing a National Marine Litter Policy with the objective to clean up the oceans, which is in line with UN Environment's global 'Clean Seas Campaign' that India joined on World Environment Day 2018. According to a study published in the journal Science on February 2015, it is estimated that India dumps 600,000 tonnes of plastic waste into the oceans, annually.[58]

In the context of Goa, currently, the marine and coastal governance is based on a complex and intersecting set of policies and administrative frameworks pertaining to tourism, fisheries, panchayat, and coastal development. For example, waste management of the beaches is under the purview of the tourism department (through a vendor such as Drishti), not the panchayat. When the contract with the vendor ends, no department takes the responsibility of periodical beach cleaning. In one of the interviews with the government officials, it was communicated that the last beach cleaning exercise was done around 1.5 years ago, and it is pending owing to the renewal of vendor's contract. As a result, the marine policy is highly complex (and at times contradictory) with no unified approach towards marine governance as a whole.

Scope for refining policies

There are many socio-economic benefits of establishing policies to prevent marine litter. Besides reducing the litter, they can generate employment in informal sector, enhance tourism, make fisheries sustainable, and conserve biodiversity. Recommendations to refine the policies to address the issue of marine litter are given in Table 6.2.

Addressing the issue of mismanagement of plastics

Since around 90% of the marine litter constitutes plastic materials; mainstreaming resource efficiency and circular economy through its entire lifecycle is of utmost important. In Annexure 4, Figure 3 shows the barriers identified by stakeholders to resource efficiency for plastics.

Table 6.3 lists the various measures that, if taken, can help in managing plastic waste.

Good practices for replication

There are many good practices around the world and in India that are attempting to tackle the issue of marine litter. For example, Tera Mera Beach[59] and a pop-up called Waste Bar at Baga beach. They incentivize beach clean-up. There is a need to scale up these existing initiatives. Through the #NoSUP - no single-use plastics campaign –an existing social innovator campaign targeting juice stands, etc.– awareness is being raised about reducing use

58 Singh, Karanvir. 2018. National marine litter policy: government begins work on an action plan to check plastic waste flowing into oceans. Details available at https://swachhindia.ndtv.com/national-marine-litter-policy-government-begins-work-action-plan-check-plastic-waste-flowing-oceans-21330/, last accessed on January 21, 2020.

59 https://timesofindia.indiatimes.com/city/goa/now-trash-is-cash-at-pop-up-waste-bar-on-baga-candolim-beach-belt/articleshow/67764344.cms

of plastic straws and cups (Aranya Research). Water refill stations can be constructed to avoid excessive waste from PET bottles. There are existing social innovators (e.g.carry your bottle) working on creating a network for replenishing refillable bottles. Initially using 20litre bottles (already recycled at 100%, so as not to put huge drain on local water. But their longer-term objective is to also extend the focus to potable public water. Here, digital technology can play an important role, particularly in helping in mapping out and making water routes visible.

Annexure 2 documents a few other good practices that can be replicated in Goa.

Table 6.2 Policy recommendations to address marine litter

Type of recommendation	Recommendation
Institutional	• More integrated and cohesive marine governance – keeping in line with integrated coastal zone management paradigms – involving long-term resource efficiency for the oceans including waste/dumping and marine health • Demarcate specific zones on beaches, e.g. water sports zones and wildlife watching zones on every beach • Better and sustainable infrastructure provision for marine tourism
Information-based	Standards for sustainable marine tourism operations in Goa – focused especially on minimizing impact to Goa's marine and coastal wildlife as well as water quality
Regulatory	• Guidelines for sustainable marine tourism operations in Goa • Guidelines for motorized boat operations and water sports operations including waste management within the habitat of sensitive Schedule I species such as Humpback dolphins, Olive Ridley sea turtles, and coral reefs
Capacity building	Capacity building of boat operators towards conducting more resource-efficient/waste-free boat operations

Table 6.3 Managing plastic (waste) across life cycle stages

Life cycle stage of plastic	Measures that can help in managing plastic (waste)
Manufacture	• Mark the larger products and packaging with an appropriate identification code/grade of plastic • Up-scaling of bio-plastics (which is biodegradable) production and other alternatives to plastics • Leverage the Swachh Bharat Mission and Smart Cities Missions for resources (financial, skill building, and collaborations) to systemize collection and delivery of items made from natural fibres that can be recovered and reused • Encourage the sale of naked products and incentivize businesses (particularly within the food industry) to use sustainable packaging • Start a certification scheme for responsible businesses as an incentive • Provide incubation and start-up support including access to investment for new RE entrepreneurs • Cost of managing plastic waste including recovery and recycling should be internalized in the pricing of plastic

Use	• Shift values from convenience to value and sustainability • To discourage use of plastic bottled water, people's trust in public drinking water should be rebuilt again through regular testing and certification, better management of groundwater, public water stations everywhere • Post a notice and stickers on menu cards in restaurants to bring attention to use of plastics during the meal and to say no to plastic straws when offered by waiters • Ban single-use plastic packaging, such as thermocol in the state • Enable a mechanism to raise awareness and promote suppliers of RE products and services such as bio-alternatives to plastics • Amendment to the GST on sale of second-hand packaging, as a step towards incentivizing businesses to opt for sustainable fibre-based packaging
Disposal	• Manufacturers can take accountability for recovery and disposal of products and to build a robust collection system • Create an 'unwrap stall' outside stores to give back the packaging of products • Create 'recover units' to make it easier to collect waste from central locations • Identify ways in which plastic bottles can be redistributed and used as optimally as possible – for example, in road construction, to make fabric, yarn, and other products

Source: Authors' compilation based on stakeholders' inputs

6.4 RECOMMENDATIONS AND SUGGESTED ACTION

Use of economic instruments

Environmental taxes/charges can be levied to implement the 'polluter pays' principle (PPP) for tourists. These are particularly effective instruments for the internalization of externalities, i.e. the incorporation of the costs of environmental services and damages (and their repairs) directly into the prices of the goods and services or activities which cause them. They can also provide incentives for tourists and administrators to change their behaviour towards a more 'eco-efficient' use of resources, to stimulate innovation and structural changes, and to reinforce compliance with regulations. Further, the funds collected on the basis of the tourist eco-taxes and charges are earmarked exclusively for the improvement of the environmental quality of a tourist destination.

- Under the polluter pays principle (PPP), fines for littering, dumping waste, and illegal disposal can be imposed
- Under the user pays principle, tourist taxes could be imposed, which can then contribute to beach cleaning and improving waste infrastructure
- Incentives for fisherman for removing debris, including plastic
- Financial award could be given to coastal villages that have integrated waste management systems to manage the entire waste streams

Use of regulatory measures

- Phasing-out/ban of certain items or materials like single-use plastics: Gradual elimination of certain items or materials from the market or certain areas (and therefore, the corresponding waste streams). Examples from across the world include Plastic drink straws –ban in Miami (USA) and plastic water bottles <0.6 litre in San Francisco, which will phase out the sale of these containers in certain areas

  – The government of Goa from 2 October 2019 will discontinue the use single-use plastic water bottles in its offices, meetings, functions and all departmental canteens and instead use eco-friendly, reusable alternatives to provide water. In August 2019, legislators in Goa approved a bill setting fines from Rs 2,500 to Rs 3 lakh, for manufacture, sale and use of single-use plastic items and carry bags.

- Smoking ban/zoning on beaches: Prohibit smoking on beaches or restrict it to certain areas to prevent passives moking and littering
- Improved enforcement of current legislation: Use enforcement as a tool to ensure stakeholders comply with existing legal provisions. For example, enforcement of ship waste acceptance rules in harbours

Clear institutional responsibility

Due to the multi-sectoral and cross-cutting nature of marine debris, there is a strong need for defining the institutional responsibility for effectively managing the same. Importantly, the institutional framework for the state and local governments' marine debris actions needs to be firmly embedded into their solid waste management strategy and the action plans.

National policy

There is a clear need at the national level to consider the various fiscal and incentive mechanisms that could help to reduce the

marine debris and plastic pollution therein. These include policies such as the Extended Producer Responsibility (EPR) schemes and targeted deposit schemes that can help reduce littering and boost recycling. The EPR concept needs to be taken to the level of supermarkets and various brands, where under the EPR, these entities will be asked to take back packaging of certain items from consumers, allowing these to be reused instead of being indiscriminately dumped.

Promotion of eco-friendly alternatives to plastics

It is important to engage citizens, businesses, and communities to make a transition from plastics and switch to eco-friendly alternatives. These could include use of earthen cookware, bamboo toothbrushes, wheat and bamboo straws, biodegradable bags, and many other similar environment-friendly products that can substitute plastics. Many of these products also have additional benefits such as social and health benefits. For example, earthen vessels absorb moisture due to their porous nature, let heat circulate slowly through the food being cooked — making it aromatic and retaining the nutrition — and provide required minerals that include calcium, magnesium, iron, and phosphorus. Also, the use of earthen vessels can help revive the dying pottery industry in India and create employment opportunities for many.

Local-level investments

It is important to identify the hotspot leakage points at the local level and establish easily accessible waste collection points in all local communities and consider increasing collection frequency as needed. Cooperation with the local communities and NGOs could be strengthened in this context.

Green public procurement

Environmental considerations can be integrated into procurement decisions to reduce the usage of disposal items in lieu of reusable materials. Examples from across the world include:

- Non-biodegradable cutlery in US National Parks: Many of the national public parks run by the US National Park Service require all food vendors to use biodegradable plates, cups, and other disposable food containers as opposed to items made from polystyrene. The vendors are also instructed not to distribute straws with drinks unless specifically requested by the customer. Even then, only paper straws are allowed.

Promote voluntary initiatives

Fishing for litter: Fishermen voluntarily collect and bring ashore all waste that has been 'bycaught' during their normal fishing operations. This is common practice in United Kingdom, Netherland and is being adopted in many other places

Underwater clean-ups in hotspot areas: Divers remove abandoned, lost, or otherwise discarded fishing gear (ALDFG) from accumulation areas (e.g. wrecks), with additional benefit of reducing the impact of ghost fishing. Divers can do this on a voluntary basis or be paid to do so. Example: NL, Healthy Seas Initiative.

6.5 STAKEHOLDER ENGAGEMENT

Table 6.4 provides the mapping for stakeholder engagement to address the issue of marine litter. There is significant importance of multi-stakeholder multi-mode engagementas well as collaboration among public, private, institutions, and information exchange to harmonize the interests and address the constraints of different groups to enhance consumer awareness.

Table 6.4 Mapping of stakeholder engagement to address the issue of marine litter

Stakeholder responsible	Mode	Description	Examples
Fishing sector	Substitution with washable/ reusable crates	Avoid disposal and litter of single-use packaging	Avoid litter from EPS fish boxes in and near fishery harbours
Retail/ consumers	Participate in deposit-refund scheme	Deposit refund schemes impose a deposit on a product (e.g. glass bottle) at the point of purchase, which is refunded upon return of the product container (e.g. empty bottle). This is an incentive scheme and not intended to raise revenue	Beverage bottles –in several European countries (e.g. Germany, Denmark, Sweden, Malta); plastic cups – some examples at coastal events
Designers/ producers	Redesign of products	Redesign of products that may reduce their environmental impact and/or the resource efficiency and/or promote circular economy, e.g. design bottle caps to avoid their detachment from the bottles	E.g. Redesign bottle plastic cap to avoid detaching from main item –previous experiences of aluminium cans pullers
Tourism department and panchayat	Improved cleaning operations in certain areas	Improve cleaning operations and frequency in certain areas or at different points along the pathway of litter to the marine environment	Tourist concentration zones, fishery harbours, marine activity concentration zones
Producers	Improved labelling of products	Improved labelling to clearly draw attention of consumer to dispose items properly, possibly highlighting some of the impacts and risks	Labels on single-use consumer packaging

Stakeholder responsible	Mode	Description	Examples
Fishing sector	Promote collection at the port	Fishermen are encouraged to bring ashore and dispose their fishing material at the port/harbour. It usually implies reduction or absence of disposal fees for disposal of old gear and encouragement to reel in abandoned/old fishing gear and deposit it for free at designated points near fishing harbours. Costs of collection and treatment can be compensated by incineration or recycling of the material, some of which (e.g. nylon) are valuable.	Some initiatives worldwide, including Healthy Seas Initiative and Fishing for Energy (USA). There is at least one case study (Korea, 2003, described in UNEP/FAO report, 2009[60]) where fishermen received economic incentives for bringing the ALDFG ashore. Amounts started at 587 tonnes in 2003 to reached over 5.000 tonnes in 2006. However, the incentives were paid by public funds.
Fishing sector/ manufacturers	Report time and site of loss of fishing gear to authorities	Providing sensors on the new fishing nets. These sensors would detect the user and location of the net if it is discarded in the sea	Already in practice in specific fishery harbours
Consumers/ recyclers	Participate in voluntary, centralized collection of certain products in exchange of a community benefit	Centralized collection of high-value recyclable item/material in exchange of a benefit for differently abledor deprived people in the community. It follows an agreement with recycling companies, which will buy the material collected	Plastic bottle caps in Turkey: The community is encouraged to collect plastic lids, following an agreement with recycling company to exchange a certain amount of lids for wheelchairs for differently abled people. In Turkey, the Blue Lid Campaign collected over 500 tonnes between 2010 and 2013, resulting in almost 500 wheelchairs.
State government/ retailers	Voluntary phasing-out or minimization of certain products	Businesses (e.g. retailers) take initiatives to phase-out, substitute or reduce to a minimum certain packaging or service items, to prevent waste and improper disposal, e.g. plastic single-use cutlery, straws, stirrers	Voluntary initiatives whereby restaurants and bars agree to stop serving straws with the drinks, unless asked explicitly by the consumer. An example is the 'Straw-Wars' Campaign started by David Rothchild, which gathered quite a support in London
Beach users	Awareness raising in specific sensitive areas or targeting specific items	Awareness programmes and campaigns to foster change in behaviour. Should complement existing and appropriate infrastructures for waste collection	Targets for single-use plastics, beer bottles

Stakeholder responsible	Mode	Description	Examples
State government/ fishing sector/ NGOs	Awareness raising against littering and improper disposal of fishing gear	Awareness programmes and campaigns to foster change in behaviour. Can complement any other initiatives	'Fishing for litter' with a side effect of bringing on land one's own waste as well
	Awareness-raising campaigns against improper disposal in the toilet		
	Local science and technology institutions (both public and private)	Execution of the RE strategy particularly with reference to providing knowledge including scientific information related to ocean sciences (marine litter, marine life, coastal economy, etc.)	
Maritime activities	Awareness raising for good waste management offshore	Awareness programmes and campaigns to foster change in behaviour	Complementing existing policies (e.g. MARPOL Regulations)

Source: Adapted from Mike Van Acoleyen et al., 2013[61]

60 Macfadyen, G.; Huntington, T.; Cappell, R., 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies, No. 185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 115p

61 Mike Van Acoleyan, Ilse Laureysens, Stijn Lambert, Linde Raport, Christiaan Van Sluis, Belinda kater, Eline van Onselen, Joana Veiga (EUCC), Maria ferreira (EUCC). 2013. Marine Litter Study to support the establishment of an initial quantative headline reduction target – SFRA0025, European Commission Belgium

7 OPERATIONALIZING RESOURCE EFFICIENCY IN GOA

7.1 ACTION PLAN

Through stakeholder consultations, it clearly emerged that Goa's resource efficiency and circular economy (RE and CE) strategy should provide an opportunity to create awareness, engagement, innovation, and resilience, and encourage the people of the state including those in rural areas to participate in making Goa sustainable.

This chapter presents the opportunities that could constitute the action plan for operationalizing RE and CE in Goa and how the plan is proposed to be implemented over time (Refer to Table 7.1). Each action point suggests how key stakeholders must be involved to ensure effective implementation and how their leadership is needed to drive the real change. However, technical expertise from specialists and social innovators in different areas of RE and CE research, outreach, and communication and delivery, can support departments, panchayats, municipalities, and industry to better understand and execute the plans. Further, think tanks and other civil society organizations can also play an important role in taking forward the agenda, particularly in creating awareness and capacity building.

Table 7.1 Action plan for operationalizing resource efficiency and circular economy in Goa

Category of action	Recommendation	Action to be taken to implement the recommendation	Main Implementation agency
In short term			
Institutional	An inter-departmental committee to take forward the RE and CE agenda in the state (to begin with the implementation of this action plan) is formed Prioritize and detail opportunities in each focus sector based on potential impact	The inter-departmental committee will be setup with the representation from the different state departments and could be chaired by DPSE to begin with and subsequent rotation of the chairpersonship amongst the member departments Set of prioritized and detailed opportunities per priority sector (tourism, construction, marine litter)as given in this report	DPSE Industry associations
Awareness generation	Public communication and information campaigns about the RE and CE strategy for the state of Goa	RE and CE strategy paper is uploaded on the DPSE website and links to the same also provided on other government department websites; a dedicated Goa RE website for building awareness and inspiring action across stakeholder groups/sectors Media reporters could also cover this and make the common citizen know about the strategy	DPSE

Category of action	Recommendation	Action to be taken to implement the recommendation	Main Implementation agency
Demonstration to grassroots level	Set up a demonstration village	Potential pilot could be set up at Calangute; the local panchayat leadership has come forward on this proposed action and the idea of model village has also received endorsement from the Goa Waste Management Corporation	Calangute panchayat with support from other stakeholders including local RE team that will be constituted
Capacity building	Conduct 3 workshops for building capacity of the state government officials about RE and CE and the prepared strategy paper	These workshops should be targeted at building capacity on all aspects including technical, technological, financial as well as managerial components to integrate RE and CE measures in the policymaking and planning of the respective government departments in the state across different sectors. Specific training modules could be developed and shared with all the departments in the state government and industry associations	Goa State Pollution Control Board
Capacity building	Strengthening and developing the skills on resource efficiency in the priority sectors through training	Sectoral training programmes focused on RE and CE opportunities identified in this report	Industry associations; consultants/R&D centres
Information database	Directory of social innovators Showcase of good practices in selected sectors	A directory of businesses and social innovators whose work directly or indirectly impacts resource efficiency in the state could be created and people made aware of the same. These innovators could provide knowledge, share experiences, and suggest ways to upscale many of the existing and potential innovations for fostering RE and CE in Goa. The directory can be regularly updated and made available both online and offline A compendium of good practices can be prepared for different sectors:	DPSE through appointment of knowledge partner
Collaborative platforms	Encouragement of voluntary industry collaboration platforms, encouraging value-chain and cross-sectoral initiatives, and information sharing	To facilitate interaction between stakeholders from civil, public, private, and educational spaces across sectors and discuss issues of concerns and identify opportunities This platform could also be used by the rich community of aware businesses and social innovators, who are already working on RE and CE-based models and are also ready to support RE and CE in Goa through collaborations to scale up RE and CE activities to reach all the stakeholders To facilitate multidisciplinary research, development and innovation in RE and CE across different institutions and research bodies	DPSE

Category of action	Recommendation	Action to be taken to implement the recommendation	Main Implementation agency
Compliance and enforcement	Support enforcement of pro-resource efficiency and circular economy policies	Coordinated state enforcement monitoring system could be set up,possibly engaging other stakeholders e.g. business/colleges as sentinels Equipping enforcement officers, including police, and environmental inspectors with the skills and technical knowledge they need Technology could provide transparency and accountability to support enforcement of and compliance with pro RE and CE policies Incentives developed for early adopters of RE practice and operations, possibly linked to licenses	Goa Pollution Control Board, Department of Tourism, GWMC, and relevant departments working together
In medium-long term			
Information-based	Waste reporting and statistics	Production and publication of state-level disaggregated waste statistics	Goa Pollution Control Board and Goa Waste Management Corporation
Information-based	Creation of a database on eco-innovative and sustainable technologies	These technologies would help in addressing the RE and CE aspects across the different life cycle stages of materials and in sectors	National and international institutions: research and development centres, engineering institutes, technology support centres
Information-based	Resource efficiency monitoring framework	For this, targets and indicators at the state level, sectoral level will need to be identified and monitored Baseline data should be collected	DPSE with support from industry associations and think tanks working in the area of RE and CE

Category of action	Recommendation	Action to be taken to implement the recommendation	Main Implementation agency
Monitoring and reporting for SDG12	SDG monitoring and framework for SDG 12	Regular monitoring by the state government on the SDG12 indicators, specifically: • Number of waste recycling plants installed (Indicator 12.5.1) and operational • Number of municipal corporations and panchayats using waste segregation techniques(Indicator 12.5.2) • Number of municipal corporations banning use of plastic (Indicator 12.5.3) • Formulation of national SCP framework and integration of SCP with national/state planning process (Indicator 12.1.1) • Green public procurement policy developed and adopted by the central ministries/ states/UTs (numbers)(Indicator 12.7.1) • Number of sustainable tourism strategies or policies and action plans implemented with agreed monitoring and evaluation tools(Indicator 12.b.1) • Encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships (Indicator 17.17)	DPSE, municipal corporations, panchayats
Policy	Economic instruments and legislations	Enforcement should be strengthened and made stringent related to user fees and spot fines for waste disposal Financial support to resource-efficient and circular business models, for example, direct subsidies, tax cuts, refund policies on resource use, provision of capital, financial guarantees	Goa State Pollution Control Board
Information-based	Labelling and rating	Eco labels or environmental labels can be designed to include aspects of resource efficiency in the products and services provided by the priority sectors	BIS, MoEFCC, sectoral industry associations

Category of action	Recommendation	Action to be taken to implement the recommendation	Main Implementation agency
Policy	Infrastructure creation	Materials recovery facilities[62] should be constructed at different locations in the state where recyclables are sorted and prepared for reuse, e.g. industrial parks, clusters, and panchayats Collection centres or drop-off sites for different types of household waste such as furniture, electronics, old medicines, used batteries, etc., could be set up across the state	Municipal government; technical and financial support from private players could be provided
Policy	Public procurement	Guidelines on the resource efficiency and circularity of materials and products integrated into public procurement policy:	State Public Works Department (further implementation also by municipal authorities)
Business support		Technical support, advisory, training and demonstration of best practices to business	Financial institutions, government
Awareness generation	Education	Youth: School and university curricula could provide early exposure to students about concepts underlying resource efficiency, giving Goan youth a head-start advantage in circular economy and ensuring behavioural change over time. Specific awareness programmes in schools and colleges could be undertaken to encourage a switch from plastics to eco-friendly alternatives General public: State and local consumer/ producer education plans can be developed and disseminated to raise awareness on the need for and benefits of a resource-efficient and circular approach to production and consumption as opposed to a linear approach	Department of Education, Government of Goa and with engagement of the education institutions in the State and social innovators specializing in education, communication and sustainability

The success of the action plan in the context of the state's development agenda will need the government to establish and enforce inclusive and integrated policy frameworks for sustainable development. This must be supported by businesses that need to demonstrate their commitment to sustainability in core business models and value chains with enhanced action; social innovators, who can see opportunities for new markets that plug the gaps in what the sector needs and follow through with viable business models, educators and academia, who can build knowledge and skill in young people, media that can raise awareness and inform people of the problems and opportunities for behavioural change, and individuals and the civil society that can advocate for and adopt consciously

sustainable practices and behaviours. Mobilizing and co-ordinating action from all these different stakeholders will be the focus of implementation.

After identifying the key action points, it is important to identify the stakeholders interested in that particular action or policy intervention and their type and level of involvement. A template for this stakeholder analysis is suggested in Table 7.2.

The monitoring and evaluation of actions will need to be done for the ultimate success of the implementation of the action plan. For this, the suggested actions and implementation process will need to feed into the logic model's process and output indicators. Refer to Table 7.3.

Table 7.2 Template for stakeholder analysis for implementation of Action Plan

Stakeholder	Primary purpose, affiliation, funding	Potential role in the action/ policy process	Level of knowledge of the issue/ specific areas of expertise	Level of commitment	Available resources – human resources, technology, financial	Constraints/ external support, if required

Table 7.3 Template for logic process and output indicators

	Inputs	Processes	Outputs	Outcomes	Impact	Risks encountered	Solutions to address the risks
Indicators							
Data source (existing and frequency of collection and reporting)							
Evidence and/or assumptions							
Communication methods for evaluating the indicators (including frequency)							

62 GIZ and TERI are jointly working on Waste NAMA project in Panaji to look into the implementation of relevant waste management practices such as effective source segregation and establishment or strengthening of existing Material Recovery Facility (MRF) which could house processes like micro-composting and bio-methanation among other waste processing measures. The objective is thus to reduce the amount of waste land-filled under precarious conditions helping decrease the levels of GHG emissions from the sector. The project will lead to better segregation and enable recovery of more secondary raw material for remanufacturing and reprocessing.

7.2 CREATION OF A DEMONSTRATION VILLAGE –POTENTIAL PILOT

Stakeholder consultations have also suggested for the creation of a demonstration village with various initiatives including social innovations that foster RE and CE in the village and this could also be a potential pilot for testing some of these initiatives and innovations. One of the panchayats in Calangute has come forward on this idea, which also has approval from the Goa Waste Management Corporation. The projects of social innovators could also lead to positive implications of sustainability aspects of the village. For example, the used cooking oil upcycling infrastructure would either lead to setting up of local cottage industry to manufacture soaps (tapping the experience, knowledge, and know-how of existing social innovators in Goa) or longer-term exploration of using the used cooking oil in biofuel aggregator/plant.

In terms of the institutional arrangement and responsibilities for creating the demonstration village:

- A local RE team on the ground would be constituted for the demonstration village that will connect and coordinate with stakeholders, monitor the setting up of social innovations in the village, and connect with the panchayat, where needed. The local RE team can comprise the existing panchayat/committee members, youth connectors, and an expert from outside of the village but with strategic oversight who could provide mentorship and some basic training in methods of collaboration and coordination. Stipends to the team can be provided by tapping grant funding sources or CSR/sponsorship from local businesses
- The Start-up Village Entrepreneurship Programme, which is a sub-component of the Deendayal Antyodaya Yojana – National Rural Livelihoods Mission (DAY–NRLM) of the Ministry of Rural Development, Government of India, could support entrepreneurs (including social innovators in this case) in rural areas to set up local enterprises and help develop a model for village engagement that empowers people to contribute.
- The Atal Incubation Centres could assist the villagers in creating a sustainable, scalable and profitable business model in their networks/ cluster of villages. These centres could provide sector-specific knowledge through their strong network of mentors, provide trainings and enable access to prototyping facilities, test beds for innovative solutions and pilot implementation for these.

Over time, other villages (in talukas such as Pernem and Salcete) could take on some aspects/ initiatives fostering RE and CE, based on interest and enthusiasm of local people, and/or presence of particular social innovators and/or advanced business practices.

7.3 BUSINESS MODELS FOR FOSTERING RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GOA – A FEW EXAMPLES

This section presents a few business models that are based on transformation of something that is readily discarded into something of utilitarian value. These business models have embedded in them the principles of circular economy (refer to Figure 7.1). The business models also show how social, environmental, and economic values are being created across India and especially Goa by embracing resource efficiency and circularity. These business models were identified in collaboration with the government and the stakeholders and these also emerge from among the environmental threats of priority consideration in Goa.

USED COOKING OIL AND CONVERSION INTO BIODIESEL AND OTHER REPURPOSED PRODUCTS

There is no systematic waste disposal system for cooking oil in India and it is often dumped into wastewater, polluting water bodies and soils. Tending to spread in broad thin membranes when mixed with water, a single litre of oil can contaminate as much as 1 million litres of water. Additionally, after a certain amount of use, cooking oil becomes unsafe for consumption due to polar compounds. High levels of Total Polar Compounds (TPCs) lead to health issues like hypertension, atherosclerosis, Alzheimer's disease and liver disease. India is one of the largest consumers of vegetable oil, with the potential to recover almost 2.2 billion litres of used cooking oil (UCO) for the production of biodiesel by 2022. Given Goa's dependence on tourism and hospitality industry, large volume of UCO is continuously generated, and a system is needed to circulate this resource in safe, sustainable and economical way. The following case study, whilst not centred in Goa, demonstrates methods for recovering used cooking oil and repurposing it into biofuel.

Further, in July 2018, the national food safety regulator, FSSAI (Food Safety and Standards Authority of India) notified new standards for UCO. FSSAI is working in partnership with the Biodiesel Association of India (a non-profit national

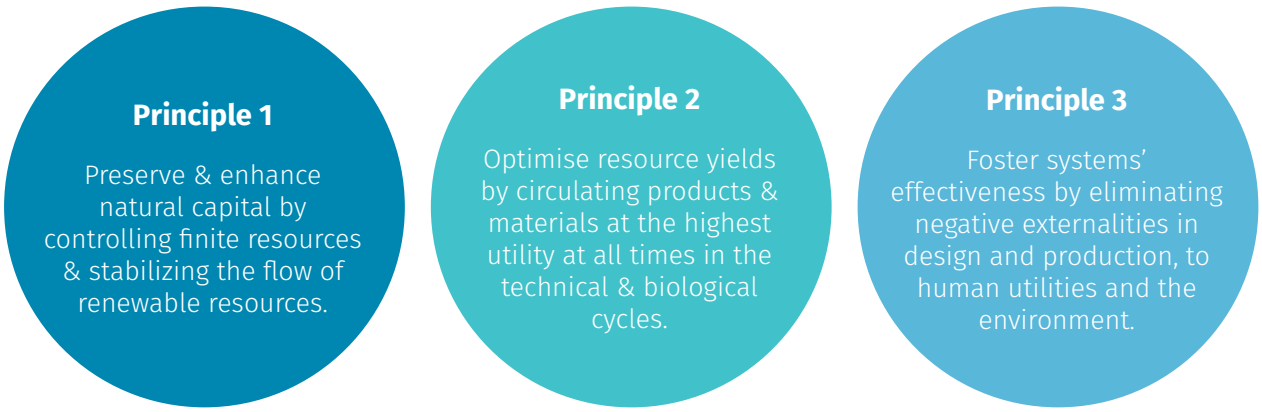


Figure 7.1 Circular Economy (CE) principles (adapted from the Ellen McArthur Foundation 2018)

association representing the biodiesel industry) and the food industry to ensure effective compliance of used cooking oil regulations. Regulations stipulate that the maximum permissible limit for Total (TPCs) in cooking oil is 25%, beyond which it is unsafe for consumption.[63]

The business model discussed in this section whilst not centred in Goa, demonstrates a possible system for recovering used cooking oil and repurposing it into biofuel..

Overview

Name of business	Hardcastle Restaurants Pvt. Ltd (HRPL)
Value creation	Conversion of used cooking oil into biodiesel
Driver for change:	• Institutional policy for risk management, i.e. to reduce greenhouse emissions and environmental footprint • Build brand reputation as a sustainable business • Compliance with national regulations to repurpose used cooking oil into biodiesel
Distinguishing CE business model feature(s)	• Circular value chain • Recovery and collection including industrial symbiosis • Collaborative/sharing economy

Story and value proposition

McDonalds, the global fast food chain, took a global corporate decision to partner with franchisees to reduce greenhouse gas emissions related to McDonald's restaurants and offices by 36% by 2030 from a 2015 base year. Through collaboration and partnership with suppliers and producers, the company also committed to a 31% reduction in emissions intensity (per metric tonne of food and packaging) across the supply chain by 2030 from 2015 levels.

In 2017, as part of efforts to execute its global sustainability practices in India, Hardcastle Restaurants Pvt. Ltd (HRPL), the master franchisee of McDonalds in west and south India, piloted, an initiative to run its supply trucks on biodiesel made from used cooking oil (UCO). Nine months later, McDonalds had converted more than 450,000 litres (approximately 35,000 litres a month) of UCO into biodiesel, to power 12 supply delivery trucks for its restaurants in Maharashtra[64]. To realise this, HRPL partnered with Unicon Biofuels who treat and convert the UCO into biodiesel and the national food safety regulator Food Safety and Standards Authority of India – FFSAI.

Recovery of materials –partnerships for infrastructure, logistics and quality

FFSAI launched the Repurpose Used Cooking Oil (RUCO) initiative in August 2018, to facilitate collection and conversion of used cooking oil to biodiesel in 101 locations across the country have been identified to enable the collection of UCO at large-scale through RUCO. It can be used in compression-ignition (diesel) engines with little or no modifications. A single aggregator can collect from approximately 800 kitchens. FSSAI wants businesses using more than 100 litres of oil to maintain a stock register and ensure that UCO is only handed over to registered collecting agencies. FSSAI also lists 19 biofuel plants across the country to which the UCO will be sent for processing. UCO aggregators will buy the oil through a barter arrangement, or at a specified cost, from the clients and the biofuel can thereafter be bought back by the customers. Currently no sector in India is mandated to use biofuels and not all transportation

63 FSSAI.2019.RUCO initiative. Details available at https://fssai.gov.in/ruco/,last accessed on January 21, 2020.

64 Financial Express (2018) How McDonald's is powering its trucks by recycling used cooking oil; accessed 05.05.2019

engines are equipped to handle biodiesel. It is therefore unclear who the biggest customers for the biodiesel will be and if the market is ready for it.

Technology for testing and monitoring

The software to monitor compliance of this regulation has also been put in place. Small handheld devices have been distributed for rapid on-site testing of oil for TPC levels. FSSAI has launched a microsite to monitor the progress of the collection and conversion of used cooking oil into biodiesel. RUCO has equipped network partners with technological support such as GPS, traffic monitoring, mobile apps, and a Unified Payment Interface. The app keeps the process transparent using receipts, and details of dispatch, stock and handling/processing of losses.[65]

The potential to scale up

With these enabling factors in place, HRPL envisions scaling up operations to service 275 restaurants with biodiesel-fuelled trucks. In order to achieve this, its biodiesel production will have to increase by 67%, to 750,000 litres per annum. This is not as sizeable an amount as it appears to be. In 2018, McDonalds alone generated close to 1.5 million litres of cooking oil monthly, across 470 restaurants in west and south India. HRPL hopes to service all its restaurants with biodiesel fuelled supply trucks by 2022.[66] The initiative has brought positive press for McDonalds and it is hoped that it will spur other chains to follow suit.

Environmental and social benefit

Cooking oil is prevented from adulterating water and soil, and replaces fossil fuel for transport. Socially, there are health benefits from reduced pollution and carbon emissions. Additionally, a new biofuel value chain in Goa could provide livelihoods at the village/aggregator level.

Enabling support

To be able to create the circular business models for used cooking oil, first, the government with the private sector could build accessible biofuel plants in Goa. There should be identification of aggregators in all panchayats, who can recover used cooking oil from hotels and restaurants. It is important to install appropriate hardware and software systems to track the movement of used cooking oil through the system. Learning from the business model implemented in Maharashtra could be drawn by discussing with the FSSAI and these learnings could then be; contextualise it for Goa using available state and central government funding. The developed biofuel could be incentivized and encouraged to be used in transportation by subsidizing the costs. And this could be supported by raising awareness of the problem of releasing cooking oil into the environment and opportunities for responsible management.

65 Varshney, R. 2019. https://yourstory.com/2019/01/coking-oil-clean-fuel-fssai. *Your Story*. Details available at https://yourstory.com/2019/01/coking-oil-clean-fuel-fssai, last accessed on January 21, 2020.

66 Singh, P. 2018. Can you smell burger on the red light? Could be McDiesel! *Iam Renew*. Details available at https://www.iamrenew.com/sustainability/can-smell-burger-red-light-mcdiesel/, last accessed on January 21, 2020.

RECOMMENDATIONS

- ❖ Research the viability of a cooking oil-to-biofuel value chain in Goa and map logistics
- ❖ Build accessible biofuel plants in Goa
- ❖ Identify aggregators who can recover used cooking oil from hotels and restaurants – ensure every panchayat has an aggregator
- ❖ Install appropriate hardware and software systems to track movement and quality of the used cooking oil through the system
- ❖ Work with FSSAI to understand the business model implemented in Maharashtra; contextualise it for Goa using available state and central government funding
- ❖ Incentivize and encourage use of biofuel in transportation by subsidizing costs
- ❖ Support and promote small-scale entrepreneurs with RE business models for bacterial breakdown or upcycling such as soap
- ❖ Raise awareness of the problem of releasing cooking oil into the environment and opportunities for responsible management

Other opportunities for used cooking oil

- **The breakdown of used cooking oil by bacteria[67]–the *Sustainable Designed Solutions* story**

At a small scale, Sustainable Designed Solutions works with individual households, independent restaurants, and hotels and small businesses in Maharashtra and Goa, to deliver bacterial-based purification of kitchen waste from oil and grease. Tanks are set up on the property. Kitchen waste is deposited along with a corresponding proportion of effective microorganisms (EM) culture. It takes approximately 24 hours for the bacteria to break down the oil, an energy and labour-free process. The setup is one-tenth the price of building and maintaining a chemical-based sewage treatment plant (STP).

The chemical-free waste water produced following bacteria treatment is used in home gardens and for other green growth, reducing the need for fresh water. Sustainable Designed Solutions is in discussion with the Maharashtra and Goa governments to explore if the excess water produced by their clients can be diverted to grow fruit farms along national highways; the farms can be leased out to farmers. This will not only provide livelihoods but also increase food and water security, particularly in drought-prone areas. Importantly, the business provides options and opportunities for individuals to be a part of the solution.

- **Creating soap and detergents from used cooking oil**

Goa has a number of small businesses already making soap from cooking oil and fat-based oils. One example is Resora Soaps. Stakeholders have suggested the idea of village-based recovery and collection units for used cooking oil that

67 Based on personal communications with Sonny Thomas (May 11, 2019)

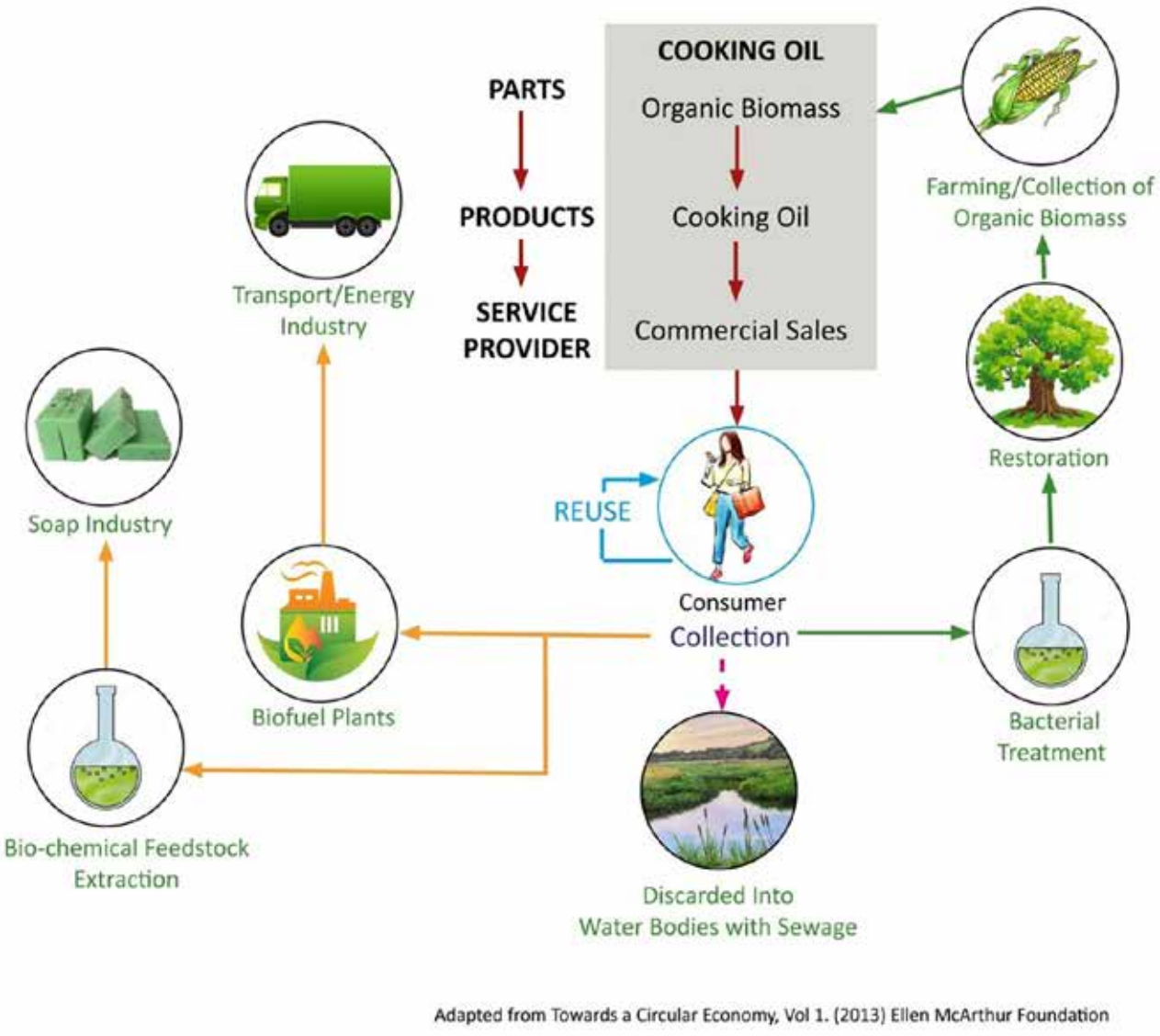


Figure 7.2 A systems overview of resource efficiency of used cooking oil

could provide local women with cottage industry enterprise opportunities that could in turn be sold back to hotels and restaurants, thus creating a more circular value chain. There was also appetite for this from the hospitality industry.

Figure 7.2 presents the potential circular business models for used cooking oil and these could help fuel a new future for managing used cooking oil and generating value.

REPACKAGING THE FUTURE[68]

Overview

Name of business	The Sustainable Green Company
Value creation	Recycling bio-based waste to create packaging products
Driver for change	• Environment protection – to reduce plastic waste • Revenue from new market/ business opportunities
Distinguishing CE business model feature(s)	• Circular value chain • Recovery and collection including industrial symbiosis • Durability, modularity with repair services • Personalization, made to order and lock-in

Story and value proposition

Over 42% of global plastic waste is packaging materials.[69] Across the world, waste recycling is now focused on management rather than value recovery. The Sustainable Green Company, founded by Ajay Gramopadhye in Goa, uses bio-based content (i.e. discarded materials made from wood pulp or other fibrous cellulosic materials) to create customized packaging products for electronic goods. His intentions are threefold: i) to provide compostable packaging products in replacement of thermocol; ii) to simplify packaging products by using the same material to create them (making it easier to recycle); and iii) to provide alternative packaging options for responsible, fast-moving consumer goods businesses.

Recovery of materials

Discarded paper boxes and similar fibre-based materials are bought from scrapyards and collectors. The material is cleaned (to ensure no foreign objects are present), dried, and shredded.

Design and manufacture of goods

Packaging products are designed in-house. Manufacturers of electrical products collaborate on the design process with a shared understanding of the limitations of the materials being used, and to ensure basic functions of the packaging are met (as required): product protection, effective product use, point of sales presentation, and communication of brand and content information. Moulds are commissioned and accordingly constructed. It is then machine moulded into the packaging and transported back to the manufacturers.

68 Personal communications with Ajay Gramopadhye (May 9, 2019)

69 Ritchie, H, and M Roser. 2018. Our World in Data. Details available at https://ourworldindata.org/plastic-pollution, last accessed on January 21, 2020.

Distribution, jobs, and skills

The Sustainable Green Company employs 14 permanent staff members, who are skilled in design and manufacturing. Indirectly, they further support a staff of 11 members who work at their partner company for transportation and delivery of the packaging products to clients.

The consumer – use, reuse, recover (or biodegrade to replenish natural stocks)

The Sustainable Green Company model uses biological materials that can be used in consecutive lifecycles, although there is no guarantee of the packaging coming back to the same source for recycling. Tracing packaging through its use and disposal cycles is far too challenging and expensive. In choosing fibre and cellulose-based materials that are biodegradable, manufacturers are bearing the costs of ownership and responsibility to ensure that the disposal of packaging (if it cannot be recovered) helps close the loop on the resource chain. It is believed that the products (depending on their thickness) will biodegrade within 2 to 3 months if environmental conditions are desirable.

Environmental and social benefits

The reuse of natural fibres from discarded bio-packaging reduces pressure on finite, non-renewable resources (like trees). Importantly, in rethinking product-packaging solutions, harmful packaging like thermocol is prevented from entering the environment and causing toxic damage to people, animals, and ecosystems. The manufacture of bio-packaging using discarded bio-materials is also less carbon emitting, although its energy consumption is unknown.

Key enabler –building relationships for a customised service and product

The Sustainable Green Company model builds personalized, long-term relationships with manufacturers of fast-moving consumer goods, like Siemens, Crompton Greaves and IFB. Made-to-order production minimizes material requirements and avoids potential losses from overstocking. However, building customized moulds is expensive, once built, they cannot be changed. Each mould can only be used for a single customer and product. On average, 10,000 units of a packaging product must be sold in a month to achieve economies of scale. If a manufacturer is convinced of the value of the packaging however, this is not a challenge. At present, The Sustainable Green Company is providing packaging for specific Siemens phone models for the whole of India. Overall, the costs of this product do not differ significantly from plastic packaging. Although the technology is made in Goa, it is expensive. Additionally, The Sustainable Green Company purchases the source material from collection units, who buy it from scrap dealers; throughout the chain, the waste materials are taxed (see Figure 7.3).

The tax hurdle

Under the current tax regime in India, second-hand packaging products (like recycled bottles and cardboard boxes) are subject to GST (Goods and Services Tax) if they are being leveraged for business purposes. Specifically, GST is charged on the value of supply, which is the difference between the selling price and the purchase price of the packaging product (i.e. the profit made from resale). In instances where the packaging products are selling at a lower price than they have been bought at, GST is not charged. In the case of second-hand bottles for example, if taxed at full rate, the tax impact goes from 5–6% to 12–18%.[70]

70 Oberoi, R. 2017. Alcohol out of GST for now, but beer will still get costlier. The Economic Times. Details available at https://economictimes.indiatimes.com/markets/stocks/news/alcohol-out-of-gst-for-now-but-beer-will-still-get-costlier/articleshow/58818443.cms, last accessed on January 21, 2020.

Circular business models for recovered packaging

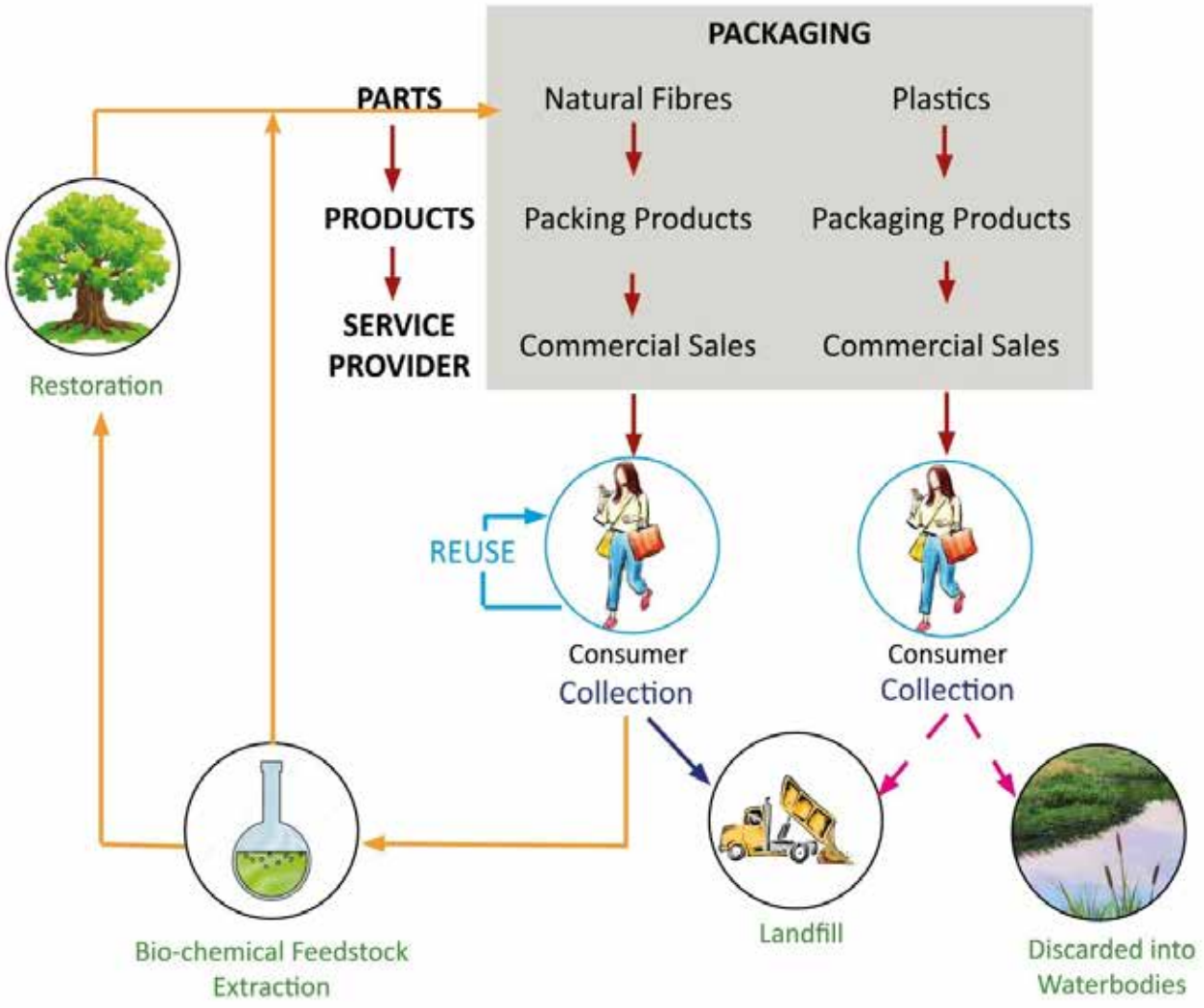


Figure 7.3 A system overview of resource efficiency in packaging products (some natural fibers include corn starch, sugarcane, bananas, coconuts, shrimp, seaweed, jute, hemp, and bamboo)

For some businesses, this means increasing the price of products so customers bear the burden of cost. For many fast-moving consumer goods businesses, the expenditure is largely on packaging, which can already be 40% to 50% of the cost for buyers.[71] As Clinton Vaz, Founder of vRecycle Waste Management Services (Goa) notes, it is punishing to manufacturers who are recycling and reusing these materials, and customers who are choosing to consume responsibly, making it a barrier in the transition to resource efficiency. As such, there are challenges convincing manufacturers to buy back used packaging, even though their material value remains high.

Enterprise opportunities for Goa

Business models for alternatives to plastic packaging represent a huge opportunity for Goa. The use of discarded packaging to recreate packaging is just one of a number of ways of creating circular packaging (see Figure 7.3). Other business models built around packaging include:

- Packaging made from natural fibres such as Pappco Greenware.
- Bio-plastics, where regenerative natural materials are used to create biodegradable plastic. Goa has a good growing environment for other starch/cellulose-based plastic alternatives being manufactured elsewhere such as corn starch, sugarcane, bananas, coconuts, hemp, and bamboo. Two distinct social entrepreneurs in Goa who participated in the consultations are looking to create new packaging businesses from marine harvests – one from seaweed and another from prawn waste.

Incubation start-up support and investment are needed however to help such businesses grow.

RECOMMENDATIONS FOR GOA

- ❖ Leverage the Swachh Bharat and Smart Cities Missions for resources (financial, skills building, and collaborations) to systemize collection and delivery of items made from natural fibres that can be recovered and reused
- ❖ Appeal for an amendment to the GST on sale of second-hand packaging, as a step towards incentivizing businesses to opt for sustainable fibre-based packaging
- ❖ Encourage the sale of naked products and incentivize businesses (particularly within the food industry) to use sustainable packaging, or no packaging at all
- ❖ Start a certification scheme for responsible businesses as an incentive
- ❖ Ban single-use plastic packaging such as thermocol, in the state
- ❖ Provide incubation and start-up support including access to investment for new RE entrepreneurs
- ❖ Enable a mechanism to raise awareness and promote suppliers of RE products and services

71 CEN.2016. The Cost of Plastic Packaging. Details available at https://cen.acs.org/articles/94/i41/cost-plastic-packaging.html, lastaccessed on January 21, 2020.

BOX 7.3: ***THE RISE OF NAKED PRODUCTS – THE ECO-POSRO STORY***

Globally, waste management needs vast improvement. In order to avoid the problem of waste packaging in the first place, the concept of '*naked products*' and zero-waste was born. *Eco-Posro* (*posro* means 'small shop' in Konkani) is a zero-waste store, founded by childhood friends Jonah Fernandes and Eldridge Lobo, which sources, transports, and packages all its products without plastic or other harmful packaging. The store sells organic household items ranging from groceries (e.g. grains, vegetables, cheeses, locally produced vinegars and masalas) to cleaning products, toiletries, and cosmetics.

Eco-Posro works directly with a network of largely local (within Goa and its surrounds), small-scale suppliers, farmers, wholesalers and distributors, many of whom were initially reluctant to transport their products without the plastic packaging. Products are transported in jute bags and other natural-fibre-based packaging to the shop. Traditional methods of storage have been revived to ensure that products stay fresh (e.g. to prevent moisture from affecting fresh produce, they are stored in rice containers). Customers are encouraged to bring their own containers, although the shop does sell glass bottles (which can be bought and sold back for 50% of the original price) and provide paper bags.

Prevention of plastic packaging entering the system and supporting local producers with market linkages to conscious consumers **will play an important role.** The zero-waste concept may be a significant mindset change for some, but Eco-Posro restores customers' faith with the power to change current packaging paradigms/expectations by demonstrating what a zero-waste lifestyle can be. It helps that the cost of fresh produce is on par with that sold in Mapusa, challenging the notion that transitioning to zero-waste is a more expensive lifestyle. Although tested by the relatively short shelf lives of organic produce, Eco-Posro says that demand is growing significantly enough that the produce does not stay long on the shelves. Aware consumers are using the reusable glass packaging for their own use at homes, whilst some return packaging to the shop for 50% of the cost price.

COCONUT – A REGENERATIVE MATERIAL

Goans have a rich traditional and cultural history with the coconut, employing all parts of the versatile coconut palm tree for different uses. The copra is an essential source of cooking oil and cosmetics, and is used in various local curries and other dishes as well. Husks are used in the manufacturing of several household items like mats, ropes, and mattresses and are also burned at sunset to keep mosquitos away. The tender coconut holds highly nutritional water within its shell, which is also used for cups, pots, and cooking utensils. The fronds of the coconut tree are used to make baskets and thatch roofs,[72] the trunks of the tree are used in construction.

Today, many of these traditional practices are being discarded and may soon be lost in favour of purchasing 'modern' plastic (e.g. ropes) or imported alternatives. Meanwhile, new markets and products based on coconut materials are being developed around the world, and in non-coconut growing countries outside India, there is excitement about the 'discovery' of the coconut's amazing properties! There are RE opportunities for new business models exploring the coconut as a material. One example from Kerala is described below.

Overview

Name of business	Malai Biomaterials Design Pvt. Ltd
Premise	Creating vegan leather for the fashion industry, from bacteria cultured on waste coconut water
Driver for change	• Environment protection – reduce harmful leather production • Revenue from export markets and new business opportunities
Distinguishing CE business model feature(s)	• Circular value chain • Recovery and collection including industrial symbiosis • Durability, modularity with repair services • Personalization, made to order and lock-in

Story and value proposition

Malai Biomaterials Design Pvt. Ltd is a sustainable fashion label that produces vegan leather from coconut waste. It aims to substitute animal leather with sustainable, organic and vegan materials. This is realized by developing bio-composite substitutes to leather using sustainable bacterial cellulose, grown using agricultural waste water sourced from coconut oil mills and processing units in Kerala. The agricultural waste water was previously sent to sewage treatment plants or irresponsibly discarded into waterbodies. The waste coconut water is sterilized and prepared as a nutrient on which the bacteria feed and cellulose grows, forming a jelly from which different materials are created.[73] These materials

72 D'Source. 2019. Coconut palm leaf craft – Loutolim, Goa. Details available at http://www.dsource.in/resource/coconut-palm-leaf-craft-loutolim-goa/introduction, last accessed on January 21, 2020.

73 Raut, A. 2019. Malai: a sustainable, vegan alternative to leather. *Architectural Digest*. Details available at https://www.architecturaldigest.in/content/malai-a-sustainable-vegan-alternative-to-leather/, last accessed on January 21, 2020.

Figure 7.4 A shoe made from coconut-water cultured bacteria-generated cellulose material © Malai Biomaterials Design Pvt. Ltd

are shaped into products including shoes, wallets, and clothes.

Design and innovation

The material design was the brainchild of Zuzana Gombosova, a material researcher and designer from Slovenia, and Kerala-born Susmith Suseelan, a mechanical engineer and product designer. Although the original idea was to create packaging from cellulose bacteria, their experimental outputs displayed a striking resemblance to leather (and sometimes paper), in its strength, flexibility, and ability to be processed and used. At present, Malai partners predominantly with brands in Europe and USA. Collaborating with companies to fashion their material into diverse products has given Malai the scope to experiment with the material further, depending on individual needs of each company. A domestic market is now being explored to cater to the growing demand for sustainable fashion in Indian cities.

Environmental benefits

The production process consumes less energy and water during manufacturing (compared to leather), and does not use toxic chemicals at any stage.[74]

Opportunities for Goa

An R&D into new materials made from diverse coconut fibres could be a good source of innovation. Similar scientific research into other locally grown regenerative crops such as bamboo, banana, hemp, etc., which are all being used internationally and other parts of India could also yield new markets for Goa.

In the meantime, economic benefits could be created from locally produced coconut-based products for a modern market such as:

- Modern designs and new markets for products made from durable coconut fibres such as household items (bowls, plates, etc.)
- Niche/high-end coconut water and coconut oil markets that draw on local production to service the tourism or export markets

RECOMMENDATIONS FOR GOA

❖ Record and revive local skills and traditional knowledge in regenerative processes for coconut-based products

❖ Build skills, livelihoods, and market linkages to feed a cottage industry based on coconut products, for local, national, and international sale

❖ Work with tourism industry to understand what non-RE products can be substituted with coconut-based products to provide local flavour, greater resource efficiency and less waste

❖ Invest in/partner for R&D into how coconut – and other locally grown regenerative crops such as bamboo, banana, hemp, etc.,– can be manufactured to replace plastics and/or contribute to circular value chains

74 Arora, N. 2019. 'Malai' — a sustainable fashion label using coconut waste to make vegan leather. *HomeGrown*. Details available at https://homegrown.co.in/article/803378/malai-a-sustainable-fashion-label-using-coconut-waste-to-make-vegan-leather, last accessed on January 21, 2020.

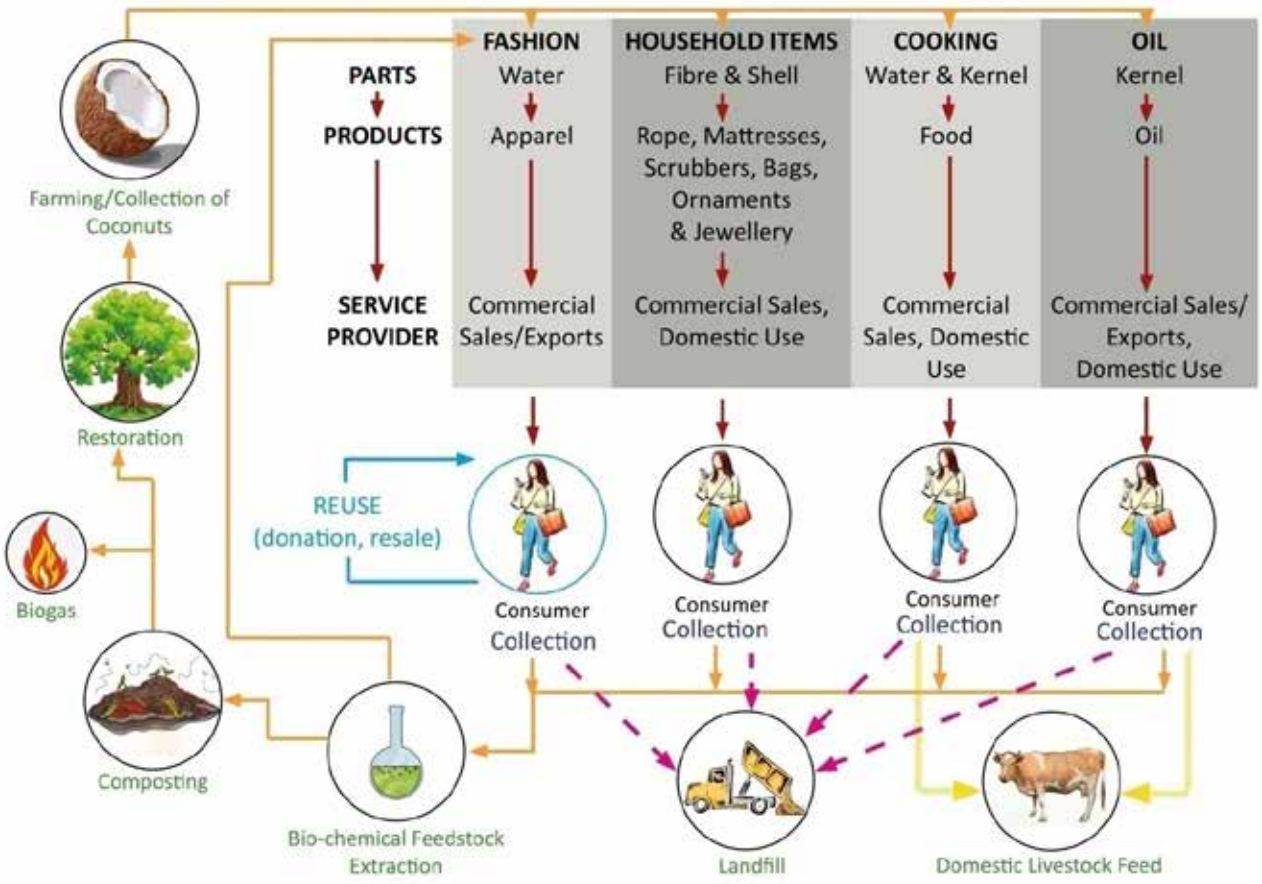


Figure 7.5 A system overview of resource efficiency of coconut products

STRATEGY FOR FOSTERING RESOURCE EFFICIENCY AND CIRCULAR ECONOMY IN GOA

ANNEXURES

ANNEXURE 1: **WASTE GENERATION BY HOTELS**

Types of non-hazardous waste generated by hotels

A hotel's solid waste stream is as diverse as it is enormous. Office paper, restaurant food waste, oil and grease from cooking facilities in hotels, restaurants , food shacks, amenity bottles, plastic and aluminum beverage containers, countless cardboard packaging boxes, heavy machinery, and guestroom furnishings all find their way into a property's dumpster. Although this waste is diverse, the hotels typically generate a fairly consistent type of waste (Refer Figure 1). The majority is paper and food waste, and there are lesser amounts of metal, plastic and glass. Variation in a hotel's waste composition can be attributed to differences in the scope of operations and target market of the hotel. For example, limited-service hotels and motels often do not offer an on-site restaurant. This eliminates most of the food waste that makes up a large portion of a full-service hotel's waste stream. Some hotels cater to business travellers who leave paper-type waste behind; other hotels cater to families on vacation who leave a lot of container waste (take-out boxes and bags, soda bottles and cans); and others cater to the convention and trade-show market which generates significant cardboard waste.

Zein et al., 2008[75] have categorized the various types of non-hazardous waste in the hotel industry. Refer Table 1

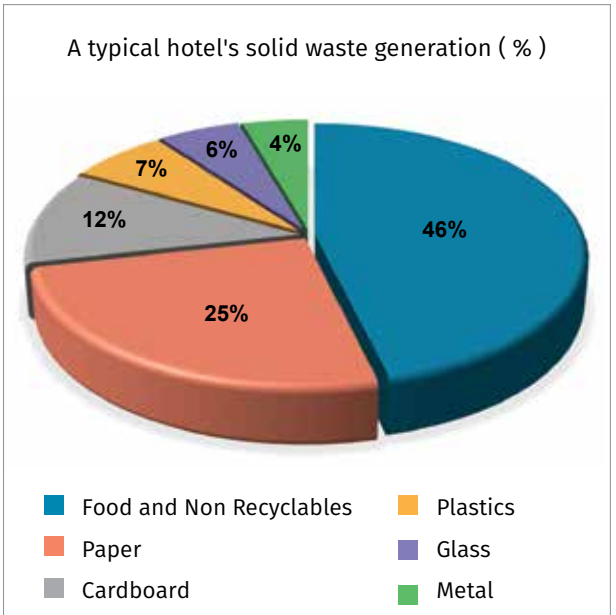


Figure 1: A typical Hotel's waste generation across major categories

75 Zein, K., Wazner, M.S., Meylan, and G. 2008. Best Environmental Practices for the Hotel

Table 1 Details of non-hazardous waste types generated by hotels

Non-hazardous waste type	Components	Source
Household wastes	Food/ Kitchen waste, used or dirty paper and wrapping, plastic wrapping or bags, composted wrappers	Hotel's different departments
Cardboard	Packing	Hotel's purchasing and other departments
Paper	Printed documents, brochures, menus, maps, magazines, newspapers	Administration, reception, guest rooms, restaurants
Plastic	Bags, bottles, household goods, individual portion wrappers for various products	Kitchen, restaurants, bars, guest rooms, Administration
Metal	Tin jars, jar lids, soda cans, food containers, mayonnaise, mustard and tomato puree tubes, aluminium packing	Kitchen, restaurants, bars, guest rooms
Glass	Bottles, jars, flacks	Kitchen, restaurants, bars, guest rooms
Cloth	Table cloth, bed linen, napkins, clothes, rags	Kitchen, restaurants, bars, guest rooms, bathrooms
Wood	Wooden packing pallets	Purchasing department
Organic waste	Fruit and vegetable peelings, flowers and plants, branches leaves and grass	Kitchen, restaurants, bars, guest rooms, gardens
Soap and cleaning supplies	Used soap bars, shampoo and conditioners leftover in the bottles provided for these amenities in the hotels, leftover cleaning supplies	Guest rooms, common toilets

ANNEXURE 2: **GREEN/ SECONDARY BUILDING MATERIAL**

There exists many examples of use of green and/or secondary building material use outside of Goa which could also be considered for use in Goa. Refer Table 2 [76]

Table 2 Alternative materials for construction activities

Recycled Plastic	Plastics are one of the most energy-efficient substances considering their entire life-cycle. The typical lifespan of plastic applications in buildings is up to 30 to 50 years. The first Plastic Bottle house was erected in 2015, on an island of Bocas Del Toro in Panama. Here, Bezau and his team have reused plastic bottles as construction materials for shelter.
Grasscrete	Grasscrete is also called the *"Sustainable Urban Drainage"*. It is a green alternate to typical concrete surfaces for parking lots, driveway and other access roads providing drainage uses and refining stormwater absorption. Grasscrete is advantageous for businesses as well as developers as it drains at about the same rate (90%) as would an ordinary lawn in the same location. With 47% concrete and 53% holes filled with grass, it will help to form a natural bio-filter to significantly eliminate pollutants. Style Earth Precast, Bangalore, India, is one of the leading manufacturers and suppliers of Precast Grass Pavers, Concrete Grass Pavers, Grasscrete Paving blocks.

76 http://www.asiagreenbuildings.com/14221/green-building-material/

Timbercrete

Timber Crete is an amalgamation between timber waste from numerous sources and concrete – a green material that is lighter that solid concrete with superior strength and insulating potentials.

This green material provides unique thermal qualities that combine thermal mass and insulation usually turned constructed for eco-housing. Timber Crete is also bushfire proof, which allows minimal heat transfer and radiation. The other benefit is that this material is very user-friendly, which can be nailed, screwed and sawn easily by anyone.

Wood

The nature of wood has always provided a classic, durable and historically reliable green building material that has a longevity, an aesthetic facet and adds flair to buildings.

Manufacturing wood for construction is less energy intensive than other materials, including concrete, steel, cement or glass production with some percentage of recycled material. The finished product also has lower embodied energy.

ECO WOODEN HOMES, Karnataka specialize in manufacturing customized high quality pre-fabricated wooden houses, villas, gazebos, bar-counters, security cabins, beach houses, roof tops, farm houses and pavilions.

Ferrock

Ferrock is a carbon-negative cement alternate which bargains a robust and green alternative to standard cement manufacturing methods and helps reduce a significant amount of carbon emission between fuel burning to running cement mixers and chemical processes.

Ferrock cement structures are longer-lasting and do not need continuous repairs and replacement.

ANNEXURE 3: **GOOD PRACTICES FOR MANAGING MARINE LITTER**

Initiative by Fishing Community of Kerala

- Started by Xavier Peter and 5,000 other fishermen/boat owners in Kollam, Kerala
- Since August 2017, they have been hauling back to land all the plastic that they find while they're out at sea
- Involving government agencies, they've set up a recycling centre in the region, to clean, sort, and process all the sea-tossed plastic bags, bottles, straws, flip-flops, and drowned dolls/toys that they fish out. So far 65 metric tons of plastic waste has collected and used in making of roads

Hawai'i Nets-to-Energy Program

- Marine debris accumulates in and around the islands of Hawai'i due to oceanic currents and winds in the North Pacific
- Much of the debris is made up of fishing nets, a type of gear not used by Hawaii's fisheries, that have been lost, abandoned, or discarded
- Fishermen, communities, and trained divers remove these nets and transport it to the City and County of Honolulu's H-Power energy from waste facility run by Covanta Energy
- Since 2002, over 800 tons of derelict nets have been used to create electricity—enough to power nearly 350 Hawai'i homes for a year.

Beat the Micro-bead

- Tiny plastic particles are often used in our cosmetics and personal care products as a scrubbing agent, emulsifying agent or just as cheap fillers
- Tiny plastic particles are often used in our cosmetics and personal care products as a scrubbing agent, emulsifying agent or just as cheap fillers

BEAT THE MICRO BEAD

www.beatthemicrobead.org

- Stakeholders: producers, consumers and governments
- US passed a federal law to ban micro-beads in rinse-off personal care products in 2018
- Supported by 100 NGOs from 42 countries
- 448 brands from 119 different manufactures have promised to remove plastic microbeads from their products

In Fashion

- Pharrell Williams the multi-talented musician and entrepreneur has partnered with G-Star Raw, Bionic Yarn and Parley for the Oceans to deliver the "Raw for the Oceans" Fall/Winter 2015 collection that features items for both men and women, such as distressed jeans, denim jackets, hoodies, coats, T-shirts and tank tops
- The clothing line boasts that in its three seasons, the equivalent of 2 million plastic containers have been recovered from ocean coastlines around the world. The pieces contain thread spun by Bionic Yarn, a New York-based company that takes materials such as plastic bottles and recovered ocean plastic, breaks them down into chips and shreds them into fibres.

Building with fishing net frames and bottle bricks

- Samarpan foundation substituted the traditional construction materials like steel and bricks with discarded fish nets and PET bottles and built a 30 bed hospital on Bali Island in the Sundarbans, West Bengal
- Local community was involved and hence employment was generated
- This infrastructure support for impoverished communities and protect environment through reduction in plastic waste

Sustainable Green Company: Repackaging the future

The Sustainable Green Company, founded by Ajay Gramopadhye in Goa, uses bio-based content (i.e. discarded materials made from wood pulp or other fibrous cellulosic materials) to create customised packaging products for electronic goods. His intentions are threefold: i) to provide compostable packaging products in replacement of thermocol; ii) to simplify packaging products by using the same material to create it (making it easier to recycle); iii) and to provide alternative packaging options for responsible, fast moving consumer goods businesses.

Arannya Environment Research Organisation

This is a group of like-minded youngsters from Goa, who are helping the young generation to connect with nature, to explore and experience the rich natural heritage of the state and work towards wildlife conservation through research, education, outreach and action. They conducted a unique awareness campaign on 'Say no to single use plastics'. This was targeted especially towards the small businesses/street vendors. They approached all the street vendors in Old Goa and created awareness through screening and video about harmful effects of single use plastics such as straws. They convinced the vendors to try and not give out plastic straws to customers. With an objective to aid the vendors in effective communication with the customers and create an impact, hangers as shown in the adjacent photograph were designed and distributed to all the street vendors.

ANNEXURE 4: **BARRIERS AND CONCERNS LINKED TO CIRCULAR FLOW OF SELECTED MATERIALS**

Figure 1 Barriers and concerns to Circular Flow of plastics

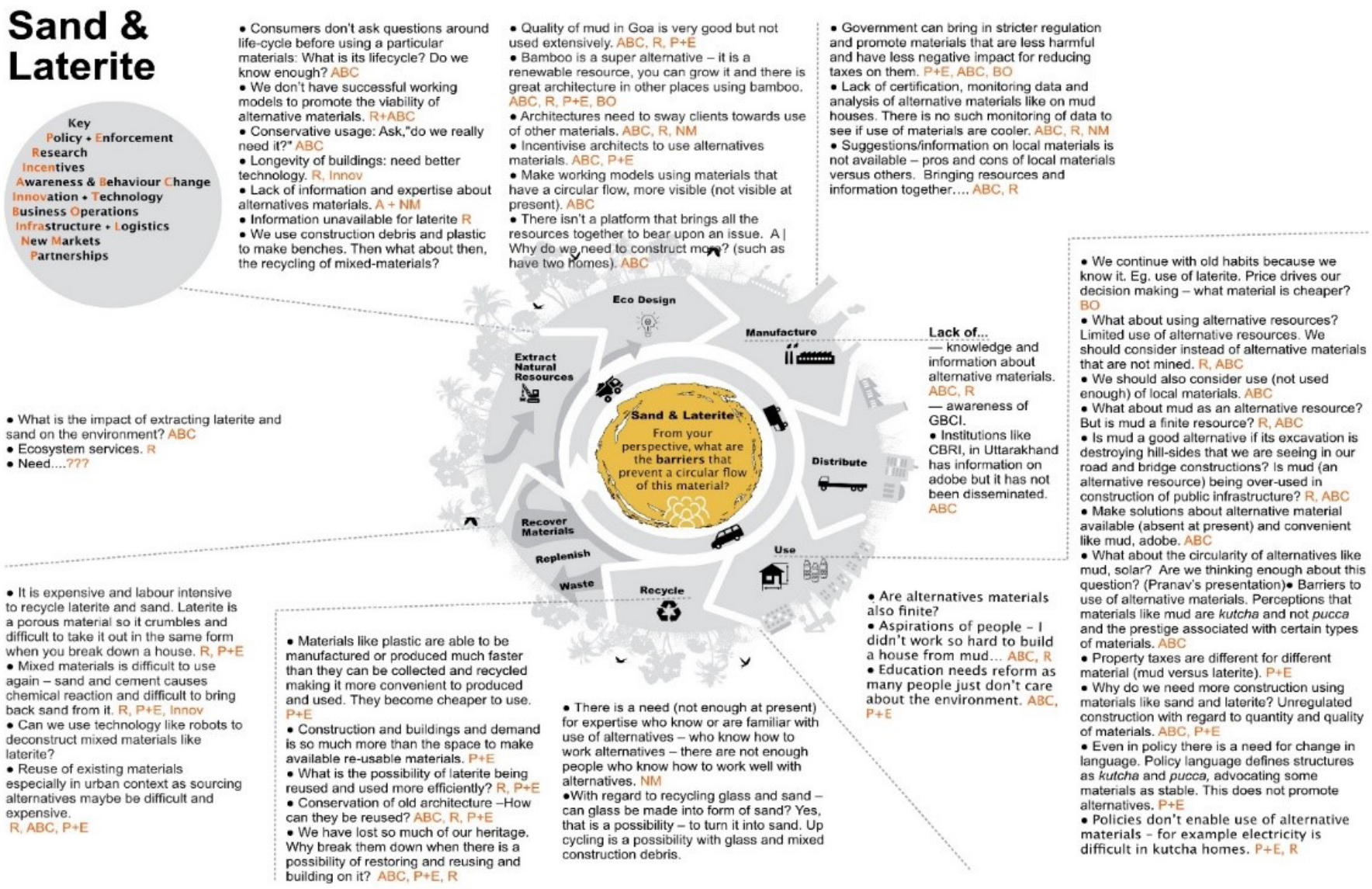


Figure 2 RE barriers for two of Goa's natural resources used in construction - Sand and Laterite as identified by stakeholders

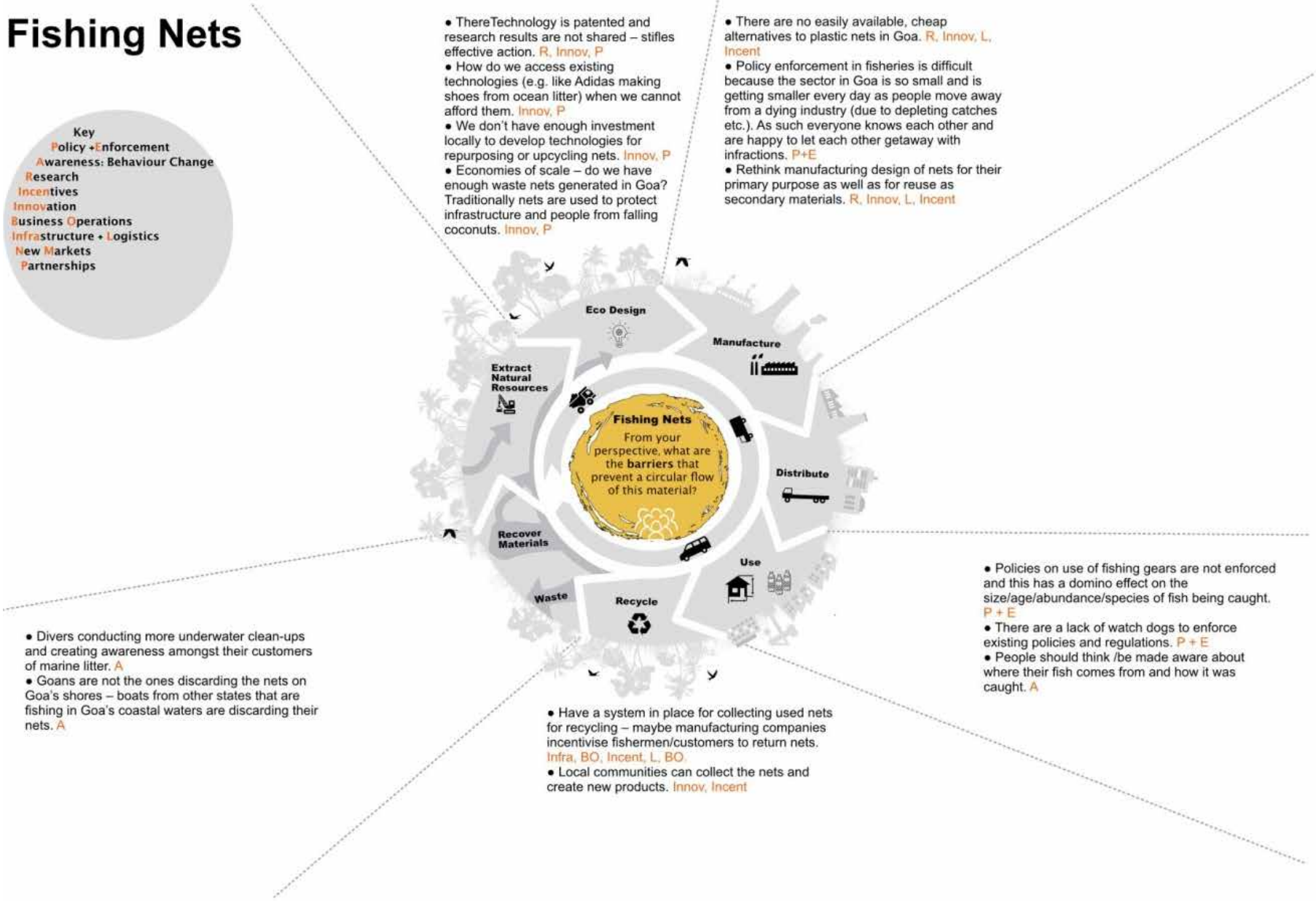


Figure 3 Barriers to circular economy in fishing nets