

4.4 Project Idea for Technology 3: Restoration of Coral Reefs

Project Idea:

'Restoration of coral reefs of southern and south-western coastal belt of Sri Lanka, as a soft barrier against sea level rise and coastal erosion and as a tourist attraction to promote eco-friendly tourism'

4.4.1 Introduction/Background

Coastal belt of Sri Lanka is blessed with near shore patchy fringing reefs and offshore bar reefs and they are unevenly distributed along the Southern, North-western, Northern, Eastern and South-Eastern coastal belts of Sri Lanka. According to Swan (1983) these near shore fringing reefs consists of 2% of the coastal belt. Both the fringing reefs and offshore reefs have been reported to be of varying conditions and they have been categorized into three main habitat types, i.e. the true coral habitats consisting of live coral as well as calcareous substances, sandstone and rocky habitats¹⁹. The growth of coral reefs around Sri Lanka has been influenced and being influenced by both natural phenomena (i.e. monsoonal and warm water currents, tsunami, strong waves, tidal variations, etc.) and anthropogenic activities (i.e. coral mining; destructive fishing activities, such blast fishing, seining, use of moxy nets, etc.; recreation, release of effluents, sewage and other pollutants to near shore areas, sedimentation due to sand mining, deforestation & land reclamation; etc.), which cause impacts on the light penetration, salinity and productivity, especially in shallow coastal waters due to increased turbidity, sedimentation, freshwater intrusion and eutrophication. Mainly due to such reasons coral reef development in the southwestern sector of the coastline is very poor, and therefore extensive coral reef habitats are limited to areas with lower levels of sedimentation with semi-dry climates found in the north-western and eastern coastal areas and a chain of fringing coral reefs occur around the Jaffna Peninsula²⁰.

Coral reefs deliver ecosystem services to tourism, fisheries and shoreline protection. The annual global economic value of coral reefs has been estimated at \$US 375 billion. For centuries, reef resources have been utilized for food and building materials. Increased human activities in recent times have begun to degrade the quality of the reefs, particularly the near shore habitats. The major uses of the reefs are extraction of living and dead coral for the lime industry, capture fisheries and the harvesting of exotic reef resources such as ornamental fish for export and for tourism related activities²¹. Most of the fishing is concentrated in coastal waters classified as within the first 40 km from the shore. Export industry for reef

¹⁹ Rajasuriya & De Silva, 1988; De Silva & Rajasuriya, 1989; Rajasuriya, De Silva & Ohman, 1995

²⁰ Rajasuriya, 2011

²¹ Rajasuriya, 2011

fish, invertebrates and live coral for the ornamental fish is rated as the third highest in volume and value after prawns and lobsters²². In addition to the above coastal areas, with fringing reefs have become important locations for tourism development and recreational activities such as swimming, snorkeling, scuba diving and viewing corals through glass- bottom boats etc.

Major causes of reef degradation are sedimentation, destructive fishing methods such as the use of explosives and bottom-set nets, mining of coral from the sea for lime production and uncontrolled harvesting of reef resources. Pollution and sewage released to reef sites have also contributed to the overall degradation of the marine environment. Coral mining in the sea to produce lime for the construction industry has destroyed most of the fringing reefs along Sri Lanka's southwestern coast.

Furthermore, the majority of hotels along the coast line have been constructed without proper planning and as result numerous problems such as liquid and solid waste disposal have become major issues. In some locations such as in Hikkaduwa these issues have become acute and it has now begun to have an adverse impact on the marine environment²³. (Nakatani et al. 1994; Rajasuriya et al 1995). Dumping of garbage into city waterways and onto beaches has a negative impact on the marine environment in general and on the reefs in particular. Oil pollution in harbours is a chronic problem particularly when fishing boats are anchored in the protected bays formed by fringing reefs or estuaries.

There are several major problems to be addressed and they are, Inadequate awareness among all stakeholders on the importance of non-extractive uses of coral reefs, time taken for recovery of reefs subjected to destruction due to anthropogenic activities and the sensitivity of reef ecosystems to slight changes in coastal environmental conditions; Inadequate financial assistance for restoration programmes and for providing diving training and equipment to persons to be employed for coral restoration activities; Inadequate knowledge on technology adopted for restoration of coral reefs and on the most suitable coral forming and associated species to be used for restoration of coral reefs; Lack of alternative livelihoods to communities depending on dune resources for socioeconomic activities; Poor coordination/cooperation among stakeholders, when rapid development programmes are introduced to the coastal belts; Unplanned land-based development programmes and socioeconomic activities that cause sedimentation and pollution within the coastal areas and Limited time available for coral transplanting programmes annually due to rough sea conditions prevailing during monsoonal periods.

The proposed project will be implemented in the Southern, South-Western and Eastern and provinces of Sri Lanka, for restoration coral reefs subjected to natural disasters and anthropogenic activities and also in coastal areas where ecotourism could be promoted. Hikkaduwa, Unawatuna, Weligama & Polhena from the Southern coastal belt, shallow reef areas in Kandekuliya, Bar reef sanctuary, Arippe, Silawatturai and

²² Baldwin, 1991

²³ Nakatani et al. 1994; Rajasuriya et al 1995

Thalawila from North-western coastal belt, Delft Islands from the Northern coastal belt and reefs damaged due to recreational and destructive fishing activities in Trincomalee (Pigeon Islands) and in Baticoloa (Pasikuda & Kalkuda) from the Eastern coast of Sri Lanka will be included in the restoration programme.

4.4.2 Objectives

1. Restoration of coral reefs as soft coastal barriers against SLR,
2. Reduce the impact of anthropogenic activities on the reef ecosystems,
3. Provision of eco-friendly alternative employment opportunities to coastal communities to reduce destructive socioeconomic activities and unemployment problem among coastal communities through SMEs and promotion of ecotourism through community-based organisations.

4.4.3 Outputs and measurable

The following are the measurable out puts of the proposed project;

1. One hectare of corals transplanted in each reef site after the 5th year of the project.
2. One hundred persons trained for scuba diving, coral restoration and coral growth monitoring activities and at least 25 youth trained as tour guides from each reef site selected for restoration.
3. Two responsible community participatory organisations established for each coastal district related to reef sites to provide information, disseminate knowledge, promote ecotourism and research and to manage reef related activities.
4. At least one artificial reef in each of the sites selected to be used for ecotourism.
5. Reduce unemployment of coastal communities depend on reef resources by 25% at the end of 5 years.
6. Adoption of environmentally friendly policies for coastal development programmes after 1 year.
7. Improved awareness among government officials on the importance of collaborative approach on development programmes within the coastal region, for their sustainability.
8. Preparation of unbiased IEEs and EIAs to grant approval to all coastal developmental activities and economic programmes after 0.5 years.
9. Twenty five to ninety percent reductions of unsustainable socioeconomic activities from 2 to 7 years.
10. Twenty five to seventy percent recovery of natural reefs from by 1.5 to 7.0 years.
11. Ten (10) trained persons available in each reef sites to serve as trainers to handle all training activities related to reef restoration programmes after 1.0 year.
12. Availability of a long-term management plan for coral reef ecosystems, acceptable to all stakeholders after 2 year.

13. Sustainable management of coral reefs through stakeholder participation from second year onwards.
14. Existence of a data base with baseline information, on coral biodiversity and physicochemical conditions required for each reef forming organism to maintain a live reef.
15. Identifying early signs of bleaching and hazards after 0.5 years.
16. Healthy coral reefs, growing satisfactorily without or less disturbances from exotic materials, from year 1 to year 7 and onwards.
17. Severe punishments imposed to persons/organisations involved in coral reef destructive activities,

4.4.4 Relationship to the country's sustainable development priorities

According to the National Environment Policy (2003) of Sri Lanka, coral reefs ecosystems are an important component of coastal environment and it should be conserved and managed together with its biodiversity, soils, water and aesthetic values, to increase the productivity to meet the protection from the impacts of natural hazards and SLR to present and future generations for their products and services and to enhance the contribution to the welfare of the coastal communities and by strengthening the national economy, with special attention paid to equity in economic development, while securing rights to coral reef resources and services without harming their sustainability and by sharing the benefits & costs. Biodiversity in the natural coral reefs should be conserved to maintain biological resources (flora & fauna) as reservoirs for the benefit of present and future generations, as laid down by the National Policy on Wild Life Conservation (2000), for the benefit of the coastal communities as laid down by Coast Conservation Act No. 57 & Act No. 64, Coastal zone management plan (CZMP1997 & 2004), conservation Act. 1990 and *Mahinda Chinthana* (2005) p p 61 & 64 and *Mahinda Chinthana* way forward (2010) Vision for the New Future is the Government of Sri Lanka's Ten Year Development Policy Framework²⁴.

4.4.5 Project Deliverables

Protection of coastal, communities and their properties, from impacts of SLR/climate change and provide alternative livelihoods to those involved in destructive socioeconomic activities associated with coral reef ecosystems; Low cost technology made available, to restore reef ecosystems and to establish artificial reefs to be used for ecotourism as a sustainable industry to reduce unemployment and to provide alternative employment opportunities to those who involved in unsustainable activities within coral reefs; Unemployed youth trained tour guides to be involved in ecotourism; Conservation and protection of biodiversity of coral reefs to the benefit of present & future generations; Improvement of aesthetic values of the coastal reef habitats and Information on economically important reef forming and reef associated

²⁴ Mahinda Chinthana Policy Framework, 2005.

species that could be cultured and used for economic, medicinal and agrochemical practices are the project deliverables.

4.4.6 Project Scope and Possible Implementation

Selection of 12 most suitable reef sites from Southern, North-Western, Northern and Eastern coastal belt of Sri Lanka, to be restored as soft barriers against SLR, to ensure protection and sustainable socioeconomic development of communities living in their vicinity and to support the development of country's socioeconomic standards; Technology used for restoration could be made available through detailed publications for future expansions of such projects to other degraded reef sites, to ensure successful restoration of all coral reefs and for their sustainable management as soft barriers against SLR and other impacts from climate change; Information on the most suitable species of corals to be used for restoration programmes for Southern, North-Western, Northern and Eastern coastal belts of Sri Lanka could be identified, with the correct diversity and composition to be used for each specific site depending on the physicochemical and biological nature of the sites; Such information could be made available to all stakeholders through booklets/leaflets prepared for dissemination of knowledge;

Most of the activities will be conducted with community and stakeholder participation and the project will be associated with establishment of information centres, education/awareness and improvement of employment opportunities, which will benefit the coastal communities and therefore the stakeholders will ensure the sustainability of the project; Collaboration and cooperation among different stakeholder groups will be improved for successful implementation of the programme

4.4.7 Project activities

Following are the main activities of the proposed project;

1. Awareness to all stakeholders & training programmes on reef restoration and conservation related eco-friendly socio-economic activities (eco-friendly tourism, diving & snorkelling, coral transplanting, captivity breeding of ornamental fish, etc.) to 10 persons from each selected sites and from related institutions to serve as trainers.
2. Selection of suitable sites & transplanting of corals in those sites
3. Formation of community participatory organisations with diving & snorkelling facilities with the involvement of trainers and committed persons from the community for restoration work and to provide security to sensitive coral reefs and transplanted corals
4. River basin management programmes and control of land use patterns to reduce coastal sedimentation
5. Development of a seasonal monitoring & resilience programme and a sustainable management plan by using GIS & remote sensing techniques & through consultation of stakeholders and experts.
6. Evaluation of success

4.4.8 Timelines for proposed activities

Table 4.6: Proposed timelines for Implementation of Project Activities

Activity	Year 1				Year 2				Year 3				Year 4				Year 5				Year 6				Year 7			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Awareness to all stakeholders & training for 10 persons from each selected sites																												
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4.4.9 Budget/Resource requirements

Table 4.7: Approximate Budget Estimate for the Proposed Project

Activity/Sub Activity		Budget (US \$)		
No.	Activity/Sub Activity	Domestic	International	Total
1	Awareness to all stakeholders & training programmes on reef restoration and conservation related eco-friendly socio-economic activities to 10 persons from each selected sites and from related institutions to serve as trainers.	38,000	118,000	156,000
2	Selection of suitable sites & transplanting of corals in	50,000	200,000	250,000

	those sites			
3	Formation of community participatory organisations with diving & snorkelling facilities	150,000	1,500,000	1,650,000
4	River basin management programmes and control of land use patterns to reduce coastal sedimentation	80,000	230,000	290,000
5	Development of a seasonal monitoring & resilience programme and a sustainable management plan	8,000	60,000	68,000
6	Evaluation of success	5,000	16,000	21,000
Subtotal: Cost of Project Activities		331,500	2,103,500	2,435,000
7.	Cost of Management (10% the cost of project activities)	243,500	-	243,500
Total budget for Technology 3		575,000	2,103,500	2,678,500

The cost of project activities would be approximately US \$ 2.435 million and the project management cost would be around 10% of the cost of project activities (US \$ 0.244 million). Estimated total cost of the proposed project including the project management cost would be approximately US \$ 2.679 million. Required funds will be obtained through domestic (US \$: 0.575 million) and international (US \$: 2.104 million) sources as indicated in the budget estimate

4.4.10 Measurement/Evaluation

An internal monitoring programme (quarterly) and periodic external evaluation (biannually and mid-term) would be implemented for project monitoring and evaluation. Quarterly internal monitoring will be carried out by the planning unit of the Coast Conservation Department. External evaluation will be carried out by an independent panel of experts appointed by the line ministry (Ministry of Fisheries and Aquatic Resources) in consultation with the donor agency.

Monitoring and evaluation of project activities will be done as follows;

Awareness can be evaluated by the level of involvement of different stakeholders in restoration programmes. **Restoration rate of coral reefs could be measured** by manually measuring the expansion of reef areas transplanted with corals and by measuring the growth of coral colonies, changes in diversity and density of different coral forming and associated organisms. **Coral growth** can be measured by the expansion of area covered by live corals.

Efficiency as a soft barrier against SLR could be measured by the increased stability of the coastal land and elevation of the coastal beaches. **Effect on reduction of unemployment** can be evaluated by numbers of persons employed in sustainable reef related activities. **Impact on tourism** could be evaluated by the number of tourists visit coral reefs and artificial reefs for ecotourism. **Improvement of socioeconomic standards** could be evaluated by the percentage increase of average annual income of coastal communities involved in reef related sustainable activities.

4.4.11 Possible Complications/Challenges

Inadequate funding for initiation and continuation of the project until it reaches, self sustainable levels, inadequate involvement of local communities, NGOs & INGOs in restoration programme, resistance from the stakeholders and community (tourist resort owners, fisher communities, etc.) to give up their unsustainable socioeconomic activities, that are harmful to reef ecosystems, inadequate patronage at provincial and national government level and inadequate funding for capacity building at research & higher education institutions for research activities related to coral reef restoration could be challenges for the project..

4.4.12 Responsibilities and Coordination

Stakeholder	Responsibility	Collaborations
Coast Conservation Department (CCD)	Integrated coastal Zone Management, Coastal Protection & coordination of coastal projects & development plans	All stakeholders of the coastal belt
M/Environment & Natural Environment	Policy decisions, financial planning and administrative matters related to coastal environment	All stakeholders, line ministries Treasury
Universities	Training, awareness & research	R & D institutes, CCD, CBOs, NGOs
Tourist Board	Development of coastal tourism and eco-tourism related to coral refs and artificial reefs	Tourist hotel/resort owners, CCD, CEA,
Tourist hotel owners	Development coastal tourism and eco-tourism, reduce environmental impacts to restored reefs during recreational activities of tourists	Tourist Board, M/ local government and provincial councils, CBOs, NGOs,
National Physical Planning Department/	Identification of suitable development plans for the coastal belt to reduce impacts on coral reefs	CCD, M/Tourism, Tourist Board, M/Local government & Provincial Councils
Central Environmental Authority (CEA)	Conducting IEEs & EIAs for development projects in the coastal belt	CCD, MEPA,. Research & Higher Educational Institutes
M/ local government and provincial	Planning of development programmes and socioeconomic activities for the well being of	CCD, M/Environment & natural Resources, CBOs, NGOs,

councils.	coastal communities, provide funding for restoration related activities	
M/Technology & Research	Providing funds for R&D activities related to reef ecosystems and their resources	M/Finance & Planning, Universities & Research Institutions, National & International funding sources
Coast Guard	Protection of coastal belt from harmful activities	CCD, MEPA
Community –based organizations (CBOs)	Involvement of community for rehabilitation of coral reefs, establishment of artificial reefs, promote awareness on the importance of coral reefs and for dissemination of knowledge on conservation, management of corals, to all stakeholders, etc.	CCD, Universities & Research institutions, NGOs, INGOs, SMEs, M/Industrial Development, M/Tourism, Tourist Board, Tourist Hotel owners
MEPA	Protection of coastal & marine environment from pollution and man-made hazards	CCD, CEA, Coast Guard, Universities & R & D Institutions
INGOs & NGOs	Organising community participatory activities such as workshops, training, finding finances, etc. for activities related to reef restoration & for socioeconomic development of coastal communities	CCD, CBOs, M/ local government and provincial councils, Higher educational & Research Institutions
National Science Foundation (NSF)	Encourage preparation of research proposals related to Sand dune restoration, sustainable utilization of resources and provide funding for projects related to them	M/Finance & Planning, Higher Educational & Research Institutions, International funding agencies

Duplication of roles will be minimized by allowing **Coast Conservation Department, which is the organization responsible for Integrated coastal zone management to be the main stakeholder and project implementing organization** to conduct the project in collaboration with the participation of all other stakeholders with respect to different activities; by obtaining the cooperation and collaboration of all stakeholders when developing the project proposals, identifying the specific responsibilities of each stakeholder within each project; through preparation of multidisciplinary development projects, with sub projects to be handled by different stakeholder groups/ institutions/organizations with separate budgetary allocations to each institution; by including of key officials from relevant stakeholder institutions/establishments when forming a project coordinating bodies; through participation of all stakeholders, during project progress review meetings and by involving community-based organisations in all restoration programmes.