सत्यमेव जयते
GOVERNMENT OF GUJARAT

Development of **Seaweed Culture**

Agro and Food Processing

Government of Gujarat

Vibrant GUJARAT™ 10-13 Jan 2017
Connecting India to the World | 8th Global Summit

Contents

Project Concept

The concept

The project aims at establishing seaweed culture given the high potential of raw material availability and demand in fertilizer and pharmaceutical market.

Seaweed culture overview

- The Seaweeds are macrophytic algae, a primitive type of plants lacking true roots, stems and leaves. Seaweeds grow in the shallow waters, and lack root system and conducting tissues like land plants.
- Four groups of seaweeds are recognized according to their pigments that absorb light of particular wave lengths and give them their colours of green, blue, brown and red.
- The greatest variety of red seaweeds is found in subtropical and tropical waters, while brown seaweeds are more common in cooler and temperate waters.
- Asia stands as the world leader in seaweed cultivation and more than 80% is contributed by China, Korea and Japan.
    - Currently there are 42 countries in the world with reports of commercial seaweed activity. China holds first rank in seaweed production, with Laminaria sp. accounting for most of its production, followed by North Korea, South Korea, Japan, Philippines, Chile, Norway, Indonesia, USA and India.
    - These top ten countries contribute about 95% of the world's commercial seaweed volume.
    - About 90% seaweed production comes from culture based practices.

Types of seaweeds			
S No.	**Type**	**Common name**	**No. of species**
1	Chlorophyta	Green algae	900
2	Phaeophyta	Brown algae	1500
3	Rhodophyta	Red algae	4000

Uses of seaweeds

- Seaweeds provide valuable source of raw material for industries like health food, medicines, pharmaceuticals, textiles, fertilizers and animal feed.
- Used for production of Agar, Alginates and Carrageenan. Chemicals from brown seaweeds such as alginic acid, mannitol, laminarin, fucoidin and iodine are extracted on a commercial basis.
- As a staple food in Japan and China. Seaweeds are rich in minerals, vitamins, trace elements and bioactive substances, and are called medical food of the 21st century.

Project Concept

Project brief

- Seaweed culture can be best developed along the coast lines of Amreli district and Kutch in Gujarat.
- Machinery and equipment required for seaweed culture include seeds, bamboo rafts, nylon ropes of different lengths and measures, anchors, fishing nets, mats, ladders, baskets, knives and floats.
- The capital cost required in establishing a single self help group for seaweed culture consisting of 20 members with 45 rafts each (a total of 900 rafts) is INR 6,21,000.

Process of cultivation

Single Rope Floating Raft (SRFR) method developed by CSMCRI is suitable for culturing seaweeds in wide area and greater depth.

↓

A long polypropylene rope of 10 mm diameter is attached to 2 wooden stakes with 2 synthetic fiber anchor cables and kept afloat with synthetic floats. The length of the cable is twice the depth of the sea (3 to 4 m).

↓

Each raft is kept afloat by means of 25-30 floats.

↓

The cultivation rope (1 m long x 6 m diameter polypropylene) is hung with the floating rope. A stone is attached to the lower end of the cultivation rope to keep it in a vertical position.

↓

Generally 10 fragments of Gracilaria edulis are inserted on each rope. The distance between two rafts is kept at 2 m.

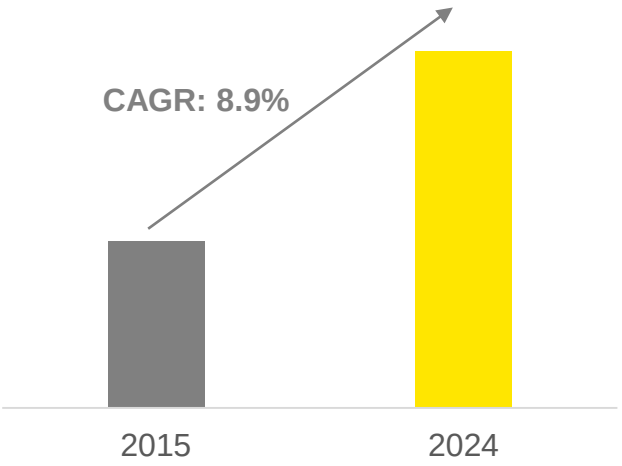
↓

Floating raft technology has been recommended to be used in certain areas in the Gulf of Kutch for deep-water seaweed cultivation

Market Potential

Seaweed demand globally

Global commercial seaweeds market size (US$ billion)



Source: Grand View Research, Inc.

Applications of seaweed in various sectors	
Food	Cosmetics
Medicine	Fertilizers
Animal Feed	Textiles

- Demand for red seaweeds is estimated to grow at the highest rate due to its functional qualities.
- More than 80% of the demand for commercial seaweed in 2015 was from Asia Pacific and the region is forecasted to witness the highest growth of more than 9% during 2015-24.

Seaweed potential in India

- Seaweeds grow abundantly along the Tamil Nadu and Gujarat coasts and around Lakshadweep and Andaman and Nicobar islands. There are also rich seaweed beds around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam, Pulicat and Chilka.
- Out of approximately 700 species of marine algae found in both inter-tidal and deep water regions of the Indian coast, nearly 60 species are commercially important.
- The surveys carried out by CSMCRI, CMFRI and other research organizations have revealed vast seaweed resources along the coastal belts of South India. On the West Coast, especially in the state of Gujarat, abundant seaweed resources are present on the intertidal and sub tidal regions.
- The seaweed industry in India is mainly a cottage industry and is based only on the natural stock of agar-yielding red seaweeds, such as Gelidiella acerosa and Gracilaria edulis, and algin yielding brown seaweeds species such as Sargassum and Tubineria.
- India produces 110-132 tons of dry agar annually utilizing about 880-1100 tons of dry agarophytes. Annual algin production is 360 to 540 tons from 3,600 to 5,400 tons dry alginophytes.

Market Potential

Why Seaweed Farming in India

- Remedy for non-availability of required quantity of seaweeds for various uses
- Provide occupation for the coastal people
- Provide continues supply of raw material for seaweed based industry
- Provide seaweeds of uniform quality for use in industry
- Conserve natural populations of concerned seaweeds
- Seaweed farming is aecofriendly activity
- Major tool to treat coastal pollution in the sea and reduce CO2 in global warming

Single Rope Floating Raft method (Coir Rope & Nylon Rope)

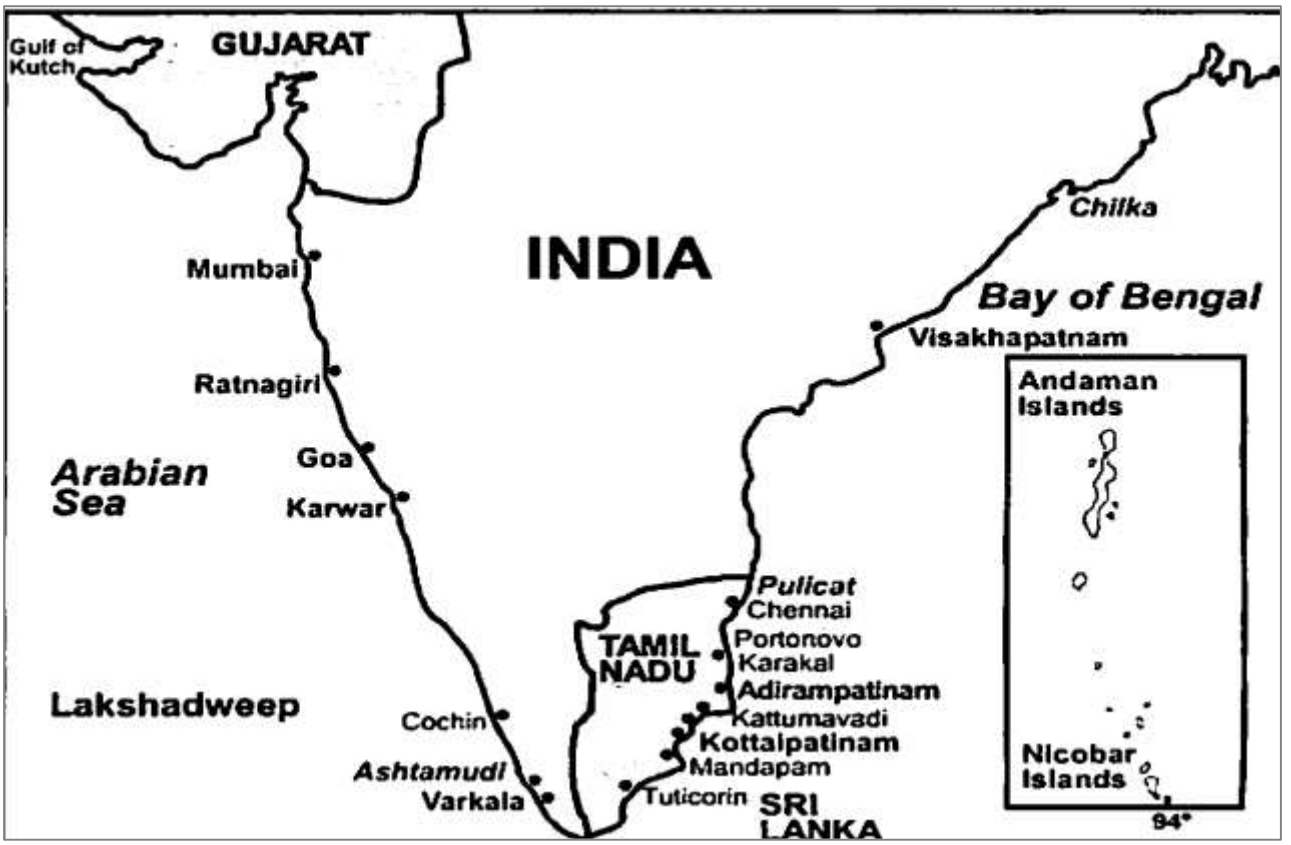
Methods of Seaweed Farming in India

Fixed Bottom long line method (Coir Rope & Nylon Rope)

Integrated Multi Trophic Aquaculture (IMTA) method

Market Potential

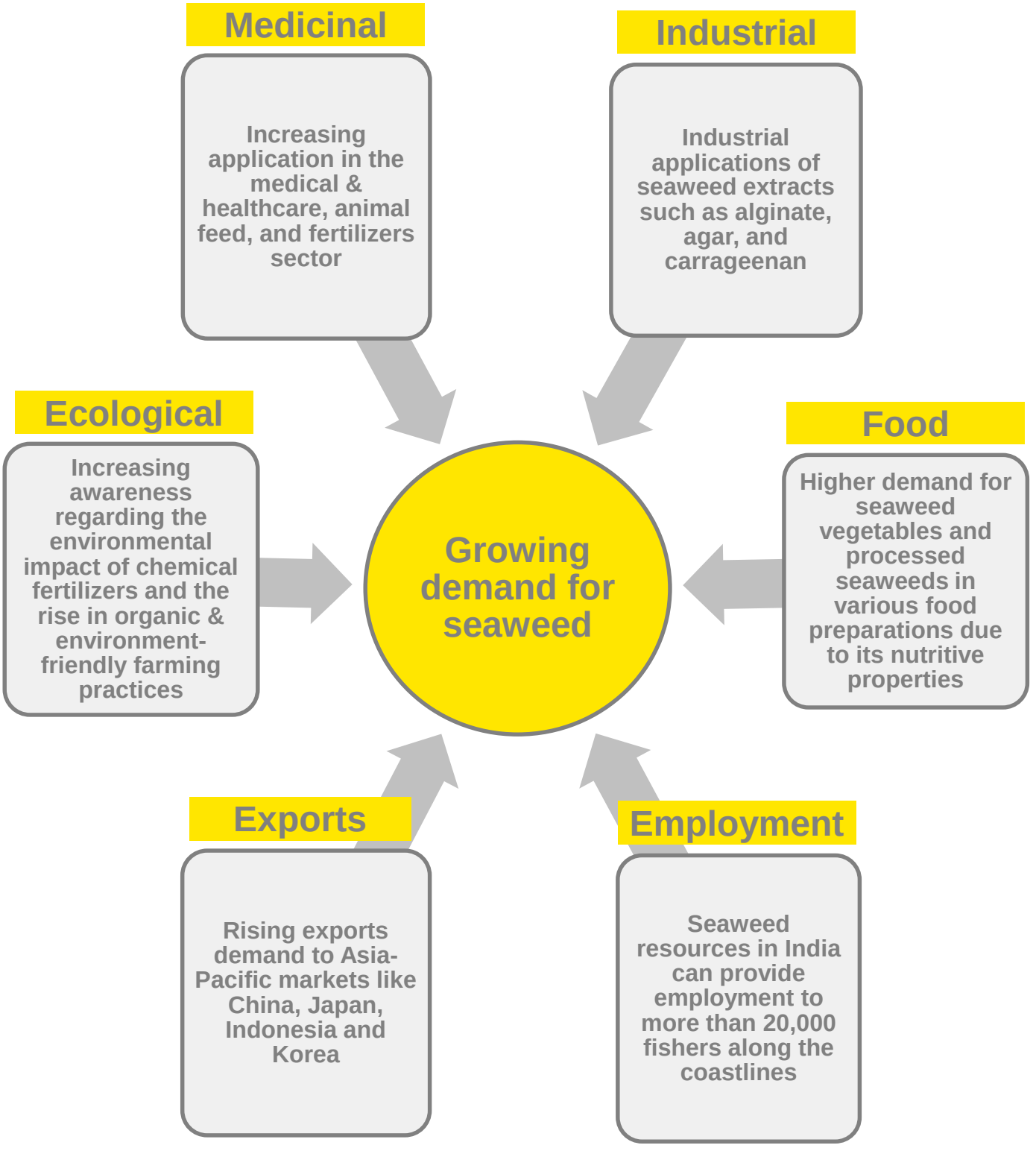
Seaweed areas in India



- India has not taken up seaweed cultivation in the past though it is bestowed with a coastline of more than 17,000 km, embracing 821 species of seaweeds.
- India can grow more than one million tonnes of seaweeds in six states-Gujarat, Tamil Nadu, Kerala, Andhra Pradesh, Maharashtra and Andaman & Nicobar Islands.
- In the global markets each tonne of average quality agar-agar is sold for more than US$2000 (INR120,000) and the country has the potential to generate more than INR200 crore in foreign exchange annually apart from providing additional income and gainful employment to thousands of people on the coastline.
- Central Salt Marine Chemical Research Institute (CSMCRI) and Central Marine Fisheries Research Institute (CMFRI) have developed culture techniques for some of the commercially important seaweed species in India.
- As a result of this effort, a lot of Self Help Groups, Village Youth Groups and NGOs have come forward to promote seaweed cultivation as an alternate livelihood option for the coastal poor.
- Given the huge demand for these resources in the international market and availability of adequate manpower and interest in the country, seaweed cultivation has a very good prospect and it can be developed as a successful cottage or co-operative sector industry.

Growth Drivers

Application of seaweeds in human food, animal feed, pharmaceuticals, agriculture, cosmetics, production of bio-fuel, and wastewater management has been important for the growth of the commercial seaweeds market



Gujarat - Competitive Advantage

Gujarat has the second highest annual seaweed yield in the country

Station No.	Area	Annual yield in tonnes (fresh wt.)
I	Tamil Nadu	22,044
II	**Gujarat**	**20,000**
III	Maharashtra	20,000
IV	Lakshadweep Islands	8,000
V	Goa	2,000
VI	Kerala	1,000
VII	Unexplored areas	27,000
	Total	**100,00**

Source: Food and Agriculture Organization of the United Nations

- **Nascent stage:** Seaweed cultivation is relatively new in Gujarat and provides supplementary activity to existing fishing and its ancillary activities. It can provide a regular and sustainable income source by leveraging local entrepreneurial talent.
- **Start new industries:** Seaweed cultivation in Gujarat can be instrumental to start a set of new industries to manufacture carrageenan, agar, algin products and several bio fertilizer industries.
- **Employment opportunities:** Commercially Kappaphyphycus Alvarezii cultivation is suitable on Gujarat cost that can generate employment in coastal villages. It has the potential to provide income and employment to about 10,000 families in the state.
- **Large coastline:** Around 1,900 areas have been mapped suitable for cultivation along Gujarat coast. Sites along the coast of Junagadh, Porbandar, Kutch, Bhavnagar, Amreli and Jamnagar districts are suitable for seaweed farming.
- **State initiatives:** The State-run Gujarat Livelihood Promotion Company (GLPC) has signed MoU with CSMCRI to promote seaweed cultivation along the state coast.

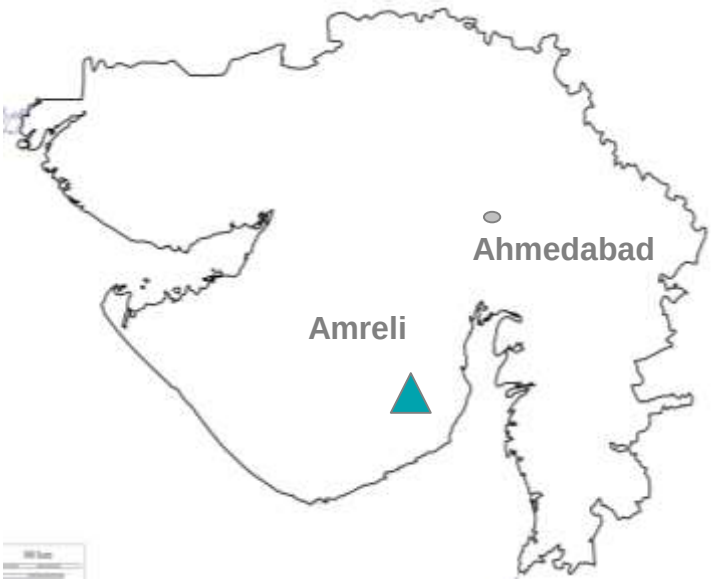
Source:

Project Information

Project at a Glance

Project Name	Development of seaweed culture
Location	Amreli, Gujarat
Area of the district	6760 sq. kms
Focus Sector	Seaweed culture, agro-based industries, fisheries, food processing
Target Audience	Lower income and Self Help Group along the coastline

Project Location– Amreli (Gujarat)



11 Talukas

595 villages

9 Municipalities

Located in north east corner of Saurashtra peninsula in Gujarat, surrounded by Bhavnagar district in east, in north Rajkot district, in west Junagadh district and Arabian Sea in the south.

1. Costal line

The district has a coastal line of about 62 Kms. India's first private sector port and the world's third largest container terminal operating port, Pipavav, is located in the district.

2. Small and Medium Enterprises

More than 5,455 units of SMEs are present in Amreli. It is a base for cement, metallurgical, electrical equipment, ports and ship building industries.

3. Agro-based industries

They are also well developed in the district, while fisheries are coming up in Rajula and Jafrabad talukas.

4. Connectivity

NH8E passes through the district connecting it to Junagadh and Bhavnagar; total rail length is 271 km; and nearest airports are in Bhavnagar, Rajkot and Vadodara.

Project Information

Infrastructure Availability

Logistics & Connectivity

Rail

- The total length of railway lines in the State as on 31st March 2014 was 5,258.49 route kilometres (~9% of India)
- India's first bullet train to run between Mumbai and Ahmedabad by 2023

Road

- Out of the total road length of 79,755 kilometres., the length of surfaced roads was 77,725 kilometres. (97.45%) in 2015
- National Highways – 3,884 kilometre
- State Highways – 18,017 kilometre
- IRI (International Roughness Index) for Gujarat is less than 4 meters/kilometre,

Air

- 9 operational domestic airports
- 1 International airport – Ahmedabad
- 6 new airstrips are being developed in Ankleshwar, Dahej, Palitana, Ambaji, Morbi and Dwarka

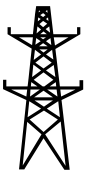
Port

- 46 ports along 1,600 kilometre coastline, including 1 major port at Kandla and 45 minor ports
- Gujarat leads in project clearance in coastal areas with a success rate of 93%

Utilities

Water

- An extensive water grid network of 75,000 kilometre for irrigation and drinking
- Currently, the Gujarat Water Supply and Sewerage Board (GWSSB) is providing water to 490 villages in 22 districts



Power

- 2nd largest state in terms of installed power capacity after Maharashtra
- Power generation capacity : 29,431.13 MW
- Per capita power consumption was 1,839 units in 2014-15 against the national average of 1010 units

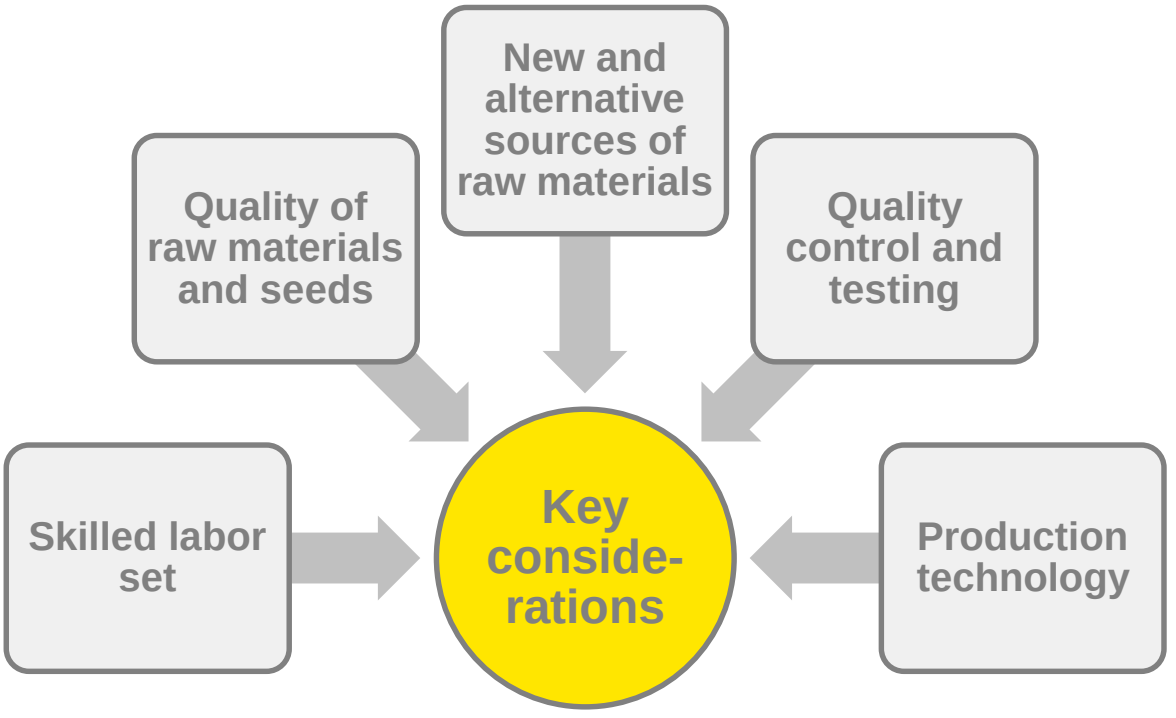
Project Information

Raw materials/ equipment required for seaweed cultivation

Bamboo rafts	Five cornered anchors
3-mm nylon rope (1.25 mm thickness / 4.5 m length / 20 lengths)	20 ropes for seeding 400 cuttings
36 m of 6-mm thickness nylon rope (for the manufacturing of the raft)	3.5 x 3.5-m nets for reducing grazing by fish
28 m of 2-mm thickness ropes for tying the nets to raft bottoms	1 kg nylon rope of 5.4 m length pieces for tying together a batch of 10 rafts.
Anchor ropes 17 M of 10mm thickness. 1 length for a batch of 10 rafts	65 kg of seed materials (including 5 kg-loss in handling)
Mats/ladders/baskets/ knives, etc.	Floats

Key Considerations

- Seaweed mariculture has now become a potential employment generating and income earning activity, which is practiced by more than thousand members of Self Help Groups (SHG) with the support of private investments, industries, financial institutions like NABARD (through scheduled commercial banks), National Fisheries Development Board (NFDB) and NGOs led by Aquaculture Foundation of India.



Project Information

Key Manufacturer/ Exporters / Wholesale Suppliers in India

- Sri Lingeshwar Andavar (Self Help Group)
- Aquagri Processing (p) Ltd.
- Pssgt Export (p) Ltd.
- Parshv Chem Industries
- Mars Petcare Company (p) Ltd.
- Suboneyo Chemicals Pharmaceuticals (p) Ltd.
- Redox Industries Limited
- Darshan Bio Tech (p) Ltd.
- Aushadh Agri Science (p) Ltd.
- Sikko Industries Ltd.
- Migrow Agro Products (p) Ltd.
- Blue Clouds International Ltd.
- United Agro Chemicals (p) Ltd.
- Pruthvidhara Crop Care (p) Ltd.
- Gujarat Livelihood Promotion Company (GLPC)

Potential Collaboration Opportunities

The potential collaboration would be between the investor and a research institute supported by various self help groups and fishing communities present in the coastal region of Gujarat as important human resources.

- The research institutions and NGOs for collaborations :
  - MarineAlgal Research Center, CSMCRI
  - Central Marine Fisheries Research Institute (CMFRI),
  - Central Salt and Marine Chemicals Research Institute (CSMCRI)
  - Aquaculture Foundation of India

Economics of seaweed farming (raft culture)

The Kudumbam (family) model of cultivation (KMC) is a farming system initially introduced by PepsiCo and then widely adopted for Kappaphycus culture in Tamil Nadu. Cultivation is organized by members of a SHG who normally belong to the same family but may include other members from the same community. Collectively, the group prepares the rafts, seeds the lines, provides maintenance and harvests on the due date. Basic infrastructure is facilitated by the company, the harvest is purchased on a buyback basis and payments are effected by the company through the bank accounts of the SHG.

S. No	Item	Quantity
1	Expenditure for a single raft	INR 690
2	Rafts required for a single person	45
3	Members in a SHG	20
4	Rafts required for a single group of SHG (45X20)	900
5	Cost of 45 rafts per farmer	INR 31,050
6	Total expenditure for 900 rafts (900X690)	INR 6,21,000
7	Subsidy at 50% for 45 rafts per farmer	INR 15,525
8	Bank loan (50%)	INR 15,525
9	Production from 45 rafts in 45 days (kg fresh weight)	300
10	Seed material allocated to the next stocking cycle (kg)	60
11	Production of dried weed	24 kg
12	Interest on bank loan at 11%	INR 1,708
13	Insurance	INR 380
14	Returns (24 kg @ 14.00 x 270 days)	INR 90,720
15	Net returns for the first year	INR 73,107

Source: Central Marine Fisheries Research Institute

Approvals / Incentives

Blue Revolution 2020, Government of India

Blue Revolution 2020 has identified development of Seaweed Cultivation as a key area for formulation and implementation of such projects with the objective of integrated development and management of fisheries in India. Financial assistance of INR1000 per raft for setting up seaweed culture (50% centeral + 50% state), would be provided under this scheme.

Seaweed Culture Incentives from Government of Gujarat

- In year the 2012-13 Sea Weed Culture Scheme approved by Agri, & Co.Op. Department as new Item with provision of Rs.5.00 Lakhs
- As per scheme, Sea Weed culture cultivation will be carried out by women Self Help Group/ Sakhimandal.
- Maximum 45 raft will be given to the one Self Help Group/ Sakhimandal.
- Unit cost of Raft INR1000 and 100% subsidy will be given to beneficiaries.
- Sea weed culture training will be given by Gujarat Livelihood Promotion Company (GLPC)
- Training Programme for 10 Days, and stipend of INR100/- per day given to the beneficiaries.
- In the new condition of the scheme the unit cost of tube net is INR1340 and 100% subsidy will be given to beneficiaries.

Fisheries Incentives from Government of Gujarat

- Establishment of fresh water prawn seed hatchery.
- Fish culture through FFDA's
- Fish seed Production and rearing by employing local youths
- Reservoir Fisheries Development
- Leasing out the fishing rights of reservoirs
- Fish marketing subsidy
- Distribution of kerosene to fishing vessels on educed rates
- Group insurance scheme and housing schemes for all active fishermen
- Strengthening of Fisheries Co -operatives
- Fisheries Resource Assessment.

Approvals / Incentives

Incentives from Agri business policy 2016, GoG.

GoG has prepared a Agri business policy 2016 for strengthening agriculture-related infrastructure and promoting food processing industry. Discussed below are the various subsidies and incentives established for promoting the industry.

Subsidy		
Projects	**Admissible Subsidy**	**Maximum Limit (INR crore)**
New project in agro food processing	25%	0.5
Cold chain, food e-radiation, packaging houses and food parks	25%	5
Primary processing or collection centre of farm produces at village level	25%	2.5
Capital investment subsidy for reefer vehicles	25%	0.5
National Horticulture Board provides capital subsidy for construction, expansion and modernization of cold storages	40%	• INR6,000/MT (normal cold storages) • INR7,000/MT and INR8,000/MT (specialized cold storages) • INR32,000/MT for CA storages

Commissioner of Fisheries

https://cof.gujarat.gov.in/contact-us.htm

Department of Animal Husbandry, Dairying & Fisheries

http://dahd.nic.in/

Gujarat Agro Industries Corporation Ltd.

https://gaic.gujarat.gov.in/index-guj.htm

Office of the Commissioner of Fisheries, Gujarat

https://cof.gujarat.gov.in/contact-us.htm

Industrial Extension Bureau

www.indextb.com

Gujarat Industrial Development Corporation

www.gidc.gov.in

Office of Industries Commissioner

www.ic.gujarat.gov.in

This project profile is based on preliminary study to facilitate prospective entrepreneurs to assess a prima facie scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.

For further details:

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