Assessing aquaculture feasibility: technical, economic and social factors

Working paper 1

Information paper 6

Feasibility assessment to improve aquaculture development

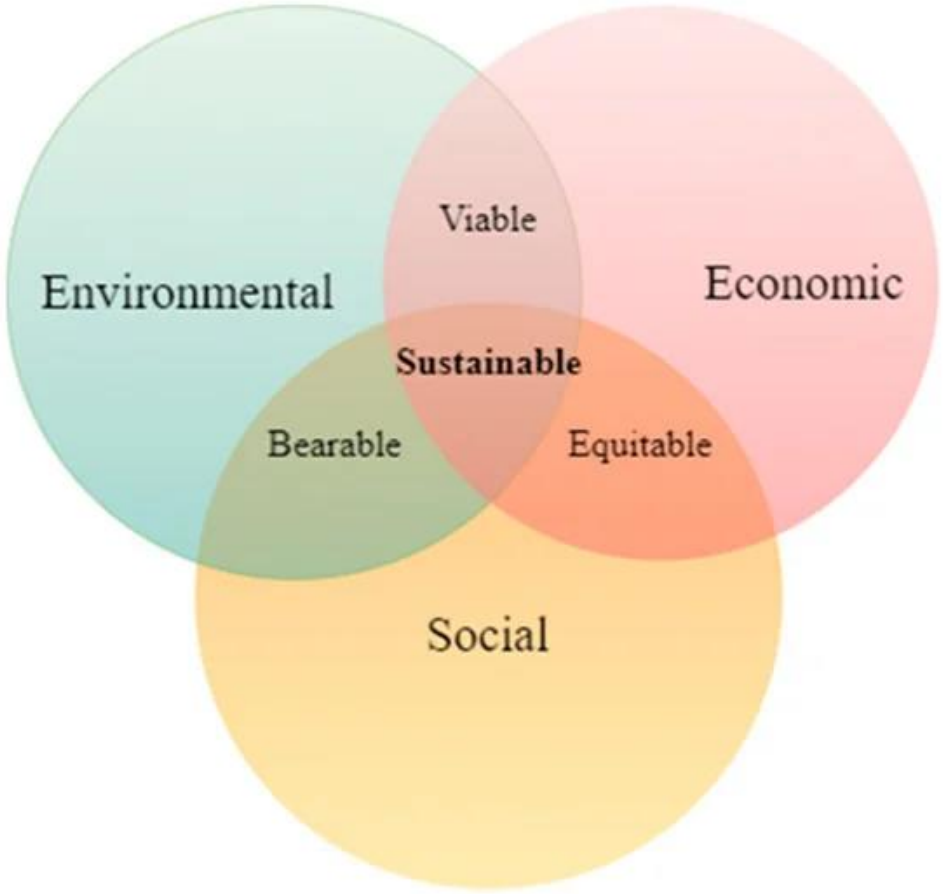
Pacific Community
Communauté du Pacifique

- Increase chances of success of a project
- Ensure that investment is justified
- Help to choose the best farming conditions

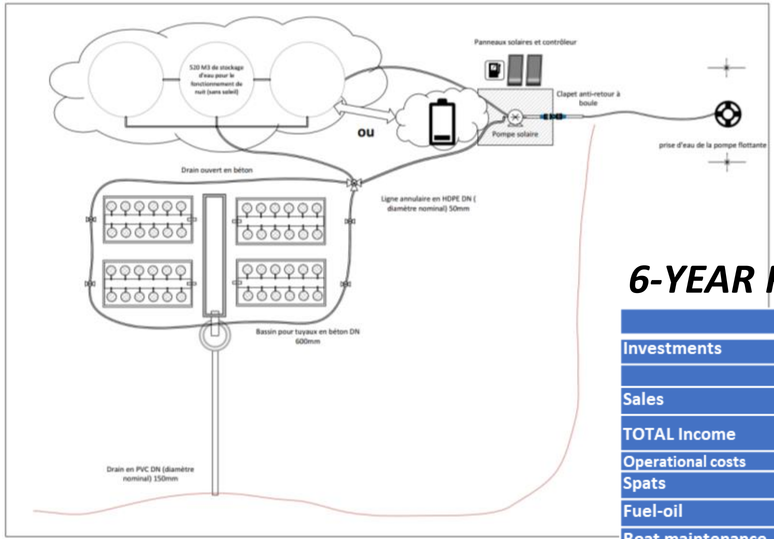
Technical factors include:
Environmental conditions, water quality, infrastruture requirements, choice of species…

Economic factors include:
Investment needs, costs and revenues projections, financial risks, pricing and production strategy…

Social factors include:
Impact on local communities, acceptance, cultural considerations, gender and social inclusion opportunities, capacity building priorisation, well-being of populations…



Case study #1: Rock Oyster farming in New Caledonia



6-YEAR FORECAST

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Investments	-17,539,115	-	-	-	-1,574,184	-1,009,376	-2,416,342
Sales		0	0	6,750,000	8,648,438	8,864,648	11,357,831
TOTAL Income		0	0	6,750,000	8,648,438	8,864,648	11,357,831
Operational costs							
Spats		0	600,000	600,000	600,000	600,000	600,000
Fuel-oil		55,500	55,500	111,000	138,750	138,750	173,438
Boat maintenance		25,000	25,000	50,000	62,500	62,500	78,125
Delivery (fuel car)		0	0	25,900	25,900	25,900	25,900
Packaging		0	0	180,000	225,000	225,000	281,250
Salary		0	0	0	0	0	0
Fixed costs							
Land rent concession		120,000	120,000	120,000	120,000	120,000	120,000
Gear maintenance		200,000	200,000	200,000	200,000	200,000	200,000
Bank loan charges		255,487	255,487	255,487	255,487	255,487	255,487
Amortisations		3,088,009	3,268,101	3,357,823	3,672,660	3,874,535	1,419,794
TOTAL Costs		3,743,996	4,524,088	4,900,210	5,300,297	5,502,172	3,153,994
Profit before tax		-3,743,996	-4,524,088	1,849,790	3,348,140	3,362,476	8,203,837
Tax		0	0	0	0	0	2,548,848
Profit after tax		-3,743,996	-4,524,088	1,849,790	3,348,140	3,362,476	5,654,989
Net op. cash flow		-655,987	-1,255,987	5,207,613	6,705,963	6,720,299	6,074,803
Discounted cash flow	-17,539,115,	-639,988	-1,195,467	4,835,786	6,075,272	5,939,765	5,238,284
Free Cash flow		693,083	-3,384,184	3,531,263	4,218,878	4,999,897	3,430,703
Cumul free cash flow		693,083	-2,691,101	840,162	5,059,040	10,058,937	13,489,640

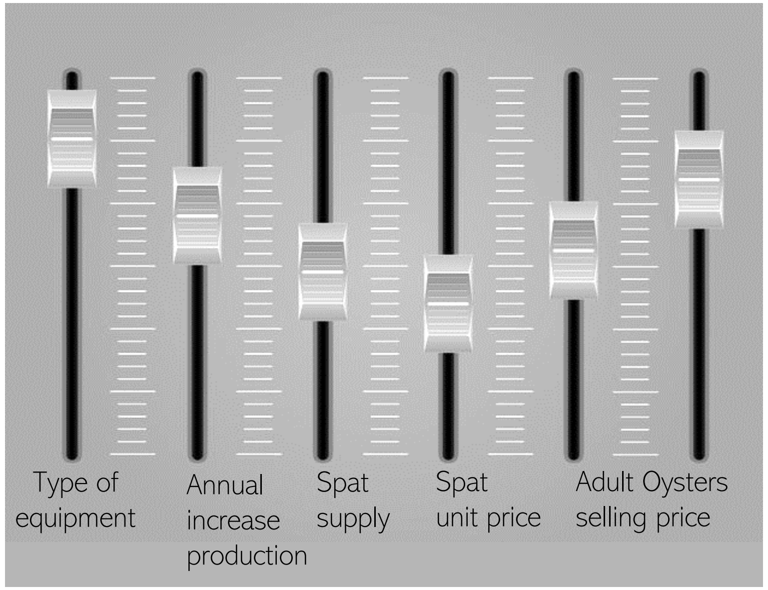
NPV with 2.50% discount rate	459,891
IRR	3.1%

INVESTMENT PLAN

Investment needs						
Equipment	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
2 tanks	8,377,657 F	0 F	0 F	0 F	0 F	0 F
Collectors	0 F	448,611 F	448,611 F	1,009,376 F	1,009,376 F	1,710,331 F
Growing baskets	312,388 F	451,847 F	0 F	564,809 F	0 F	706,011 F
Barge	6,000,000 F	0 F	0 F	0 F	0 F	0 F
dock processing	1,500,000 F	0 F	0 F	0 F	0 F	0 F
Total needs	16,190,045 F	900,458 F	448,611 F	1,574,184 F	1,009,376 F	2,416,342 F

Investment of 17,539,115 F (Y1+Y2+Y3), funded by:	
Bank loan 70 %	12,277,380 F
Subsidy 30%	5,261,734 F

Case study #1 : Economic modelling for oyster farming



Economic indicators

Cashflow

Annual net profit

IRR > 2%

NPV > 0

Profitable scenario over a 6-year period of activity:

- Equipment: 2 tanks
- Increase of production: +25% every 2 years
- At least 90% spats supplied by external hatchery – 10% collected
- Spat price < $0.10 / Unit
- Adult Oysters selling price: +2.5% every year

→ Compromise found on the farm size

→ Most sustainable option for spat supply

→ Price constraints for spats

→ Alternatives to reduce operating costs

Benefits from this feasibility assessment

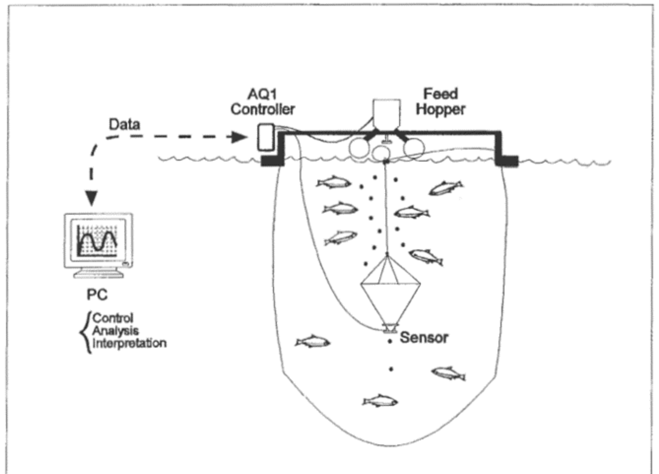
- Economic tool to improve planification, communication and negotiation
- Allows identification of potential future problems
- For the farmer: adjustment of farming strategies, communication tool
- For authorities: help for decision-making

Case study #2: Finfish farming in Fiji

- Sea cage design and operation
  - USD $5000 10m Diameter Cage (USD $2000 4m x 4m Square)
  - Constructed Onsite
  - Weather Resistance
  - Knotless Net - Predator Net
  - Grid Mooring
  - Bathing - Net Change - Grading – Harvest

Credit: AKVA AU

- Technology for fish performance
  - Automatic Feeding
  - Automatic' Grading (Fish Pump)
  - Net Cleaning
  - Ocean Transfer Size Increases (RAS)
  - Vaccination (in RAS)



Credit: AQ1 Systems Tas AU

Figure 1. Schematic showing the configuration of the Adaptive feeding system in a 65m circumference polar circle.

Case study #2: Comparison of economic viability

Pacific Community
Communauté du Pacifique

Farm sizing

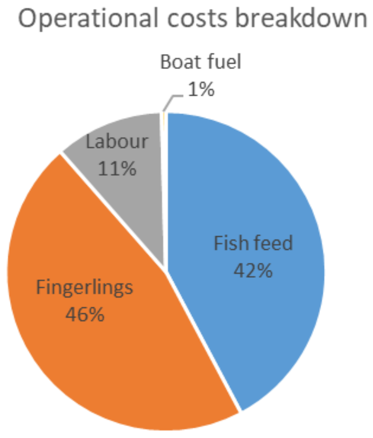
9 cages de 64 m^2
Fish Density per cage: 10 Kg/ m^3
→ Production per cage, one cycle = 640 Kg

CAPEX for a farm

Equipment need for 9 cages	**$ AUD**
HDPE Fish cage float pipes and handrails	22,500
Cage net, predator net, bird net	16,500
Mooring system grid components	4,800
HDPE pipe welder, extrusion welder	3,000
Panga boat	13,400
Feed storage room and equipment	4,000
TOTAL CAPEX $	**64,200**

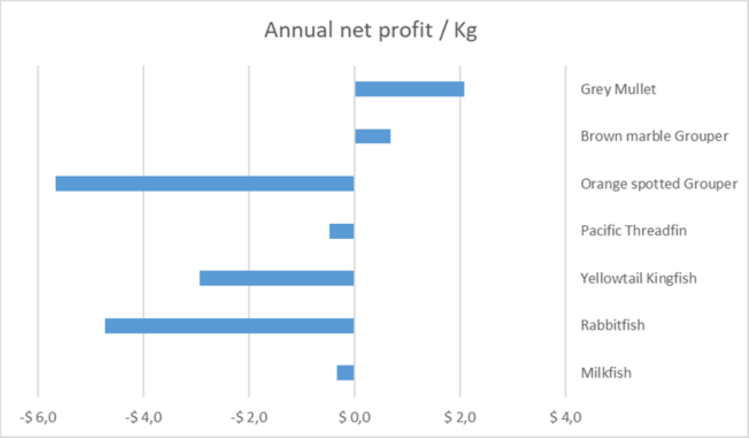
Operationnal costs for the 7 species – for one cage - one production cycle

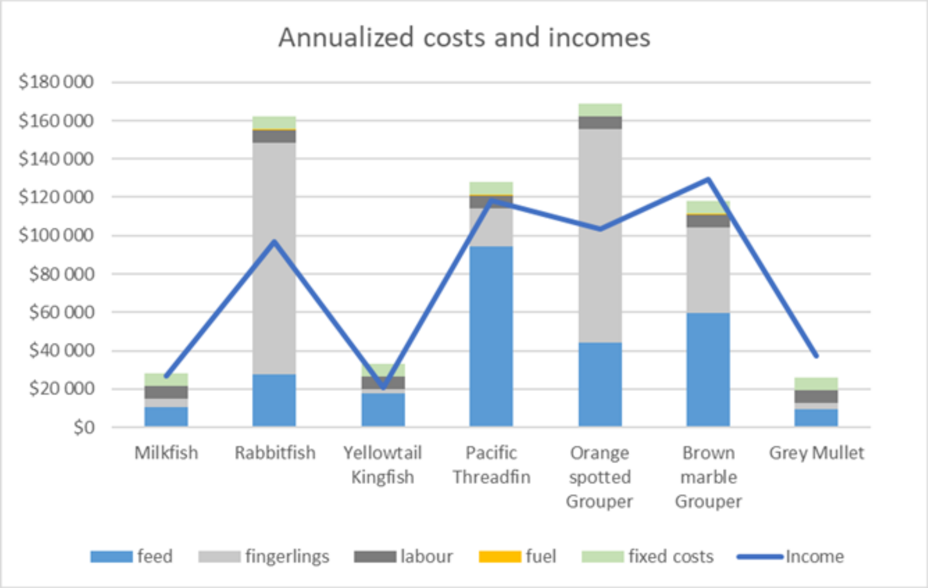
$ AUD - 1 cage, 1 cycle	**Milkfish**	**Rabbitfish**	**Yellowtail Kingfish**	**Pacific Threadfin**	**Orange spotted Grouper**	**Brown marble Grouper**	**Grey Mullet**
feed	1,275	1,270	2,675	3,060	2,440	2,215	1,105
Fingerlings - purchase	255	5,075	320	425	5,865	1,565	300
Fingerlings - freight/packaging	265	535	35	220	335	90	135
Labour – feeding (4x /day)	465	180	590	125	215	145	465
Labour (grading, collecting)	110	45	140	30	50	35	110
Labour maintenance	210	80	265	55	95	65	210
Fuel boat	30	10	40	10	15	10	30
TOTAL Operational costs	**2,610**	**7,195**	**4,065**	**3,925**	**9,015**	**4,125**	**2,355**
TOTAL costs per KG of fish	**$4 /Kg**	**$11 /Kg**	**$6 /Kg**	**$6 /Kg**	**$14 /Kg**	**$6 /Kg**	**$4 /Kg**



Case study #2: One-year production forecast

One year activity 9 cages x 64m3	Milkfish	Rabbitfish	Yellowtail Kingfish	Pacific Threadfin	Orange spotted Grouper	Brown marble Grouper	Grey Mullet
Annual production (Kg)	5,317	13,824	4,189	19,749	11,520	17,280	5,317
Nb fish produced	10,634	55,296	1,047	32,914	28,800	11,520	5,317
Selling price (AU$/Kg)	5	7	5	6	9	8	7
Revenue (AU$)	26,585	96,770	20,945	118,490	103,680	129,600	37,220
Variable costs (AU$)	21,690	155,355	26,590	121,220	162,335	111,265	19,565
Fixed costs (AU$)	6,620	6,620	6,620	6,620	6,620	6,620	6,620
Net Income (AU$)	**-1,725**	**-65,205**	**-12,265**	**-9,350**	**-65,275**	**11,715**	**11,035**
Net income/kg (AU$/kg Fish)	**0**	**-5**	**-3**	**0**	**-6**	**1**	**2**

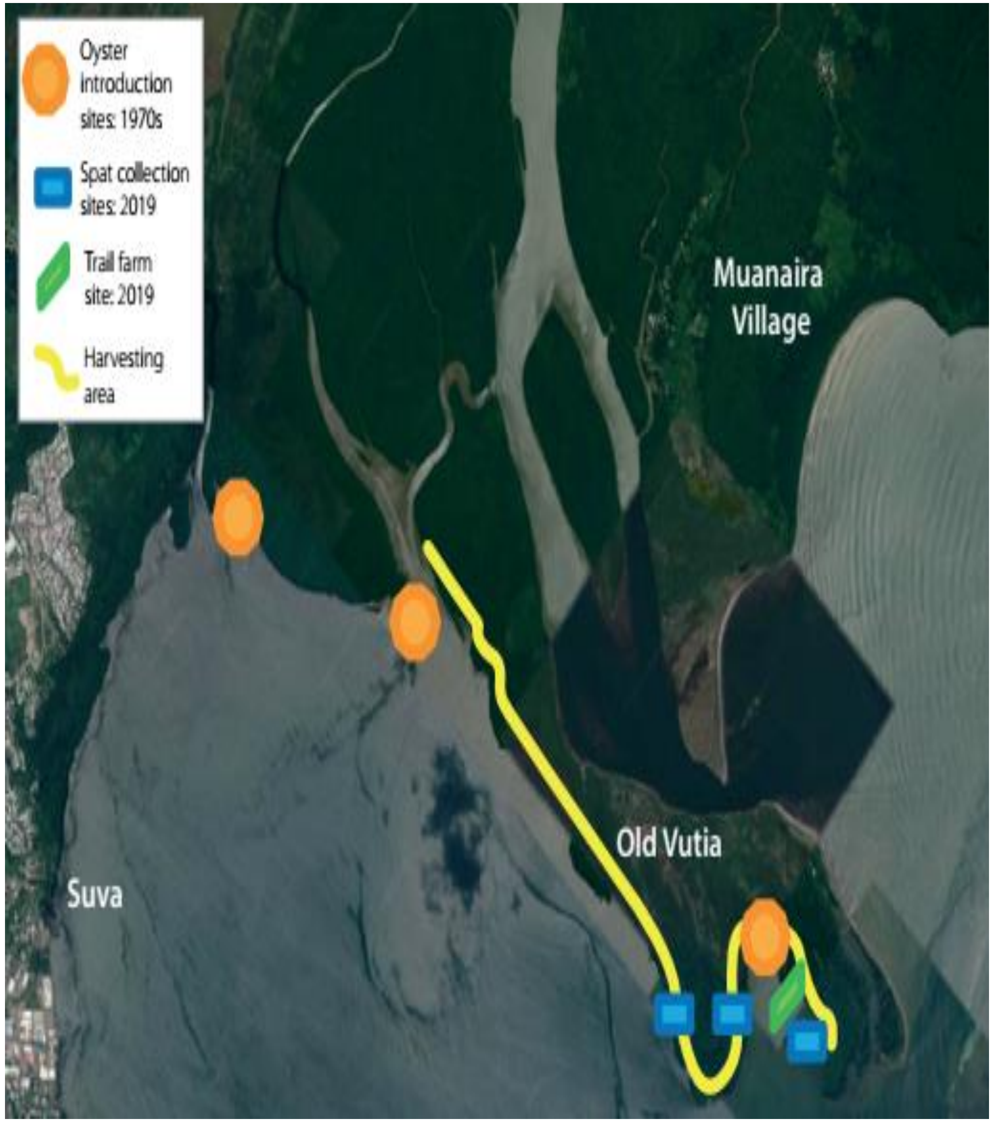




- Feed and fingerlings are the main operationnal expenses
- Different farming strategies can reduce operationnal costs (e.g. automation, hatcheries or fishing vs. purchase of fingerlings…)
- Under studied farming conditions, most profitable species are Mullet, Brown Marble grouper and Milkfish

Case study #3

Development of Mangrove Oyster Aquaculture in Fiji



Socio-economic characterizations of mangrove oyster aquaculture in Fiji

- Joint venture started by MoFF, SPC and the Womens Group of Muanira, Vutia in 2018.
- Spat collection and grow-out in baskets
- Muanaira village - Rewa Province, Fiji
- Wild harvest of spat to aquaculture (Crassostrea sp.) - Mapping
- Mostly women
- Secondary income source
- Constraints: transport

Pacific Community
Communauté du Pacifique

Value-chain analysis

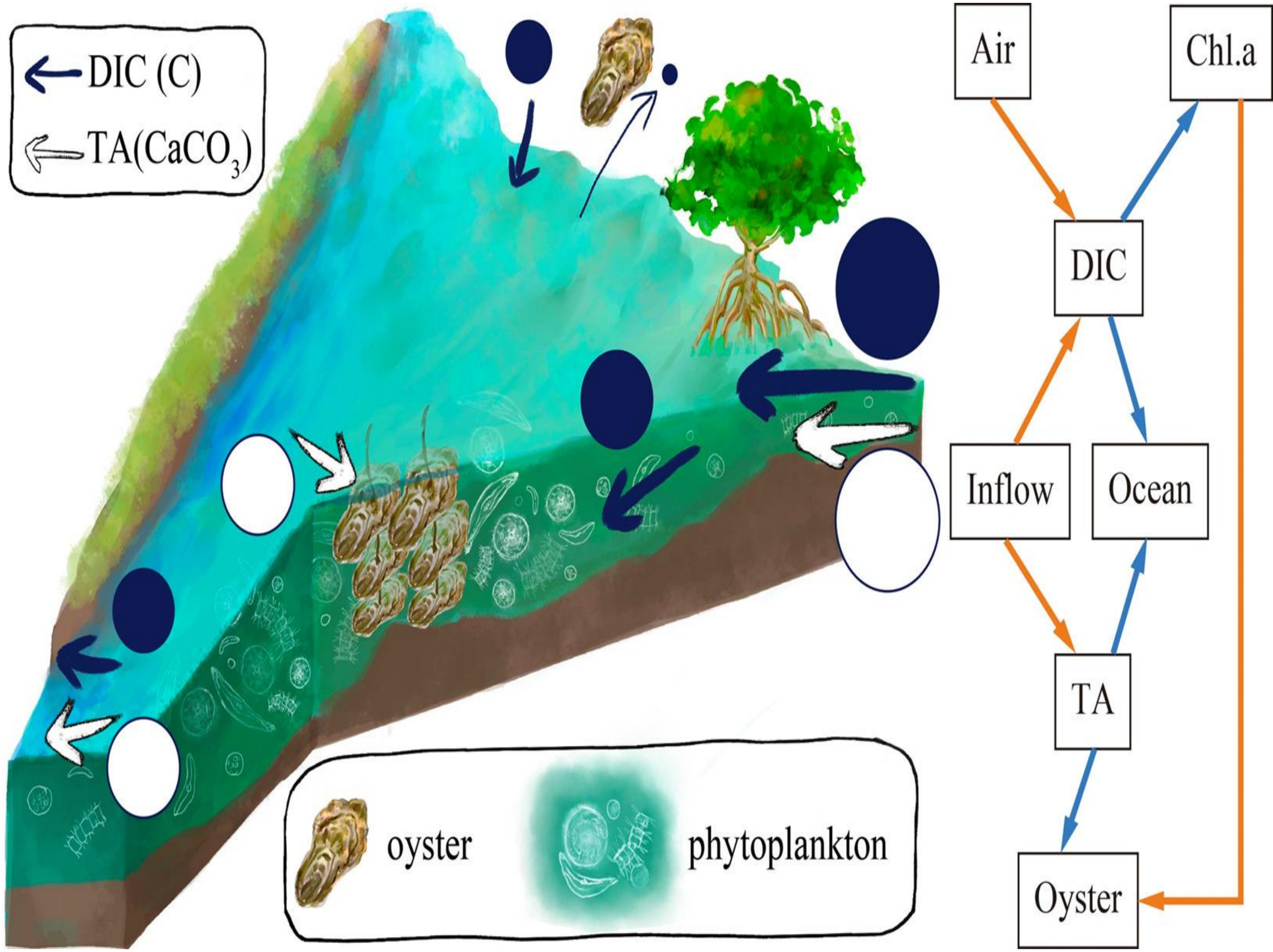
- Mostly sold as live ($20/doz) to high end restaurants. Some cooked and shelled – low value, sold to family/friends and some markets
- Fresh – higher value
- Interest from some restaurants
- Quality assurance and food safety issues

What has happened since

- Expansion to sites in the western Division.
- Research and trails on depuration process.
- Highly positive growth rates of oysters researched and published (*Vunakon et al. 2023, Growth rate of farmed Mangrove oysters (Magallana bilineata) at Laucala Bay, Suva, Fiji, Journal of Aquaculture Science, Vol 8 (2): 74-82. DOI: https://doi.org/10.20473/joas.v8i2.48697*

Why Mangrove oysters

- Support Blue carbon project.
- Improvement of livelihood.
- Economic returns.
- Food diversification.



Next Phase

- Research and hatchery production of mangrove oysters. (Juveniles)
- Expansion of sites, through feasibility study.
- Securing quality assurance and food safety accreditation.

Feasibility assessment to improve aquaculture development

- Multidisciplinary approach in feasibility assessments helps to increase success of aquaculture projects
- Tools and consultative processes exist to include economic and social factors
- data collection based on discussions with key stakeholders
- SPC can support PICTs through the provision of
  - documentation and advice on how to conduct feasibility assessments,
  - data collection methods,
  - templates for socioeconomic surveys,
  - sampling protocols,
  - trainings,
  - tailored economic modelling tools.

Feasibility assessment to improve aquaculture development

Members are invited to:

- Note the benefit of feasibility assessments in the context of aquaculture development in PICTs.
- Note the available tools for assessment of technical, economic, and social factors for success in aquaculture projects.
- Exchange experiences and considerations on how to improve capacity to assess the feasibility of aquaculture proposals.
- Identify priority areas and needs for further actions to increase capacity for aquaculture feasibility assessment among PICTs.