Ōpōtiki Harbour Transformation Project, Workstream 15: Supporting Innovation

Summary Report of Opportunity Assessment and Expert Review Findings

Introduction

This document sets out an overview of key findings of work undertaken for Workstream 15 (WS15) Supporting Innovation, of the Ōpōtiki Harbour Transformation Project.

The purpose of WS15 is to develop a plan to create and identify innovation opportunities that will generate wider value from, and improve economic feasibility of, the Ōpōtiki Harbour Development and Marine Farm projects. WS15 particularly focuses on new science and technology-based economic innovation opportunities that will generate increased use of the Ōpōtiki Harbour and facilities. This report summarises findings from the 'Opportunity Assessment' and 'Review' tasks in the project; focussing on recommendations as to specific initiatives for future development.

Two distinct areas of focus were covered in the work:

1. New open ocean shellfish opportunities, leveraging the existing water space (led by Chris Batstone, a resource economist and aquaculture industry specialist).
2. Macro algae (seaweed) related opportunities, particularly aquaculture and bio-actives (led by Dr Ralf Schlothauer, chemical engineer, ex-CTO at Comvita and currently Chief Innovation office at NZ Manuka).

Their full reports have been appended, the purpose of this summary is to outline key findings from the two reports and recommend next steps from an overall perspective the development of a business case.

Initial Opportunity Assessment One: Open Ocean Aquaculture

Work in this task was led by Chris Batstone, and focussed on assessing opportunities for new open ocean shellfish aquaculture in the existing Eastern Sea Farms consented space. Specifically, it examined three species identified by stakeholders as of particular interest:

1. Pacific oysters or *Tio*
2. Flat oysters (*Tio para*)
3. Geoduck (*Hohehoe*).

The opportunity assessment included review of evidence and key expert interviews. Individuals consulted were:

- Kevin Heasman (Cawthron Institute)
- Professor Andrew Jess (University of Auckland)
- Gary Hooper (Aquaculture New Zealand)
- Jim Barrett (Stewart Island Oysters).

Key findings are:

1. Pacific oysters have immediate, realistic potential for commercialisation within the Whakatohea space. This is because:
    a. The physical infrastructure is ready or accessible
    b. The natural environment is proven conducive
    c. There are substantial and growing markets
    d. Indicative commercial modelling shows realistic and positive case for investors
    e. The key risk factor – disease – are manageable. Innovation and good practice in biosecurity management is required for successful pacific oyster harvest. Existing expertise in aquaculture in Whakatohea Mussels Ltd, plus relationships with Cawthron Institute, University of Waikato and other research partners provide significant capability to address this need.
    f. The key next step is to deliver a commercial proof of concept and detailed feasibility study to an investor ready stage. This should be achievable relatively quickly and with existing knowledge.
2. Flat oysters are also a credible opportunity to generate harbour usage through aquaculture in the marine farm. However, they are a longer-term proposition because they are not proven in Eastern Bay of Plenty waters (in contrast to Pacific Oysters).
    a. The key next step is testing/proving growth flat oysters in the conditions of the Whakatohea marine farm. Once this is achieved, all the advantages outlined for Pacific oysters are also true for 'Flats' (points a-d above). This can be progressed in parallel with the Pacific oysters as there is significant potential for shared resources and infrastructure should the feasibility be demonstrated.
3. Geoduck, at this stage, is a long term and high risk/high potential return opportunity. This is because open ocean production is at very early stages and market opportunities less well known.
    a. Research and development is required is to develop commercially viable open ocean systems.
    b. The key next step is to support Cawthron's current research that is exploring this area and potentially work with the team to secure additional research funding.
4. Other species of interest have been suggested as of potential value to the marine space, scallops and crayfish.
    a. These have been suggested by stakeholders outside the region. If they are of interest, then key next step would be to commission an opportunity assessment similar to this one.

Initial Opportunity Assessment Two: Algal Aquaculture and Bioactives

Work in this task was led by Dr Ralf Schlothauer, and focussed on opportunities around marine algae or seaweed; particularly:

1. Aquaculture (that is growing and harvesting seaweed);
2. Biotech (that is, processing, or extraction/synthesising compounds, from seaweed.

The opportunity assessment was based on a range of sources:

1. Desk research and review of secondary sources;
2. A survey of the regional algal population led by Professor Chris Battershill, providing an initial empirical database of species and locations;
3. Two one day workshops with experts relating to seaweed aquaculture and biotechnologies;
    a. Science/research: Cawthron Institute, University of Waikato, James Cook University (QLD Australia), Victoria University (Ferrier Institute), Scion, University of Canterbury
    b. Commercial/stakeholder: Quayside Holdings, NZ Manuka Group, Agrisea, MBD Energy, Comvita, Manaaki Te Awanui, Bay of Plenty Regional Council
4. A site visit to MBD Energy and James Cook University, a leading algal research and commercial operation in North Queensland, Australia;
5. A programme of three summer student projects funded by Priority One over December 2016/2017 (the Summer Marine Innovation Lab).

Through the conduct of this work it became clear that the distinction between 'aquaculture' and 'biotech' is not always helpful; for example for many biotech products there is a need for large amounts of seaweed, which may only be delivered by aquaculture (either growing off shore or onshore). The opportunities were therefore assessed by grouping them into a portfolio of value tiers; ranging from low risk / margin to high risk / high margin.

1. Biochar. This involves burning algae to make a charcoal like substance that is useful in soils. This is particularly an option where there are high quantities of beach cast waste algae. The technology to do this is proven and available; and the Bay of Plenty Regional Council already spends money on clean-up of algae (marine and freshwater). The key next step is development of detailed feasibility study using the significant existing information.
    a. This is more relevant to Tauranga Harbour and Rotorua Lakes as the Eastern Bay of Plenty has cleaner water and no major problem macro algal blooms. There may however be potential for processing facilities around Opotiki Harbour. Also, it may be one element of an overall package of activity that delivers commercial viability.
2. Bio-stimulants for soil and plant health. There are already companies in NZ using seaweed as a basis for soil and animal health products (e.g. Agrisea, NZ Manuka). Currently these companies are severely restricted by lack of available raw material as no harvest or farming of the desired algae is permitted in NZ.
3. Pet and stock feed. There are number of companies internationally who have developed stock feed supplements using seaweed. These are higher value applications than for soil and plant, but also have higher barriers in that any claims to benefit would need to be proven. Again however, the technology to do this largely exists.

4. Human food and nutraceuticals. Humans have been using seaweed as a food product and/or additive in many countries. As an example, sea lettuce flakes imported from China and France currently command $9 for 10gms or $900 a kilo in NZ organics stores. As for the other areas, much of the technology and know-how for production of seaweed for humans exist.

5. Bioactive extracts and biopolymers. The highest value, and highest risk/cost opportunities from seaweeds are in use of bioactive compounds within them. These can deliver benefits ranging from products like agar, to plant sprays (e.g. anti-PSA treatments), to anti-inflammatories, to anti-cancer treatments. Progress in these areas requires new scientific knowledge – therefore the potential for value capture is high. However, commercialisation of such products is massively expensive and risky in early stages and significant national and international partnerships required.

For these options, there are essentially two options to provide the biomass necessary to support commercial production.

1. Develop open ocean aquaculture of target species in the Eastern Sea Farms space. This would mean growing desired species, potentially through a partnership with an existing NZ company as customer for the product. Opotiki Harbour would be uniquely positioned to service this, and given that this is likely to be the only consented space for some time, the option for aquaculture of seaweed is unique to Opotiki.

2. Onshore using fast growing species (Sea Lettuce or Ulva). This would mean construction of a High Rate Algal Pond (HRAP) system on shore, for growth / harvesting. Sea Lettuce is proposed as the initial target because it grows easily and quickly, and the commercial production is well proven internationally. Initial analysis suggests Opotiki provides a particularly attractive site for commercial scale HRAP systems, either around the Harbour, or Waiotahi Estuary. Other Bay of Plenty opportunities lie in Kaituna estuary and Rotorua Lakes.

    a. On shore systems appeal as more commercially feasible than offshore. This is due to reduced barriers e.g. regulation, less cost and risk (the systems are known, proven and can be applied 'off the shelf') and ability to control quality and quantity of product. Once a facility is established with one species, there would be potential to move to other species. Given the state of technology it should be feasible to produce a detailed feasibility study for investment.

        i. On shore systems further provide the potential for sequestration of nutrients thereby improving water quality as well as creating a biomass with commercial value.

    b. Off shore systems may well be better served for seaweed based consumer products (e.g. for human health where 'natural' attributes can help command premiums) or where compounds with valuable attributes naturally occur (therefore providing supply for bio-actives or pharmaceutical applications). Enough is known about these species to provide a detailed feasibility study that would inform decisions about future investment.

This portfolio of opportunities is mutually enabling; it allows for both relatively 'simple', shorter term opportunities that would in turn help build the capability, resources, and relationships that can progress higher value, riskier opportunities.

A key conclusion is that much of the technology to get started on seaweed initiatives already exists globally and is in large scale commercial use by companies like MBD Energy in Australia and Olmix in France. New Zealand is a long way behind these other countries and there is significant opportunity to both rapidly accelerate and radically de-risk developments through international partnerships. These would also facilitate access to IP. Attempting to start from scratch and/or undertake these developments in isolation is likely to be expensive and slow.

Conclusions and Recommendations

The two opportunity assessments have demonstrated there are significant, credible innovation related opportunities to grow commercial activity of relevance to the proposed Opotiki Harbour development. In particular, it is clear a number of these opportunities have little 'technical' risk; in that enough is known that detailed feasibility studies can be undertaken which would give a relatively clear indication of investment potential, and that they could credibly be operating within two to five years. This is especially the case for Pacific Oysters, HRAP generated products and off shore seaweed aquaculture. Other opportunities, such as Flat Oysters require relatively small amounts of work to reach this stage.

The number of opportunities does suggest there is some risk of dispersal of resource and effort if too many are pursued at once. As an overall model, we suggest the following for development of Opotiki related innovation opportunities:

1. Focus primarily on shellfish, leveraging off existing capability and the open ocean aquaculture project, and particularly those opportunities closest to being investor ready.
2. Partner regionally to progress seaweed opportunities (HRAP, offshore). This will enable the Opotiki Harbour project to leverage off investment, resources, capability being invested by other stakeholders without significant dilution of focus on shellfish.

Within this overall structure, the following recommendations are derived from the opportunity assessments:

Shellfish

1. Develop a full feasibility study for Pacific oysters in the Eastern Sea Farms space, leading to an investment case ready for market. This needs to be accompanied by a plan for managing biosecurity risks. This will provide details of resources required, production and market plans and estimates of returns to an investor-ready state.
    1. Growth rates, food cycles to support a simulation model for investors.
    2. Clean seas 2005.
2. Determine technical feasibility of Flat oysters in the Eastern Sea Farms space (in partnership with Cawthron Institute). If demonstrated, then move to a feasibility study (which should be able to leverage work undertaken in 1 above).
3. Support investigation of Geoduck in Cawthron's current Open Ocean Aquaculture project; in particular, work with project leaders (i.e. Kevin Heasman) to identify key milestones that would signal a need for increased commercial engagement.
4. Undertake an opportunity analysis for scallops and crayfish (given state of knowledge suggest that a similar exercise is undertaken as for open ocean aquaculture of shellfish for this report).

Seaweed

1. Partner with other Bay of Plenty regional stakeholders to progress onshore aquaculture opportunities (Quayside Holdings, Bay of Plenty Regional Council, University of Waikato, Priority One); and specifically to explore potential to partner with MBD Energy and James Cook University to accelerate this via:
    1. Development of a full feasibility study for development of an HRAP system, and related processing in the Opotiki region.
    2. Further investigation / definition of production, supply and logistics resources and systems required for development of a high value cluster in the region.

3. Note that separate to this there should be investigation of the potential for biochar; that is not directly relevant to the Opotiki Harbour project in that the biomass would be sourced in the Western/Southern Bay.

2. Undertake a full feasibility study for development of offshore aquaculture of target seaweed species; particularly *Ecklonia radiata* (a brown species of particular interest to Agrisea) and red seaweeds like *Pterocladia*, *Gracilaria*, *Gelidium*, of particular interest to NZ Manuka Group.