

2.20 Commercial-scale harvest and cultivation of the native New Zealand seaweed species *Asparagopsis* to trigger the establishment of a new high-value regional aquaculture sector

Evaluation, Cover Sheet and Decision Form

Project:	Commercial-scale harvest and cultivation of the native New Zealand seaweed species <i>Asparagopsis</i> to trigger the establishment of a new high-value regional aquaculture sector		FOR: Approval
Applicant:	CH4 Limited	PDU ID:	Commercial Information
Application type:	Main PGF	(A) Total Project Value:	\$ Commercial Informa
Funding type:	Grant	(B) PGF Funding Sought:	\$ Commercial Informa
Entity Type:	Company	(C) PGF Funding Recommended:	\$500,000
Region:	Southland	(D) Applicant Contribution:	Commercial Information
Tier:	1 - Regional	(D/A) Co-contribution Rate:	Comm % (minimum)
Sector:	Aquaculture		
Application summary:	<p>To commercially-scale the harvesting, cultivation and processing of the red seaweed, <i>Asparagopsis</i>. The applicant has noted that <i>Asparagopsis</i> is the only seaweed known to accumulate the key active ingredient Bromoform, which research indicates has the ability to significantly reduce methane emissions from cows and sheep.</p> <p><i>Asparagopsis</i> is a species that is native to NZ waters, and thrives in the cooler waters to the south of the country. The success of <i>Asparagopsis</i> in reducing methane production in ruminant animals, as indicated by the applicant (apparently by more than 90%) has been proven in trials by the Commonwealth Scientific and Industrial Research Organisation ('CSIRO') in Australia, and repeated by the University of California Davis and Penn State University in the US. We are informed by the applicant that CSIRO holds a worldwide patent covering the use of an <i>Asparagopsis</i>-derived feed supplement for the reduction of methane production in ruminant animals.</p> <p>The applicant has advised that, capitalising on New Zealand's natural advantages and drawing upon an expert team of New Zealand and Australian scientists, it has the opportunity to be the first supplier and the global leader in the cultivation and supply of <i>Asparagopsis</i>.</p> <p>The project involves initially harvesting modest levels of wild <i>Asparagopsis</i> from Big Glory Bay,</p>		

Stuart Island/Rakiura, under an existing Otago University permit to enable genetic and chemical characterization, harvesting of seed stock as well as material for initial processing. The applicant plans to simultaneously start the cultivation and farming of the species in permitted water space.

It is recommended that SROs:

Support the PDU recommendation to Approve \$500,000 grant from the PGF fund towards the commercial-scale harvest and cultivation of the native New Zealand seaweed species *Asparagopsis* to trigger the establishment of a new high-value regional aquaculture sector because:

- PDU has been advised that the applicant has now been able to raise co-funding (\$^{Commercial information} indicated) by way of a co-contribution (which is sufficient to meet the min. ^{Comm} % condition, and also ^{Commercial Information}).
- ^{Commercial Information}
- Additional comfort has been provided to PDU in relation to the project by SRO, Al Morrison, following discussions with NIWA.

Noting

Subject to:

- a. Evidence, satisfactory to the PDU, that the project management line in the budget breakdown is not heavily weighted to Tuia.
- b. evidence, satisfactory to PDU, of a minimum level of co-funding, by way of cash, of ^{Com} % of the project cost
- c. evidence, satisfactory to PDU, of the ability to harvest the required volume of seaweed under the University of Otago permit ^{Commercial Information}
- d. support from MFAT in relation to the grant (^{Commercial Information})
- e. completion of satisfactory due diligence by PDU

Note:

- f. Job creation related to the project is minimal (^{Com} contracted Divers; ^{Commer} persons for growing/harvesting support; and with processing initially done by ^{Commercial Information}).
- g. The applicant has indicated that it will be beneficial to the Maori economy, but PDU notes this is in future phases of the project, assuming the commercialisation is successful.
- h. ^{Free and frank opinions}
- i. ^{Free and frank opinions}

Section A: Triage – Assessment against PGF eligibility criteria

Is the project:

➤ an illegal activity?

No

➤ located in the three main metropolitan areas?	No
➤ seeking investment in large scale infrastructure of social assets?	No
➤ three waters	No

PROACTIVELY RELEASED

Application description

CH4 Ltd, the applicant, is a newly incorporated company (11Dec2018), with a number of small individual shareholders, but with Tuia Innovation Ltd as the major shareholder (Commercial Inf %). The applicant has advised that Tuia Group is providing business and legal support to CH4 through its formation and initial growth phase. The related costs are Commercial Information

. Tuia Innovation is a separate investment vehicle representing the shareholding of 4 of the founders of CH4 (Nick Gerritsen; Alan Groves; Toko Kapea; and Guy Royal).

The application is to fund a programme to trial and commercially scale the harvesting, cultivation, and processing of *Asparagopsis* seaweed. It is understood that this project is Commercial Information work streams being undertaken by the applicant, with the goal to export an initial Commercial Information of seaweed material to Commercial Info, for testing as a feed supplement to mitigate methane emissions in ruminants. The applicant has advised that this project is already underway and will proceed regardless of PGF funding.

MPI has advised that *Asparagopsis* (see picture below) is a common red seaweed found throughout NZ (Kermedecs to Stewart Island) in about 6-12 m of water and extremely common. This seaweed is also found in South Australia (Port Lincoln) and Chile. The applicant advises that overseas studies confirm that Bromoform when added to feed, can reduce methane emissions by as much as 90-95% (apparently it interacts with gut bacteria), and this has the potential to become a significant industry and wish to make this happen in New Zealand. MPI is also aware of the potential for this compound to reduce methane emissions based on growing overseas research.



The application includes the following table in relation to the costs.

Cost Description:	\$ (excluding GST)
Project Management	\$ Commercial In
CSIRO partnership/access	Commercial
Logistics, processing	Commercial
Materials and Consumables	Commercial
University of Otago – permit and collection	Commercial Inf
Niwa partnership – seedling growth programme	Commercial In
Commercial Information – quality testing	Commercial
Total	Commercial In

A more extensive breakdown was provided by the applicant following further enquiry by the PDU.

The primary objective of the project, over the next 12 months (the focus of the application) is to harvest and grow Commercial Information of *Asparagopsis* with the requisite Bromoform levels to fill an order from Commercial Info, and demonstrate and secure their ability to scale up further.

The project initially involves the harvesting of modest levels of wild *Asparagopsis* from Big Glory Bay, Stuart Island/Rakiura, under an existing Otago University permit, to enable genetic and chemical characterization,

harvesting of seed stock as well as material for initial processing. However, the applicant has advised that they are required to seek an amendment to that permit to enable their harvesting 5 tonne programme in October/November. Commercial Information

In terms of funding the project the applicant has indicated the following, as per the application.

Source of Funding:	\$ (excluding GST)	Status / Commentary [i.e. received / confirmed / in principle]
Provincial Growth Fund Funding (through this application)	\$ Commercial Informat	Application
Capital raised	\$ Commercial Informa	Received
Total:	\$ Commercial Information	

The applicant, in the application submitted, indicated that the PGF funding support is essentially required due to timing (and the short seasonal opportunity to commence the project in 2019), and as there was little chance of securing the necessary capital from other sources within this tight timeframe. Commercial Information

MPI's recommendation (paper dated 12 September 2019 – Ref 'PDU 1279'):

- *The applicant has advised that this project is already underway and will proceed regardless of PGF funding.*
- *There appears to be a good economic opportunity for the applicant to collaborate with Iwi and the aquaculture industry as this project develops.*
- *The application has merit seeking a means to significantly reduce methane emissions in ruminants both within a New Zealand and worldwide context.*
- Free and frank opinions
- Free and frank opinions
- *There needs to be a good alignment with other related work (i.e., Cawthron) to ensure good value for money for Government investment.*

Co-Funding: Commercial Information

In relation to the project cost, and co-funding, the applicant's response to question 12. of the application showed as follows:

12. Please set out the proposed sources of funding for the Project:

Source of Funding:	\$ (excluding GST)	Status / Commentary [i.e. received / confirmed / in principle]
Provincial Growth Fund Funding (through this application)	\$ Commercial Information	Application
Capital raised	\$ Commercial Information	Received
Total:	\$ Commercial Information	

The applicant's response to question 22. of the application then indicated a total project cost of \$975,000, indicating no co-contribution (see below).

22. Please provide a complete breakdown of the costs of the project:

[Note that figures in this table must align with other figures provided in Q11. Please use as many lines as it takes to provide us with the appropriate detail. If more suitable, please attach a budget spreadsheet to this application]

Cost Description:	\$ (excluding GST)
Project Management	Commercial Information
CSIRO partnership/access	Commercial Information
Logistics, processing	Commercial Information
Materials and Consumables	Commercial Information
University of Otago – permit and collection	Commercial Information
Niwa partnership – seedling growth programme	Commercial Information
Commercial Information – quality testing	Commercial Information
Total	Commercial Information

The cost of the project was again confirmed by the applicant as being \$ Commercial Information in its response (13Sep19) to further clarification sought by PDU.

However, in response to further requests by PDU for clarification the applicant advised (20Sep19):

- Additional funding had been raised since submission of the PGF application (Commercial Information), but total share capital contribution to date remained at \$ Commercial Information (as per the application).
- Capital commitments of approx. \$ Commercial Information have been subscribed Commercial Information
- Commercial Information senior management staff are FTEs on CH4 activity (annual salary cost indicated as \$ Commercial Information)
- Tuia Group will be contributing a range of support services for the CH4 project.

Overseas Investment Office

- | | |
|---|----|
| ➤ Is the application being made by a non-New Zealand based legal entity? (Foreign investment laws may apply and the Overseas Investment Office consulted) | No |
|---|----|

Section B: Operational Assessment Criteria (Complete for Eols and Applications)**(Rate and comment – 1= poor, 5 = very good - Provide the number for this project, not subsequent phases)****Fund and government outcomes**

Please highlight number below

Would the project:

<p>➤ create permanent jobs?</p>	<p>The Applicant states that initially there will be some contract work (divers, growers and some processing) as they establish the market. They expect, at full implementation for all of NZ, that we will create between ^{Commercial Informat} [redacted] NEW jobs, possibly more.</p> <p>In response to a subsequent question by the PDU, the applicant, advised, in relation to immediate employment opportunities (i.e. this trial):</p> <ul style="list-style-type: none"> - Divers (^{Com} [redacted] contracted) - Growing/harvesting support (^{Comme} [redacted] persons) - Processing (initially done by ^{Commercial Information} [redacted]) 	<p>Commercial Information</p>
<p>➤ deliver community benefits?</p>	<p>The trial itself provides limited community benefits – although the potential, should the trial and commercialisation be successful, is acknowledged.</p>	<p>Commercial Information</p>
<p>➤ increase utilisation of and returns on Maori assets?</p>	<p>The applicant has advised that ^{Commercial Information} [redacted] for the implementation of the aquaculture in water space available to them, creating meaningful numbers of skilled jobs in economically disadvantaged regions of the country. However, PDU notes that this is not in relation to the trial – but potential for the future.</p> <p>Free and frank opinions</p> <p>[redacted]</p>	<p>Commercial Information</p>
<p>➤ enhance the sustainability of natural assets?</p>	<p>The trial itself will effectively have no impact. However, if the process and product can be successfully commercialised, there will be benefits. The initial implementation will create ocean farms where presently there is no/little economic (or other) activity, and do so in a sustainable, environmentally-friendly way.</p>	<p>Commercial Information</p>
<p>➤ mitigate climate change effects, or</p>	<p>If the trial is successful, and the process and product is successfully commercialised, it has the potential to produce</p>	<p>Commercial Information</p>

assist with the lowering of emissions?	significant benefits in terms of reducing emissions.	
Additionality		
Would the project:		
➤ add value by building on what is already there, without duplicating effort?	<p>Additionality could include:</p> <ul style="list-style-type: none"> - Leveraging distressed aquaculture assets - Driving the repurposing of existing processing infrastructure/ development of new regional processing infrastructure - Employment in cultivation/ harvesting/ processing <p>This project has the potential – but only if the trial is successful and the process and product can be commercialised successfully, to have an impact in the Southland region initially (and over time in Nelson-Marlborough and Northland)</p>	Commercial Information
➤ be a catalyst for productivity potential in the region?	This project has the potential, ultimately (and if the trial is successful and the process and the product can be commercialised) to provide direct economic impact regionally, where aquaculture can be located.	Commercial Information
Connected to regional stakeholders and frameworks		
Does the project:		
➤ align with regional priorities, such as frameworks, or regional plans?	<p>Aquaculture has been identified as a key area in the Southland Regional Development Strategy (SoRDS). The letter of support from Great South is noted.</p> <p>Key other groups indicated by the applicant it is connecting with are:</p> <ul style="list-style-type: none"> • Commercial Information • Commercial Information • Commercial Information • Commercial Information • Commercial Information • Commercial Information • Commercial Information 	Commercial Information
➤ have the support of local governance groups (councils, iwi and hapu)?	Commercial Information	Commercial Information
Governance, risk and project execution		
Does the application show:		

<p>➤ robust project management and governance systems?</p>	<p>As advised by the applicant, there are three sets of governance over the Project:</p> <ol style="list-style-type: none"> 1. Overall governance is via the board of CH4 (Bios have been provided, and they appear capable – noting Due Diligence has not yet been undertaken). 2. Technical advisory oversight is provided by the Technical Advisory Board. 3. There will be a market-facing advisory board in due course. <p>Key governance meetings will be monthly and management meetings will be on a weekly basis.</p> <p>There will be bi-weekly interaction with the project team and monthly meetings preferably on site.</p> <p>Regular interactions with CSIRO’s primary seaweed culturing expert will also be structured weekly or bi-weekly as the need arises.</p>	<p>Commercial Information</p>
<p>➤ plans for future ownership and operational management?</p>	<p>The applicant advises that CH4 intends to be a world-wide leader in the cultivation and processing of Asparagopsis and a major supplier to the dairy sector.</p> <p>The initial focus is on the aquaculture scaling and development of viable seed stock in NZ market and then scaling to meet geographic demand.</p> <p>Specific details of future ownership are unknown.</p>	<p>Commercial Information</p>
<p>➤ how the project will be delivered and managed?</p>	<p>CH4’s key managers and a team of subject matter experts have been assembled to deliver the various aspects of the project. A project plan has been prepared.</p> <p>Providers have been hand-selected and pre-qualified, based on knowledge of their capabilities and previous experience in working with them. The main providers will be:</p> <ul style="list-style-type: none"> • Niwa (Wellington and Bream Bay Aquaculture Park) • University of Otago’s Marine Biology School • Commercial Information 	<p>Commercial Information</p>

Section C: Risk Management Evaluation			
Does this application demonstrate consideration of the following risks?			Yes
Type of risk	Risk description	Mitigations	Risk Rating
<input checked="" type="checkbox"/> Project risk	<p>Unable to secure permit/consent to harvest. It is noted that the harvest will use the University of Otago's special permit, ^{Commerc}</p>	<p>- Commercial Information</p> <p>Environmental team</p> <p>- Maintain constant Commercial Information</p> <p>- Actively be in region for face to face engagement with mana whenua</p>	Low/Medium
<input checked="" type="checkbox"/> Operational risk	<p>Trial is unsuccessful, and unable to commercialise.</p> <p>Inability to culture seed stock for aquafarms.</p> <p>Inability to increase yields beyond simple rope growing.</p> <p>Licenses required in New Zealand for full scale aquafarms.</p> <p>Project economics simply do not create the market.</p>	<p>Unable to determine mitigants – but options noted below.</p> <p>Explore partnerships with others who are evaluating this approach (such as ^{Comme}).</p> <p>Utilise expertise at NIWA (and others) we pursue other advanced farming techniques.</p> <p>Condition for the applicant to provide evidence, satisfactory to PDU, of the ability to harvest the required volume of seaweed under the current permit.</p> <p>Change the growing from Asparagopsis to kelp (or other species) where this is a substantial existing export market.</p>	Low/Medium
<input checked="" type="checkbox"/> Force majeure/Insurance risk	N/A at present for trial.		N/A

<input checked="" type="checkbox"/> Macroeconomic risk	Has the impact of possible external economic changes been considered?	Limited risk for trial.	Low
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Section D: Funding and financial analysis		Please highlight number below
Does the application show:		
➤ How strong is the financial position of the applicant organisation?	Request is for a grant. Start-up company, with a [redacted] Commercial Information [redacted]	Commercial Information [redacted]
➤ How does the scale of the project compare to their overall business?	Start-up company.	Commercial Information [redacted]
➤ Why is Crown funding being sought rather than commercially-available funding?	The applicant has advised that Government funding is (urgently) required to enable CH4 to take advantage of the short seasonal opportunity to commence the project in 2019 (Asparagopsis grows over the Spring/ Summer period, so this project had to start in September 2019); and that there is a significant stall-out risk if this window is missed. The applicant has advised that there is little chance of CH4 securing the necessary capital from other sources within this tight timeframe, as early stage biotechnology and aquaculture investment has an insignificant profile within the NZ capital markets let alone at the level required to commence this project. Other funding mechanisms such as debt/ project financing are not relevant at this early stage. While PDU concurs with this assessment, it also notes the application was only submitted 28 August 2019.	Commercial Information [redacted]
➤ What does the independent financial analysis/ business case indicate?	<i>If applicable.</i>	Commercial Information [redacted]
➤ Is the funding model requested appropriate? Is the PDU recommending a different model?	Potential issues with [redacted] Commercial Information [redacted] and the grant being viewed as a subsidy are noted by PDU (noting [redacted] Commercial Information [redacted]) Further enquiry was made by the PDU of the applicant, who subsequently advised that whilst they could consider a potential [redacted] Commercial Information [redacted]	Commercial Information [redacted]

➤ Has the applicant provided evidence of market pull for this project?	A copy of a purchase order from ^{Commercial Info} [redacted] has been provided, in relation to the initial supply of material for the trial.	Commercial Information [redacted]
➤ Has the applicant provided evidence that their supply chain is secure?	It is proposed that an existing University of Otago permit be used to harvest for the trial [redacted] Commercial Information [redacted].	Commercial Information [redacted]
Summary of funding and financial analysis:	A start-up company, with a limited capital base, and potentially some issues around their ability to source sufficient material. They also have a short window of opportunity.	Commercial Information [redacted]

Funding arrangements

	Project Activity	Responsible:	Date / Period:
1	Material (Asparagopsis) Collection, including large-scale harvest	CH4/University of Otago Niwa/ ^{Commercial Info} [redacted]	Commercial Information [redacted]
2	Evaluation for Bromoform content of species	CH4/Niwa/ ^{Commercial Information} [redacted] Commercial Information [redacted]	Commercial Information [redacted]
3	Material evaluation for methane reduction (in vitro)	^{Commercial Information} [redacted]	Commercial Information [redacted]
4	Design seaweed cultivation/growth methodology trials	CH4/Niwa/CSIRO/ ^{Commercial Information} [redacted] Commercial Information [redacted]	
5	Conduct growth and cultivation pilots	CH4/Niwa	Commercial Information [redacted]
6	Secure future access to marine aquaculture space for cultivation	CH4/marine space owners/Iwi/ToKM	
7	Business modelling for COG	CH4/advisors	Commercial Information [redacted]
8	Evaluation of business economics	CH4/advisors	Commercial Information [redacted]

Detail as to how any grant would be made available / distributed has yet to be determined.

Consultation from partner agencies undertaken or implications

MPI

Free and frank opinions

MPI supports the approach to utilise existing aquaculture infrastructure (particularly the abandoned oyster farms in Stewart Island), but note that any significant expansion of seaweed production is likely to require access to new water space. ^{Free and frank opinions} [redacted]

They note the applicant will be working with Otago University to initially survey wild seaweed beds around Stewart Island to assess available biomass and harvest up to ^{Commercial Information} [redacted] and that this harvest will use the University's special permit. [redacted] Commercial Information [redacted]

MPI also notes that, whilst there is potential in supporting commercial activity in this area there will be learnings associated with this that government entities should stay actively engaged with the work. The learning includes the practicalities of:

- Finding the right location for the growth of this seaweed
- Commercial Information [redacted]
- Appropriate Health and Safety procedures for handling large volumes of seaweed containing Bromoform
- Extraction methodologies that enable stable storage of the active molecule (which is quite volatile so likely easily lost from the seaweed)
- Economics of harvesting the very large volumes of seaweed needed (ie from ocean to saleable product)
- The thousands of hectares likely to be needed for seaweed harvest
- The market perception to seaweed added to cow diets by dairy and meat industries in USA and Australia.

MPI Recommendation:

"We note:

- *The applicant has advised that this project is already underway and will proceed regardless of PGF funding.*
- *There appears to be a good economic opportunity for the applicant to collaborate with Iwi and the aquaculture industry as this project develops*
- *The application has merit seeking a means to significantly reduce methane emissions in ruminants both within a New Zealand and world wide context.*
- *That given the strong R&D focus of this proposal,* [redacted] Free and frank opinions [redacted]
- [redacted] Free and frank opinions [redacted]

There needs to be a good alignment with other related work (ie, Cawthron) to ensure good value for money for Government investment."

Conflicts of interest and T&Cs

Due diligence is to be completed, this is a condition of funding.

Further information from applicant

PDU has sought, and obtained from the applicant, further information and clarification of issues.

Summary statement of Peer Review undertaken

The following Peer Review has taken place in connection with this application:

All applications are discussed between the Regions Team and Investment Team during the assessment process and prior to submission to SROs / IAP.

Consultation with the relevant partner agencies has occurred allowing them to provide any relevant technical advice with any feedback included verbatim within this application form.

In the development of this form:

- i. A peer review by an Investment Director has taken place and included the following to the satisfaction of the peer reviewer:
 - a. An evaluation against the PGF criteria;
 - b. Financial analysis;
 - c. A risk assessment, highlighting any relevant or key risks;
 - d. Conflicts of interest have been noted and accepted
 and the peer reviewer concurs with the recommendation proposed.
- ii. The Head of Investment has reviewed this recommendation.
- iii. This application has been reviewed by the PDU SLT.

Peer Review has been completed

Yes

Supporting proposal:

Yes

Appendices:

Yes - [Applications and supporting letters, and MPI's full comments are as annexes]
 Withheld - Commercial Information

Author of paper:

MJB, Investment Director, PDU Investment Team