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	Score
Synthesis and integration	
Justification	
Critical reflection	
TOTAL	

ASSESSOR'S USE ONLY

ABSOLUTE
WILDERNESS
Freeze Dried Food
PLANT POWER

Synopsis: Absolute Wilderness – Plant Power

Context

Foods with a purpose can be convenience foods, lifestyle need foods, dietary foods or foods for people with specific physical issuers or allergies. They meet people's requirements in times of specific needs.

New Zealanders love the great outdoors. Camping, tramping, hunting and wilderness adventures are an integral part of the Kiwi lifestyle. Our country is a destination for adventurers and tourists from all over the world. With internationally renowned trails like the Able Tasman coast track, Tongariro alpine crossing, Milford Sound track and Te Aroha, there is so much to explore and so many ways to do this. Many kiwi teenagers chose to complete the Duke of Edinburgh program which involves outdoor experiences and tramping

The Duke of Edinburgh award program is a globally renowned educational framework that challenges youth to discover their full potential by giving opportunities to learn a skill, get physically active, give service to their community and take part in an adventure. There are three levels, bronze, silver and gold, and at each of these levels the participants must complete an outdoor tramp to take them out of their comfort zone and build resilience.

- At bronze level you complete a 2-day, 1-night tramp
- At silver level you complete a 3-day, 2-night tramp
- At gold you complete a 4-day, 3-night tramp and a 5-day, 4-night residential project

THE DUKE OF EDINBURGH'S INTERNATIONAL AWARD
AOTEAROA NEW ZEALAND HILLARY AWARD

Tramps of this type require much preparation, with lightweight, simple to prepare nutritious foods. The nutritional value content is important to help restore the nutrients lost through exercise and exertion. There are several companies in New Zealand who produce freeze dried foods for this purpose. I have been researching and trialing a variety of these products and have found that they are described as delicious and nutritious with menu style descriptions, but this is not always the case! Disassembling these products has been both interesting and disappointing – often the foods are not palatable, look unappetizing, smell bad, are over salted or over sweet, and generally not enjoyable, and, are extremely expensive.

While the freeze-dried foods meet a real need, I believe there is room for huge improvement, and for a greater variety of simple meals, suitable for all age groups. There is also a gap in the market for meals suiting specific dietary requirements such gluten free, dairy free, vegetarian and vegan. My stakeholders for this project are a group of students who are part of the Duke of Edinburgh program, currently preparing for their next 3-night tramps. As well as proper equipment, they require highly nutritious, easy to prepare and actually tasty food to keep them fueled on their journeys.

Why freeze dried?

Freeze dried food is lightweight, portable and easy to prepare with only hot water which makes it ideal for taking of tramps and hikes. Other premade meals such as canned food and

packets are much heavier, take up a lot of space and oven need cooking utensils to prepare. This is not ideal for tramping as extra weight in your pack is the last thing you would want while walking in extreme conditions. So, freeze dried food is convenient, easy and tasty (mine will definitely be). [redacted] from the company "Absolute Wilderness" was invaluable support throughout this project. He was responsive to any questions I had about the process as well as flavours, packaging and further developments. He also gave me extremely positive feedback on my final product when I couriered him a sample.

BRIEF

I am going to develop a prototype for nutritious and appetizing freeze-dried meals, requiring only hot water to prepare – a breakfast, dinner, and dessert, suitable for teenagers who undergo intense physical activity in the wilderness. These meals will be vegan, gluten free and allergen aware to make freeze dried food accessible to as many people as possible.

Specifications

- Vegan
- Gluten free
- Dairy free
- Prepared with just boiling water
- Hydrated in 15 minutes
- Nutrient dense
- Hydrated quinoa
- Hydrated vegetables with a bite
- High quality
- Reduced sodium compared to existing products
- Portable
- True to description
- Ethically sourced ingredients
- Food safe, robust packaging
- Packaging enhances visual appeal and ease of use

Attributes

- Balanced flavours
- Mild spice
- Flavourful sauce
- Rich, creamy sauce
- Authentic aroma
- Visually appealing - fresh and colourful
- Long shelf life

Constraints

- Money (expensive machinery – replacing freeze driers with dehydrators when not accessible, not giving the same result)
- Time (class, school terms, COVID lockdowns and level 2.5, Level 2
- Seasonal resources
- Myself – time management and skill set

[redacted]

Vegan

This specification is very important to my product as it is what makes it unique and makes it acceptable to a wider range of consumers. Veganism is a widely growing food trend that needs to be tended to my food producers so there are products containing to meat or animals' products that people following this lifestyle can consume. Hence why my Thai Green Curry is plant powered with chickpeas and quinoa to fill the gap in the market of vegan freeze-dried food. [redacted] from Bowl and Arrow was very interested in my project and gave me on-going feedback at each stage of my product. Her company specializes in raw, vegan and dehydrated foods and she is local, so in between our Lockdowns, I was able to meet with her for sensory analysis.

Gluten Free

This specification is also very important as the inability to properly digest gluten is a common food intolerance that is not often available in freeze dried food. Some studies show that gluten intolerance becoming more common due to environmental and food changes, as well new wheat varieties having higher gluten contents – so, it because of this that my product is gluten free to attend to this gap on the market. Nutritionist and Researcher [redacted] from Massey University was a great support in helping me develop sound nutritional qualities in my product.

Target Market

My target market is for those among the 1.5 million people who tramp in New Zealand (according to a 2017 survey collated by The Mountain Safety Council) every year. Specifically, the teenagers in this group who are completing the Duke of Edenborough program, as there are approximately 8000 registrations annually and 22,000 teenagers engaged in the Award at one time in New Zealand. These teenage adventurers require nutritious, easy to prepare and portable food accessible for their tramps. Therefore, my product is targeted at this market to make this range of freeze-dried food accessible for refueling purposes while tramping as it becomes an apparent need. I used members of the Duke of Edinburgh team at my school as key stakeholders and they willingly involved themselves in target market focus group sessions when the Covid 19 levels allowed this to happen.

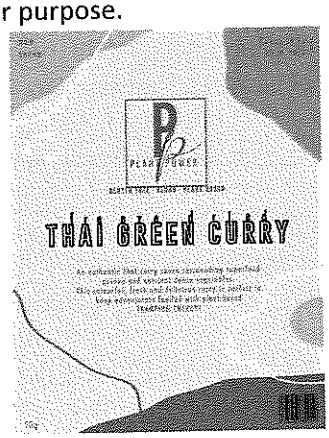
Using the Freeze Dryer

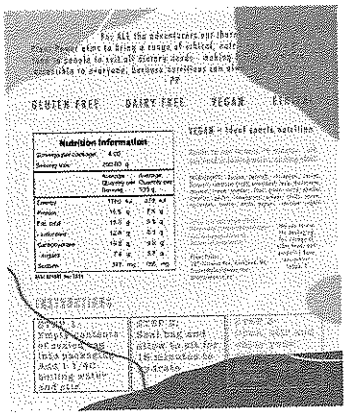
When developing my prototype I freeze dried my final product. With expert advice from [redacted] (pharmaceutical pharmacist at TriplePoint), I was able to learn the freeze drying process and the functions of a freeze dryer to be capable of implementing this in my own product. Freeze dryers work by snap freezing then vacuuming to remove the vapour – this is a very critical point called subliming. I transported blanched vegetables onto freeze dryer trays, snap froze them at -90°C, and then placed in the freeze dryer. I monitored this process through via a computer program throughout the process.

Packaging

My prototype requires adequate packaging that meets the requirements of being food safe, extending the shelf life and being practical for tramping. To ensure meeting requirements I consulted with [redacted] **from Total Pack** and [redacted] **from Tio Pablo** for information surrounding the ethics and design of packaging. This informed me on packaging

requirements for freeze dried products – focusing on shelf life and food safety over composability, as this could make it likely that the product could come into contact with moisture. Therefore, I designed a pouch with the food vacuum sealed inside for freshness, making it fit for purpose.



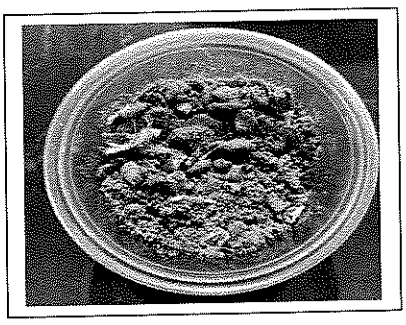


Final formulations

Choc Berry and Beetroot Chia Pudding

Ingredients	Amount
Chia seeds	40g
Flaxseed meal	20g
Coconut milk powder	30g
Freeze dried strawberries	8g
Freeze dried raspberries	8g
Beetroot powder	5g
Cocoa powder	10g
Pea protein powder	30g
Toppings	
Coconut chips	10g
Pumpkin seeds	7g
Sunflower seeds	7g
Cacao nibs	7g

Thai green curry powder



Thai Green Curry

Ingredient	Amount
Quinoa	180g
Coconut cream powder	80g
Carrot	38g
Broccoli	100g
Mushrooms	6
Leeks	11g
Sliver beet	60g
Capsicum	1
Chickpeas	120g

Curry powder

Ingredient	Amount
Fried shallots	2T
Fried Garlic	2T
Lemon Grass	7g
Ground ginger	1t
Chili flakes	1t
Onion powder	1t
Garlic powder	1t
Ground coriander	1t
Ground cumin	1t
White pepper	1t
Coconut sugar	2t

Technological Modelling

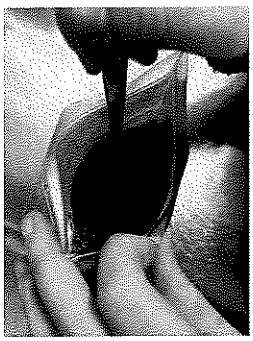
The technological modelling process was essential and refers to the practices I undertook to develop my product. This included both functional modelling and prototyping. Functional modelling was all the testing that happened to produce a possible design concept for my desired final product. The prototyping took place toward the end of the project where it was appropriately evaluated for its fitness for purpose. This enabled me to justify the decisions I made - around the functional reasoning – ""how to make it happen" and "how it is happening", and practical reasoning "should I make it happen?" and "should it be happening?"

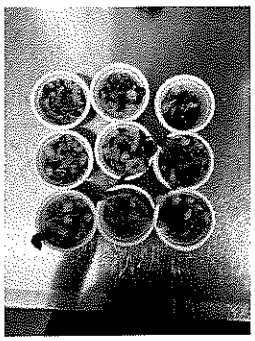
This part of the process helped me define both competing and contestable factors – things my product needed to be and things I wanted my product to be. This meant I needed to prioritize needs over wants – empathizing with the client and prioritizing their vision and values over mine.

The completion of tests and trails allowed me to develop my concept into the most desirable product possible. Comparing and contrasting techniques, processes and results from functional modelling enabled me to make decisions that informed the development of my product. I used both subjective and objective testing methods and a variety of sensory analysis tests from discrimination, paired preference, hedonic scales, surveys, check all that applies, to mechanical tests, using dehydration to simulate the freeze drying process. I tested different vegetables, levels of the spice flavour, proteins (tofu and quinoa) and carbohydrates (vermicelli noodles and quinoa) to develop a final formulation that meets all brief specifications. I followed the same template when completing each test – all having an aim/introduction, the ingredients and process, photos, feedback, and a conclusion that indicated the decisions made from that trial.

Stakeholder Feedback

Stakeholder feedback was a crucial element in the decision-making process that helped develop my concept designs. It allowed me to make informed decisions when moving forward after each trial, it also helped me answer my big questions and make developments that my stakeholders favored. I used a group of stakeholders from my target market of a range of different ages, abilities and tramping interests to get fair feedback. Stakeholder feedback has constantly dictated the development of my final formulation for my freeze-dried Thai green curry.





This report will discuss the journey of the development of my final prototype which I accept as fit for purpose.

I will show how functional modelling and prototyping have been used during the development work and how this enabled me to make informed decisions and to select materials and processes to complete an exciting and innovative prototype.

When I received the final feedback from [redacted] I was extremely proud of my product and this gave me the confidence to do a presentation to my schools Board of Trustees when asked to do so by my Principal. Two of the Board members asked "where to nest" with my product – they both commented that they would "absolutely" purchase it!

It has been a really tough year with the Lockdowns and rules and regulations at school, even accessing ingredients was difficult, so I had to be really flexible in my approach. I used Project Management skills that we had discussed at the beginning of the year to keep on track and to make steady progress, albeit a bit out of conventional order.

Re: feedback

[redacted]

To [redacted]

14/10/2

You replied to this message on 18/10/2020 5:07 pm.

1 MB | [redacted] 3 MB | [redacted] 744 KB | Plant Power.pdf 3 MB

Hi [redacted]

Attached is my feedback for your students. Firstly, I would like to say that I'm blown away by the quality of your students work. A number of the products could be put into the market with no changes to the flavours and ingredients. I'm sure they would sell well.

Overall, I found the packaging innovative and very user friendly - both the trays and the Bircher cup. There is a large (unsatisfied) market for home consumption of freeze dried meals that need to be presented in a convenie easy to use format. Just as your students have done here.

Please pass on my congratulations to your students. They have done very well.

I couldn't find an evaluation form for the Butter Chicken (Food Emergency). However, I feel the student has don an excellent job of designing the packaging. I would give this 5/5 for design. Clarity of the instructions was very good. I especially liked the extra set of instructions on the top of the tray. They have obviously put a lot of thought into the design of this packaging. Its very professional.

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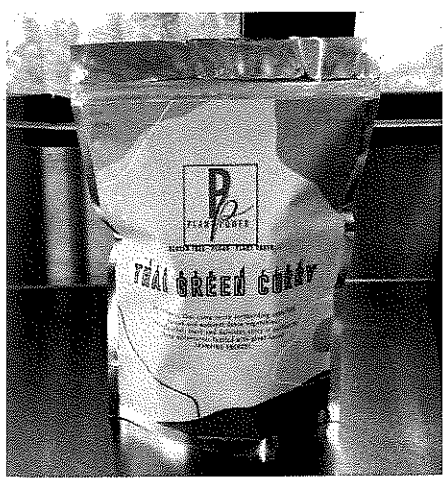
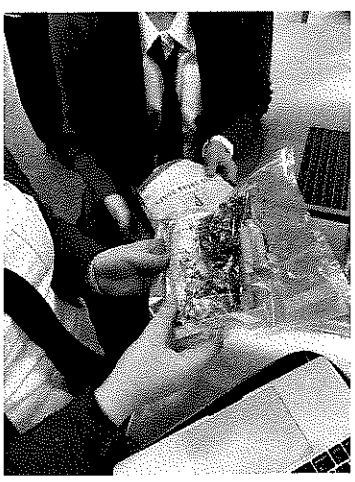
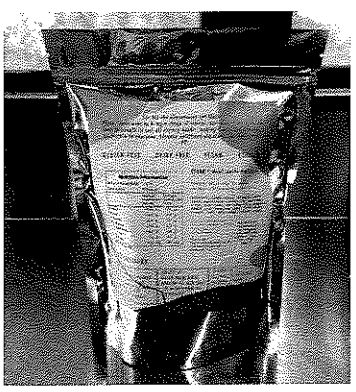
Kind regards

[redacted]







Project Management

What is project management?

Project management is the way that a person organizes and manages themselves and their resources that are necessary in completing the project. It is the whole practice of initiating an idea, then planning, executing and controlling how it goes to achieve specific goals. The primary challenge of project management is achieving all of the goals for your project within the given constraints. It is the efficient use of time, materials and resources.

I am going to establish a project schedule reflective of the physical and social environment where the outcome is to be developed and implemented, informed be existing practices in project management.

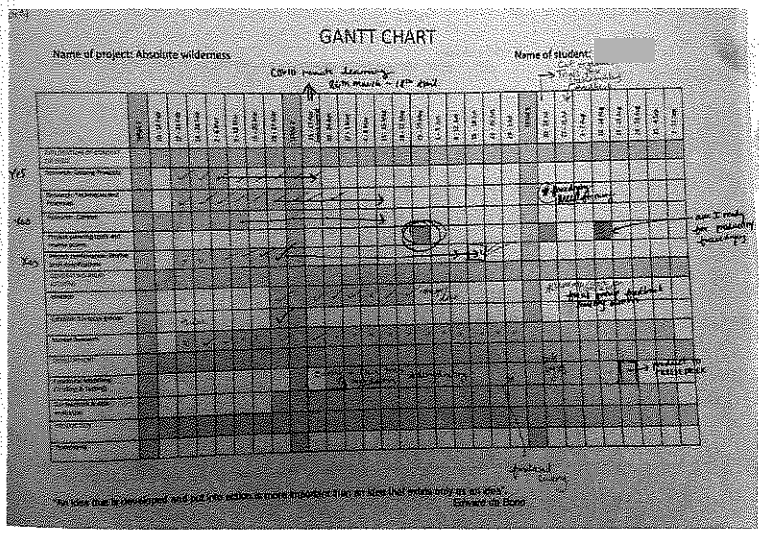
I will implement the project schedule to co-ordinate

- Goals
- Planning tools
- Resources
- Progress review points to ensure completion of an outcome

I will reflect on the practice undertaken and the revise my project schedule.

What is a GANTT chart?

A Gant chart is a type of bar chart that illustrates a project schedule. They outline all the tasks involved in completing a project to give an overview that helps with organization. They illustrate when certain tasks need to be done and completed by in order to stay on progress and complete your project.



I effectively used a GANTT chart from the start to finish of my project to ensure it reached completion. I constantly referred to it, updated when needed (especially when the COVID-19 lockdowns arose) and tracked my progress – this helped my product be ready in time for production.

Project Management Systems

During a project there are some keys aspects pf project management to remember...

Plan - Forecasting activities, initial activities

Process - Overall approach to project; looking at existing products

People - People in your team, How am I going to collaborate and communicate with people

Power - Decision makers and lines of authority

There are also 5 systems of project management that result in a successful and suitable outcome of a project these are ...

Initiating The initiating process is to determine the nature and scope of the project. This is a crucial stage of project management as if it is not performed well it is unlikely the project will be successful and suitable for your stakeholder. The initiating stage should include a plan that encompasses several areas which can be in which can be recorded in a series of documents these are called project initiation document intend to include...

- Project proposal: idea behind project, overall goal, duration
- Product breakdown structure: hierarchy of deliverables outcomes and components there
- Work breakdown structure: a hierarchy of the work to be done down to daily tasks
- Responsibility assignment matrix: roles and responsibilities aligned to deliverables/outcomes
- Tentative project schedule: milestones important dates deadlines
- Analysis of business needs and requirements against measurable goals
- Review of the current operations
- Financial analysis of the costs and benefits including a budget
- Stakeholder analysis including users and support personnel for the project
- SWOT analysis: strengths, weaknesses, opportunities and threats to the business

Planning After the initiation stage the project is planned to an appropriate level of detail. The main purpose is to plan time cost and resources adequately to estimate the work needed and effectively manage risk during project execution. This again must be completed to a high level in order for the project to succeed. Project planning generally consists of ...

- Selecting the planning team
- Identifying deliverables and creating the product and work down breakdown structure is
- Identifying the activities needed to complete those deliverables and networking activities in their logical sequence
- Estimating the resource requirements for the activities
- Estimating time and cost for activities
- Developing the schedule
- Developing a budget
- Risk planning
- Developing quality assurance measures
- Gaining formal approval to begin work

All of these processes must be completed to a high standard in order to begin a successful project.

Executing During the executing stage we must know what other planned times that need to be executed. This phase involves proper allocation coordination and management of human resources. Other resources such as materials and budgets must also be executed well and allocated such time to be done so the output of this phase is project deliverables.

Project documentation Documenting everything within a project is key to its success. To maintain budget scope effectiveness and paste a project must have physical documents pertaining to each specific task. Correct documentation makes it easy to see whether or not a project requirement has been met. Documentation provides a paper trail anybody who needs to reference your project in most cases this will be a supervisor or someone using your project for their own. With correct documentation success can be tracked easily and observed throughout the project this can often be the backbone to project management.

Monitoring and controlling This phase consists of processes performed to observe project execution so that potential problems can be identified in a timely manner allowing for enough time for corrective action to be taken in short this phase is to control the execution of the project. Key benefit is that project performance can be observed and measured regularly to identify variances from the project management plan. Monitoring and controlling includes:

- Measuring the ongoing project activities
- Monitoring the project variables against the project management plan and the project performance baseline
- Identifying corrective actions to address issues and risks properly
- Influencing factors that could come to the circumvent integrated change control so only approve changes are implemented

Multiphase projects the monitoring and control process also provides feedback between project phasers to implement corrective or preventative actions to bring the project into compliance with the project management plan. Project maintenance is an ongoing process and it includes...

- Continuing support of end users
- Correction of Errors
- Updates the product over time

In this stage supervisors to pay attention to how effectively and quickly use your problems are resolved. When changes are introduced to the project the viability of the project must be reassessed. It is important not to lose sight of the initial goals and targets of the project. When changes occur the forecasted result of the project may not justify the original proposed investment in the project.

Closing Closing includes the formal acceptance of the project and the ending thereof. Administrative activities include the archiving of the files and documenting lessons learned. This phase consists of...

- Contract closure: complete and settle each contract and close each contract applicable to the project or project phase
- Project close: finalise all activities across all of the process groups to formally close the project for a project phase

This phase also includes post implementation review. This is a vital phase of the project for the project team to learn from experiences to apply to future projects.

All of my knowledge surrounding **project management** was implemented constantly during my technological modelling to ensure my project on *freeze dried food* would be a success.

Exploring the Context

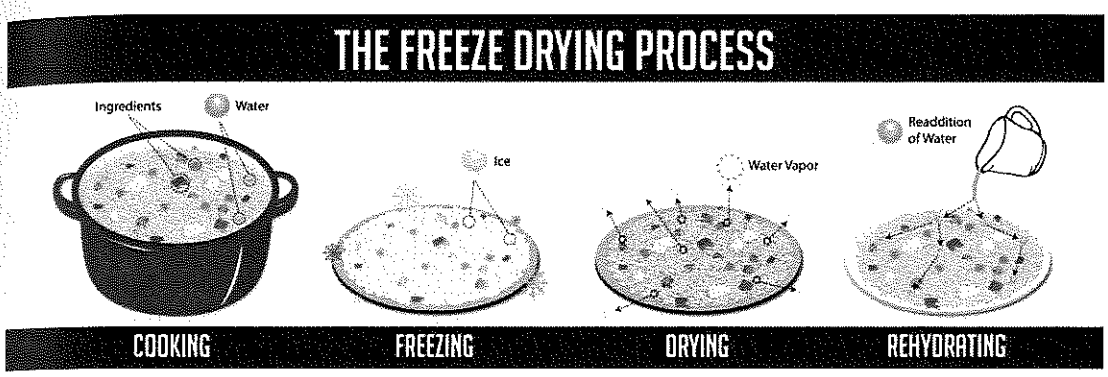
At the beginning of my technological modeling I had to explore the context to gain an in-depth understanding on what I was about to embark on...

An introduction to freeze dried food

What is freeze dried food? Freeze dried food is food that has had all its water content removed to extend its shelf life and keep it from spoiling for a long time. It can be stored for years ready to eat by just revitalizing with water (typically hot water).

What is freeze drying? Freeze drying is the process of removing water from perishable materials to extend the shelf life as well as making it more convenient for transport. It is done

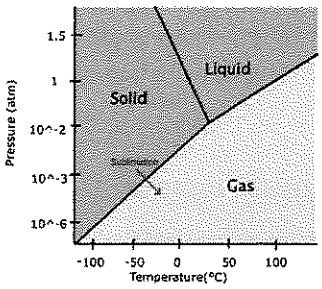
by freezing the material, then lowering the pressure and adding heat which allows the frozen water to sublimate (solid to gas).



3 Primary Stages of Freeze Drying:

Freezing Phase Products can first be frozen in various ways such as being done in the freezer, a shell freezer (chilled bath) or using a freeze dryer. Chilling them below their triple point (a point where solid, liquid and gas forms of a substance coexist in equilibrium) ensures that they will sublime rather than melt, preserving its physical form.

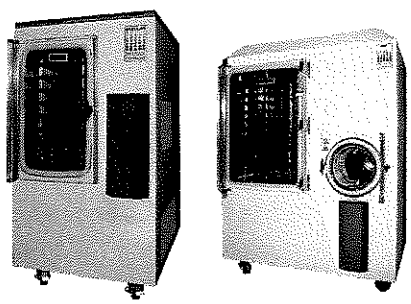
Primary Drying Phase (Sublimation) Freeze dryings second phase is sublimation, about 95% of the water is removed at this stage. The pressure is lowered and heat is added to the material to allow the water to sublimate. A vacuum is used to speed up this process and a cold condenser allows the water vapor to solidify to it, saving the vacuum pump from water vapor. Here you have to be careful that the heat doesn't alter the structure or appearance of the material.



Secondary Drying Phase (Absorption) The third stage of freeze drying is absorption, this is where the ionically bonded water molecules are removed from the material. This is done by increasing the temperature more than in the primary drying phase to break bonds between the water and the material being freeze dried. After this process is complete the vacuum is broken with an inert gas then the material is sealed. Freeze dried materials often have a porous structure from having the moisture removed and are dried to 1-5% residual water content.

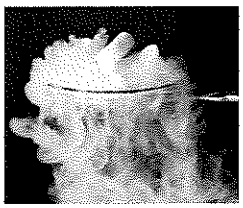
Freeze Drying Machines: They contain:

1. Chamber (oven)
2. Shelves in chamber (where you put your product)
3. Heat transfer fluid circuit (connected to shelves
4. Pump connectors cooling circuit (silicon oil)
5. Electric heater (controls heating)
6. Tray or vials on shelves
7. Door (exposed to a lot of force)
8. Door gasket (to help with excess force)
9. Ice condenser (area where vapour is trapped)
10. Ice coil (inside ice condenser, protects pumps)
11. Vacuum pump line (keeps pressure low)



Other freeze drying methods:

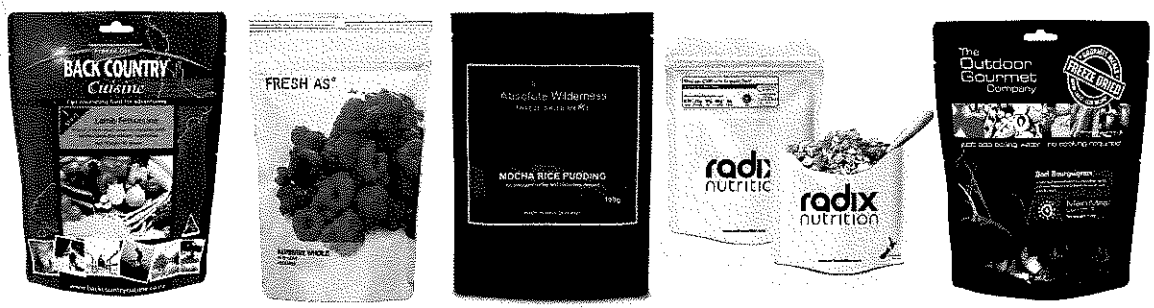
Freezer Method This is the easiest but longest way to freeze dry your own food. For this all you need to do is place your materials on a tray and out them in the freezer. This drying process takes several weeks and can only take the materials to the sublimation phase. To see if the food is done drying you can remove a frozen piece and let it come to room temperature, if it becomes darker in colour then it is not ready.



Dry Ice Using dry ice to freeze dry food is a very quick process and it takes all the moisture out if the material. There is risk involved when doing this so you must wear insulated gloves and use a large container. You just pour the dry ice over the food and once no more dry ice is left in the container then the process is finished.

The difference between freeze drying and dehydrating: Freeze dried foods have 98% of their water content removed whereas dehydrated foods have only 80% of their water content removed, giving freeze dried food a much longer shelf life that can be more than 2 years. Freeze dried food is flash frozen and then vacuumed to vaporize the water, from this they retain their original structure, taste, smell and nutritional value. Dehydrated foods loose about 50% of their nutritional value from heating during the dehydrating process and tend to be chewier from this as well. Freeze dried foods also rehydrate much quicker than dehydrated food (around 5-10 mins compared to 10-20 mins).

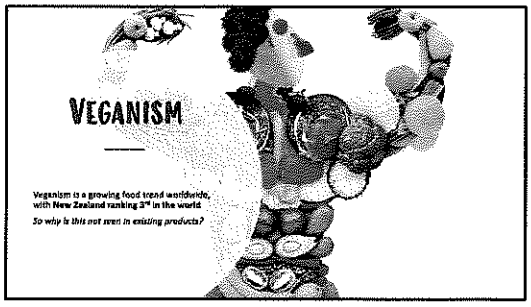
Some existing freeze-dried products on the market in NZ include:



To learn more about the freeze drying process and how the machines worked, I consulted with [redacted] a pharmaceutical freeze drying expert at TriplePoint. Some key points I learnt from him were:

- Solid – vapour = very critical point in freeze drying (sublime)
- Once Frozen a vacuum is added to remove the vapour
- 0.5-2 millibar for food (on the machine)
- Fat content is important
- Vapour trap/ice condenser/ice coil – traps water vapour before it gets to the pump
- Don't heat to fast – the shelf gets hot, but products can lag behind from heat transfer, little changes like this can make big effects so much do research and development
- Failure rate depends on how well the machine operates and is looked after – important to use a checklist before machine is started

vegan freeze dried food range and there is little to none vegan food in this area and I want vegan food to be easily accessible to all.



I spoke about this when presenting to the Board of Trustees:

"Veganism is the practice of abstaining from all meat and meat products to avoid animal exploitation and the environmental impacts that can be caused by this. It used to be a taboo subject and questionable diet, but over the years has become quite a popular lifestyle and interest in vegan products has grown. Veganism in New Zealand has risen from 7% in 2017, to 10% in 2018 and 15% in 2019. Interestingly, New Zealand is the 3rd most vegan country in the world, just behind the UK and Australia. This made me question – why are there no existing freeze dried food products catering to this need? What can I do about this?"

Gluten Free

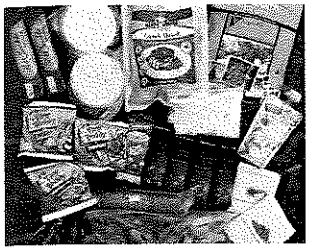
An intolerance to gluten is a reasonably common problem that around 65,000 New Zealanders are affected by. Other dietary requirements relating to gluten like allergies and coeliac disease are also an issue. Gluten intolerance is when the body cannot properly digest the protein gluten which is found in wheat, barley and rye. Common symptoms from consumption can be nausea, diarrhoea, constipation, bloating and increased passing of gas – these are all things that you would not want to be experiencing while tramping. Therefore, my products will be gluten free to suit consumers with this need and make freeze dried food accessible to more people.

I also spoke about dietary requirements when presenting my project:

"I found an interest in dietary requirements when exploring my context, specifically focusing on gluten free. There are so many dietary requirements that aren't catered for in existing freeze dried food products for tramping. These requirements can be anything from intolerances (gluten, lactose etc.), allergies (egg, nut etc.) and cultural beliefs (Halal etc.). Dietary requirements have been on the rise due to genetic changes and differences in the environment – so again, with them being so common, why are they not well catered to?"

Tramping

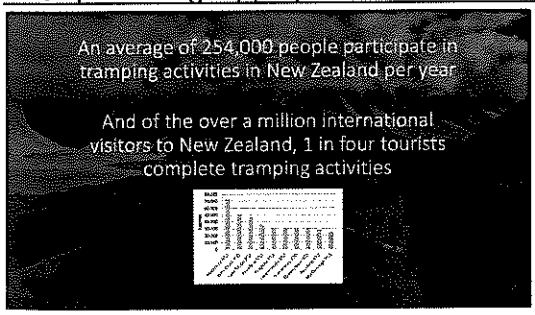
Tramping is a beloved way to explore the great outdoors, stay fit and connect with the environment. It is the recreational activity of going for walk in through bush tracks, rough country and mountains. There is an abundance of incredible tramping tracks available to us here in New Zealand like the Milford Sound, Able Tasman and Tongariro crossing (pictured right). With all these tracks right in our own back yard, there's no surprise why it is becoming such a popular activity.



Tramping requires very important PREPARATION – clothes, tents, bedding, bags and most importantly food. All outdoor activities can have their risks, but this is easily manageable with sufficient preparation of the fundamental basics from the gear you are taking to the paths you are traveling. Map

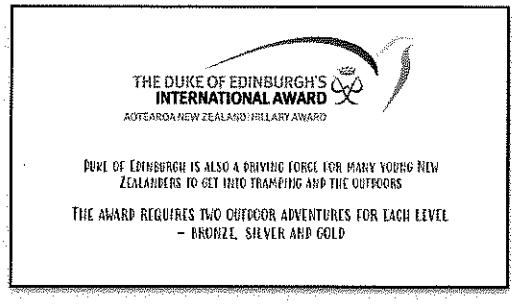
FOOD is an extremely important part of tramping preparation. It is required for energy, sustenance and to essentially keep you energized for tramping all day long. Extended energy expenditure like tramping requires sufficient energy to get enough energy 'in' vs the energy 'out.' Constant exercise means that calories are constantly being burned to keep you going, so it is important to refuel properly through food. An hour of tramping can burn around 430 calories – this is more calories than two pieces of toast would give you (313 calories) – which puts into perspective how important nutrition is when it comes to tramping and how much food your body actually requires.

I discussed tramping in New Zealand, the Duke of Edinburgh program and tramping nutrition when presenting my project to the Board of Trustees:

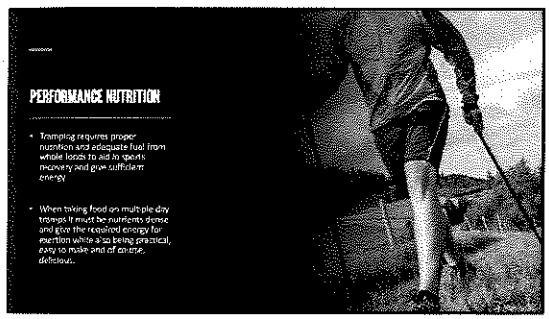


"I embarked upon this Absolute Wilderness project to develop a 'food for a purpose.' This essentially means a food product that meets a need – which in this case was ***tramping****. Tramping is so popular in our country as New Zealanders love the great outdoors. Camping, tramping, hunting and wilderness adventures are an integral part of the Kiwi lifestyle. Our country is a destination for adventurers and tourists from all over the world. With internationally renowned trails like the Able Tasman coast track, Tongariro Alpine crossing, Milford Sound track and Te Aroha, there is so much to explore and so many ways to do this. With all these amazing great walks, it is no wonder tramping is such a popular activity!"*

"Another driving force for the love of tramping throughout New Zealand is the Duke of Edinburgh Program. Many kiwi teenagers chose to complete this program which involves outdoor experiences and tramping. The DOE award program is a globally renowned educational framework that challenges youth to discover their full potential by giving them opportunities to learn a skill, get physically active, give service to their community and take part in an adventure. There are three levels, bronze, silver and gold, and at each of these levels the participants must complete an outdoor tramp to take them out of their comfort zone and build resilience.



- *At bronze level participants complete a 2 day, 1 night tramp*
- *At silver level participants complete a 3 day, 2 night tramp*
- *At gold level participants complete a 4 day, 3 night tramp and a 5 day, 4 night residential project"*



"With tramping being so popular in our country, proper preparation is required - with the most important aspect of this being ***food*** *and nutrition. A whopping 400 calories are lost every hour while tramping, this requires adequate fuel to replace the much needed energy. Trampers should be consuming at least three full meals and two snacks – of these, meals should be at least 500 calories, and snacks should be high in calories for energy (such as dried fruit, muesli bars, trail mix or canned tuna). So tramps require plenty of preparation with lightweight, simple to prepare and nutritious foods. The nutritional value content is highly important to help restore nutrients the body uses during exercise and exertion."*

NEXT STEPS – After exploring the context it came time to research into existing freeze dried food products on the market. In doing this I would gain an understanding of my competition and find gaps in the market.

Disassembling Existing Products

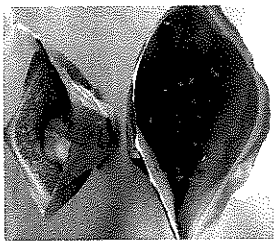
Why disassemble existing products? I must investigate into and try existing products on the market to find their positives, flaws and see where there is a gap in the market. It is important to see:

- How they function
- To get firsthand knowledge
- My own opinion
- Compare existing companies' products

Testing what is on the market gives me the knowledge to improve the status quo and fill a gap in the market. It will allow me to see what improvements I can make to develop a product that will be capable to compete in the market. Important aspects to disassemble are taste, appearance, packaging and instructions. So, I will begin testing...

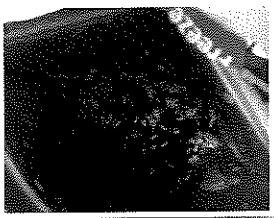
In this test I will be investigating existing savory products on the market. I will see how these products function and taste to become aware of the gaps in the market and what improvements I can make to fill these. I think they will be quite bland and unappealing but am excited to try them to see how eat they are to make and what their flavours are like.
In this initial existing products test I will take notes on some aspects of the meals that stand out to me, whether they be positive or negative.

Roast Lamb and Vegetables (Back Country Cuisine)
Separate package of potato mash. Lamb is with the veggies and gravy. Inviting mint smell but a very strong mint flavour in the gravy. The vegetables are very hard and chewy, especially the peas. The gravy has a pleasant flavour but is very thick and grainy. The mashed potato is under seasoned and has no flavour.

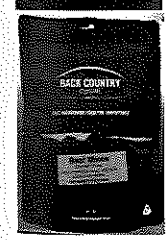


Cottage Pie (Back Country Cuisine)
Separate Package of potato mash and mince. Very sweet and unseasoned, unpleasant taste. The vegetables cooked well, but there wasn't a great variety.

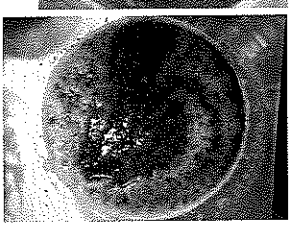
Beef Stroganoff (Back Country Cuisine)
Unappealing appearance - bland beige and brown. Nothing enjoyable about it, the flavours were unbalanced and texture like baby food. No colourful nutritious vegetables. Almost tasted like nothing at all.



Venison and rice noodle stir fry (The outdoor gourmet company)
Packaging leaked. Flavorful, spicy sauce but very salty – Asian flavours were enjoyable. The venison is soft but still slightly chewy. Noodles were nice and soft but in very small pieces, would have liked them to be longer as it wasn't very enjoyable to eat this way.

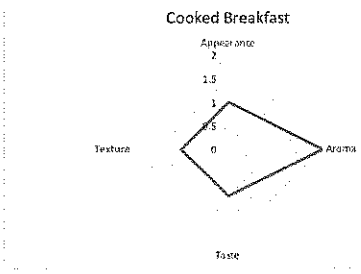
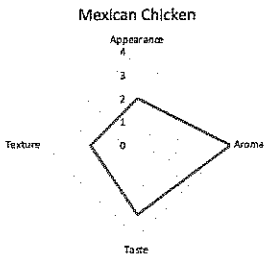
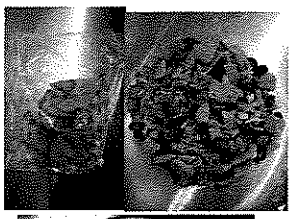
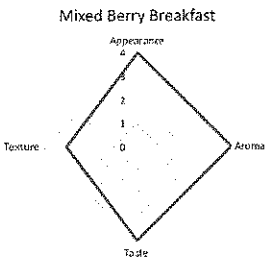


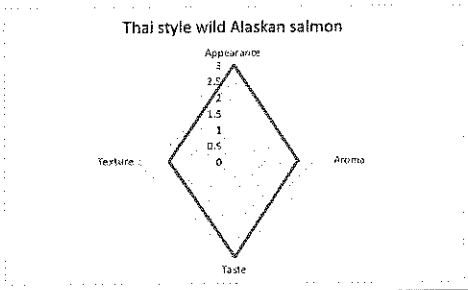
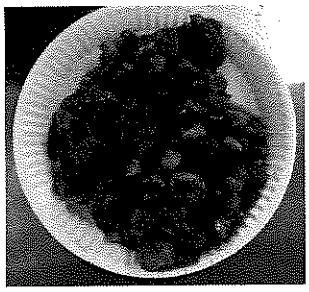
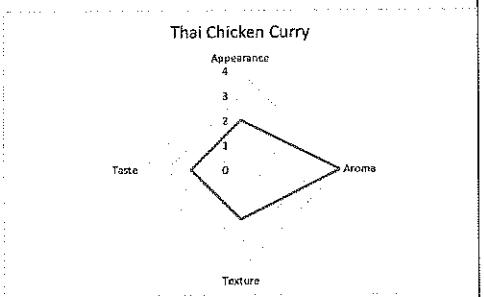
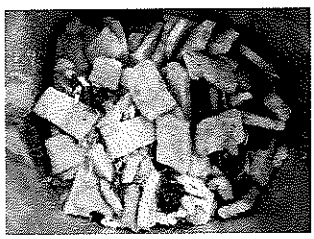
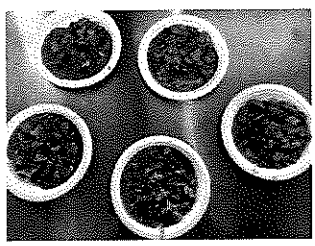
Beef Mince (Back country cuisine)
Very unappealing appearance – brown lumps in liquid. Chewy, lumpy texture and a bland, unpleasant taste. Unseasoned and nothing enjoyable about it



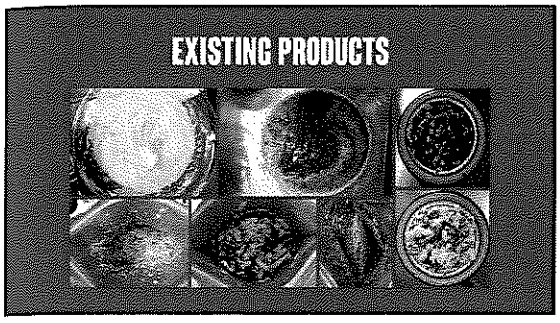
This initial investigation into existing products helped me to see that the freeze-dried food on the current market is not overly enjoyable and tends to be quite basic meals and boring flavours. This knowledge allows me to see that I can get creative with what I develop and make it exciting for someone to eat.
NEXT STEPS – Research some more existing products in depth to help me fully gage what is lacking on the market and find the gaps I must fill.

I am going to be testing five more freeze dried meals to complete my existing products research. These will give me my final opinion on the current market, show the clear gaps and I will learn what competing products could be like. I will also rate each product out of 5 (1 being the worst, 5 being the best) on their appearance, aroma, taste and texture.

Comments	Photos
<u>Cooked Breakfast (Back Country Cuisine)</u> All the components are mixed together – this is not what you would expect from the description and not what a cooked breakfast would usually look like. Doesn't meet expectations of a "hearty combo" of beef, tomato, egg and hash brown. Unappealing – looked like mush, bland colours, everything was mixed together. It didn't rehydrate fully, there were still dry powder areas. Egg was chewy, meat was uncooked, tomato was very overpowering and the whole thing was under seasoned. Overall the WORST freeze dried meal I have tried 	 
<u>Mexican Chicken (Back Country Cuisine)</u> Nice aroma cooked and uncooked, but had an unappealing appearance – didn't absorb moisture well so very runny sauce. Chicken had a chewy, gummy texture like tofu and beans and corn were dry and hard Unbalanced flavours and was very spicy, I could barely eat it Not enough corn chips, they were also very broken up and slightly stale tasting. 	 
<u>Mixed Berry Breakfast (Radix Nutrition)</u> Has a sweet berry aroma and nice appearance – natural colours and nice chunks in the meal. The liquid/sauce was quite runny and would have preferred it thicker. The nuts stay nice and crunchy and coconut chips give a good flavour and texture. Is just like something I would make for breakfast so found it really enjoyable, also is dairy and gluten free! Love the ingredients, wholesome and natural 	 

Really nice packaging too – easy to read instructions and makes a nice bowl	
<u>Thai Style Wild Alaskan Salmon (Radix Nutrition)</u> Aroma is very strong and unenjoyable. The hydrated meal is attractive appearance and very colorful, but doesn't have an authentic Thai flavour. There is a very fishy flavour throughout and foul aftertaste. The vegetables are in very small pieces. The salmon is cooked inconsistently but the pieces that are cooked are very nice and fall apart – but the ones that weren't were dry and powdery in the middle. 	 
<u>Thai Chicken Curry (Back Country Cuisine)</u> The main ingredient in the sauce is sugar – this is very unappealing to me an many health conscious consumers. Salt is in the middle of the ingredients list, meaning that there is a high amount of it in the meal. Colours and flavours added – unnatural and unappealing Vegetables are green beans and peppers, this is only two vegetables, so not highly nutritious. The packaging LEAKED while rehydrating – this is terrible and I would expect much better from a product that's costs $32.99 	 

Conclusion Testing existing freeze dried food products helped me gain knowledge in how they worked in terms of hydration – each one I trialed only required hot water, a stir and 10-15 minutes to sit for preparation (apart from the berry breakfast which used cold water). Most importantly, it showed me areas in which they were lacking: taste, appearance, nutrition and dietary needs. All of the savory meals were unattractive, unbalanced, not very enjoyable and didn't have many vegetables, so wouldn't supply adequate vitamins and minerals to a tramper. They all were very salty and had high sodium levels – why was this? Because salt is used as a preservative.



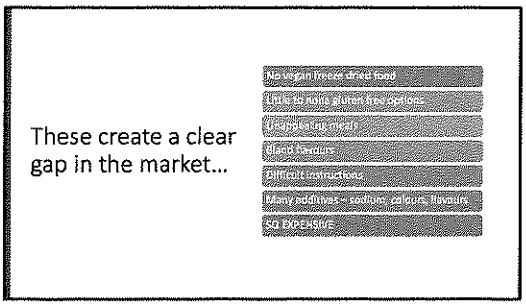
I talked about existing product in my presentation:

There are several companies in New Zealand who produce freeze dried foods for tramping purposes such as Back Country Cuisine, Radix Nutrition and Absolute Wilderness. But when looking into a variety of these products, I found most to be highly disappointing. Even just looking at them I knew that they were nothing to be excited for after a hard day's tramp. They are often said to be 'delicious and nutritious' with menu-style descriptions, but this is not always the case! Disassembling what was already on the market was both interesting and disappointing – often the foods were not palatable, have an unappetizing appearance, an off-putting aroma, are over salted or over sweet, are generally just not at all enjoyable and are extremely expensive. The disappointments and what I would call 'down falls' of these products left many gaps in the market for me to fill.

As well as the gaps existing products left to fill:

While the existing freeze dried food products meet the need, I believe there is huge room for improvement for a greater variety of simple, nutritious meals suitable for all age groups. I could go on and on about the gaps in the market as there were just so many that arose, but there were some key gaps that stood out to me. They were:

- *No existing vegan freeze dried food product*
- *Very little gluten free options*
- *All unappealing and tasteless*
- *Hard instructions to follow*
- *Many additives such as sodium, colours, flavours and preservatives*
- *So overpriced!*



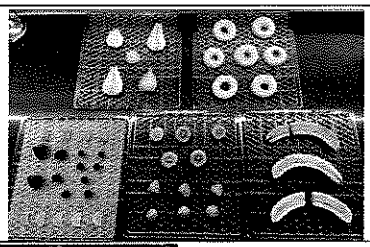
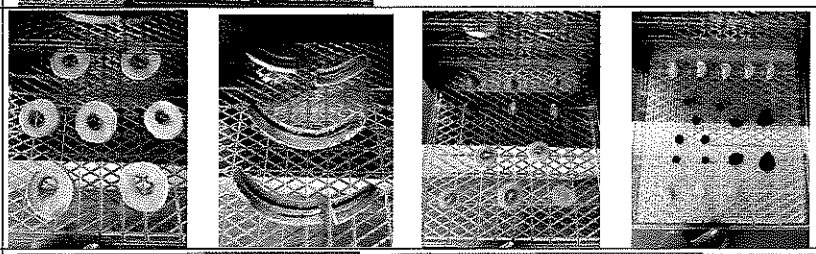
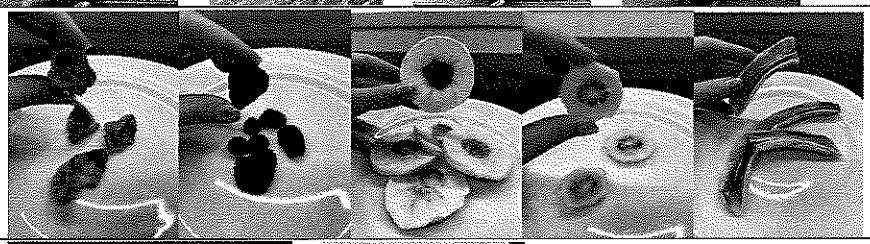
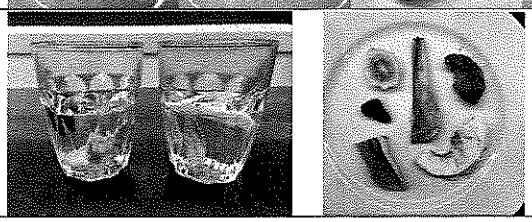
The gaps in the market that interested me the most were the lack of vegan and gluten free products. This makes it difficult for people with these dietary requirements and lifestyles to access freeze dried food – so I knew I needed to change this.

NEXT STEPS – After researching into existing products and gaining an understanding of my competition, I can now begin functional modeling to develop my own range of freeze dried products.

Initial Dehydration Test

As freeze drying is very expensive and hard to access, I had to use a different approach while initially developing my product to make best use of my resources. To do this I used a dehydrator as this would work best and give the closest results to freeze drying (because dehydrating is taking the moisture out of the food, which is a part of freeze drying)

During the COVID-19 lockdown, I am again making the most of my time at home and will be dehydrating a selection of fruit in the dehydrator at 60°C. I managed to safely collect a dehydrator from school (non-contact) so am now able to complete some trials with this. I will see how it affects the taste, appearance, texture and rehydration properties of each fruit. I will be dehydrating banana, apple, pear, kiwifruit, feijoa, mandarin and some berries – I am having to work with what I have on hand as access to supermarkets is limited.

Step	Photo
Prepare fruit and arrange on dehydrator trays	
6 hours	
12 hours (done)	
Rehydration This only took about 5-10 mins	

Conclusion This test was really interesting and helped me understand how some fruits react to being dehydrated. The apple dehydrated the best – it tasted exactly the same as fresh, had a slight bite and chew and kept its appearance. The banana also dehydrated really well – it kept its appearance, was chewy, was very sweet and tasted amazing. The mandarins didn't dehydrate so well as they became dry and crisp on the outside but were still very moist on the inside. The pear dehydrated the least so would need longer than 12 hours to remove more moisture. All the fruits rehydrated within 5 – 10 mins and all had the same appearance, taste and texture as normal – this shows that it will work well for any ingredient in my product development. I got feedback from my family on this and they could barely tell they were rehydrated, they just thought they were the actual fruit.

Feijoa and berries (for chia pudding options) – The strawberries dehydrated really well and were sweet and chewy. The blueberries, blackberries and raspberries didn't dehydrate well at all, were still very moist (I must keep in mind that I used frozen berries) . The feijoa dehydrated well, they kept their great intense flavour but were quite gritty.

NEXT STEP – Now with certainty that dehydration will work for my trials, I am going to interview my key stakeholders. I also have to keep up with my project management to keep my technological modeling on track during the shock COVID-19 lockdown.

COVID-19 – NZ in Lockdown (25/03)

At this point in time, New Zealand is enforcing social isolation due to the corona virus epidemic growing in our country. Given this unexpected global event I am now having to rethink the management of my project and make adjustments to suit the circumstances. I am now unable to attended school so am doing online learning, lacking resources, don't have as much teacher support available and can't contact stakeholders easily. It is because of these circumstances that I am adjusting my project management.

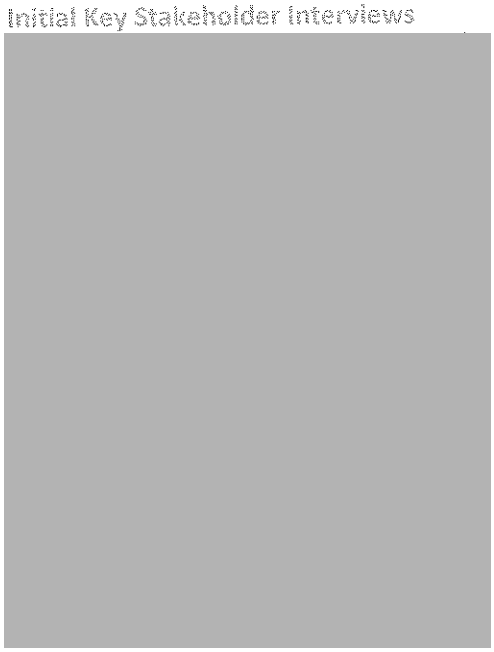
Today I have taken some time to revisit and update my calendar and Gantt chart so keep me aware and up to date with my project. These two project management tools are extremely important when it comes to managing my project as they allow me to put it into perspective. In this case, it has allowed me to look further forward into my project and complete come later task that I am able to do at this time.

I have got my context, initial brief and am ready to start thinking of questions for my stakeholders for when I interview them. For this I must book a meeting with each stakeholder, which will have to be over FaceTime due to the current circumstances.

Message I sent to stakeholders when arranging to complete their interviews, they all said yes.

I am going to complete my stakeholder interviews, update my Gantt chart, calendar and to do list to adjust to the circumstances. I will be sure to stay on top of my project while learning from home by using my project management tools.

Initial Key Stakeholder Interviews



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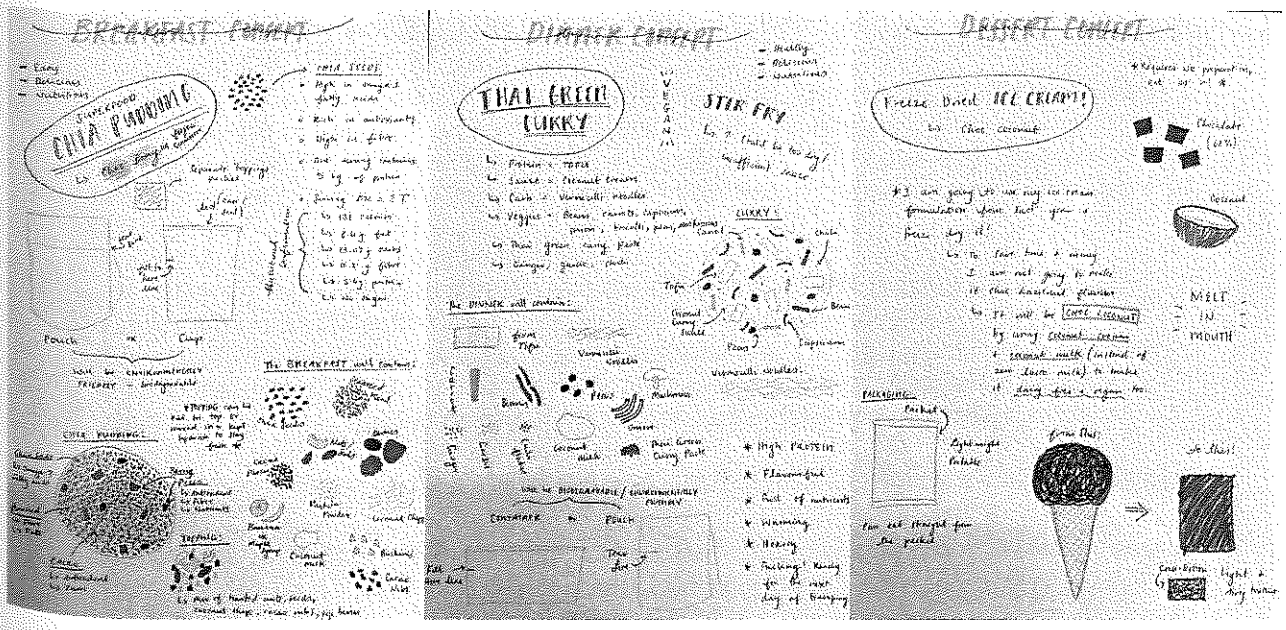
- She is lactose intolerant, so limits her dairy intake and is best not to consume
- Is currently completing the Gold award level in the Duke of Edinburgh program
- Has tramped often due to DOE
- Has only taken freeze dried food once on a tramp because, in her opinion "it all turns into mush"
- Would prefer to have snacks at lunch over a freeze dried meal
- Is interested in my range of freeze dried meals being for breakfast, dinner and dessert
- Loves Asian food for donner, especially Thai
- It interested in my project and willing to be an ongoing stakeholder

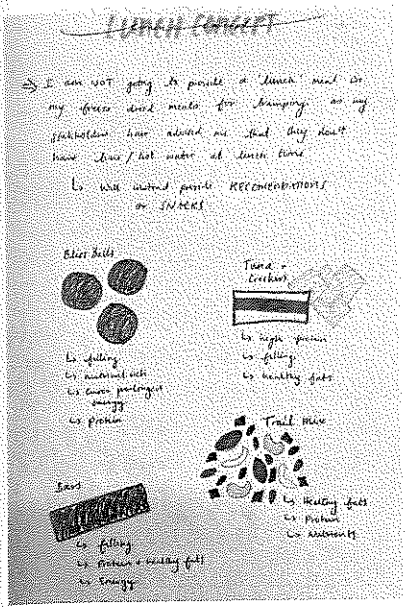
C C

- She is vegetarian and shows a great interest in becoming vegan in the future
- Has concerns surrounding animal welfare and ethics
- Often doesn't take freeze dried food as first choice, but has used Back Country Cuisine before and didn't enjoy very much
- Sees freeze dried food as practical but something that can often be very unenjoyable
- Is mostly interested in a freeze dried dinner, but supports a breakfast and dessert too
- Claims there is not enough time to prepare a lunch with hot water while tramping
- Loves Asian food
- Is interested in my project and willing to be a key stakeholder

Interviewing a group of my *stakeholders* was highly important so I could learn about them and what they liked, because it is key to meet your consumers wants and needs in product development. After learning that all of these stakeholders (interviewed 4 *key* stakeholders) have low expectations when it comes to freeze dried food, I knew I needed my range of freeze dried foods to change this preconceived opinion. I also found that a freeze dried meal would not be ideal for a lunch while tramping as there isn't enough time to boil water and prepare. NEXT STEPS – I need to create conceptual designs for my freeze dried breakfast, dinner and dessert. I will then begin my initial trialing and testing for these once showing my stakeholders for their opinions.

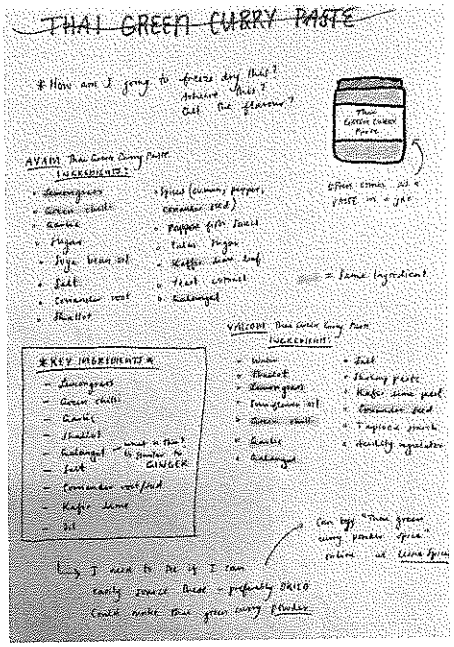
Conceptual Designs





<- Explaination as to why I am not developing a freze dried lunch and alternative lunch ideas.

Researching Thai green curry paste to see what spices I will need to combine to make an authentic Thai green curry powder ->



As I was still in lockdown I sent photos of these to my stakeholders to get their feedback.
One of their replies was:

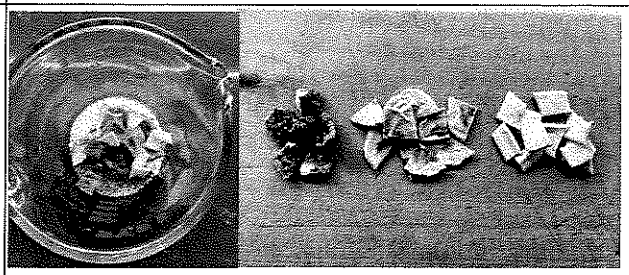
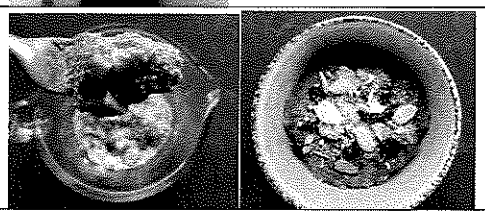
Breakfast *-I really like the idea of a chia pudding as I find it really difficult to find breakfast options for when I am tramping. It would also be really furling which I love*
-I think either of these flavours would be amazing
-The ingredients included all look really appealing especially the nuts, berries, coconut chips, banana and coconut milk as I love anything coconut flavour.
-I like how you said topping could be kept separate cause this way it would give a bit more texture and crunch to the breakfast, otherwise it could get soggy
Lunch *-Smart not to do a freeze dried lunch as it is just too complicated to prepare*
-Perfect snack ideas! These are the types of snacks I would have in a day during my tramp that are great for energy
Dinner *-I really love this idea! I love Thai curries and always feel like curries for dinner after a long day of tramping so this would be perfect.*
-I prefer the Thai green curry over a stir-fry
-I really like the coconut flavours so would really enjoy this, also the ginger and there spices I can tell it would be very flavourful which is something to look forward to when tramping
-I like the vegetables in it especially beans, mushrooms and carrot, however, peas aren't my favourite so the options could be like pumpkin (I'm not sure if this would work being freeze dried though)
Dessert *-Another amazing and yummy looking idea!*
-Ice cream is now of my favourites desserts so to take this on a tramp quid be so good
-Unique idea, never seen this been done or be taken on a tramp before
-Chocolate and coconut are two of my favourite flavours and a great combination together!
-After being a stake holder for your ice cream last year, which I really enjoyed, I know this would be a really nice tasting dessert if it could be freeze dried and making it coconut instead of hazelnut would still taste really good
-Due to it having no preparation this would be so useful, easy and handy to have on a tramp

This, as well as positive feedback from other stakeholders, helped me make an **informed decision** to move forward with my concepts and take them to the prototyping stage by beginning to test formulations.

Trialing and Testing

Chia Pudding (Trial 1)

I am going to complete my first trial of a chia pudding. I am most interested in seeing how it rehydrates – how long it takes, if everything hydrates, how its looks etc. I will be using some fruit that I have dehydrated from previous trials in the recipe. Note: I am only able to trial the feijoa apple flavour at this stage due to lack of resources for chocolate, berry and beetroot with COVID-19 restrictions.

Step	Photo
Combine ingredients: 2 T chia seeds ½ T coconut milk powder ½ dried feijoa (cut small) ½ dried apple ring (cut small) 3 dried banana rings (cut small)	
Add ½ C boiling water Cover and stand for 10 minutes (stir halfway)	
Add toppings	

Conclusion This trail successfully showed me that a chia pudding will work well as the breakfast meal in my tramping range of freeze dried food. The chia seeds and dried fruit hydrated very well and had an ideal texture for a chia pudding. The apple and feijoa pieces added a nice bite as well as good flavour, and the banana was great as a sweetener. It wasn't very creamy so I could add more coconut milk powder or use coconut cream powder. It definitely needs more fruit for taste, texture and nutrients and also some protein powder for added nutrition.

I got stakeholder feedback from [redacted] (a key stakeholder), she said:

- The texture is good for a chia pudding
- Love the flavour – especially from the apple and feijoa pieces
- Doesn't have the most appealing appearance but better once toppings are added
- Toppings add a nice crunch
- Could have more fruit pieces

NEXT STEPS – Trial another flavour (Chocolate, berry and beetroot) of chia pudding along side this one and get stakeholder feedback. Firstly I will look into beetroot pwder more to be well informed with it's benefits. I will make this a sensory and elimination test feedback session to decide which flavour the freeze dried chia pudding will be.

Beetroot Powder

Beetroot powder has many health benefits – especially when it comes to sports nutrition, recovery and energy. Beetroot is such a nutritious vegetable full of vitamins, and as beetroot powder it is much more concentrated and beneficial. Some health benefits include:

- Strengthen heart health
- Increase exercise endurance
- Powder through high intensity workouts reduce recovery times
- Boost brain health

Of these, the endurance related benefits really stand out to me and would be so beneficial for tramping as it is a long period of exertion.
I spoke to an athlete, cyclist and his mother, to get their opinion on this. He said he "swears but beetroot powder for performance" and takes 1 tsp three times a for a week leading up to competition – and sees its effect (as he has won medals).
Beetroot powder's performance properties are why I want to include it in my freeze dried choc, beetroot and berry chia pudding.

Chia Pudding (Trial 2)

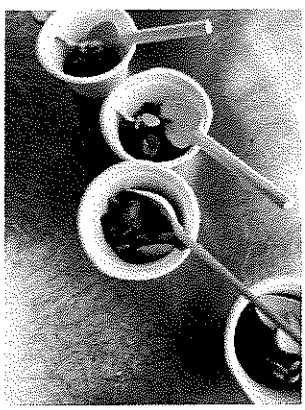
I am going to trail two flavours of chia pudding – Apple Cinnamon and Choc Berry Beetroot. This test will be crucial in the decision making of what flavour to move forwards with as I am no longer doing a range of flavours due to time constraints the COVID world pandemic has impacted on my project. I want to see which flavour is preferred and for what reasons; taste, texture, health benefits etc. Feedback from my stakeholder focus group will assist me in making an informed decision on what flavour to moved forwards with.

Ingredients

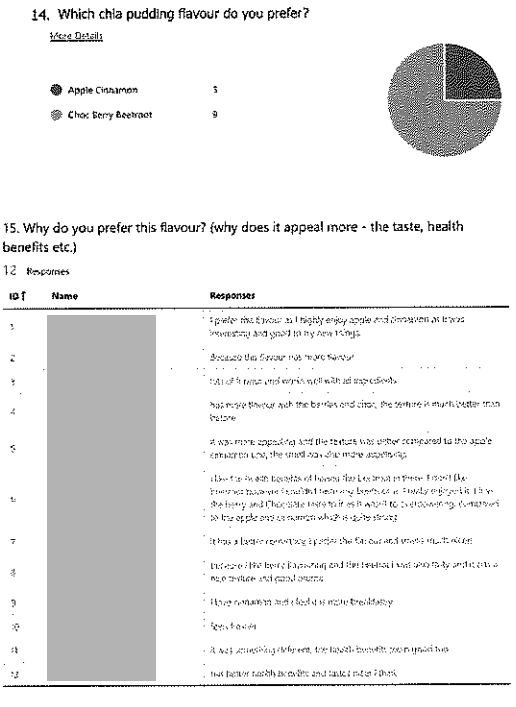
Apple and Cinnamon	*Choc Berry and Beetroot*
2T chia seeds	2T chia seeds
4 dried banan coins (cut)	1/4C freeze dried raspberries
1/4C freeze dried apple	1/4C freeze dried strawberries
¼ t cinnamon	1t beetroot powder
1 T coconut cream poeder	2t cocoa powder
	1T coconut cream powder
	2t coconut sugar

Photos

Stakeholders loved eating out of the biodegradable cups with biodegradable spoons! Were happy with the ethical thoughts behind my testing.



My stakeholder focus group giving feedback on the chia puddings



Conclusion *For feedback from my stakeholders I sent them a Microsoft forms survey to fill out – this was a simple, hygienic way to get their opinion in a way that would simply calibrate the results*

Overall, the choc berry and beetroot was the favourite, therefore this is the flavour I will be moving forwards with, I am able to make this informed decision due to the stakeholder feedback received. The appearance and taste was preferred due to the appetizing colour and fresh, tasty large pieces of strawberries and raspberries. It hydrated well and was a nice thick texture (also works with just cold water!) The apple and cinnamon chia pudding had an overpowering cinnamon flavour and not enough variety in texture with the fruit.

Overall, my stakeholders couldn't find areas for this chia pudding to improve on – they found the chocolate and beetroot flavours to be balanced (chocolate covered the beetroot nicely) and that the berries were sweet but also slightly start to add some depth to the flavours.

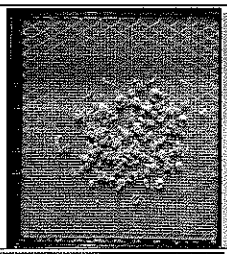
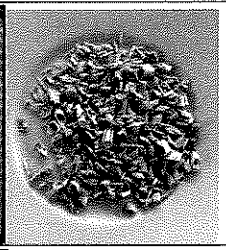
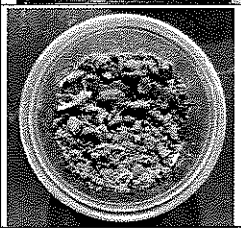
NEXT STEPS – So, with great confidence in this Choc Berry and Beetroot Chia Pudding I will get experts to try it like this when I send my range of meals to them. For now, I will move on to developing my freeze dried Thai Green Curry through a series of trialing and testing getting crucial stakeholder feedback along the way.

Initial Thai Green Curry Trial

I am going to complete the first trial of my Thai Green Curry – the dinner meal in my freeze dried food tramping range. I will first have to create a Thai green curry powder (as I have researched into this and its main components). Then I will trail a one serving meal using this curry powder as well as other ingredients I have on hand and prepared. I am aware that this meal will be more complicated and have more components than the chia pudding so may take more trialing and testing, and will require adequate feedback.

Thai Green Curry Powder

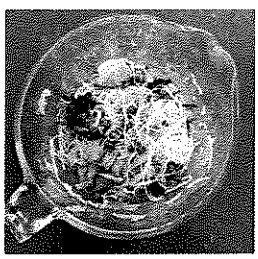
Step	Photo

Dehydrate lemongrass (6 hours at 40°C)	 	
Combine spices together:		I will use this curry paste to trail a Thai green curry rehydration and see how in functions/tastes

Thai Green Curry

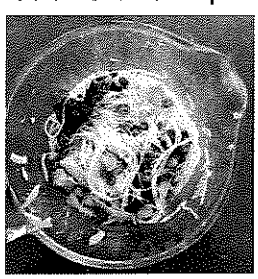
1) Add all ingredients to a bowl
- 100g dehydrated tofu
- 50g vermicelli noodles
- 1/4c dehydrated peas
- 1/4c mushrooms
- 1/4c pumpkin
- 20g coconut cream powder
- 1t Thai green curry powder

2) Add 1 cup boiling water, cover and stand for 10 minutes (stir half way)



This is what it looked like at 10 mins with 1c water, needed more as there wasn't enough to fully hydrate everything or make a sauce

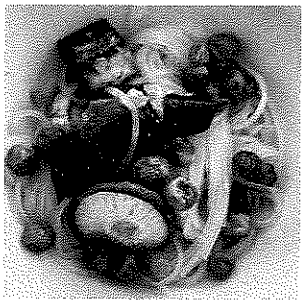
3) Add an extra ½ cup water, stir and stand for 5 more minutes



This is what it looked like after 15 mins with 1 1/2 C water – this was a better ratio of sauce to noodles/veggies/tofu and everything was hydrated better

Conclusion This trial helped me see that a Thai green curry would work well as the dinner meal in my tramping freeze dried food range. Overall, it rehydrated and tasted well. The vermicelli noodles were perfectly cooked once rehydrated and went really well with a coconut curry sauce. The grated pumpkin and mushrooms rehydrated really well, but the peas were still a hard/crunchy. The Thai green curry flavour

was quite subtle, but authentic, so I could increase the amount of curry powder I use and see if this works. I will need to think about how some of the vegetables can rehydrate better – and eventually work out what could bring more protein and nutrition to this meal. Beans? Chickpeas? Quinoa? It could also be creamier. I got stakeholder feedback from my family (with my sister being a key stakeholder):



- Has a colourful, fresh appearance
- Vegetables are attractive
- The tofu rehydrated well and tastes nice – good being marinated in soy sauce
- The peas were slightly hard still
- Noodles were a really good texture and went well with the curry
- Coconut curry flavour was delicious but not very strong
- Would be a nice warm, comforting meal while tramping
- May not be filling enough – possibly add something for more protein

NEXT STEPS – Moving forward with my curry I need to test the tofu again to be certain it will work. In my next trial I will also increase the amount of Thai green curry powder and coconut cream powder to make the flavour stronger and the sauce creamier

Thai Green Curry (Trail 2)

I am going to complete another trial of my Thai Green Curry. I will try to improve it from last time by increasing the intensity of flavour in the sauce by adding more curry powder and coconut cream powder. I will also add more vegetables – including zucchini and carrot noodles, beans, capsicum. These will add to the nutrition content as well as the volume and taste of the meal.

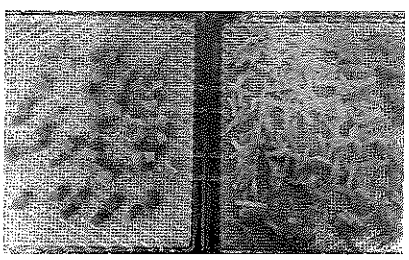
Dehydrated Vegetables Adding more vegetables to the curry will boost its nutritional content and add vitamins and minerals to assist in recovering from tramping. I will be adding:

Spiralized carrot and zucchini (zoodles)

- Spiralized, blanched and dehydrated at 50°C for 8 hours

Dehydrated Pumpkin

I am going to dehydrate some grated and cubed pumpkin to see which way of cutting will rehydrate best. I will be blanching them first to help retain the flavour and colour while being dehydrated.



- Grated (80g) and cubed (40g) then blanched – to help retain colour and flavour while being dehydrated. Dehydrated at 50°C for 8 hours

Dehydrated beans

- Blanched and dehydrated at 50°C for 8 hours

Dehydrated Capsicum

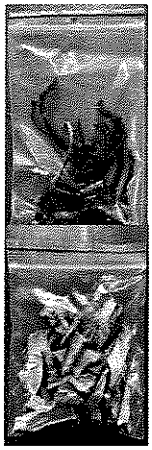
- Sliced and dehydrated at 50°C for 12 hours

Dehydrated Jackfruit

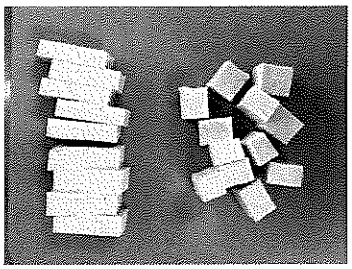
- Dehydrated at 50°C for 8 hours

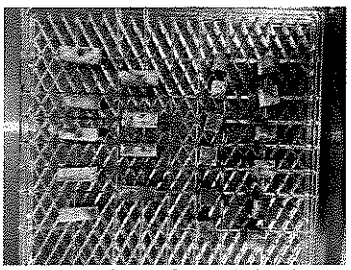
Dried Mushrooms

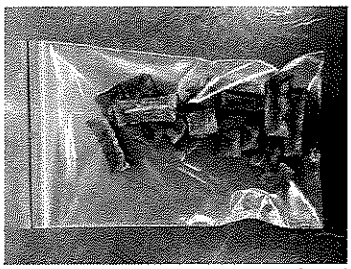
- From an Asian supermarket



Dehydrated Tofu I am dehydrating the tofu cut in two different shapes – cubed and rectangles. This is to see which rehydrates and holds it's form the best when being hydrated as the curry. It will also be marinated in soy sauce for added flavour, a deeper more appealing colour and preservation. Dehydrated at 60°C for 8 hours.

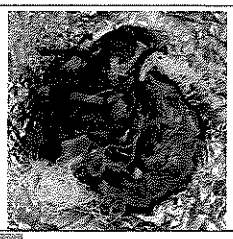
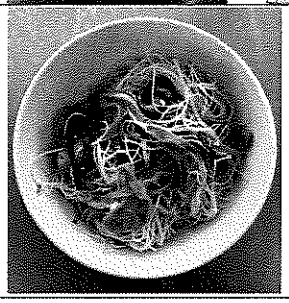




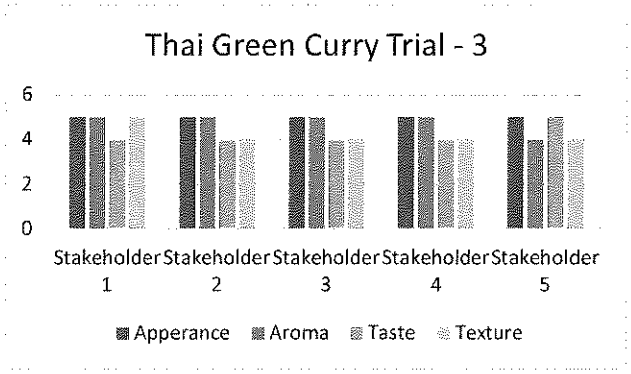


NOTE: It is not necessary to cook the tofu before dehydrating as it is already a cooked food. To make tofu, soybeans are soaked, boiled and made into soymilk, this milk is then cooked again and thickening agents called coagulants are added to help it form into a cake.

Step	Photo
Add all ingredients into a bowl: 100g Tofu (35g dehydrated) 50g vermicelli noodles 7g dehydrated spiralized carrot (1 whole) 2g dehydrated spiralized zucchini (1 whole) 10g dehydrated jackfruit (1/4C) 3g dehydrated green beans (1/4C) 4g dehydrated capsicum (1/4C) 6g dehydrated diced pumpkin 1/4C dried mushrooms (0g) 30g coconut cream powder 1T Thai green curry powder	

Add 1 1/2C boiling water and cover Stir after a 5 minutes and re-cover Cover with tinfoil to insulate and imitate the freeze dried packaging			After 5 mins
After 15 minutes, stir and eat			

Conclusion This trial was overall quite successful and gave me good guidance and information to move forward with. The flavour from the curry power (by increasing it) was authentic and tasty. The vegetables made it very appealing and colourful – the carrot, mushroom, pumpkin and capsicum were definitely the most flavorful and rehydrated the best. The green beans were not enjoyable and very hard/chewy, and the jackfruit had a very unpleasant flavour and hard texture that didn't compliment the rest of the curry – so I will not be further using these. Moving forward with vegetables, I will use carrot (cut in sticks, not spiralized to make it easier to eat), capsicum, mushrooms, pumpkin and possibly add silver beet, leek or spring onion and broccoli. This will help give sufficient nutrients while being enjoyable to consume. The tofu was NOT successful. After being completely dehydrated, it barely rehydrated in the curry and was very hard, chewy and inedible. I got stakeholder feedback from my classmates to get other opinions:



They had comments such as:
"had a good coconut flavour"
"was unable to eat the tofu"
"could have more spice"
"cut the noodles smaller to make it easier to eat"
"would like the carrots cut in sticks"

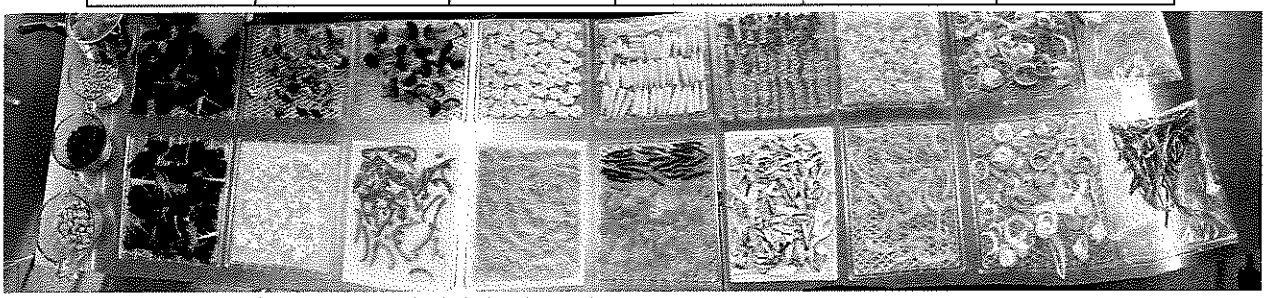
NEXT STEPS – This trial was very helpful in progressing my Thai Green Curry formulation. Moving forward from this to my next trial I will eliminate the tofu and trial **chickpeas**. I am also going to trial **quinoa** instead of vermicelli noodles as I want to see that these work successfully before having a paired comparison test between the noodles and quinoa. Before

my next trial I am going to work out how long different vegetables and legumes take to rehydrate.

Vegetable Rehydration Time Chart

*All of these vegetables and legumes were rehydrated with boiling water

Green Bean	*Corn*	*Silver beat*	*Pumpkin*	*Broccoli*	*leek*
10+ mins	7 mins	7 mins	8-10 mins	4-5 mins	5 mins
Carrot	*Capsicum*	*Black Beans*	*Butter Beans*	*Chickpeas*	*Quinoa*
10+ mins	4-5 mins	5 mins	5 mins	5 mins	10+ mins



Rehydration of vacuum sealed dehydrated veggies

I rehydrated a mixture of dehydrated vegetables. This took 10 minutes in a sealed, biodegradable and eco-friendly container.
They all rehydrated well and were desirable textures.

This has helped me learn that every vegetable I use in my Thai Green Curry will rehydrate successfully within 15 minutes. So I will now move forward with another test.

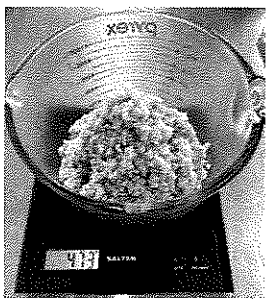
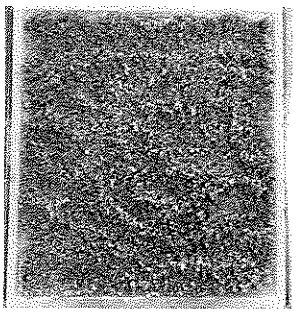
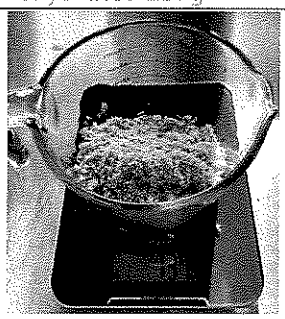
Thai Green Curry Trial 3

I am completing another Thai green curry trail to see what improvements I have made and can still make. I am using chickpeas as my protein source and quinoa as my carbohydrate (it is a protein source as well). As tofu was unsuccessful, I have chosen not to move forwards with it, so am hoping to see that chickpeas rehydrate well to replace this. Also, as vermicelli noodles are not very nutritious, I am trialing quinoa to see if it could work well to replace these as it is much more nutrient dense.

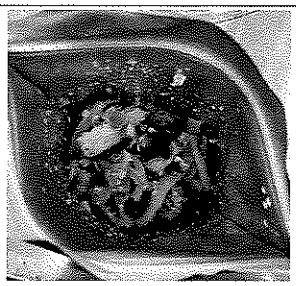
Thai Green Curry Powder	*Thai Green Curry*
1T Fried Shallots	45g quinoa (1/2 C)
1T Fried Garlic	50g chickpeas (1/2 C)
1 t dried lemongrass	12g carrot (1/2 C)
½ t ground ginger	10g broccoli (1/2 C)
½ t chili flakes	8g pumpkin (1/4 C)
½ t onion powder	2g mushroom (1/4 C)
½ t garlic powder	1g bamboo shoots (1/4 C)
½ t ground coriander	1g spring onion (1/8 C)
¼ t ground cumin	0g silver beet (1/2 C)
¼ t white pepper	0g capsicum (1/4 C)
1 t coconut sugar	40g Coconut cream powder

	1 T Thai green curry powder

Quinoa I am using quinoa in this trial to see how it works and compares to vermicelli noodles. Although the noodles work well in the curry, they are not very nutrient dense or filling which is most definitely not beneficial after a big day of tramping. Whereas, quinoa is a complete source of plant-based proteins and carbohydrates and also contains twice as much fiber as other grains.

Pre-dehydrating 473g	*Dehydrating*	*Dehydrated 137g*
		

Curry

Dehydrated	*Hydrated*	*Curry*
		

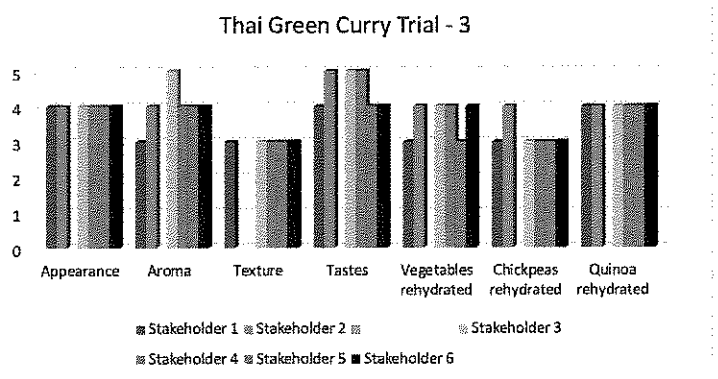
Conclusion *For feedback from my stakeholders I sent them a Microsoft forms survey to fill out – this was a simple, hygienic way to get their opinion in a way that would simply calibrate the results. It was important to be hygienic because of COVID-19*

This was overall a successful trial. It gave me a great sense of direction in terms of what vegetables I should be using – such as definitely having broccoli and carrot and eliminating the bamboo shoots and pumpkin as they were the least popular in taste and hydration. It also helped me understand that quinoa works well being dehydrated and rehydrated with hot water, so this could be a much more nutritious carbohydrate option in my meal. I also know to increase the amount of coconut cream powder to help make a thicker and creamier sauce.

Stakeholder Comments "I like the silver beet and the broccoli. Think sauce needs to be thicker, but great taste. Visually appealing."

"really like the flavours however the sauce could be slightly thicker I really like the broccoli

"the flavour is really nice and it has a good level of spice - I really like the broccoli and I think it is a really good meal!"



NEXT STEPS – Now that I know with certainty that all of the vegetables rehydrate well, chickpeas work and that the quinoa was successful, I am going to complete one last trial with my final formulation – a comparison trial between a curry with vermicelli noodles and a curry with quinoa. Before this I will do some research into cultural appropriation to ensure my freeze dried Thai Green Curry doesn't appropriate at all.

Cultural Appropriation

When creating my Thai Green Chicken Curry it has come to my attention that I could be cultural appropriating a Green Curry from Thailand as my concept is a Thai Green Curry. I am looking into culture appropriation to see if it is ethically right to move forward with the concept or if I am disrespecting the Thai culture and stop developing this concept.

What is Culture appropriation? Cultural appropriation is when someone takes an aspect or something from a different culture and strips it from its name and reclaims it as their own. This can lead to the inappropriate use of a cultural item or custom.

"Cultural appropriation, also called cultural misappropriation, occurs when a person from one culture adopts the fashion, iconography, trends, or styles from another culture. Some of the most controversial and harmful examples of cultural appropriation happen when the culture being appropriated is one of a historically oppressed group."

An example of cultural appropriation that is current in the media is in fashion where brands take outfits from different cultures and rebrand them as their own and say that they are now high fashion. As this is taking from another culture and making it their own and re-labelling it, this is cultural appropriation.

How am I not culturally appropriating? With my Thai Green Curry concept, I feel confident in the ethics behind my brand and my concept to be able to move forward with it. In cultural appropriation parts of cultures are taken and relabelled as their own, however in the case of my Thai green chicken curry, I am making sure that I do not relabel the flavour as my own through keeping Thai is the title of my concept and information of the packaging. I have also researched into the flavours and existing recipes to make the flavours authentic as possible for the curry. My intentions behind making the Thai curry as well is not to take their flavours and rebrand them as my own. With this said, I am confident and happy to moved forward with my final trial.

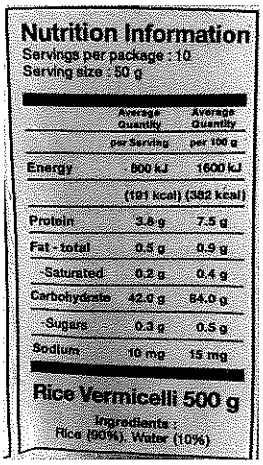
Thai Green Curry Trial 4

This is the most significant curry trail yet in my product development. I will be trialing my final formulation and comparing rice noodles and quinoa. I want to know which carbohydrate hydrates optimally and compliments the curry the best. Stakeholder feedback will be crucial so I will be having a sensory analysis focus group come together to taste and give feedback. I hope to have my freeze dried Thai green curry finalized after this trial using stakeholder feedback to make informed decisions.

Vermicelli noodles vs. Quinoa (Health benefits)

I have been using vermicelli noodles in my curry, they are affordable and work well – but, are not very nutrient dense and give minimal benefits. Quinoa, on the other hand, is a superfood and one of the most nutrient dense grains readily available on the market.

In terms of calories, both are very similar per serve with vermicelli noodles being 191cal and quinoa being 194cal. Vermicelli have a higher amount of carbohydrates (42g) compared to quinoa (34.5g) per serve, but quinoa has nearly double the protein being 7.2g per serve, compared to vermicelli having 3.8g pf protein per serve. This is very important for plant-based vegan diets. Quinoa also has no saturated fat and less sodium that vermicelli noodles (6mg compared to 10mg) which is important as I am creating a product with lower sodium levels than what there already is on the market.



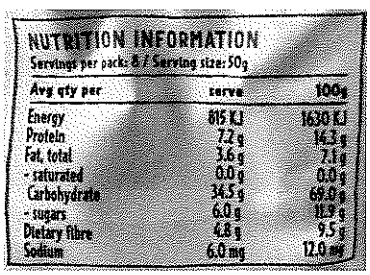
Nutrition Information

Servings per package : 10
Serving size : 50 g

	Average Quantity per Serving	Average Quantity per 100 g
Energy	800 kJ (191 kcal)	1600 kJ (382 kcal)
Protein	3.8 g	7.5 g
Fat - total	0.5 g	0.9 g
Saturated	0.2 g	0.4 g
Carbohydrate	42.0 g	84.0 g
Sugars	0.3 g	0.5 g
Sodium	10 mg	15 mg

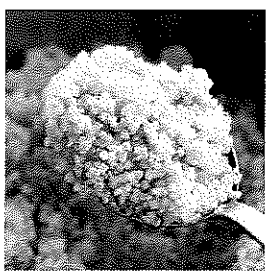
Rice Vermicelli 500 g

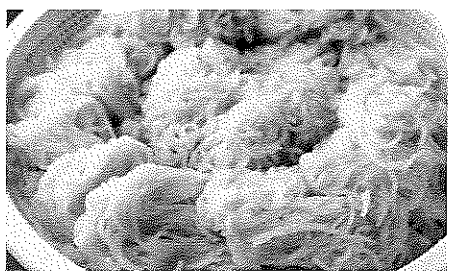
Ingredients :
Rice (90%), Water (10%)



NUTRITION INFORMATION
Servings per pack: 6 / Serving size: 50g

Avg qty per	serve	100g
Energy	815 KJ	1630 KJ
Protein	7.2 g	14.3 g
Fat, total	3.6 g	7.1 g
- saturated	0.0 g	0.0 g
Carbohydrate	34.5 g	69.0 g
- sugars	6.0 g	11.9 g
Dietary fibre	4.8 g	9.5 g
Sodium	6.0 mg	12.0 mg





Because of the added benefits that quinoa has, I am trialing it to see if it will work in my curry and getting stakeholder feedback of preference between the two carbohydrates to help me move forward with the superficial option to develop a desired product.

Trial I halved the recipe and to one half added vermicelli noodles, and to the other added quinoa. I also added half the amount of boiling water to each curry but let them hydrate to the same amount of time (15 minutes).

Formulations

Ingredients (noodles)	*Ingredients (quinoa)*
25g vermicelli noodles	25g quinoa
25g chickpeas (1/4C)	25g chickpeas (1/4C)
6g carrot (1/4 C)	6g carrot (1/4 C)
5g broccoli (1/4 C)	5g broccoli (1/4 C)
1g mushroom (1/8 C)	1g mushroom (1/8 C)
1g leek (1/8 C)	1g leek (1/8 C)
0g silver beet (1/4 C)	0g silver beet (1/4 C)
0g capsicum (1/4 C)	0g capsicum (1/4 C)
½ T Thai green curry powder	½ T Thai green curry powder

Photos

Biodegradable bowls and cutlery supporting the ethical nature of my testing

Conclusion *For feedback from my stakeholders I sent them a Microsoft forms survey to fill out – this was a simple, hygienic way to get their opinion in a way that would simply calibrate the results. It was important to be hygienic because of COVID-19*

The main purpose of this trial was to get stakeholder feedback to inform my decision on whether the Thai green curry should be made with vermicelli noodles or quinoa. My research backs up that fact the quinoa would be much more nutritionally beneficial, but a test was required to see my target markets preference. In exactly halving the recipe it was a fair test between the two carbohydrates and was easy to decipher between which was the favourite.

The rice noodles hydrated well as expected and do go well with the curry, but are more difficult to eat and don't carry the flavour of the sauce. The quinoa hydrated well and suited the curry, especially because it soaked up the sauce which made it really add to the meal. 9 out of 12 of my key stakeholders preferred the quinoa and had comments such as:

"Flavour was better (with quinoa), more nutritional value, it tastes creamer whereas the noodles were a bit bland."

"Quinoa soaks up way more flavour and tastes a lot better"

"I love the taste and the sauce really adds that boost of flavour to the quinoa. I believe that if you went on a tramp it would give you lots of energy."

Therefore, as a result of this trial the Thai green curry will contain quinoa as it adds to the flavour and enjoyment of the meal as well as having amazing health benefits and nutritional value. I am able to make this informed decision from the stakeholder feedback I received that majorly preferred quinoa in the curry, with 75% of stakeholders wanting this. Therefore I now have my final Freeze Dried Thai Green Curry formulation.

24. Do you prefer the THAI GREEN CURRY with RICE NOODLES or QUINOA? Taking into consideration the texture, taste and health benefits Both are good sources of carbohydrates - Rice noodles are lower calorie and less nutrient dense - Quinoa is a plant protein source and nutrient dense

More Details

22. Quinoa/Rice noodle Comparison: Rate the TEXTURE of the RICE NOODLES in the Thai green curry 1 being hard, not hydrated properly 5 being al dente and hydrated well

More Details

12 Responses

3.75 Average Number

23. Rate the TEXTURE of the QUINOA in the Thai green curry 1 being hard, not hydrated properly 5 being al dente and hydrated well

More Details

12 Responses

4.33 Average Number

25. Why do you prefer this? (the taste, health benefits, fuel while tramping etc.)

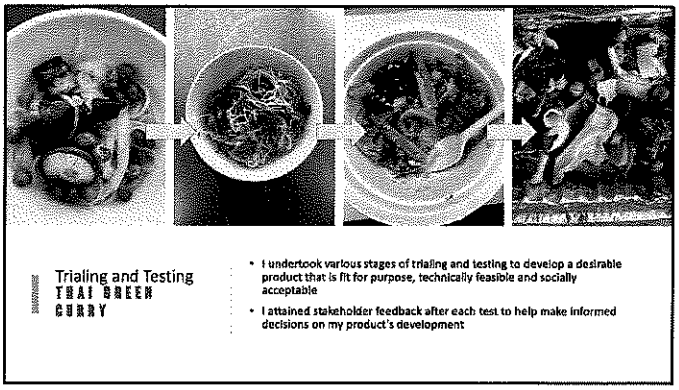
12 Responses

ID↑	Name	Responses
1	[redacted]	I love the taste and the sauce really adds that boost of flavour to the quinoa. I believe that if you went on a tramp it would give you lots of energy.
2		SUCH A GOOD TASTE
3		the flavour is very rich and taste way more fresh compared to the curry with the noodles
4		it soaks up way more flavour and taste a lot better
5		flavour was better, more nutritional value, it tasted creamer, noodles were a bit bland
6		easy to eat (noodles slip), more flavourful (soaks it up), quinoa is more hearty and filling
7		socks the cream and flavour, much more flavousome!!!
8		because I like the taste better and I like how the texture is different from the rest it adds differentiation
9		I feel it is healthier with less carbs and is good for digestion!
10		health benefits. Easier to eat. Makes me feel fuller. Soaks up the flavour of the sauce
11		tasted better
12		tastes better and would be more excited to eat

A seen above, quinoa was rated higher that the vermicelli noodles in terms of texture and hydration (4.33 out of 5 compared to 3.75 out of 5).

There are also so many positive comments regarding quinoa in the Thai Green Curry.

I spoke about all my developments in tests and trials throughout my functional modeling to the Board of Trustees:

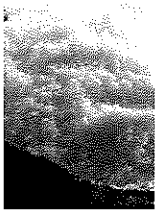
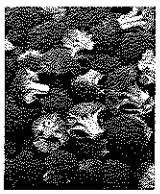


After research into existing products and establishing gaps in the market, I began the technological modelling of my own freeze dried meal: a Vegan and Gluten Free Thai Green Curry. I undertook ongoing stages of trialing and testing to develop the ideal formulation that met my stakeholders wants and needs. Along the way I planned for tests, got stakeholder feedback from them, concluded my trials and navigated the next steps I needed to take. The stakeholder feedback received from each trial was essential in making informed decisions so that my product would be suitable for my target market. Through tests, my curry developed from being a bland tofu and rice noodle Thai Green Curry, to a flavorful, highly nutritious chickpea and quinoa Thai Green Curry that attained plenty of positive feedback from my stakeholders.

With my trailing and testing being competed for my freeze dried Thai Green Curry and now knowing the final formulation, I will look into these selected ingredients and their ingredient properties to show their benefits and prove why they were chosen.

Selected Ingredients - Thai Green Curry

Ingredient	Function	Why I have chosen to include this ingredient
Quinoa 	Quinoa adds to the texture of the meal and helps to complete and bring it together. Quinoa is a good source of carbohydrates and keeps you full for a long time, giving sustained energy. It is also a great plant based protein source	I have include quinoa as it is available all year round for me to access and is reasonably affordable and bring the cost down of my meal. Quinoa is reliable and consistent I know that it will be available whenever I need. It is a great source of carbohydrates and protein - carbohydrates are essential nutrients and needed in a complete meal to replenish energy and keep you satiated; and protein is needed for growth and repair. Quinoa is known to be a superfood and an excellent source of nutrients. It is one of the most protein and fibre rich foods – a cup of quinoa two times the protein and about 5 grams more protein than the same amount of rice. A serving (1/2 C) of it contains 14g of protein ad 6g of fibre. Adding this instead of a grain also allows my product to be gluten free as it is a whole grain that is naturally free from gluten. The quinoa used is ethically grown and sourced.

Coconut cream powder 	Coconut cream powder is added for a creamy flavour that is authentic to the curry. Coconut cream is commonly used in curry and makes my curry true to label.	Coconut cream powder is fairly easy to access and very cost efficient as it is very low cost. It adds a rich and authentic flavour. Adding coconut cream also makes my product dairy free and therefore opens my product to the market of diary free and vegan. Coconut cream is rich in vitamins B, C and E and is full of antioxidants that help reduced risk of major dieses. It is also a healthy fat, an essential nutrient for the body as it is a concentrated source of energy that also aid s in the digestion of vitamins A,D,E and K. I know that for a major effect of the coconut cream to have proper benefits mass amounts would need to be consumed for any effects to be noticed however it is still worth added to the curry.
Carrot 	Carrots add to the colour and texture of the curry. The carrot maintains the bite and texture and adds flavour.	Carrots are available all year round and are easy to access at supermarket and are reasonably priced at all times. Carrots dehydrate well and maintain colour and flavour when rehydrated. Carrots are sources of fibre and vitamins and have many health benefits. They also make the curry visually appealing.
Broccoli 	Broccoli adds green to the curry, give a great flavour, adds colour and nutation. Broccoli has worked constantly well when rehydrating every time.	When testing the concept and trailing the vegetables broccoli has been one of the favourite vegetables every time. It is readily available and cost effective as the price is low. Broccoli is full of fibre and vitamins that help stimulate brain development. I am able to source this ethically and locally from New Zealand. It also gives a fresh appearance to the curry.
Red Capsicum 	Red capsicum adds great colour to the dish and makes it look appealing for the target market. It also adds flavour and nutrients.	Red capsicum at this time of year is very pricey however I have made other adjustments and sacrifices so that I will still be able to make a profit and have a tasty dish for my target market. Capsicums has been a very popular vegetable that I have included and catches your eye in the dish. They are an excellent source of vitamins A, C and E. Their natural sugars also help sweeten the curry to balance the flavours.
Chickpeas 	Chickpeas are a plant based protein source that increase the nutrition of this meal. Protein is necessary for growth and repair – especially when exercising to aid muscle recovery.	Chickpeas add protein to the meal to give you energy and assist in muscle growth. That are plant based and therefore suitable for those who chose not to consume animals. Chickpeas are a part of the legume family that help boost digestion, regulate blood sugar levels and keep you satiated. A serving of chickpeas contains 19g of protein as well as many important vitamins,

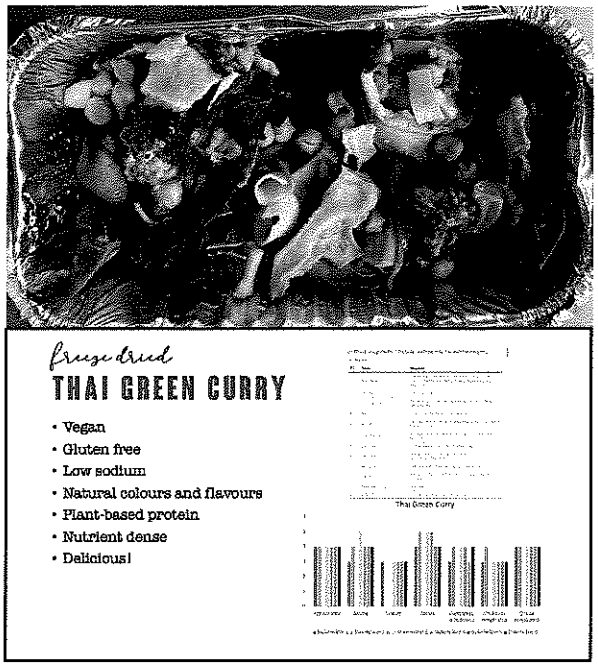
		minerals and fibre – making it a very beneficial food to consume for refuelling after a day of tramping. They are readily available and widely accepted in New Zealand and to my target market, they are also very cost effective.
Leek 	Leeks add to the fresh green colour in the curries appearance and add an onion flavour.	Leeks are a vegetable in the Amaryllidaceous family, this means they are in the onion family, they add an onion flavour that is fresh and looks appealing. They are also a stomach-friendly alternative to using onions as they are more easily digested.
Curry powder 	The curry powder has been experimented with and trailed to make the flavour authentic and true to label. The curry powder has been tested and adjusted to make the flavour strong and flavourful.	A mild spice is present for flavour and some warmth. The spices added are authentic and true to label and disruption. The spice mix mixes and distributes well through the curry so all of the curry has a strong and delicious flavour. The ingredients are accessible all year round and are cost effect as only a small amount is used to create the curry powder.

Ingredient Properties

Property/ desired attribute	Why my product requires this property/attribute	Ingredients
Contains protein	Research shows that protein makes up the building blocks of organs, muscles, skin, and hormones. Your body needs protein to maintain and repair tissues. Meanwhile, children need it for growth. A diet that is high in protein may also help lower blood pressure, fight diabetes, and more The Reference Daily Intake (RDI) for protein is 46 grams for women and 56 grams for men. (1). They are a macronutrient, so are necessary for the body. Protein is so vital when it comes to tramping as it is crucial for muscle tissue repair during the prolonged exertion. IT gives your body the amino acids needed to rebuild the proteins in the muscles. As well as repairing, it also builds and strengthens muscles. (2)For this reason, it is important that my Thai green curry is rich in protein to aid growth and repair of muscles during exercise. It is also important to my product that the protein as plant based as it is a vegan meal,	Chickpeas Quinoa
Contains carbohydrate	Carbohydrates are the sugars, starches and fibres found in some foods that are very crucial in a healthy diet. They are macronutrients – meaning that they are one of the three main ways the body obtains energy (calories). Thy can also only be obtained through diet (3).	Chickpeas Quinoa

	Research shows that consuming carbs to rebuild glycogen stores is important for people who exercise (Healthline Media). The rate at which glycogen stores are used depends on the activity, with endurance sports using more glycogen. Therefore, carbohydrates in a meal for adventurers are crucial for energy after excessive exertion on the body.	
Vitamins and minerals	Vegetables are important sources of many **nutrients**, including **potassium**, dietary fibre, folate (folic acid), **vitamin A**, and **vitamin C**. There are 13 vitamins essential to the body: vitamins A, C, D, E, K and the B vitamins (thiamine, riboflavin, niacin, pantothenic acid, biotin, B_6, B_{12}, and folate). All vitamins help your body in different ways such as resisting infection, keeping your nerves healthy, helping your body to absorb energy from food and helping your bool clot properly. (5) Minerals such as iodine, fluoride, calcium, magnesium and potassium also help the body function properly.	Chickpeas Quinoa Carrot Broccoli Capsicum Leek Silver beet
Flavour enhancer	Flavour enhancers are what give a meal it's certain taste. Without which, the food would be bland and unenjoyable. Every spice in the curry powder has a certain flavour profile that combine together to give and authentic Thai flavour. This makes the curry true to label and gives it authentic flavour. Coconut cream powder gives a rich, creaminess to the sauce. Its sweet flavour works with the spices to balance the flavour.	Curry powder Coconut cream powder
Visually appealing - colour	You eat with your eyes - appearance is one of our key sensory judgments when making decisions about the food we eat. We have four senses (appearance, aroma, texture, taste) that consciously or subconsciously obtain information from the food we are about to eat. (6) For example, a salad made of colourful leafy greens, red peppers, carrots and pickled onions would seem much more enticing than a bowl of iceberg lettuce.	Carrot Broccoli Capsicum Leek Silver beet
Contains Fat	Fat is an essential nutrient in every diet and is another macronutrient that the body requires daily to keep running properly. They are needed to give your body energy and support cell growth. (7) There are four different fats; saturated, trans, monosaturated and polysaturated fats – these all have different chemical structures and physical properties. Coconut is a saturated fat, so provides fat in a form of medium chain saturated fatty acids. It is always a necessary part of daily meals and should be included in post-exercise meals as it doesn't effect recovery, instead gives wholesome energy (2)	Coconut cream powder

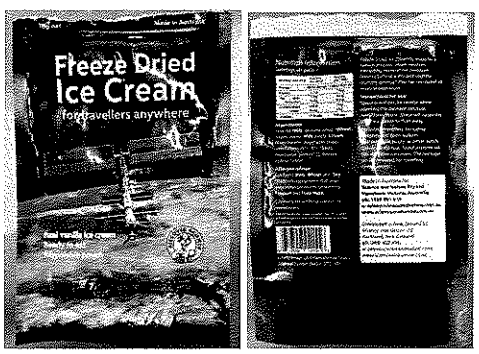
I discussed the benefits of ingredients in my Board of Trustees presentation:



So, with this in mind I had great confidence in the prototype that my functional modeling had helped me develop. My Freeze Dried Thai Green Curry filled all the issues and gaps that existing products left, especially the existing Thai Chicken Curry. It is vegan, gluten free and highly nutritious. Every ingredient has a purpose, from the chickpeas and quinoa being excellent sources of plant-based protein and carbohydrates, to every vegetable giving vitamins and minerals to support a healthy diet and immune system. As well as this, it tastes delicious – with 100% of my stakeholder feedback backing this statement. It also only requires hot water and 15 minutes of hydration to prepare. What more could you want from a freeze dried meal suitable for tramping? It has all the flavour, nutrition and practicality needed for a specialty food product like this.

NEXT STEP - With all testing and trialing for the **Choc Berry and Beetroot Chia Pudding** and the **Thai Green Curry** being complete, I am going to work on my dessert, freeze dried **Chocolate Coconut Ice Cream.**

Freeze Dried Ice Cream

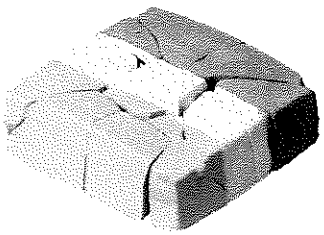


The dessert in my tramping range of freeze dried meals will be dairy free & vegan Chocolate Coconut freeze dried ice cream.

Currently, there is only one freeze dried ice cream product available to us on the market here in New Zealand (pictured). This Astronaut product is a basic vanilla ice cream – full of milk, wheat and soy – so not very dietary friendly for those with allergies, intolerances and requirements such as veganism.

The astronaut ice cream is marketed as 'Real Vanilla Ice Cream' and sold for $11.99 – which is very expensive for a product that is only 16g! Terribly, the internal bag was unsealed, the product was misshaped and broken up into all different sizes with a lot of dust. Visually this product was a crumbly, white block and in terms of taste it was overly sweet and left a sickly aftertaste. The texture was interesting as it changed immediately from a freeze-dried block to creamy ice cream once in your mouth. So, my ice cream product will have this effect but while also being flavorful with a balanced chocolate and coconut flavour and being

vegan-friendly along with the rest of my meals. And with only one existing product available, it will fill a gap in the market of freeze dried desserts for people to enjoy while adventuring as a much needed sweet treat at the end of a long days hike.



Background Freeze dried ice cream was originally developed by the Whirlpool Corporation under NASA for the Apollo missions, however it was never used in a mission. Freeze-dried foods in general were developed so that foods could be sent for long-duration space flights, like to the moon, to reduce the weight of the water and oxygen normally found in food.

After disassembling the existing product, I will be working alongside freeze drying expert [redacted] to develop my own product that improves upon and fills the gap I the market for novel freeze dried ice cream

The astronaut freeze dried ice cream uses the stabilizers: propylene glycerol (477), monody glyceride (471) and guar gum (412). I will be using locust bean gum (410) and xanthan gum (415) as the stabilizers in my ice creams as I have access to these and certain they create a desirable product from previous tests.

From investigating into this existing product, I have discovered various area of improvement that I can focus on to develop a desirable product. These were issues such as:

- The product being overly broken
- Excess inedible powdery residue in the packet
- Not fully sealed – in both packets, the inside bag containing the freeze-dried ice cream was open and spilling throughout the bag, this is NOT food safe and most definitely NOT acceptable for a product of such high price as well
- Different sized and ununiform shaped pieces

Therefore, I will be sure to have my product sturdily packaged, safely sealed and prepared in more uniform pieces to meet consumer expectations and food safety requirements.

Concept: *Chocolate Coconut Freeze Dried Ice Cream*

This final concept is presenting the best outcome to what the brief was asking me to create. The purpose of my concept is to clearly communicate my product to demonstrate the look and function of my product.

Context: Ice cream is a significant part of New Zealand's culture as we are leading dairy product country. This simple frozen treat has devolved into a large market with a large variety of frozen desserts. There is a growing issue of lactose intolerance in the world and New Zealand as it is estimated that one in 12 adults in New Zealand suffer from lactose intolerance. Although lactose free dairy products are currently a nice segment in the market, there is an increased demand for lactose free products. There is also a growing trend in the vegan diet and plant based foods as people change their lifestyle and increase demand for this.

Brief: Although lactose free dairy products are currently a niche segment in the market, there is an increased demand for lactose and dairy free products. I have been asked to develop a lactose free frozen dessert for lactose free consumers. It will be completely dairy free and vegan to also be suitable for plant based diets.

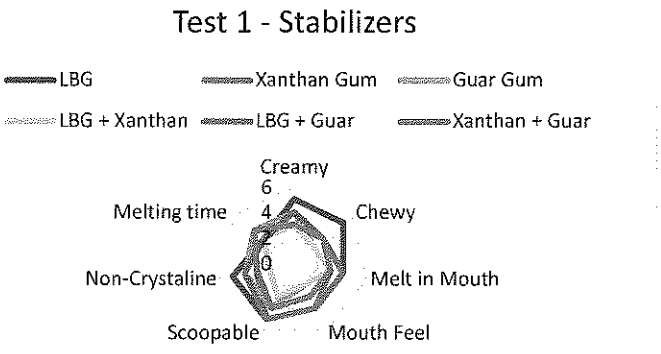
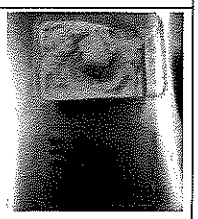
Specifications of my *freeze dried* ice cream:

- Dairy free
- Lactose free
- Vegan
- Gluten free
- Ethically sourced ingredients
- Chocolate appearance
- Creamy texture
- Enticing
- Contains only natural colours and flavours
- Robust packaging

Ingredients	*Grams (g)*	*Percentage (%)*
Coconut cream	370	30
Coconut milk	370	30
62% dark chocolate	130	15
Egg replacer	34	7
Sugar	87.5	17.5
Stabilizer	0.75	0.15
Total	520.95	100

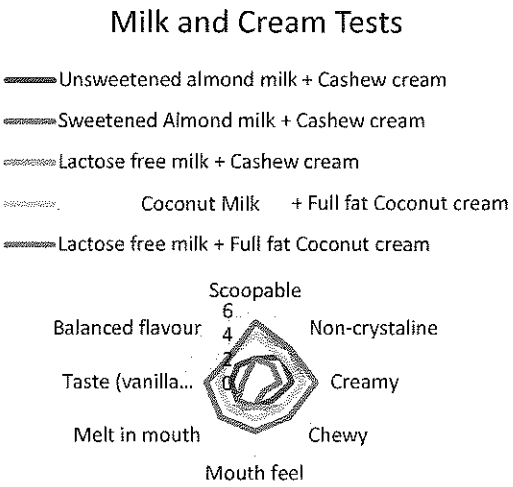
Planning Tests - *STABILISERS*

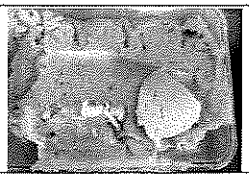
	I am comparing the stabilizers Locust bean Gum (LBC) E410; Guar Gum (E412) and xanthum Gum E415
Our question	I would like to find out which stabilizer - LBG, Guar gum, xanthan gum or a combination of both gives the creamiest texture to my base ice cream.
Equipment	I will need pots, digital scientific scales, whisk, ice cream churner, fridge, freezer, ingredients, thermometer, timing device
Safety	I will keep safe by ensuring my work area is uncluttered, all equipment is sterile, my work space is organised, I have oven mitts, and I will follow the health and safety procedures when using the hob I will follow my process and HACCAP plans
Testing	I will make my test fair by keeping all the ingredients and the testing method the same, changing just the one variable which is the stabiliser
Evidence	I will observe the viscosity of the mix as I am heat processing it and the aeration process during churning – how fluffy and "cloud like" the mix is, and at what times the optimum is achieved I will also be evaluating the ice cream using sensory analysis after freezing.
Method	I will prepare the mix in the exact same way; - Mix one = 3g of LBG - Mix two = 3g of Xanthan gum - Mix three = 3g of guar gum - Mix four = 1.5g Xanthan, 1.5g LBG - Mix five = 1.5g guar gum, 1.5g LBG - Mix six = 1.5g xanthan, 1.5g guar gum

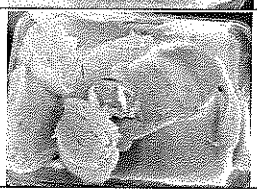
	I will measure ingredients and then use our flow chart to follow process
Results (star chart)	I will record my results by sensory analysis – using members from my target group for feedback. I will record the results in a star web chart The attributes I will be sensory testing are : appearance – glossy, fluffy, non-crystalline, smooth Texture – creamy, chewy, melt in mouth, mouth feel (not testing for flavour or appearance at this point) 
Prediction	I predict that a combination of stabilizers may give me the best result because when I investigated into the excising products many of them tended to contain more than one stabilizer.
Conclusion	The combination of Xanthan gum and LBG made the ice cream very smooth, creamy and chewy. This combination created desirable attributes in an ice cream, showing that a combination of stabilizers is best. 3g of LBG made a desirable ice cream as well. 
Explanation	This tells me that going forwards with my testing I should continue to use a combination of 1.5g of Xanthan and 1.5g of LBG as my stabilizers as they create an ice cream with the best result.

Planning Tests – *MILKS & CREAMS*

	I am comparing almond and zero lacto milk as well as cashew and coconut cream
Our question	I would like to find out which milk – almond or zero lacto, and cream – cashew or coconut in a combination creates the creamiest lactose free ice cream.
Method	I will prepare the mix in the exact same way: - Mix one = Zero lacto milk and cashew cream - Mix two = Almond milk and cashew cream - Mix three = Zero lacto milk and coconut cream - Mix four = Almond milk and coconut cream I will measure ingredients and then use our flow chart to follow process

Results (star chart)	I will record my results by sensory analysis. I will record the results in a star web chart. The attributes I will be sensory testing are: Creamy, chewy, melt in mouth, mouth feel, non-crystalline, balanced flavour, taste (vanilla flavour) 
Prediction	I predict that the zero lacto milk will create a creamier ice cream than almond milk as it has a higher fat content. I also predict that the cashew cream will work better as it may have a more subtle flavour than coconut cream, which is quite strong.
Conclusion	The zero lacto milk created a smooth, creamy ice cream and added no extra flavour. It was better than the almond milk as it was less crystalline and tasted better. I found that the cashew cream made an ice cream with a very smooth creamy texture but had quite an overpowering flavour – different to how I predicted. The coconut cream created a smooth, cream ice cream. There was a slight coconut flavour, but that could be easily covered with flavours.
Explanation	This tells me that the combination of coconut cream and coconut cream creates an ice cream that meets the desired attributes. My NEXT STEPS will be to get stakeholder feedback to assist my decision on a final base formulation. Big Questions: This test left me with the need to research into what the FAT does to ice cream/how it affects it attributes.

Ice cream	*Comment*	*Photo*
High fat Coconut cream and coconut milk ***The best formulation, this is what I chose to use***	Very good mouth feel very creamy and strong coconut taste. The ice cream was very scoopable.	

Low fat coconut cream high fat coconut milk	A little bit icy but great mouth feel and not too much coconut flavour compared to the other coconut ice creams.	
High fat coconut cream low fat coconut milk.	Strong coconut flavour a bit Icey but I think that is could be a good option.	
Lactose free milk and coconut cream	Slightly icy but overall great flavour and a good amount of chewiness a really good option though.	
Sweetened almond milk and coconut cream	Bad over powering flavour bad aftertaste and the texture is not smooth and dose not feel luxury.	

I will be working alongside freeze drying expert [redacted] while carrying the functional modelling of my product. He works in pharmaceutical freeze drying and will be teaching me about how the machines work and will help me to freeze dry my final ice cream. Initially in the functional modelling I needed to know how ice cream could be freeze dried and what was the most effective way to do so – this was done by testing store bought ice cream in a freeze dryer with [redacted]'s assistance.

Freeze Drying Ice Cream Test (store bought)

Tested with Kapiti ice cream (8.5% fat and 21% sugar) and sorbet (<1% fat and 24% sugar)

The ice cream was very easy to do – and would be the same for most products, i.e. if you just put them in and set the shelf temperature to +20 they should run fine – the fine tuning would come in to it when you are trying to get an efficient cycle for a production environment. Lower temps like +20 will be safe, but slower, and some products will not like the heat if you run the shelves hotter. To just get a batch done safely should do runs at +20 to +30 shelf temps.

The ice cream and its square trays came out of the freezer nice and cold at -20°C, but the shelves on the machine are ambient temp, +20°C, because they are heated but not cooled (as is normal for lower spec machines). So in the time it took to put the chamber shell/lid on, and the vacuum to pull down, some of the product melted. It was no issue for taste etc, just the aesthetics.

- To improve thus we could put some thick aluminium plates in the freezer to go under the square trays and act like a cold 'buffer' between the shelf and ice cream trays to stop it melting while the machine got set up.

Both (ice cream and sorbet) were so much better than normal ice cream!! Same taste but just a special texture. I think you would be hard pressed to find someone who did not like it.... Both were pretty well held together once dry.

Left: *clean cut through carboard ice cream container (3rd trial)*
Centre: *scooped with ice cream scooper (1st trial)*
Right: *roughly cut in blocks (2nd trial)*

NEXT STEPS - Moving forward the ice cream would be best not too thick, maybe <30mm?. Is it something that they can bring in a liquid form? i.e. and do the freezing at the machine? i.e. that way they can pour it into an s/s tray for example. Like the small square ones you would have seen in the images, or the large s/s trays shown in my last email. It should be cut into the desired shape prior to freeze drying as it is quite brittle and frail to cut, this was only barely capable with a serrated bread knife.

Ice cream melts pretty quick, so if you freeze it - then put in on a warm tray - then place it in the Freeze dyer, it will partially melt before the vacuum gets low. So it would be best to either

1) Freeze it on-site next to the machine in a freezer & then put it on a pre-chilled s/s tray just before loading, or

2) Freeze it in the machine itself

3) if the ice-cream has to be 'already frozen', then maybe they could bring it in frozen, then scoop/cut into whatever shapes they want & place those onto a pre-frozen tray.

It will absorb moisture quick from the air, so for unloading it would be a good idea to bring in some decent Tupperware type containers and ziplock bags etc and maybe we can seal them up while purging the containers with dry nitrogen, to displace moist air, i.e. to preserve some for later.

It looks like it might work out better if either

1) ice cream is pre-frozen and pre-cut into slabs like a brownie size etc or

2) the ice cream is frozen solid in the 30mmDeep dish tray, in the machine - and then cut later once dry.

- *Test completed with the help of* [redacted] *during the COVID lockdown period*

Final Freeze Drying - ICE CREAM

I made a **vegan chocolate coconut ice cream** following HACCAP and process plans. This involved making the ice cream base, refrigerating safely covered overnight then churning. The churned ice cream was frozen into a shallow square container – this was to make it an easy shape to cut prior to freeze drying. I cut the ice cream evenly while working quickly to ensure it didn't melt, then placed straight into the freeze dryer.

I made an appointment with [redacted] to visit the freeze drying plant with the ice cream and have his assistance to freeze dry it.

Ice Cream in freeze drier->
I spaced the pieces out to ensure nothing stuck together and everything would freeze dry evenly

My freeze dried ice cream is a successful product as it meets the brief specifications . It is completely

vegan and gluten free so is allergen aware, making is more accessible to a wide range of consumers. Most importantly – it is an exciting product! Who wouldn't want to try ice cream that appears dry and hard, but once in your mouth transforms into a creamy, dreamy frozen dessert?! It is made from locally sourced ingredients and is ethically prepared making it socially acceptable. Therefore, my chocolate coconut freeze dried ice cream is a worthy product and fit for purpose, and I **accept** it as a functional prototype. I also looked into the selected ingredients in this product and their functions:

Selected ingredients - Chocolate Coconut Ice Cream

Ingredient	Function	Why I have chosen to include this ingredient
Coconut Cream	Cream gives body and chew to the ice cream and a rich flavour. The fat in it lubricated your mouth which helps give a very smooth mouth feel	I am using coconut cream and a vegan, lactose and dairy free alternative to real cream so my ice cream can be certified vegan. It also gives the coconut flavour to compliment the chocolate. I used full fat coconut cream has a high level of fat that gives a nice rich flavour and smooth, creamy texture. This helps produce a luxurious ice cream with the most desirable texture and mouth feel as the fat helps to coat the mouth and conceal any ice crystals as well as trap air to avoid quick melting. The fat in the coconut cream also enhances flavour by adding a rich, buttery flavour and being the main carrier of added flavour to aid perception. The coconut cream is also an ethically sourced, fair trade product that meets social expectations for safe and friendly food products.
Coconut Milk	Milk also gives ice cream body and chew as well as richness and creaminess while also contributing to the melting characteristics.	Coconut milk is a vegan, lactose and dairy free alternative to real milk so my ice cream can be certified vegan. It also gives a nice coconut flavour along with the coconut cream to go with the chocolate. Coconut milk is a very rich a creamy milk that makes a luxurious ice cream - this, along with the flavour it gives, is why I chose to include it. The ice cream is silky smooth and non-crystalline using this milk. The coconut milk is also a fair trade product that is ethically sourced, so socially acceptable.
Sugar	Sugar improves the overall texture and flavour of ice cream. It also reduces the growth of ice crystals to produce and ice cream that is smooth and scoop able.	Sugar was a necessary ingredient in my chocolate coconut ice cream as it gives flavour and very importantly assists with the texture. Ice cream is expected to be smooth and creamy, so to get these desired attributes I had to include sugar so that when biting into the freeze dried ice cream it will become creamy and silky smooth in your mouth.
62% Dark Chocolate	This couverture chocolate gives a rich flavour to the ice cream that	I chose to use 62% dark chocolate as this gives the ideal level of chocolate flavour – not too sweet but not too bitter. It also gives a nice mouth feel to the ice cream as it has a low fat level so is more refreshing. This cocoa

	compliments the sweet coconut. It also makes the ice cream a realistic chocolate brown colour.	percentage is dairy free and certified vegan, therefore filling my specification for this. The Whitakers chocolate is fair trade and ethically sourced that works with hand-picked Ghana cocoa pods from 'bean to bar' . It is also a New Zealand brand so is supporting local.
Egg Replacer	Egg is often used in ice cream as an emulsifier, but to make this vegan egg replacer was used to do this.	In order to make the ice cream suitable for vegans I had to remove the egg yolk, but still needed an ingredient for emulsification. The egg replacer functions to bind the fat and water together in the ice cream, stopping it becoming separated and crystalline as the protein traps the water and surrounds it for avoid the formation of ice crystals. This ingredients was crucial to the texture.
Stabilizer	Prevents mixtures from separating into water and oil	I chose the stabilizers Xanthan and Guar gum in my chocolate coconut ice cream. The combination of these stabilizers gives the ideal texture to my ice cream – making it smooth, creamy and slightly chewy. A combination of stabilizers works the best in ice cream and is generally what most product tend to have, therefore I did this to make my product as creamy and desirable as possible.
Salt	Salt enhances flavour and freezing properties of ice cream	I put salt in my ice cream because it affects how the ice cream freezes. It reduces the formatting of ice crystals in the churning process – making a cream, non-crystalline ice cream.

My range of freeze dried food products suitable for tramping all meet the specifications of my **brief**, which was:
I am going to develop a prototype for nutritious and appetizing freeze-dried meals, requiring only hot water to prepare – a breakfast, dinner, and dessert, suitable for teenagers who undergo intense physical activity in the wilderness. These meals will be vegan, gluten free and allergen aware to make freeze dried food accessible to as many people as possible.
I looked closely into some important specifications for functional products and found ways in which I would meet these:

Specifications

Specification	Why
Lifecycle	The product I am developing is not a commonly purchased product and needs to appeal to a wide range of people – individuals of all ages and dietary requirements using for adventuring. This means I need to create a product made from commonly liked and easily sourced materials.
Technical Acceptability	My product needs to be made with safe ingredients and produced in a safe way. To do this I need to ensure I have an accurate HACCP plan and follow good hygiene practices to ensure my product is safe to consume.

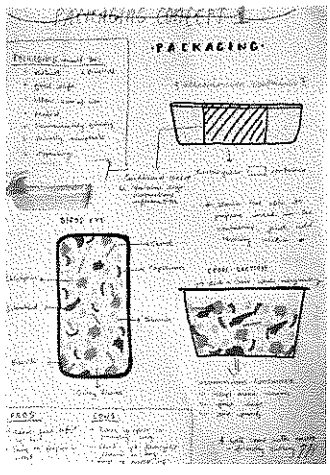
	This is especially important during these times of the COVID pandemic, where hygiene in extremely important and must be taken seriously to ensure safety in everyone's health.
Maintenance and disposal	My product needs to have a good shelf life to increase consumer appeal. A long shelf life will mean that people purchasing it for tramping do not have to worry about it spoiling while adventuring. To increase the shelf life, I need to ensure that the packaging is appropriate for the product – it must be air tight and fully sealed so no moisture or light can enter. I need to make sure that the packaging is robust so the product does not lose its visual appeal by breaking, as well as attractive for consumer appeal. It must be easily portable to not take up too much space in a tramping pack.
Ethical nature of testing	When preparing my product, I need to maintain safe food practices. I will follow both my process plan which has feedback loops and my HACCP plan. I will follow the NZ and Australian food safety requirements as well as their labelling requirements. Allergens will be clearly labelled as this is very important to my product. All dietary requirements will be stated as well. When getting stakeholder feedback, I will set up formal sessions, seeking permission from my stakeholders first. I will ensure they understand what I am going to use the feedback for, the ingredients in the product, and where and how it was made. This will ensure they are not eating anything that may harm them or that may go against personal or cultural beliefs. Information about the source of the ingredients will be available also so stakeholders are aware of the origins. I will only use ethically produced ingredients and where possible, locally sourced.
Cultural appropriateness of testing and trialling procedures	My product will only be trialled and tested in culturally appropriate ways. I need to maintain this through all tests to ensure it be acceptable to my stakeholders. I respect the beliefs of others and wouldn't encourage trying if it didn't match these. For example, my product contains no meat of any kind so would always be suitable for Muslims as there are no halal concerns.
Social acceptability	The product I am developing is made using ingredients and processes accepted by NZ society. They are for the most part locally sourced and support the New Zealand economy. Absolutely no harmful labour or unpaid work is used or required The product is nutritionally valuable and healthy, with nutritional components that are of interest to many people in society. As veganism is a growing food trend this accepted positively. The high plant-based protein and nutritious veggies are components that many consumers search for so will be happy with.
Vegan	My product is truly vegan. It will be labelled as vegan because it contains no animal products. Veganism is a growing food trend so needs to be catered to in order to fill this gap and make vegan food accessible. I am going to create a product that is filled with plant-based protein and wholefoods to make it highly nutritious to give the best

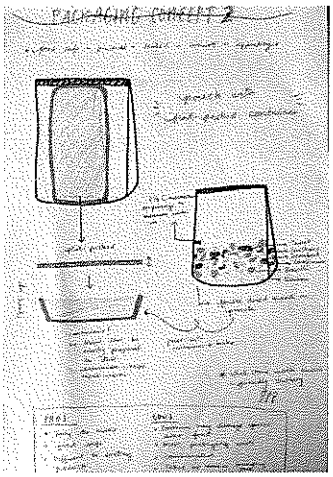
	fuel to active trampers not wanting to consume meat or other animals products.
Gluten free	The product I am developing is gluten free. This is an area of concern in terms of allergens and intolerances so will be strictly tended to. There will be no glutenous grains or additives involved in the making of the product. This will make it safe for people with gluten intolerances/allergies to consume, filling this gap in the market.

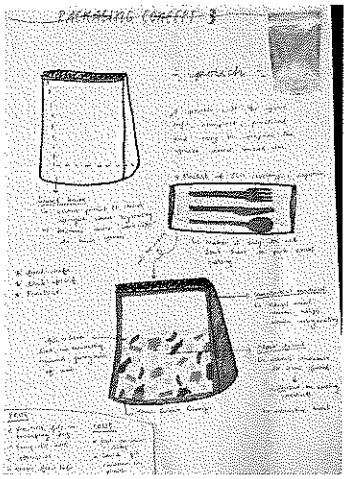
Packaging

Functional products need functional packaging, so functional modeling, concept creation and feedback was needed to create fit for purpose packaging.

Firstly I created three initial concepts and received stakeholder feedback on these:







1. Please rate CONCEPTUAL DESIGN 1: (1 being dislike and impractical, 5 being like and practical) Aluminum Container

More Details

13 Responses — 3.85 Average Number

2. Please rate CONCEPTUAL DESIGN 2: (1 being dislike and impractical, 5 being like and practical) Packet w/ Aluminum Container

More Details

13 Responses — 3.23 Average Number

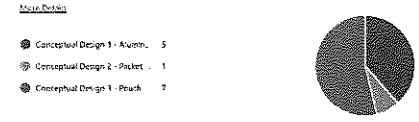
3. Please rate CONCEPTUAL DESIGN 3: (1 being dislike and impractical, 5 being like and practical) Pouch, clear front

More Details

13 Responses — 3.85 Average Number

4. Which is your preferred packaging conceptual design?

More Details



I developed logo concepts for my brand so I could design the final packaging. Some stakeholders said they liked "the simple sleek design" and how the "green relates to nature" (referring to logo 2)

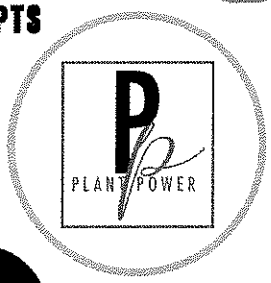
Over 50% of my stakeholder feedback supported a **pouch** for its practicality and ease of use, so I moved forward with this.

When it came to my product name, 100% of my stakeholders preferred 'Plant Power'

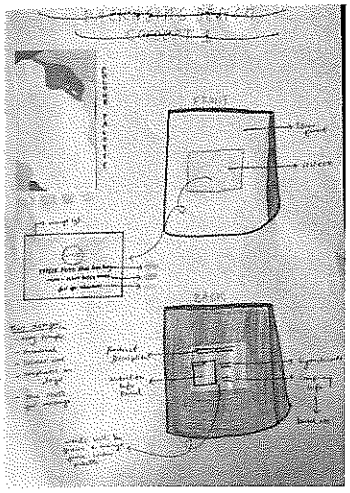
1. Which brand name do you prefer for my VEGAN FREEZE DRIED THAI GREEN CURRY product

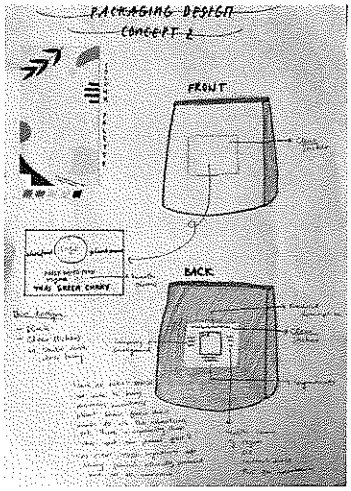
More Details

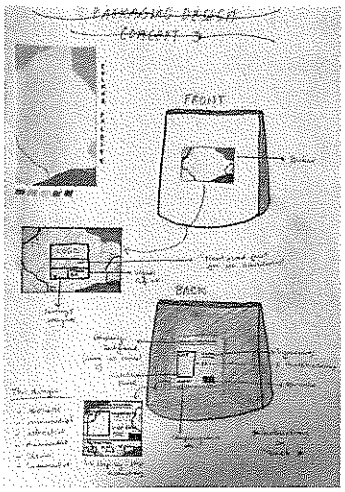
LOGO CONCEPTS



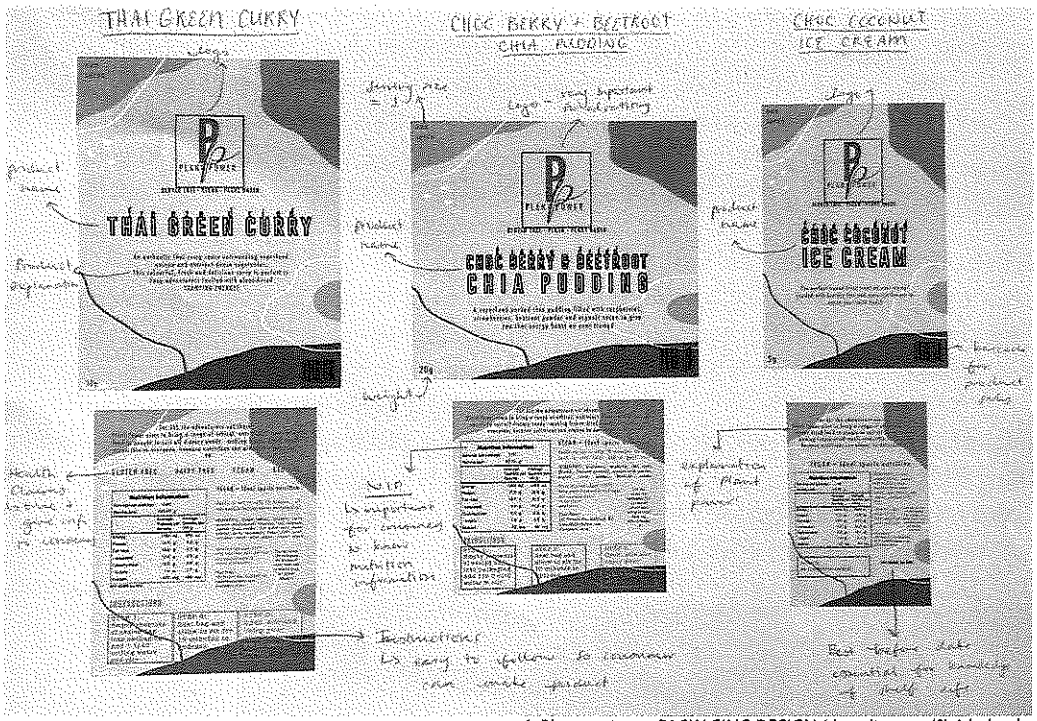
Final Packaging Concepts







Final design



I created my packaging designs as stickers that I could put onto my pouches. This was a simple, affordable and effective way to design my packaging. It is also completely food safe. My packaging is attractive, informative and practical – perfect for the tramping environment. Many of my stakeholders rated it 5/5 for being captivating and informative.

1. Please rate my PACKAGING DESIGN (does it appeal?) 1 being boring, not captivating, uninformative 5 being attractive, captivating, informative

8 Responses

ID	Name	Responses
1	[redacted]	5
2		5
3		5
4		5
5		5
6		5
7		4
8		5

NEXT STEPS – With final functional formulations for my freeze dried meals and food safe packaging, I am now ready to take my prototype to production and freeze dry the food at TriplePoint, then package this food ready for it's intended environment.

Freeze Drying – TriplePoint

After the completion of my freeze dried Thai green curry formulation I must make a final prototype. To do this I am going to see [redacted] at Triple Point (pharmaceutical freeze drying) to freeze dry components of my curry – I will be freeze drying everything but the quinoa and curry powder and dried mushrooms; so carrot, broccoli, chickpeas, leek, Silverbeet and capsicum.

Monday 10th August When arriving on site for production, [redacted] gave a overrun of the freeze drying equipment and processes we would be undertaking.

The process we took was:

1) Flash froze the ingredients at -90° on metal freeze dryer trays
2) Cut the ice cream into bite sized pieces the arranged on metal freeze dryer trays
3) Removed ingredients from flash freezer and quickly transferred to the freeze dryer with the ice cream
4) Set up a remote monitoring system to monitor the freeze drying process digitally
5) Left the ingredients to freeze dry for at least 48 hours, ready for pick up in two days time (Wednesday)

[redacted]

Tuesday 11th August On this day Auckland heard the news that we were going into another lockdown at level 3, so I was unable to go back to the plant to pack and retrieve my freeze dried products for health and safety reasons, leaving my teacher to have to do all this for me on Wednesday 12th. This meant she had to work swiftly, avoid moisture and package the products well sealed and store away from light to avoid

This freeze drying production session was so crucial in my prototype development and will give me much more desired results than the dehydrators have been. My NEXT STEPS from here will be to produce a final prototype with the freeze dried ingredients, using my own packaging and get a final stakeholder focus group together to trials making the product themselves and give necessary final feedback.

[redacted]

Packaging my Prototype

As I have now completed the trialing and testing for the functional modeling of my product, it has now come time to package my final freeze dried *Thai Green Curry, Choc, Berry & Beetroot Chia Pudding and Chocolate Coconut Ice Cream.*

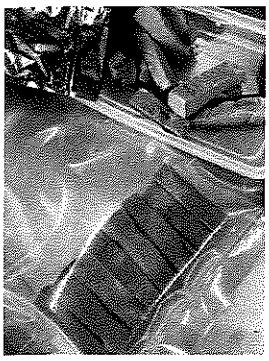
In preparation for this I took all my prepared vegetable for freeze drying to [redacted] at Triple Point, where he helped to freeze dry these. This was done on Monday 10th August, to be ready for collection on Wednesday 12th August. My plans had to change as NZ went into a sudden lockdown again on the Tuesday night after the prime minister announced we would be going back into lockdown level 3 at 11.59pm that day. This meant it was not possible for me go to Triple Point on the Wednesday to pick up my products at the arranged time of 3.30pm, so my teacher had to do this going under resourced and working quickly to ensure the product was completely moisture free when packaged. This has been stored in a dark place free of light until today, when I am using the freeze dried ingredients to construct my prototype.

Today, I am packaging my final product. When packaging the freeze dried products, I must work quickly and avoid any contact with water. We will be setting up a production line with scales and only opening one freeze dried vegetable at a time until my packaging is complete then will be closed straight away. Moisture in my packaging could be the biggest issue I would come across, and because of this my packaging is clean and dry. I will be vacuum sealing the food in a separate vacuum form bag with my technician [redacted], as I was unable to source food grade silica gel. Vacuum sealing will mitigate the risk of my freeze dried product spoiling.

This final prototype that will be ready for my final stakeholder focus group to trial on Thursday (17th). I will also be preparing another prototype to send to [redacted], the owner and research and development man for Absolute Wilderness. So, these products are being prototyped to receive adequate feedback and to see that they are completely fit for purpose.

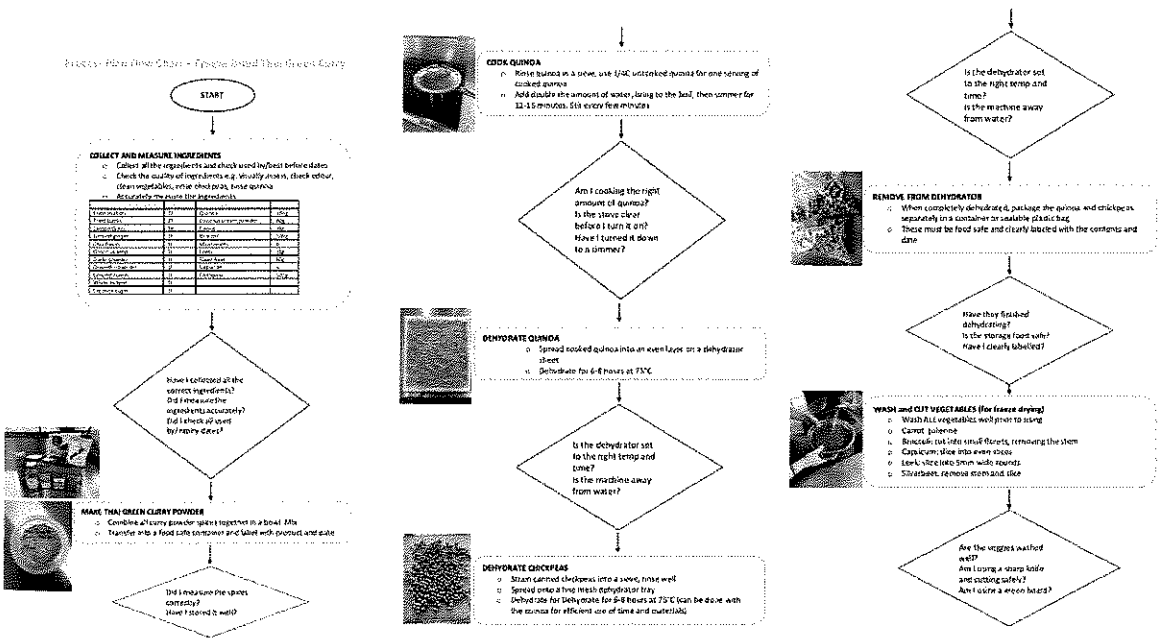


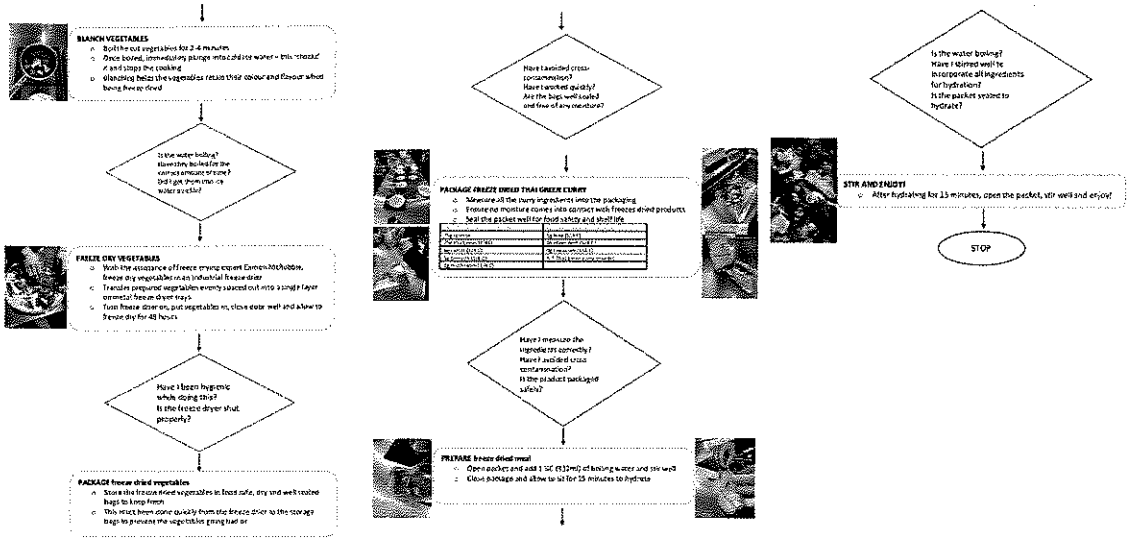



The packaging of my prototypes was very successful. All of the freeze dried foods had stayed fresh in their storage and looked amazing. They were colourful and perfectly resembled the vegetables that they are – unlike vegetables in existing products that are tiny and don't match their description. The vacuum sealing went well and will help keep my product fresh for an extended period of time, and so will my packaging. Therefore I have developed functioning prototypes.

Every test and trial completed during this development was followed out safely to ensure I met food health and safety standards, as well as practicing ethical testing methods. Following a Process Plan was very important for this as it made sure I completed each step to the best of my ability without missing anything out. I followed one every test, for each product I developed. An example of a process plan I made is one for the Thai Green Curry:





I had to keep in mind the **competing** and **contesting** factors during my technological modeling. This is because the main factors that influence the development of a new product to prototyping faze can be categorized into two areas – competing and contestable

Competing factor: A *factual*, objective factor with specific requirements that cannot be compromised.

Contesting factor: A *subjective* factor based on personal choice and opinion, so can be compromised.

My Competing Factors are:

Time Management (project management) -> Time became a prominent competing factor due to COVID-19 lockdown where I lost time and resources. So, I had to use my project management skills like critical reflections and presenting my project goals on my GANTT chart to ensure it would be ready for the production phase.

Packaging -> The issue with the factor of packaging was sustainable vs. functional. Freeze dried food can't be safely stored in biodegradable packaging because of moisture and air. One of the biggest problems in this world is carbon emissions, a lot from food waste and making packaging. But when consulting with packaging experts, [redacted] (Total Pack) and [redacted] (Tio Pablo), they both emphasized prioritizing food safety; hence my packaging was an airtight pouch.

Quality Control -> This factor was essential to make sure my product was prepared safely and the same every time. I did this by following a process plan to make sure quality control was carried out.

Meets NZ food safety standards -> My product had to meet NZ food safety standards; therefore, this is a competing factor. I made sure it did by following mu process plan and researching the safety standards early on, so I had an understanding.

Vegan and Gluten Free-> My product is vegan and gluten free (as I found a clear gap in the market here) so this is a competing factor. This eliminated all meat, animal products and wheat products, so I had to research into ideal alternatives.

My Contesting Factors are:

Fair Price -> Many specialty dietary products have higher prices because of expensive ingredients, but I wanted mine to be affordable. Often specialty ingredients are of higher

price. Example: I chose to use quinoa not rice to meet vegan protein requirements; this is more expensive. But I compromised with other ingredients such as using seasonal produce. And when I knew something would go out of season, like capsicum, I bought enough for future trials and cut, blanched and froze it, then used as needed.

Ethical/Culturally Appropriate -> It was important to me and my target market that my product be produced ethically, but wasn't a brief requirement so was a contesting factor. I used only ethically sourced ingredients and only produced my product using ethically friendly practices. It also came to my attention that I could be culturally appropriating a Green Curry from Thailand, but I feel confident behind e ethics of my product and brand that I am not relabeling a culture.

Meets stakeholder needs and wants -> This is a highly important contesting factor that was very important for product development. Sometimes my stallholder would have different opinions in terms of their wants and needs, so I had to make decisions around which were more desired or feasible. With this being more subjective it was contestable.

Taste -> It is essential for my product to taste good, and this factor is measured subjectively as people have different tastes, therefore contestable. My freeze dried Thai green curry could tastes spicy to someone, but mild to another. When I received feedback from [redacted], a freeze dried food expert working and co-founder of Absolute Wilderness, he said it was "suitable to the kiwi pallet" (referring to spice)

Product Evaluation

I have developed a prototype considering its fitness for purpose in the wider sense. My freeze dried THAI GREEN CURRY prototype meets the brief and adheres to all brief specifications. It has all desired attributes of a comforting curry being fresh, flavorful, authentically flavored and visually appealing with an array of colourful vegetables. It is made with locally sourced, fair trade ingredients that are completely vegan and gluten free, making it very socially acceptable and opening up freeze dried food to a wider market of consumers with dietary requirements. The hydration process can be easily completed with boiling water directly into the food safe, robust packaging that helps the product keep its long shelf life.

The production of my prototype was aided by my process which allowed me to safely and effectively produce my freeze dried Thai green curry through all steps from preparing the vegetables to freeze drying and then preparing the final meal. I developed my prototype through ongoing trailing and testing where I received feedback from my stakeholders to allow me to make informed decisions in selecting materials and processes. Using trialing and testing templates for each trial so they were effective and used ongoing project management tools to ensure I was trialing safely and ethically. The feedback received on each trail was both subjective and objective to give a range of data for decisions making

The selected ingredients are highly nutritious, giving plenty of nutrients and plant-based protein for optimum performance nutrition. Last but not least, it is delicious, unlike many existing freeze dried products – filling this gap in the market. The vegetables, chickpeas and quinoa are well hydrated in a creamy, flavorful coconut green curry sauce that any tramper would be thrilled to refuel with after a hard days tramp. My vegan, gluten free freeze dried

Thai green curry meets the brief specifications, is socially accepted by my target market and is therefore a desirable product that is fit for purpose.

I **accept** my products as a *functional prototypes* as they are *fit for purpose* in their wider sense. They meets all the specifications, and the ingredient properties in the selected ingredients are suitable for tramping needs. My *Freeze Dried* Choc Berry and Beetroot Chia Pudding, Thai Green curry and Chocolate Coconut Ice Cream are sustainable, culturally appropriate, ethically sourced and tested, meet health and safety requirements and have a determined life cycle considering maintenance and the ultimate disposal. They are functional in situ in a supermarket in the intended tramping environment. They meet all the brief specifications and I therefor accept my prototypes.

Due to COVID restrictions I was unable to place my product in situ in a supermarket, so mocked it up