AS91612 (3.5): Demonstrate understanding of how technological modelling supports technological development and implementation

Technological Modelling is arguably the most important thing in the development of a technological outcome. When designing a product to fit a purpose, the necessary preparation, research and refinements of ideas, needs and restricting factors must be done in order to make a realistic product that is fit for purpose. In this report I will discuss the types of functional modelling and prototyping that I have carried out through the year in support of the development and implementation of my desired outcome: a healthy, vegan dog treat.

Technological modelling can be divided neatly into two parts: Functional Modelling and Prototyping. Functional Modelling involves the research into the technical feasibility of an outcome. It involves practices such as initial background research, brainstorming, testing, trialling, talking, thinking, and asking questions. For instance in the case study of the development of the blunt umbrella after realising that a new umbrella needed to be developed, Greg Brebner spent years tinkering with kite shop kits, going through dozens of ideas on how to get the fabric as tight as possible, to get it to push out as well as up, researching different techniques for the frame work. It tends to be done more at the beginning of product development to set up the background knowledge for the next stage: prototyping. Prototyping involves trialling of the final practical feasibility and social acceptability of an outcome. It looks at the factors that influence the product's functionality, its fitness for purpose and how well it addresses the issue by testing it in the intended environment. For Greg Brebner this meant going up to One Tree Hill to test his prototypes in situation - in 100km/h plus winds and then exploring manufacturing options for a product that actually works.

This year I have worked with Andrea Carpenter, a wholesale manufacturer of handmade organic dog, horse, and cat treats, and a supplier of Animates, Petstock, Foodstuffs (New World and Pak 'n Save), and nationwide pet and vet outlets. After emailing around with my pitch - "I am a level 3 student hoping to work alongside a dog treat company to make a vegan dog treat alternative" - Andrea was actually the one to email me. As a smaller brand on the dog treat market (as compared to brands such as Pedigree and Purina), most of my competing and contestable factors were left open to be decided and discovered by me throughout my product development. Some values that she did make clear were that she didn't add unnatural additives such as preservatives, and that she tried to keep her recipes as simple and unconvoluted as possible. Less ingredients = more nutritional benefits. At the beginning it was hard to decide what my competing and contestable factors were, but over the year they not only changed but became more evident and changed in importance to my project. The main

issue was trying to design an outcome to solve the lack of vegan dog treat alternatives on the market. As a vegetarian myself, and with one vegan sibling and another vegetarian sibling, I figured that people with meat free diets might be fairly common, and a dog treat that was meat free might be a more comfortable alternative for someone who isn't a fan of meat themselves. Of course I needed to do more background research into this, but I had an idea and my teacher and Andrea were interested in letting me run with it.
As I worked on my product, developing it over the year, I began to define my competing and contestable factors into two different categories: Things my product needed to be and things I wanted my product to be. This either came down to me prioritising my wants over my needs, or prioritising my clients vision over mine.

Therefore my competing factors were:

- **Vegan -** I decided early on that I wanted my product to be meat-free, dairy-free and egg free due to personally being vegetarian and a desire to develop something different (meet a gap in the market).
- **Time -** this factor became more and more competing towards the end of my project, as concept development took me longer than I wanted it to and left me short of time towards the end of my project.
- **Protein -** I wanted to develop at least one treat with a protein content higher than 15%, in order to rival the protein found in meat based treats and also cater to the high protein needs of dogs. I decided this was a competing factor after researching into the protein needs of dogs and discussing ideal protein contents with my client, who agreed that I should aim for over 15%.

And my contestable factors were:

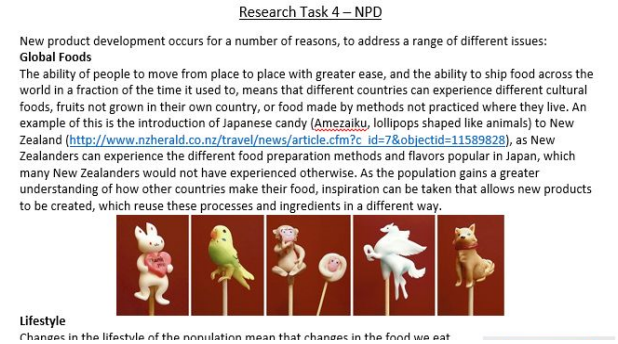
- **Price -** the problem with many meat-free treats on the market is that they are a much higher price than meat-inclusive treats, but I realised that this was probably moderately unavoidable if I was making treats with higher quality vegan ingredients. I still wanted to address it though, because a higher price would deter potential consumers.
- **Taste -** although it is important to make a treat that tastes good (and the consumer wants to buy treats that their dog will love), one can only estimate whether or not a dog will like a treat - without proper stakeholder feedback (as dogs cannot communicate this) I cannot justify that taste is a competing factor as most dogs, it could be argued, would eat anything, and so although it is important that my treats taste nice this factor is contestable rather than competing.
- **Functionality -** I wanted any treat I developed to have a specific purpose, whether it be calming, breath freshening, for training or diet supplementation,

- **Simple ingredients list -** Andrea told me that she liked her treats to have less processing and less ingredients to keep them less convoluted and retain their natural nutrition, but in order to get a cohesive dough with high protein ingredients I soon realised that this may not be as easy as I thought it would be, so this factor became contestable rather than competing.
- **High quality nutritional ingredients -** ideally I wanted to have a reason for including every ingredient in my treats (to avoid adding ingredients for the sake of adding them) but I also came to realise that in order to get a cohesive (not too wet, not too dry) dough, or a more attractive final product, sometimes extra ingredients or extra amounts of ingredients just needed to be added whether I liked it or not, which made this contestable.
- **Stakeholder wants/needs -** although incredibly important, the wants/needs of my target market and client would still be contestable against the competing factors of time and meat-free. The opinions of my client on treats she would develop (moral values such as nutritional, additive/chemical free) and the opinions of my target market on what they would and wouldn't buy although important are more flexible for my project than my time restrictions and my key brief point of developing a vegan treat, therefore making them contestable.

Throughout the year I used many different forms of technological modelling, including both functional modelling and prototyping, which I often repeated throughout my product development, in order to make informed, responsive and defensible decisions for my final outcome.

Functional modelling that I used:

Background research: When I first began to develop ideas for my project at the start of the year, I did a lot of research into food trends, innovation and new product development. It came to my attention the large number of health alternatives (a large quantity of them vegan), becoming available on the market. From dairy free ice cream to sugar free chocolate, the exponential growth in the use of seeds (chia, quinoa, flax seed), chia smoothies and kale chips, 2016 would see a rise in the health consciousness of the nation. Working as a checkout operator also helped me to see this in action: a larger number of people than I ever considered were buying almond milks and coconut ice creams. It


Research Task 4 – NPD

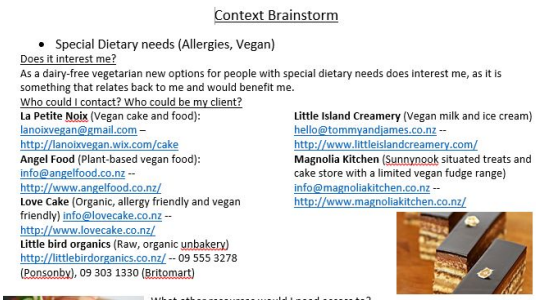
New product development occurs for a number of reasons, to address a range of different issues:

Global Foods

The ability of people to move from place to place with greater ease, and the ability to ship food across the world in a fraction of the time it used to, means that different countries can experience different cultural foods, fruits not grown in their own country, or food made by methods not practiced where they live. An example of this is the introduction of Japanese candy (Amezaiku, lollipops shaped like animals) to New Zealand (http://www.nzherald.co.nz/travel/news/article.cfm?c_id=7&objectid=11589828), as New Zealanders can experience the different food preparation methods and flavors popular in Japan, which many New Zealanders would not have experienced otherwise. As the population gains a greater understanding of how other countries make their food, inspiration can be taken that allows new products to be created, which reuse these processes and ingredients in a different way.

Lifestyle

Changes in the lifestyle of the population mean that changes in the food we eat


Context Brainstorm

- Special Dietary needs (Allergies, Vegan)

Does it interest me?

As a dairy-free vegetarian new options for people with special dietary needs does interest me, as it is something that relates back to me and would benefit me.

Who could I contact? Who could be my client?

La Petite Noix (Vegan cake and food): lanoixvegan@gmail.com – http://lanoixvegan.wix.com/cake

Angel Food (Plant-based vegan food): info@angelfood.co.nz -- http://www.angelfood.co.nz/

Love Cake (Organic, allergy friendly and vegan friendly) info@lovecake.co.nz -- http://www.lovecake.co.nz/

Little bird organics (Raw, organic unbakery) http://littlebirdorganics.co.nz/ -- 09 555 3278 (Ponsonby), 09 303 1330 (Britomart)

Little Island Creamery (Vegan milk and ice cream) hello@tommyandjames.co.nz -- http://www.littleislandcreamery.com/

Magnolia Kitchen (Sunnynook situated treats and cake store with a limited vegan fudge range) info@magnoliakitchen.co.nz -- http://www.magnoliakitchen.co.nz/

seemed obvious to me that the number of people straying away from dairy and meat was increasing. I began considering working on a vegan project for the year, when my teacher brought to my attention that at the beginning of the year on a “get to know me” sheet I had written that I really liked dogs - had I considered working on dog treats? Combining the two ideas seemed natural, and the idea of a vegan dog treat was born.

Thinking and Talking: Once I had my idea I contacted several different potential clients. I first contacted Magnolia Kitchen (a vegan bakery) and receiving a response that they couldn’t help me solidified my desire to work with dog treats, and led me onto contacting a whole range of different boutique dog treat companies. I detailed the basic outline of my project and my idea to work with a meat-free alternative. Three Dog Bakery and Bow Wow Box never responded to my email, K9 Doggy Deli responded saying that they had now closed their shop, Woofas Doggone Delights responded a month later saying they were unable to take up extra commitments, but I then received an email from Andrea Carpenter without first contacting her, to say that she was interested in my project and would love to be my mentor. This was great news for me, and I was able to begin developing my ideas further in the context of my client. As a supplier for Animates and Petstock I realised that my product was likely going to have to be more suited to a retail environment than a farmers market.

- Dog food

Does it interest me?
Yes, I have two dogs of my own and many of of my friends and family friends also own dogs.
Who could I contact? Who could be my client?
Nutro (pet food) http://www.nutro.co.nz/
Shaggy Bones Bakery (Christchurch based dog treats, creating new dog treats like pupcakes, dog chocolates and all natural treats)
http://www.shaggybonesbakery.co.nz/
Woofas Doggone Delights (Hamilton based dog treats with vegan, raw, and wheat free options)
http://www.woofasdoggonedelights.co.nz/
Addiction Pet Foods (Grey Lynn based dog food and treats) http://www.nznaturalpetfood.co.nz/
Miss Maggie’s (Ponsonby based dog treats)
http://www.missmaggies.co.nz/contact/

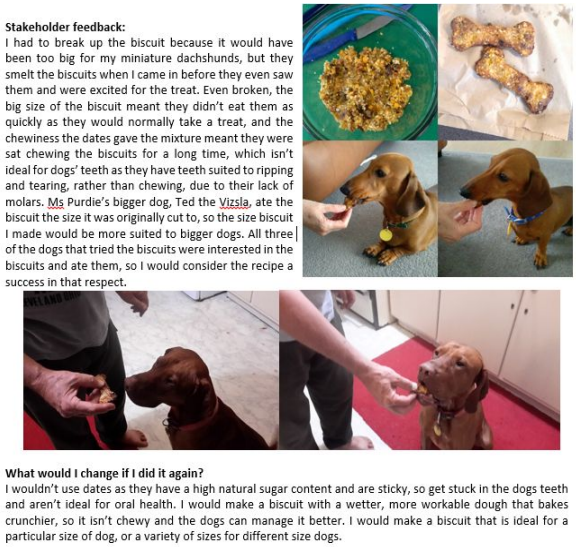
Mighty Mix (nutritious dog biscuits delivered to door) http://mightymix.co.nz

Andrea Carpenter <andie@pacificorganics.co.nz>
to me

Hello Annie
My company is Pacific Organics NZ Ltd, I am a wholesale manufacturer of Hand Made Gourmet Organic Dog, Horse and Pony, and Cat Biscuit Treats,
I supply Animates, Petstock, Foodstuffs, Nationwide Pet and Vet outlets and a number of online Pet product purchase and Gift Box Companies.
Our Brands are Sargents, Rewards, Trailblazers, Duncan & Daisys, Ollies, and Rusties. Ollies our latest brand is a ready to bake dough for you to make at home.
I am a member of the New Zealand Petfood manufacturers Assoc.
Based in Matakana Rodney, I travel to Auckland regularly.
Do feel free to contact me regarding your enquiry as I am as keen to learn as you would be :)
Kind regards
Andie

Testing and Trialling: Now that I had a client and knew what context I was going to be working in, I could begin to trial different ingredients and recipes. Using a variety of ingredients (even testing non-vegan ingredients such as dairy), gave me an idea of how different ingredients interacted with one another. Because one of my competing factors was that I wanted to create a high protein treat I focused

a lot on ingredients such as peanuts, seeds (pumpkin, flax, sesame, chia, sunflower), cashews, chickpea and wheat germ. Honing in on different combinations of these ingredients and how they interacted with different ratios of lower protein ingredients like apple, spinach, pumpkin, carrot and banana allowed me to refine the best combinations and develop my protein content from somewhere around 8% at the beginning of the project (trial number 3) to around 20% at the end (trial numbers 10 through 12). In the end, once i had prioritised my competing factors, it was more important for me to have a vegan treat than a high protein treat, and this is why throughout my testing and trialling my protein levels are inconsistent - because having a vegan treat was a factor that I was more invested in and the most key part of my brief.



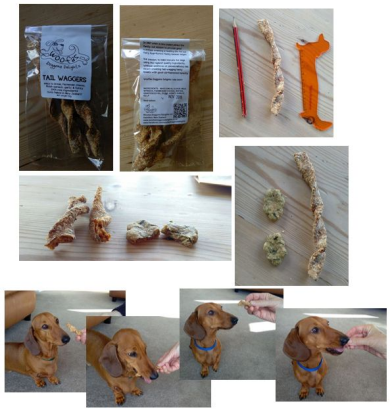
Practical Evaluations: Thinking objectively about my practical testing allowed me to get the most benefit out of the trials I did. Thinking and talking about what went wrong, what went right, and what I could have changed, allowed me to consider how to develop what I currently had into something even better. For instance the large quantities of vegetables in my third practical gave a wet, difficult to work with dough that quickly went mouldy in my sealed snap-lock shelf life tests, which informed me better of how to approach working with vegetables in my later recipes. Seeking client feedback intermittently on my progress as part of my practical evaluations boosted what I learned from my practicals as well, as it gave me an idea of what did and didn't work in the context of my client. For instance the cashew cheese trial I did for my fifth practical - although it was reasonably successful didn't gel with my client because of her wariness of using nuts other than peanuts, and the overly complicated process of soaking the cashews made it unrealistic from a commercial manufacturing perspective, which was important as stakeholder wants/needs was a contestable factor for me. Practical evaluations, however, were difficult to structure with stakeholder/consumer feedback forming any significant part of my analysis as the feedback of dogs is unreliable at best - if you would consider "they ate it" feedback. Difficulties with the validity of this consumer feedback meant that since I couldn't determine in a defensible way whether or not dogs will simply eat anything – appearance, smell and texture became more important attributes as these are what the owner sees, and as the consumer if you FEEL as though you are feeding your dog something tasty and rewarding then you probably are. When I conducted my consumer testing I focused the feedback on how the owner felt

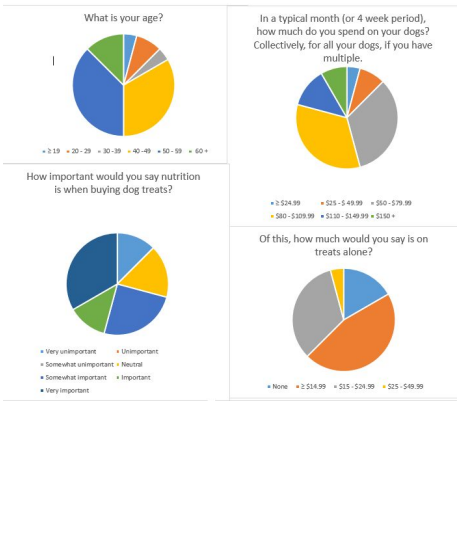
about the treat's flavors, appearance and smell, with only one question on "whether or not the dog seemed to like it". It became more and more about pleasing the owner rather than the dog, which made taste a contestable factor for me.

Product Analysis and Disassembly: Throughout my project I did a supermarket analysis of current market products, price comparisons and product disassemblies - one of these being a supermarket big name brand (Beneful Healthy Smile Ridges) and two of more high end boutique brands (Woofa's Tail Waggers and Healthy Dog and Co. Peanut Butter and Banana). Breaking down products to look at their image, ingredients, nutritional value and cost not only gave me ideas for what I could do with my treats, but what I couldn't. Identifying trends in currently available treats showed me gaps in the market and things I wanted to change, such as added sugar, salt and additives (flavourings and colours) that were nutritionally void and added nothing to the treat, and low quality ingredients (such as meat by-products and low quality cereal fillers). Identifying trends in the costs of different varieties of treats gave me a benchmark of how much I should aim to produce for one treat bag as well as how much this should cost, and product disassemblies of different treats gave me packaging ideas as well as key stakeholder (dog's and their owner's), feedback on formulations that are already available. These product analyses were important for the development of my project because it lifted my awareness of dog treats from the ones I was producing to the ones already being produced, and how mine would therefore fit into the current market as well as how they could hold their own and one up what is already available, by having their own unique attributes (such as meatless but also high in protein). This also defined price as a contestable factor for me - due to the huge variation in prices I couldn't defensibly say that price was a more important figure than meat-free ingredients and protein, which made this contestable.

Price Comparisons: Boutique dog treat stores vs Supermarket vs Average pet store

Woofas Doggone Delights – Boutique Brand	
About: Woofas are based in Hamilton, selling at the Hamilton farmers market but are also stocked by boutique pet stores such as Ella Bella's & Animal Feed Barn, specialty food outlets such as Bin Inn & The Country Providore and other pet food supplier such as Waikato SPCA.	**Pricing:** Prices vary, but generally a 50g sample is $3.50, whilst some are $4.50. Kiss crackers, Nibblers and Hearty Venison Bites are $3.50 for 40g. Lambs fry chews come in 80g packs for $7. Ordinary bag sizes, depending on the treat, are 100g or 150g and are all $9, except DCB's which are $16 for 100g. Liva Licious comes in a 450g bag for $24.
Selection includes: A range of specialty dog treats such as wheat/grain free, 100% meat, vegetarian, and even selections for raw fed diets. 	**Other:** Delivery is free over 25 dollars. Below this, shipping to my address came out to $4 standard post and $8.50 courier. Going to their stall would remove delivery costs but as a small boutique brand they are not readily available and this is not always possible.





Consumer research - Surveys: Testing out my theories of what was important to the average dog owner was important as without actual evidence that my development of the

nutritional profile of my treats and my efforts to exclude sugars and additives were in tune with the views of my target market, I couldn't justify my reasoning behind them due to them being based on "gut feeling" and my personal opinion. Conducting a survey over surveymonkey gave me the feedback of 24 dog owners from around the North Shore and Auckland that I needed to make defensible decisions about my treat's most prominent features against the numbers, and backed up my hypothesis that the average dog owner *is* concerned about the added sugars, salts and additives in treats. This defined my contestable factors of nutritional ingredients and a simple ingredients list. It gave me solid numbers rather than an airy hypotheses - 83% of people buy treats on a regular basis. 7 out of 10 people consider nutrition an important factor of a dog treat. 46% of people think the most concerning problem with commercial dog treats is chemical additives. In addition to this it helped me to make an informed decision about the price point of my treats in terms of my price analysis earlier in brief development from the numbers I received: 45% of people regularly buying treats spent over $15 a month on them. Over 50% of people would spend more than $6 on a bag of treats that better met their needs and concerns and around 17% of people would pay double that. This would determine the success I had marketing my treats at a given price point and how much I could therefore invest in the production of the treats in order to keep the costs in a place where a profit could still be turned.

VEGAN DOG TREAT CONSUMER SURVEY

Which treat have you received to test?: _____

The information gathered in this survey will be used for research and development purposes for a new vegan dog treat alternative. I am interested in knowing how much you like the product. Names and results will be kept confidential.

If your dog has known allergies to wheat, gluten or nuts do not have your dog participate in this study.

I have read and understood the above information. I consent to participating in the study and confirm:

- ✓ **My dog has no known allergies**
- ✓ **I have obtained parental permission to give this treat to my dog.**

Signed: *(student)* _____

Signed: *(parent/guardian)* _____

Please give a sample to your dog and rank it by circling the number that best fits your opinion/your dog's reaction. Additional comments would be very helpful.

1. How much do you like the **appearance** of the product?

1	2	3	4	5	6	7	8	9	10
Dislike Extremely									Like Extremely

Do you have any comments about the **appearance** of the product?

_____

_____

Consumer research - Product testing: My product testing acted as a turning point in my project simply because time was becoming more and more of a competing factor and it forced me to think objectively about what exactly I wanted to produce and would feel happy for people to take home and test. It produced the final concept that I took on to become my final prototype - which was a seasonal range of treats including Spring Picnic, Summer Fruits, Autumn Spice and Winter Peppermint - and also gave me necessary feedback on these ideas to troubleshoot issues with the preliminary recipes I had drafted for these ideas - for instance the appearance of my Winter treat, the crumbliness of my Spring treat (which affected the yield of the recipe), and the

issue that arose with the mango for my initial summer recipe going out of season. It gave me an idea of what people did and didn't like about my treats so that I could address these problems in the final prototype, such as changing the recipe for the spring picnic treat and using banana instead of mango for the summer treat.

Prototyping that I used:

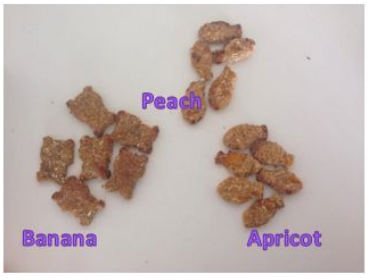
Testing and Trialling: The largest part of my prototyping was the testing and trialling. Once I knew I had the ideas I wanted from my product testing with my consumers (dogs) and target market (dog owners), I had to troubleshoot what the consumer testers had brought up as concerns. Technical issues like the crumbliness of the spring treat and the appearance of the winter treat were things that I knew I had to deal with, but during my trialling process other concerns were raised - I realised that seasonal availability of mango meant that I couldn't produce a final prototype of the summer treat with mango as an ingredient as it was no longer available fresh and was either in syrup or too expensive in frozen form. Thinking about ways that I could address the issues with my preliminary concepts and then trialling how these ideas actually play out was important and formed a large part of my prototyping process more than anything else. Even if the issue wasn't entirely addressed by my proposed solutions just repeating the recipe and working through what I did made me think more deeply about what I was doing and how I could make the recipes simpler, easier and more foolproof. I worked out I could make the spring treat recipe almost exclusively in a food processor, which was a big success for me as the simplicity and reduction of 'time costs' was something I began to think about more as I came towards the end of my project - realistically a dog treat you're going to be selling should have 20 steps and require 4 hours in the kitchen.

Practical comparison:

When making the biscuits I thought the treats with the fresh herbs would by far have the stronger smell and better appearance, but during baking both treats seemed to have as strong a smell as one another. The consistency of both biscuits was very similar – the dried herb treats were perhaps easier to cut into shapes due to lacking the larger pieces of ginger, but when baked the treats looked very similar. The dried herb treats had a more regular appearance to them as the dried herbs dispersed through the dough more easily, whilst the blanched herb treats had larger clumps of spinach, mint and parsley as the blanching causes the leafs to clump together. This made me think that if I am to use dried herbs I would not blanch them as it is extra effort for very little pay off in the final treat.

When snapped in half both treats had very much the same texture to them – crispy and flaky, almost like pastry. I like this because it means that the treats are dry but not too hard and crunchy so that the dogs can't bite through them.

Stakeholder feedback:



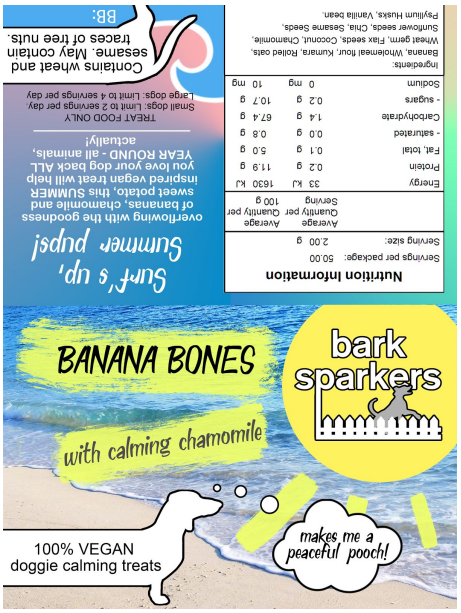
Thinking and talking: In the prototyping stage I utilised the knowledge of my client more than ever - realising that I had the knowledge of my client at my fingertips and had been neglecting to use it to its full potential it became more important than ever to share what I had done with my client and get her feedback. I consulted with her at every stage of my prototyping, from the initial final concept idea to the final prototype, with packaging ideas and pricing thoughts. I consulted my food teacher with initial packaging ideas and inspirations, worked alongside my brother and my boyfriend with packaging as I

struggled to get ideas for names and designs, and got my parents and my friends thoughts on my proposed taglines. Seeking thoughts and approval from other people for my ideas was important in these final stages as public opinion became increasingly a concern - people wouldn't buy my treats if they didn't like the look of them! Bouncing my ideas off of people allowed me to come up with the branding and range names for my treats: Bark Sparkers in the flavours Peanut Butter Picnic (Spring), Banana Bones (Summer), Cinnamon Spice (Autumn), and Peppermint Pup (Winter).

HI Annie
This is very interesting.
Potassium and Magnesium all good . Potassium in particular an excellent calming capability.
Dogs like banana..... So thats great.
We use fresh where we can . The sugars are too high in tinned I think.

HI Annie
This is all most impressive.
Regarding packaging, I find that the more you can see the product, inside the packaging, the better, especially for home bake style of Treat.
I used to pack like woofers but went away from that.
If you want to see some awesome packaging ideas go towebsite : Washbar .nz

Brainstorming, sketching and annotating ideas: In the same strand, as thinking and talking with other people gave me ideas and much needed feedback on these ideas, annotating ideas and extrapolating from them to create new ideas was important for packaging as I wanted to create something new, unique and eye catching but also take inspiration from what my client already had available and what already worked. Sketching ideas also helped me as it allowed me to tangibly see my ideas and manipulate them into something semi-final that I was happy with.



Seeking specialist help: As I'm not a photoshop expert I sought the help of my boyfriend to develop my packaging sketches into a final product that we were both happy with. Because of time being a competing factor we made the decision to only take one flavour through to the prototyping stage as all of the packaging for the different treats would be more or less the same (only differing in name, colour and description, and slight alterations to design).I decided on all of my colour schemes but only developed the final packaging for Banana Bones. Sharing ideas with family members and friends helped me to develop my ideas as I worked - In the end the logo was my boyfriend's idea, the wrap around dachshund was my brother's idea and the sun, names and description were my ideas. Working with other people and getting lots of feedback from a variety of sources on what does and doesn't work helped me to develop something I was really happy with in the end.

Completing the prototype and implementing the product in situ: Being able to see the finished product of all of my work and get feedback on the finished result was really

important for me because it allowed me to see my product and think objectively about it as a real finished product and not just as a recipe and a concept. Getting feedback on what I had created gave me an idea of what I would do differently if time hadn't been such a competing factor and what I had done that worked - how well I had succeeded in creating a product suited to my target market's wants and needs. Positive feedback like "There are a lot of dog treats available on the market. Natural and healthy treats are hard to find and not readily available. I think these would make a good adjunct to an otherwise meat based diet." and "My dog loved it - rolled on it first and then gulped it down!" proved to me that I had made a successful product, and through the technological modelling I had undertaken I had produced a result that is successful.

In conclusion the technological modelling that I have undertaken this year has assisted me in creating an outcome which I believe to fit my brief and be fit for purpose in the broadest sense. My brief outlined that my final outcome should be vegan, additive-free, added salt/sugar free, high protein and ideally less than $10 - all of these boxes were ticked by the range I developed. Positive feedback from my client and my target market suggests that my treat suits the needs of the modern dog owner and caters to the concerns highlighted in my survey, about nutrition, ingredients and price. Without the preliminary functional modelling, background research and trials I did in the beginning, which had a knock on effect to drive more sensible and informed decision making in the later stages and the prototyping and therefore more successful continued modelling towards the end of my project, I don't believe that my outcome would have been as successful at meeting the brief and being fit for purpose in the broadest sense - therefore going to show that technological modelling supports technological development and implementation all the way from an idea through to a design and finally a prototype.

Assessment Schedule, 91612 **Demonstrate understanding of how technological modelling supports technological development and implementation**		
Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria.		
Issues from the Specifications Where a candidate has provided a brief answer, the answer should not be penalised because of length. Candidate work in excess of 10 pages must not be marked. Where a candidate has used a small font markers should make a judgement about where to stop marking. This judgement should be made relative to 10 pages of Arial font Where work is illegible, it cannot be marked. Digital submissions that cannot be read cannot be marked.		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Demonstrating understanding of how technological modelling supports technological development and implementation involves:	Demonstrating in-depth understanding of how technological modelling supports technological development and implementation involves:	Demonstrating comprehensive understanding of how technological modelling supports technological development and implementation involves:
explaining how functional modelling is used to test competing and/or contestable factors to inform decisions during the development of a technological outcome explaining how prototyping is used to inform decisions for implementation of a technological outcome.	explaining how evidence regarding competing and/or contestable factors is gained from different forms of modelling to justify decisions made during the development and implementation of a technological outcome.	discussing how modelling enables informed, responsive, and defensible decision making during the development and implementation of a technological outcome.

Grade: E

The candidate has worked closely with an external client on the design and development of a ‘vegan dog treat alternative’. The comprehensive reflective nature of the discussion shows how functional modelling and prototyping have been used during the development work on the pet treats to defend and validate decisions made. How some of the relevant key factors were resolved during the process is a focus of the discussion, which clearly shows an understanding of the difference between competing and contestable factors.

Technology Schedule Appendix 1

Markers must exercise professional judgement to decide if a report demonstrates understanding. The following appendix provides guidance for markers making this judgement.

A report must use information to demonstrate understanding.

Reports described wholly or substantially by one or more of the statements in the left column demonstrate understanding.

Reports described wholly, or substantially, by one or more of the statements in the right column do not demonstrate understanding.

Where the report is made up of both used and reproduced information the marker must decide if the report is successful against the standard when the reproduced information is ignored.

Evidence of **use** of information	Evidence of **reproduction** of information
Candidate's report describes and explains the candidate's use, in their practice, of information relating to the standard	Information is presented in isolation from the candidate's Technological experiences. It offers nothing or little to suggest the information is related to a course of instruction at level 8.
Information from the candidate's practice, research, the practice of others, and teaching is related to the candidate's technological experiences. The report describes experiences you would expect to come from a course of instruction derived from The Technology Learning area the NZC. These could include but are not limited to • testing and trialling within a modelling process • developing a conceptual statement • developing a conceptual design • development of a brief • material selection • refinement of a brief • development of a prototype • development of a one off solution • further examples may be added.	
Information from research, the practice of others, or teaching is reported in the candidate's own voice.	Information is not in the candidate's voice. The word choice, sentence structure, sentence length, punctuation and so on are not what a candidate could be expected to produce.
Referenced, complex research information unchanged by paraphrase is related to other information in a manner that unambiguously constructs meaning. (very rare)	**Unreferenced**, complex, research information is presented as though it is the candidate's own work.

Where the marker suspects a report is a deliberate attempt to deceive the report should be referred to the panel leader using the Irregular Booklet process.