

No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

Assessment Schedule AS 91363

Demonstrate understanding of sustainability in design

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 report, the report 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 Ariel 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
Demonstrate understanding of sustainability in design involves	Demonstrate in-depth understanding of sustainability in design involves	Demonstrate comprehensive understanding of sustainability in design involves
<u>explaining how lifecycle considerations determine the focus for design interventions</u> <u>explaining the relationship between lifecycle design, innovation and sustainability.</u>	explaining how lifecycle analysis is undertaken and how this determines the focus for design intervention explaining how issues identified by lifecycle analysis led to design innovation being applied in the development of a sustainable technological outcome.	discussing the competing priorities and compromises made as a result of lifecycle analysis in the development of a sustainable technological outcome.

The candidate describes and explains the LCA and the 6 Rs of sustainability. The explanation is limited in some areas and reflects a generic approach to how sustainability impacts on design decisions within the practice of others. And a consequence, the candidate explains the relationship between lifecycle, design and how environmental, societal and economics considerations that influenced design-making process but does not do so in any depth.

The submission is seen as being Achieved.

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
<p>Candidate's report describes and explains the candidate's use, in their practice, of information relating to the standard</p> <p>Information from the candidate's practice, research, the practice of others, and teaching is related to the candidate's technological experiences.</p> <p>The report describes experiences you would expect to come from a course of instruction derived from The Technology Learning area the NZC.</p> <p>These could include but are not limited to</p> <ul style="list-style-type: none"> • 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. 	<p>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 7.</p>
<p>Information from research, the practice of others, or teaching is reported in the candidate's own voice.</p>	<p>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.</p>
<p>Referenced, complex research information unchanged by paraphrase is related to other information in a manner that unambiguously constructs meaning. (very rare)</p>	<p>Unreferenced, complex, research information is presented as though it is the candidate's own work.</p>
<p>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.</p>	

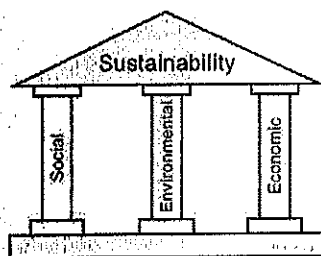
Introduction

In this report I am going to look at the different aspects of sustainability in design and explain its significance towards the designing and packaging of my product. Eventually I will come up with a well thought out decision, as to what type of sustainable design and packaging I should use for my meal replacement bar, that will be ideally consumed up the mountain by teenage skiers or snowboarders. I will be discussing how the factors of the life cycle processes and the three significant pillars of sustainability will be affecting the overall packaging of my product. I will ensure through my research that the packaging I will choose will have an eco friendly design that will not harm the environment.

Sustainability

Sustainability is the ability to sustain natural resources for our benefit (in order to meet our needs) and for the use of future generations, to meet their own. It is vital for us to be sustainable in order for everyone to experience the same "basic quality of life" and have the same opportunities and potential to flourish as a society. Sustainability can be breakdown into 3 main dimensions which are: Economic, Social and Environmental. They are known as the "Pillars" therefore, for us to become sustainable, we must find ways in order to attain the balance between the 3 without sacrificing any aspect. As well as ensuring that the decisions applied on these dimensions will not be causing any long term damages or problems. Thus we will be successful.

Three Pillars of Sustainability



Economic: Having a sustainable economy means that the government had thoroughly planned its actions and got themselves involved with the way that the country is running its businesses and trades (such as their imports and exports). This results to a balance in their economic state due to the fact that they are able to manage the value of the products that they are making, as well as the costs of making it. The employment rate also depends on this aspect

because the probability of the companies hiring more employees will depend on whether they will enter the international market or decide to stay local. Fairtrade is also evidently implemented in their businesses because it ensures the farmer/workers' (as well as their family) future and well being, which is the ideal factor for one's economy to be successfully sustainable because by doing so, they are enabling the next generations to gain access to an overall better quality of life and standard of living. Businesses apply economic sustainability throughout, by embracing strategies that will lead them to enhancing their own endeavours, as well as the people they serve. While safeguarding both their natural and human resources for future purposes.

Environmental: Having an environmentally sustainable country means that they are able to adapt to the kind of environment that is given to them and ensuring a good state for the

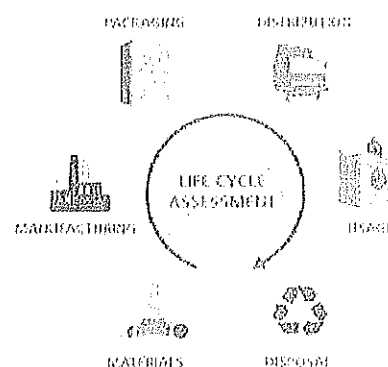
environment that surrounds them. Fair trade also links with environmental sustainability because companies who follow the FLO, have to strictly abide to the fair trade laws that are given such as: managing wastage, ensuring the fertility of the soil that is being used, and making sure that the plants being grown are purely organic. This means that pesticides and other known chemicals that are harmful to the environment, are not used to grow them, which also makes it more appealing to the public because they believe that the product they will be purchasing is more wholesome compared to non-fairtrade products. Through this, the fairtrade companies also aid the farmers by teaching them techniques in order to develop their adaptability skills, to successfully grow the plants despite the harsh and constantly changing environment.

Social: Buying ingredients that goes through fair trade, helps lessen the occurrence of poverty in a country which instantly boosts its development, which also links to its economic growth. This is because a deal is already laid out while the crops are still growing, and this secures the farmer's financial income, enabling them to plan ahead and prepare for their future. Through this process, investments are also placed which improve the area that the farmers are living in by developing their facilities and eventually their infrastructures. Giving them access to a clean drinking water which links with better sanitation, that equals to an improvement in their health.

Each of these pillars is needed to uplift the overall successful rate of being sustainable. If one of these aspects is not accomplished, then the probability of it affecting the others will be unavoidable because they all link together. An example is if a part of the natural environment will be damaged such as the fertility of its soil due to lack of proper caring, that area will suffer from a slight economic downfall which may affect the social aspect because of implications it will have on the people who will need the products grown by the soil and the demands that their trades need. But also the farmers whose income depends on the growth of their crops.

Life Cycle Analysis

The life cycle analysis, also known as the LCA, touches base with the different characteristics that designers are looking for when it comes to their product's life cycle. This includes the process of "cradle to cradle" or "cradle to grave" which enables them to assess the numerous impacts that each stage of the life cycle process may have on the environment. In order to develop conclusions based on their results, and eventually choose a design that will best fit their intention of continuing with the idea of keeping the environment sustainable. The LCA was solely introduced in order for the designer's to assess each aspect of the LCA which shows both the negative and positive impacts that the packaging has on the natural environment. This cycle consists of 5 significant steps (in chronological order) which is shown below, with a brief description as to what the designers generally have to analyse and consider when it comes to this process and refining the packaging that they will be using.



1.Raw Material Extraction and Processing → The designer has to think about the main source of the raw materials that will be used and how it will affect the final product. The transportation needed to transfer these materials to the manufacturing company should also be considered. The state of the environment and the quantity of the resources that they will be getting it from is also vital because most resources are finite such as oil. They also have to take into account how these materials will be extracted from those sources. Including its energy consumption and the gases that the machines will be producing due to combustion such as: carbon monoxide, which is considered to be a pollutant. They will have to evaluate the negative impacts these byproducts imposes in the natural environment.

2.Manufacturing → The designer will have to consider how and where every single bit of material will be taken from and made into the parts that will be used to construct the overall packaging. In this step, they will have to think of the amount of energy that they will be consuming because of the machines that will be used. As well as the effects that it may lead both to the environment and to the economic expenses. It is ideal for the manufacturing companies to be located near the place where the materials are sourced so that there is less gas being used for the transport of ingredients which also lessens the combustion that occurs. It will also be better for the people to walk the distance because it will be better for their wellbeing.

3.Assembling and transport → In this aspect, the designers will have to assess the length and quality of the production of their packaging. Especially how both of these aspects affects the environment during its manufacturing all the way to its disposal. They will have to think of the possible level of pollution that they will be causing both in air and water that surrounds the factory due to the amount of fossil fuels that they will be consuming and the gas emissions that will be released. They will have to think of ways to limit this. They will also have to assess and ensure the worker's wellbeing by making sure that they are paid fairly and that they are working in a clean environment that won't harm them.

4.Usage of product → The designer needs to think of where and how the product will be sold. Especially the impacts that it will have on the environment, just like the previous stages. They will also have to think about the trail and errors that they have done previously. So that they continue with the things that went right before when it came to their packaging and what went wrong for their consumers.

5.End of Life → This is one of the most critical stages of the LCA because this is when the designers will have to thoroughly consider how the product will be disposed of. They will have to think of whether the parts that they have used are recyclable so that it will be able to be reused or remade into something else that will eventually extend its lifespan. Which also links with the reduction of wastage.

Sustainable design

To be sustainably designing and creating packagings means that, even though we are consuming large amounts of resources for it, we are still ensuring that they will still be extant for the long term, so that we are not endangering the possibility for the future generations to have the same experiences and resources that we had, in order for them to be able to meet their own needs. This links with reducing and possibly diminishing the usage of non-renewable resources. Companies who are aiming for attaining a sustainable design packaging, touches base with the different aspects that comes with sustainability by always considering the three pillars (economic, social, and environmental) and the 6r's on each decision and step that they make. By doing so, they will also be limiting the negative impacts that their production might cause to the environment. The amount of wastage and each of our own personal choices on how to dispose our garbages will define the state of our environment and the natural environment that exists around us. An example of companies who willingly follow sustainable design packaging are Frontera.

6 R's of sustainability - The 6 r's of sustainability acts as a checkpoint for designers when it comes to making their product. A set of questions are linked and implemented in each r's for the designers to answer in order to have a well thought out final sustainable product, minimizing the negative environmental impacts that it may have on the environment.

Reduce → Reducing the resources that will be used by limiting their usage, elongates the existence/lifespan of those materials which is an advantage for future purposes. Which will also lead into reducing the possible impacts it may have on the environment such as deforestation for the production of paper made materials.

Reuse → Could the packaging they are making or some of its parts be reused after its first purpose? If it is, is it stated on the product itself as to how it should be properly disposed? This specific detail on the product makes it more likely to extend it's life.

Refuse → This is the cancellation of any plans on using materials that will definitely cause harm to the environment. An example is to diminish the use of plastic usage especially when it comes to unnecessary packaging. Or only buying necessities and eliminate the extras.

Recycle → The practice of making and utilizing products that are made out materials that can be easily recycled. This lessens the chances of a one-time-usage which decreases the amount of disposal and wastage that will take time to decompose and threaten the environment.

Repair → Is the product being produced easy to repair so that it's lifespan can increase? Are the individual materials used easy to fix

Rethink → The practice of considering both the advantage and disadvantages that the materials will cause since the day it is sourced to the day it is disposed.

Food designers' decisions when it comes to sustainable design packaging:

The Herman Miller company who produces chairs were convinced to encourage sustainability in the design of their products. This led onto the production of what they call as the Aeron Chair that gained popularity due to its components being 94-96% recyclable. They also strived to make this iconic chair's design be considered as "cradle to cradle."

The Coca-Cola company

The Coca-Cola company is promoting its new sustainable and innovative design packaging for their drinks. They are proudly claiming that the majority of their Coke bottles are 54% made out of PET which stands for polyethylene terephthalate, which is a type of plastic that is robust and light. Which is seen to be perfect to be used for the packaging. It is also deemed to be 100% recyclable and is non-toxic.



Relationship between life cycle innovation and sustainability, and how to compromise with each aspect

Innovation is the exercise of continuously experimenting with different ideas that will aid with the future generation. Looking at different aspects that they will be able to alter in hopes to create change that will eventually help them flourish. Innovation is important when it comes to sustainability because it assists establishments with a set of guidelines that will help them assess their product's level of sustainability. Especially to find ways in order to reduce the negative impacts that it imposes on the environment. Making compromises between innovation and sustainability will definitely take a long period of time. Due to the fact that each stage will have to different lengths in order to assess the factors and impacts it will have on all the three pillars of sustainability.

Food Miles

Food Miles is the term called for the transportation or journey of an ingredient. It is measured in miles from where it was produced, all the way to the consumer. It is facing numerous issues because of the negative impact that it has on the environment. Most food products are transported via airplanes because it is said to be the quickest way. Even without air transportation, road transportation is also known to use large amounts of fossil fuels which releases tonnes of carbon dioxide when they are used. It also creates greenhouse emission gases and pollution. This contributes to global warming and affects the overall natural climate of a country, while increasing its Carbon Footprint. The increasing numbers of vehicles that transport food also becomes a risk because of the social congestion that may take place and make it prone to accidents. Nowadays, people are looking for numerous ways to reduce their food miles. And research has proven that a variety of methods are successfully taking place such as: purchasing food that are grown and sold locally, consuming food that is in season, and growing

your own ingredients. Buying ingredients from the local market means that there is less packaging used because they are fresh and not frozen. Walking to those local grocers to support them also decreases the carbon footprint in the environment which also helps reduce food miles.

Ingredients	Origin	Distance from the origin to NZ (m)
Oats	New Zealand	0
Shredded coconut	Philippines	5,019
Rice Krispies	Australia	2,582
Dried raspberries	New Zealand	0
Dried blueberries	New Zealand	0
Freeze dried blueberries	New Zealand	0
Almond butter	New Zealand	0
Agave syrup	Australia	2,582
Honey	New Zealand	0
Coconut Oil	Philippines	5,019
Almonds	Australia	2,582
Pumpkin seeds	New Zealand	0
walnuts	Australia	2,582
Vanilla essence	New Zealand	0
salt	New Zealand	0
Puffed amaranth	Australia	2,582
Quinoa	Australia	2,582
Almond Milk	Australia	2,582

I ensured that I practiced sustainability in my product by doing the following:

- When it came to sourcing materials, I chose ingredients that were grown in New Zealand locally or by countries that were near such as Australia. Although, the furthest country my ingredients came from was the Philippines because this is where the coconuts grow due to its

tropical climate. To compromise the high amount of food miles used, a development is implemented in the coconut production which ensures that sustainable methods and good quality agricultural practices were applied when it comes to sourcing and producing these coconuts in the Philippines. Also, by using most ingredients that is made in New Zealand helped minimize the amount of the overall food miles that I had used in making my bar. Some ingredients that I used such as the agave nectar is a certified product made through fair trade and is organic which makes it ideal for sustainability that connects with the three pillars.

-When it came to manufacturing, I ensured that toasting the dry ingredients was done through a pan instead of using an oven because the oven consumes more electricity than the stove, which is not sustainable. Especially if one tray of dry ingredients is only being toasted. Although, the oven will be ideally used if large amounts will be made. I have created my product with the idea of selling it around the same area it is made.

-When it came to the packaging of my product, I came up with different ideas during the course of my internal and eventually ended up with choosing a minimal amount of baking paper or a very small brown paper bag to pack my meal replacement bar. This is due to the fact that according to my research at that time, it stated that paper is seen to be more sustainable in the long run because even though the baking paper is a one-time-use type of packaging, the plastic still takes a longer amount of time to degrade which increases the chances of harming the environment. My bar was also not greasy therefore the baking paper was enough protection and hold for it even though plastic will be a better option when it comes to quality packaging.

- The distribution of my product will be done by personally selling it to the my consumers. So that there are no gases used during this process which will make it more sustainable. Although, if it is to be sent to them by car, they will need to use a type of transport that will have a low impact on the environment such as green vehicles which does not depend on gasoline or other harmful fuels.

-My product is made to be consumed up in the mountains while my stakeholders are on the chairlift. Therefore, it has to keep its shape while it is stored in my stakeholder's jacket pockets as they ski. The packaging will have to be strong enough to hold it together and it has to be easy to open for my stakeholders without making a mess.

-When it comes to the disposal of the packaging of my meal replacement bar, it has to acquire the aspect of being recyclable and biodegradable so that there is less chances of it harming the environment.

Conclusion

Through this report, I have obtained more knowledge about the process of the life cycle analysis and the vital role each of its stages plays when it comes to successfully designing a sustainable product. Especially when it comes to meeting the set of standards that will decipher

whether the designers are following the guidelines correctly, in order to decrease the constant harmful threats that it imposes on the environment based on each decisions made. It has brought to my understanding that knowing where and how each of the ingredients I have used, is significant because I will have to acknowledge their impacts, both negative and positive, on the environment, as well as the economic and social aspects of sustainability. I believe that I have done a sufficient research about the life cycle of a product and ensure that what I am using is a material that will be reusable to further extend its shelf life that overall links to sustainability. Doing this report had also taught me that having sustainability present in design safeguards the quantity and quality of the resources, both natural and man made, for the future generations who will be needing the same things that we needed. With my meal replacement bar, I will have to choose more carefully. Ideally choosing ingredients that are either organic, made through fair trade, or are grown locally. In order to assist the area that we are living in so that we can help it develop the right way.

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