

# **Desirable and Sustainable**

**Consolidating strategies for developing  
sustainable products**

**By**

**Kere Wylie**

**2018**





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Consolidating strategies for developing  
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**Kere Wylie**

A thesis submitted to the Victoria University of Wellington  
in fulfilment of the requirements for the degree of  
Master of Innovation and Commercialisation

**Victoria University of Wellington**

**2018**





# Abstract;

Society's consumption, economic systems, and exponential population growth is creating more material waste than it can process. Mass production plays a large part in this unsustainable material consumption resulting in ecosystems collapsing.

This thesis was done in partnership with SUPER Design Studios (SUPER), a registered design company founded by the author. The thesis was started in response to the need for everyone and everything to be waste-free while acknowledging that current sustainable alternatives were not bringing us closer to this goal.

The objective of this thesis is to explore and propose a new Sustainable Product Development Strategy (SPDS) to create products that are effortlessly and enjoyably sustainable.

The research starts with an analysis of current sustainable product development practices; followed by interviews with sustainability industry experts focusing on the opportunities, barriers and difficulties they find working within the field. The research found that the perceived issues with sustainable products are not inherent in the products but can be attributed to flawed approaches typically used in their development. To address this issue a new SPDS was identified, by combining successful product development strategies. The SPDS encompasses a focus on three key domains. Firstly, the development team needs to be empowered and encouraged in a sustainable mindset. Secondly, the project brief needs to put the customer and environmental needs at equal importance. Thirdly, a business mindset which motivates collaboration with external individuals including stakeholders, customers and other key disciplines, needs to be developed.

The SPDS was trialled through validating and conceptualising a sustainable toothbrush product using a hybrid circular economy and subscription business model. This development encompassed strategies that utilised the SPDS methodology including design thinking, competitor analysis, a thematic analysis of secondary research, case studies, tree analysis, expert interviews and customer surveys. Overall a strong case was made for using the SPDS for the development of successful and sustainable products.

The sustainable toothbrush concept is presented in the accompanying business case which proposes that SUPER goes ahead with further development and research to create the first of a new generation of sustainable products utilising the SPDS methodology.

The hope is that applying the SPDS will create successful sustainable products that outcompete conventional products, leading to industry competitors following suit and in doing so replace the sustainable product industry.





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Unfortunately, now we all need a new joke because 'Kere have you finished your masters yet?' has expired. . . To my delight I must add.

- Lego, you the real MVP - Spotify, we had some great 3am dance parties -  
To my high school English teacher Miss Benjamin who told me I couldn't write to save myself, well surprise, I still can't, but I wrote a thesis anyway.

Last of all, I want to thank myself, very proud of you kido!

Don't be too hard on yourself, good luck for the future and stick to what you believe in!







# Tomorrow's Child

By Glenn Thomas

Without a name; an unseen face  
and knowing not your time nor place  
Tomorrow's Child, though yet  
unborn,  
I met you first last Tuesday morn.

A wise friend introduced us two,  
and through his sobering point of  
view  
I saw a day that you would see;  
a day for you, but not for me

Knowing you has changed my  
thinking,  
for I never had an inkling  
That perhaps the things I do  
might someday, somehow, threaten  
you

Tomorrow's Child, my daughter-son  
I'm afraid I've just begun  
To think of you and of your good,  
Though always having known I  
should.

Begin I will to weigh the cost  
of what I squander; what is lost  
If ever I forget that you  
will someday come to live here too.

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# Introduction

This thesis hopes to consolidate strategies for designing sustainable and desirable products by reverse engineering product attributes that are linked to a products success or failure. A toothbrush concept is later designed for university students as a case study to test the opportunity and effectiveness of the consolidated strategies. Rapid population growth has jeopardised earth's resources and support systems, endangering not only itself but other species and ecosystems (Basiago, 1995). Society can no longer maintain its current trajectory, as it relies on an economic system based on unsustainable consumption (Milbrath, 1989). Population growth and the subsequent consumption growth chews the volume of resources the Earth naturally produces in one year within eight months (Global Footprint Network, 2016); essentially creating waste faster than it can be turned back into resources. Mass-produced waste has resulted in the collapse of ecosystems and an exponential buildup of toxic gases like carbon dioxide (Global Footprint Network, 2016).

The human population is estimated to exceed 9.7 billion by 2050 (UN DESA, 2015) and would require the volume of resources that only two earths could produce to meet this increasing resource demand. The extent of unsustainability in society's lifestyles is leading humanity towards severely harmful consequences. Society is on track of no return regarding resource depletion. The sooner we act, the less long-term harm can be expected (Stevens, 2016). The growing urgency for a solution inspired this project, with the goal to aid in returning humanity to a sustainable future.

This thesis assumes the current exponential population growth and consumption-driven economic system production will not be solved in the limited time provided, and therefore focuses on design, and product development to attain a sustainable future. In his book *The Total Beauty of Sustainable Products*, Datschefski (2001) proposes that current methods of product design and development are fundamentally flawed and is the source of most environmental problems. For example, on average, thirty tonnes of waste is created for every tonne of products created, with 98% of the products manufactured being thrown away within a mere six months (p. 17). With the materials used in products designed to last for thousands of years beyond their actual use these materials build up in landfills (McLennan, 2004, p.66). Over engineering products so that they live longer than their use and owner, is described as society's greatest sin by Benyus (Benyus, 1997). Society majorly uses a linear material flow turning resources into waste without regard to their reusability, if a cyclical material flow was used instead the reuse of these materials could decrease the negative environmental impact created by current consumption and population growth (Braungart & McDonough, 2002). The opportunity lies in developing sustainable and waste free

products preventing further resource and eco-system collapse. Current products attempting this goal are referred to by many names including eco-minded, eco-friendly, environmentally friendly but will be referred to in this thesis as sustainable products.

For sustainable products to make a significant impact, SUPER proposes that the sustainable product industry needs to rapidly transition itself from the sustainable niche market into the mainstream. The assumption that such a transition can happen is because compared to a decade ago, the mindset around the need for sustainability is no longer seen as an insignificant trend or the worry of only a few environmentalists (McLennan, 2004). For the first time in history society is swapping its focus from efficiency to becoming green (F. Chicca , personal communications, October, 14, 2016). Policies are being created to enforce a sustainable change, for example the Paris Agreement on Climate Change requires countries all over the world to move towards a low-carbon emission path (McKinsey, 2011). This moral shift had originally pushed the estimated value of the environmental industry to be worth trillions of dollars by 2007 (Datschefski, 2001, p.9). A sustainable direction also offered companies competitive advantages in markets that were slowing in growth or became stagnant by challenging and encouraging them to develop new solutions and injecting the market with new innovations boosting growth (Datschefski, 2001, p.9).

However, the current state of different sustainable product markets, with different markets yielding different turnouts, demonstrates an indecisiveness in the promises that were made regarding the future of sustainable development proposed by the sustainability movement (McCullough, 2014).

Currently, the fastest growing 'sustainable markets' are home cleaning and organic foods markets, which are growing faster than their non-sustainable counterparts (Eco-ventures International, 2013). New Zealand companies Ecostore and Earthwise both boast huge growth figures with Ecostore's annual turnover of nearly \$30 million (Bradley, 2013) and Earthwise group boasting a growth of 1005% in the last four years (Deloitte, as cited in The National Business Review, 2013). Despite this exponential growth, sustainable products are still a niche only accounting for 3% of the entire industry (Packaged Facts, 2015). Arie Lewin, Director of the Centre for International Business Education Research at Duke University is insistent that sustainability will continue to remain as a niche industry (McCullough, 2014).





## Barriers to Sustainable change

### **Price**

The price of sustainable products seems to be biggest barrier stopping the sustainable product markets ability to sell, grow and be successful. A recent Nielsen global online study (Nielsen, 2015) looking at the eco-minded customer found that 25% more millennials are both able to and willing to buy sustainable products compared to the same survey done in 2014. Nevertheless, a separate international survey showed that though customers are wanting sustainable products, they are not willing to pay more for them (Packaged Facts, 2015). These findings were mirrored by a New Zealand survey by ShapeNZ (as cited by StopPress, 2010) showed that price was the dominating factor and reinforcing that no matter what most customers say few will pay extra for sustainable products (International Institute for Sustainable Development, 2013\*\*).

### **Customer scepticism**

National Geographic's global study (as cited by Townsend & Niemtzow, 2015) revealed customer's concern for the environment has increased significantly, yet sustainable purchasing has decreased. This has been blamed on the aesthetics of sustainable products (Vlahov, 2015) in addition to the persisting mentality that sustainable goods are less effective than their unsustainable counterparts (International Institute for Sustainable Development, 2013). It is apparent that while customers believe environmental issues are important, they are unwilling to compromise in price and quality (McLennan, 2004, p.188).

### **Customer Ignorance/Innocence**

The lack of concern has also been attributed to landfills and waste being hidden from the public's eye (Datschefski, 2001, p. 16) creating the common attitude that waste can just be sent away rather than properly dealt with (McLennan, 2004, p.xxi).

Price, scepticism and ignorance create a serious threat to the growth of the sustainable product industry. One opinion is to provide clearer communication of the benefits of sustainable products (StopPress, 2010 & IISD, 2013) to increase their credibility and sales. However, it is clear customers will rarely pick the environment over their own satisfaction. This insight may explain why home cleaning and organic foods sell so well, as the sustainable implications directly affect the customers in a positive way.

This thesis argues treating the sustainable product industry as a niche is detrimental to a sustainable future because it has created an image that sustainable products are not for the wider market, aren't of high quality and do not provide enjoyable experiences.

## Current sustainable successes

Method, an American owned sustainable home cleaning company, showed that a focus on great products, customer experience, stylish design, and an underlying emphasis on sustainability sustainable solutions can be desirable and succeed. Method brought whole new value proposition to the market, attracting both sustainably and non-sustainably minded customers. Method's revenue grew from \$34 million in 2005, to more than \$100 million in 2012 (Kurtzjan, 2013). Though niche, Method and similar businesses had created an impact in the market. By setting a new bar for conventional cleaning products, they not only took over a significant amount of the market share they also forced companies like Unilever and P&G to recapture their stolen market share by either acquiring sustainable brands (Very, 2016) or create their own (Ryan & Lowry, 2011, p. 23). Before these innovations, no one had questioned or demanded better cleaning products, especially in terms of environmental responsibility (Datschefski, 2001, p. 8). A lack of product variety had not only limited the customer's options, but had limited their understanding of what was possible, resulting in little demand for any further innovation (Schwartz, 2005, p.3). When Method arrived offering customers something they didn't know they wanted, a race of innovation and competition was created between competitors causing the the sustainable cleaning product market to exponentially grow.

Lewin, the owner of Luke's Toy Factory also believes people will not buy his toys because they are made of sustainable materials but will buy them as they are good, fun, interesting and meet the needs of the customers (McCullough, 2014). For the sustainable product industry to become mainstream in a limited amount of time, it can't wait for customers to make the personal behavioural shift to be eco-minded (Stevens, 2016). Instead, the sustainable product industry needs to target the mainstream; including those who don't care for sustainable solutions. In other words, sustainable products cannot preach to the converted but rather go for the unconverted if they want to crate a sustainable future.

This thesis agrees with Lewin's view and proposes that:

- Innovation-driven market disruption and meeting customer's needs is the best way to exhilarate sustainable practice because competitors are forced to follow and copy or innovate to keep their market share.
- Sustainable products do not fail due to being sustainable but due to poor design development.
- Sustainable products can be not only compete but outcompete their



conventional counterparts.

- Sustainability is not a niche market, but a criteria for all products.

Overall, higher cost, inaccessibility, lower quality and the increased effort needed to use sustainable products make them unenjoyable and stressful to buy and use. These difficulties are uninspiring and unappealing to the wider customer market ensuring that the sustainable product industry remains as a niche. However, by redefining and repivoting sustainable products as well as being more customer orientated sustainable products have a chance to become a strong competitor in the product industry.

## Initial Assumptions of Thesis

This thesis takes the above perspective with five key assumptions:

- 1-** To have a sustainable future, everyone must use sustainable products. However sustainable appear to be only marketed to the easily guilt-tripped, those with spendable income and consumers who are already sustainability focused. Sustainable products need to appeal to the wider consumer market.
- 2-** To have a sustainable future, sustainable alternatives need to be easily available in every industry. However, sustainable alternatives are limited or non-existent for the majority of products and services that we use daily.
- 3-** Current sustainable products appear to have too many flaws to have the ability to outcompete and replace conventional unsustainable products in time to reverse the damages done to the environment and create a sustainable future.
- 4-** The flaws highlighted above that are imbedded in sustainable products are not inherent but come from flawed product development strategies in addition to methods and can therefore they can be removed.
- 5-** There is a link between a product's success and the specific traits it has. By identifying and understanding these traits they could be applied to sustainable products.

The objective of this thesis was to understand why sustainable products are unable to appeal to the majority of customers and to then create two outputs from this research. Firstly, the proposal of a research-based sustainable product development strategy (SPDS) that would ideally be used to develop a new generation of desirable sustainable products. Secondly, the validation and development of a new conceptual sustainable toothbrush developed using the SPDS, with a possibility of it being developed by SUPER Design Studios.

## Why redesign the toothbrush?

The toothbrush product market was chosen because it provides a perfect example of the horrendous nature of an unsustainable economic system based on consumption. If toothbrushes are replaced every every 3 – 4 months as recommended, with an average weight of 30 grams and 3.5 billion toothbrushes manufactured every year and causes 91,000 tonnes of toothbrushes to be landfilled annually. The basic design of the toothbrush has also not changed since the 13th century (Colgate, 2006) providing opportunity to disrupt an apparent stagnating oral care market. This stagnation resembles the home cleaning market before Method, or the chocolate milk category before Lewis Creamery changed the playing field (Strong, 2017). Current sustainable products appear to be very similar and as mentioned do not appeal or provide enough different sustainable alternatives to the wider consumer market.

## Why University students?

University students were chosen as the target market as research showed there was strong opportunity to provide something that current oral care competitors were not. Student's expectations for products to be low price and good quality also drove this decision because the researchers believes sustainable products need to be more accessible with price being one of the biggest barriers.

## Project Partner

SUPER (see figure 1.0) is a newly created design studio founded by the author which aims to develop a new generation of sustainable products that are both sustainable and desirable. SUPER's passion to produce sustainable and successful products helped form the goals of this thesis and guide the research process.



Figure 1.0 - SUPER Design Studios Logo



## Thesis Scope

This thesis addresses core mindsets, methods and strategies needed for the development of feasible successful sustainable products. The product development is not focused on prototyping, testing and launching sustainable solutions but rather developing concepts and business strategies using the SPDS. A business case will present the concepts generated and developed within this thesis for SUPER to assess the opportunity and risk of further research, development and testing of them. This thesis does not practically test current sustainable approaches but relies on secondary research to assess the effectiveness and weaknesses.

## Thesis framework

This thesis differs from a normal thesis layout by being divided into two phases, each focused on one output.

### **Phase one**

Phase one presents and compares findings from the literature review and expert interviews about current sustainable product development practices. These findings are then discussed in relation to areas of weakness; with a new sustainable development strategy being proposed which attempts to resolve the identified issues. This Sustainable Product Development Strategy (SDPS) can be used by anyone and should increase one's ability in developing more desirable and successful sustainable products.

### ***Literature review***

Covers current sustainable strategies and methods and how they impact a product's success. Alternative strategies and methods are then proposed that should eliminate the flaws typically seen in sustainable products increasing their potential of success. Key product traits that appear to make products successful are then explored with the goal of understanding how they are generated. This understanding is then fed into the SPDS.

### ***Methodology***

Presents how the interviews with the sustainable designers and lecturers were conducted and how the data was analysed.

Findings and analysis

Showcases the key findings from the interviews and how they compare to the information gathered from the literature review.

### ***Discussion***

Overall findings are then discussed with the SPDS being proposed and outlines the three domains of the SPDS and how they can be applied to developing a sustainable product.

### **Phase two**

Phase two focuses on trialling the SPDS proposed in phase one by using it to develop a new sustainable toothbrush concept for SUPER with the developed concept and the next stage of research being presented in a business case.

### ***Methodology***

Presents how the toothbrush market was assessed and validated in addition to the methods, strategies and techniques used to understand the needs of the environment and the customer and to develop a conceptual product which meets.

### ***Literature review - Market validation***

Presents key information needed to validate a possible opportunity a new entrant in the New Zealand oral care market could pursue. The findings presented include an overview of the markets current and assumed future life-cycle, analysis of current competitors within New Zealand in addition to over sea companies that provide unique solutions, this will compile of their customer segments, current product offerings, business strategies and business models.

### ***Product research***

Uses the SPDS to develop a toothbrush that covers the two domains needed for to build a product brief.

**Environmental needs** – Presents the environmental implications created by the materials currently used in toothbrushes in addition to alternative materials.

**Customer needs** - Building off the insights from the market validation, a proposed customer segment is pointed to. Customer surveys and dentist interviews highlight key features expected from a toothbrush to provide an effective clean.



### ***Discussion of findings***

Presents the overall findings and visualises how they were addressed by the developed concept.

### ***Business case***

Application of the market validation and product R&D to propose product and business model for further development by SUPER design studios.

### ***General Discussion***

Reflects on the usability of the SPDS and the potential it for developing desirable, sustainable and successful products by covering its initial shortcomings, areas of improvement and recommendations for additional development.

### ***Conclusion***

Summarises key findings and their implications for the outputs of the thesis and their future.







# PHASE ONE

Understanding key issues with current sustainable strategies and proposing a new Sustainable product development strategy

## **A review of current sustainable product development strategies and successful product attributes**

This review explores the concept of developing a successful product, focusing on strategies and methods for developing sustainable and successful solutions; Looking firstly at understanding what unsuccessful sustainable products and any possible solutions. Secondly it explores the traits within successful products and the information needed to generate them.

### **Strategies and methods for the development of sustainable products**

This section covers current sustainable strategies and methods and how they impact the product's success.

### **Defining sustainability**

A key barrier to the growth and spread of sustainable development in the product industry is the unclear and disagreed upon definition and methodology used for sustainable development (Basiago, 1995). For example, the World Commission on Environment and Development (1987) describe sustainable development as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

While the United States Environmental Protection Agencies (2016) defines sustainability as:

“Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations.”

Sustainability definitions are broad, ambiguous and open to interpretation creating criticism over sustainability's ability to create real change (International Union for Conservation of Nature [IUCN]).

There are three key issues why defining sustainability has been a long-lasting issue.

**1-** The sustainability movement evolved outside of the mainstream causing the majority of society to suddenly unlearn outdated ideas and learn new ones causing individuals to see sustainability as invasive (Walker, 2006, p.184), making them feel like students again and that their past work has been discredited. These perceptions encourage both backlash and a slower transition (McLennan, 2004, p.3 & p.211).

**2-** Sustainability has many different definitions all over the world in very different societies causing further confusion, it is not helped that the word sustainability means 'to be maintained' which fails to accurately communicate the goals of what sustainability is trying to do (McLennan, 2004, p. 3).

**3-** The sustainability movement is young compared to other movements and is therefore still defining itself (McLennan, 2004, p.3).

This incomplete knowledge spreads incomplete information, causing confusion, contradiction and a fear around sustainability's integration into society including the workplace as it brings new principles, philosophies and methods (McLennan, 2004). Sustainability is a complex set of ideas and forcing it all into one definition simplifies, causing it to lose context and focus (Chick & Micklethwaite, 2011). The varied definitions of sustainability gravitate towards two core beliefs:

**1-** Life styles, technology and population growth are negatively impacting the environment

**2-** As the dominant species humans have the responsibility to guard Earth's eco-systems (McLennan, 2004, p. 36).

Instead of focusing on an agreed overarching definition there is an opinion that sustainability and sustainable development should instead be seen as an intent to improve and do better (Sherin, 2013) as even an imperfect definition provides direction do better (Ryan & Lowry, 2011, p. 121). Sustainability can then be used as a moral compass when developing solutions. However the implication of using it as a moral compass is that it develops products that are morally right for the environment but not necessarily optimum for society or the user (Basgiago, 1995).

### **Sustainable values within the product development team**

Companies have the opportunity to develop sustainable products and a sustainable future by taking on sustainable mindsets, strategies and methods. However, companies also face the biggest challenges and barriers (Walker, 2006, p. 183). These challenges and barriers are predominantly created by the individuals within the workplace (McLennan, 2004, p. 211).

Individuals typically think in a particular way when developing a solution to a problem, this mindset is seen as the biggest barrier to the development of successful and sustainable products. Individuals typically:

**- Break down the problem into smaller ones**

Sustainability is complex, the issues forced upon product developers are often deemed



too big to handle and are therefore broken down into smaller and easier manageable problems (Walker, 2006, p.12). This method however, causes context to be lost and collaboration to be avoided producing ignorant and flawed solutions (McLennan, 2004, p.213). Examples of this is how a product might be made of recyclable materials, but it has been manufactured in such a way that they are unable to be separated and therefore become waste

**- *Desire for quick fixes***

Societies cultural impatience (Walker, 2006, p. 14) favours small and sooner rewards than bigger and later ones (Shenhav, Rand & Greene, p.1 2017)

**- *Preference to reduce rather than remove the problem***

Society is focused on using strategies and methods that reduce problems but do not necessarily fix or remove the problem (Walker, 2006, p. 12).

**- *Shifting the burden***

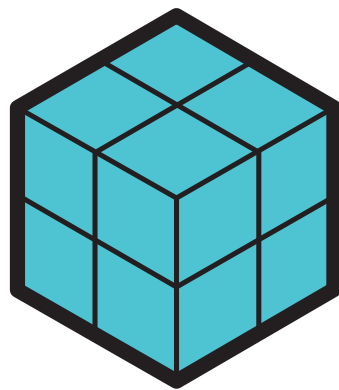
People often expect somebody else like the government, scientists or innovators to fix the bigger problems (Walker, 2006, p. 33) causing individuals to not bother reducing or changing their impact (Chick & Micklethwaite. 2011).

## **Spectrum of different Sustainable Development Strategies**

### ***Eco-efficiency***

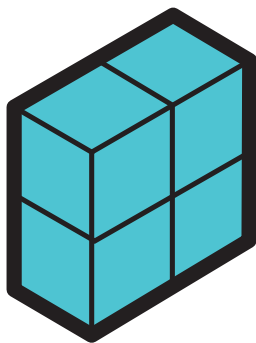
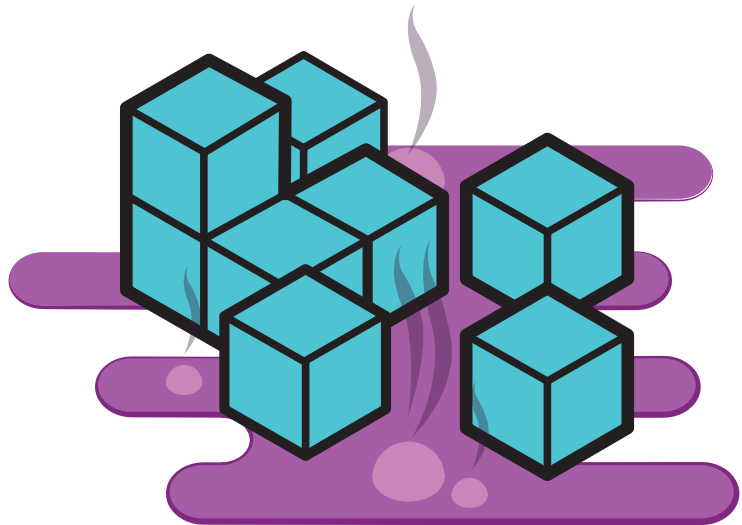
Eco-efficiency is the most commonly used Sustainable strategy. Misinterpreting the goals of sustainable development combined with a mindset which aims to break down, minimise and solve them with a quick fix has encouraged the wide use of eco-efficiency as the key strategy for developing sustainable products (Datschefski, 2001, p. 56). Eco-efficiency is a reactionary approach to manage damage and the guilt created by the environmental damage current consumption of materials and products have caused (Braungart, McDonough, & Bollinger, 2006). The core concept of eco-efficiency focuses on getting more from less (Braungart, McDonough, & Bollinger, 2006).

Core methods of eco-efficiency focus on minimising volume of materials in a product to decrease the overall environmental impact (Datschefski, 2001, p. 56) (see figure 1.1). Eco-efficiency offers both an environmental benefit and a company benefit due to the cost savings in materials as it encourages resource productivity, reduced use of toxic materials, increased recyclability and an extended product life cycle (Braungart, McDonough, & Bollinger, 2006). Eco-efficiencies ultimate goal is to create zero-waste (Braungart, McDonough, & Bollinger, 2006, p.1338).



Normal product

=



Eco-efficiency product

=

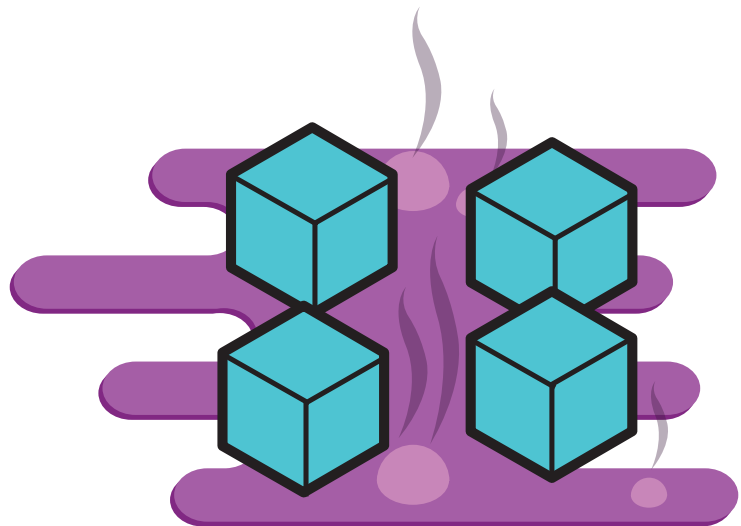


Figure 1.1 - Eco-efficiency

### *Limitations of eco-efficiency*

The limitation of eco-efficiency is that no matter how much you decrease material usage, material is still being thrown out (see figure 1.2). Reducing unsustainability does not equal sustainability (Walker, 2006, p. 20). This creates a paradox as the ultimate goal of eco-efficiency is zero waste, yet this goal is unattainable through this strategy (Braungart, McDonough, & Bollinger, 2006 p. 1339).

Many environmental laws use eco-efficiency by focusing on limiting the damage caused by waste created by production (McKinsey, 2011). However, these approaches fail to address long term underlying issues that created the problems in the first place. For example, carbon taxing and trading does not stop the buildup of greenhouse gases and atmospheric carbon, it only slows it down (Walker, 2006, p. 19). These policies end up legalising small volumes of pollution and legitimises the view that pollution is

acceptable (Datschefski, 2001, p. 23).

Furthermore, eco-efficiency does not change the current linear model of most of materials inevitably ending up at the landfill after singular or multiple uses (Braungart, McDonough, Bollinger, 2006, p. 1337 – 1338 & Sherin, 2013). For example, eco-efficiency may encourage recycling, yet it ignores the importance of contemplating key implications including how the product could be recycled. For instance, products are normally made of multiple colours and types of plastic, during the recycling process different colours of plastics (Ryan & Lowry, 2011, p. 109) and different types of plastics are mixed together resulting in a hybrid materials of lesser quality (Braungart, McDonough, & Bollinger, 2006, p.1337 – 1338). Another example are products that use precious materials which are manufactured in a certain way resulting in precious resources being turned into waste (Datschefski, 2001, p.32, see also Braungart, McDonough, & Bollinger, 2006). Most of these precious materials are rare elements that cannot be replaced (Apple, 2017).

There are many movements that fit under the umbrella of eco-efficiency; such as Natural Capital, The Natural Step, and Triple Bottom Line (Walker, 2006). The Triple Bottom Line is a common business model when it comes to the environment as it attempts to balance the environment, social and economic needs (Sherin, 2013). However, this balance is improbable as the economic needs always come first and the environment to come last (Braungart, McDonough, & Bollinger, 2006, p. 1341).

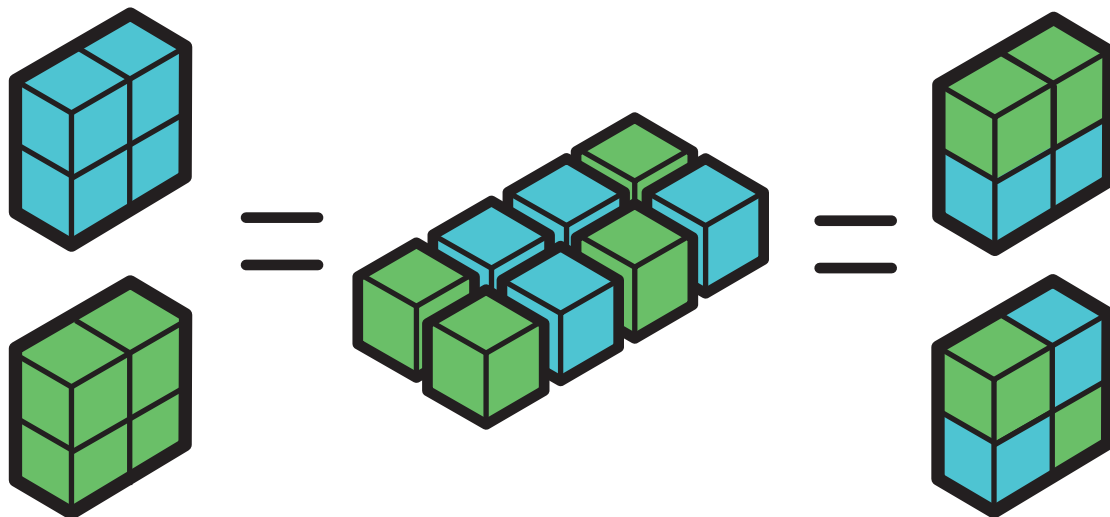
### ***How eco-efficiency impacts customer experience***

Eco-efficiency often develops sustainable products that are unappealing to customers because the focus is on minimising environmental impact rather than how the subsequent design changes negatively impact the customer's overall experience and the relationship between them and sustainability (McLennan, 2004, p.227 -229). A focus on minimisation creates a barrier to develop innovation (Braungart, McDonough, & Bollinger, 2006). Ultimately, eco-efficiency creates products that customers perceive as being synonymous with compromise because they are both emotionally and functionally disappointing.

Sustainable products are showcased as being perfect compared to conventional products, yet are clearly not as they are only morally better which misleads and disappoints customers. Transparency, honesty and simple communication of these flaws are needed to soften this disappointment and removing the idea that these sustainable products are tricking the customer (Sherin, 2013, see also Ryan & Lowry, 2011, p. 104). It is also unfair for Sustainable companies to assume and expect customers to compromise their experience for the incentive of being a good person (Christopher, 1992, p. 40, McLennan, 2004, p. 183).

### ***Eco-effectiveness***

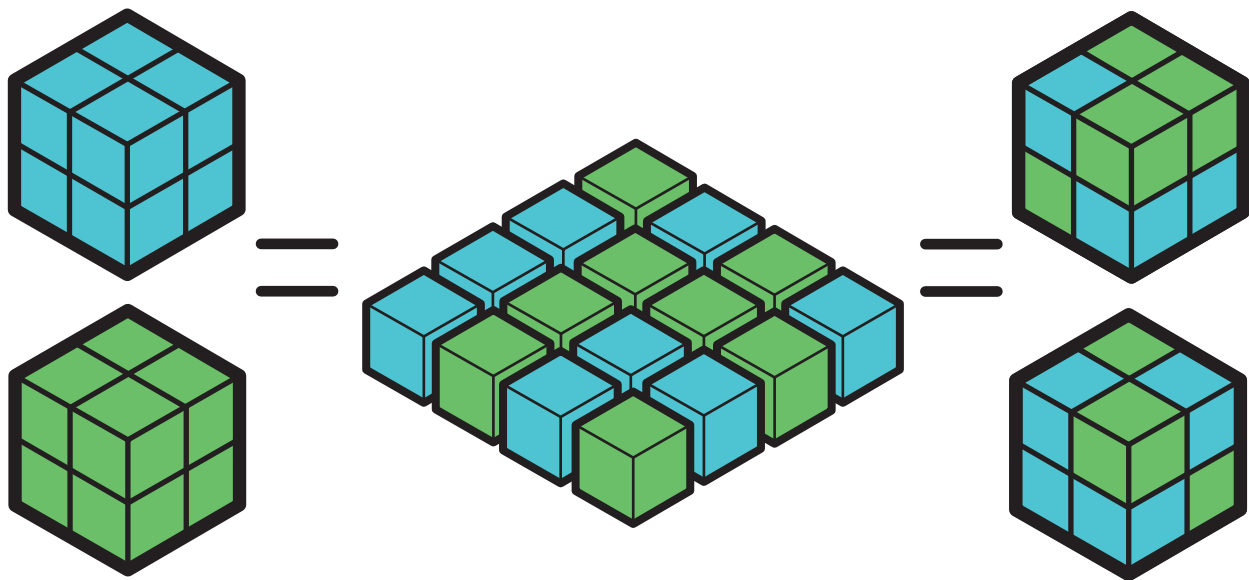
Eco-effectiveness is radically different from eco-efficiency, eco-efficiency aims at minimising wastes while eco-effectiveness looks at stopping material waste through cyclical systems, that reuse materials (see figure 1.2) and in turn stops the need to create more materials from already dwindling and over-consumed resources (Braungart and McDonough, 2003) by focusing on a cyclical material system which reuses and creates materials and systems that can maintain or increase material quality, allowing them to be used indefinitely (Braungart, McDonough, Bollinger, 2006). These two very different approaches acknowledges Russel Ackoff's work in The art of problem solving who states that there are four ways to solve a problem (Ackoff, 1978). Eco-efficiency focuses on resolving; which looks at restoring the situation to a point before the problem appeared and ignoring what initiated the problem. Eco-effectiveness dissolves the problem; by targeting the initiator of the problem (waste creation) to create a long-term solution. Eco-effectiveness demands innovation rather than minimisation and grants the freedom to use toxic materials so long as they stay within a closed loop.



**Figure 1.2 - Eco-effectiveness**

Eco-effectiveness also focuses on the relationship between the economy and the environment (Braungart, McDonough, Bollinger, 2006, p. 1338) because much like nature, the waste becomes food for something else.

Eco-effectiveness also provides the flexibility to use more material than eco-efficiency because all of the material used is reused and not thrown out. This removes the usual limitations sustainable development teams deal with (see figure 1.3).



**Figure 1.3 - Eco-efficiency allows for flexible material use**

### *Limitations of eco-effectiveness*

Eco-effectiveness is criticised for its oversimplification of the complex interactions between humans, societies and their environments (Reay, McCool, & Withell, 2013, p. 41), as it is nearly impossible to understand how different eco-systems will react to external stimulus (Klanderud & Totland, 2005). For instance, caution must be used when dealing with biological nutrients and assuming they are the solution to unsustainable problems (Reay, McCool, & Withell, 2013, p. 42). Believing all biological waste is good and healthy is a mistake, as not all biological compounds are degradable and safe for humans, organisms or eco-systems especially when dumped in large mass (Reijnders 2008). Therefore, a holistic understanding of the consequences and implications of products and their materials need to be well thought out to deal with the complex systems and demands of the environment the product is entering (Reay, McCool, & Withell, 2013, p. 42 & Bradbury, 2002). This shows the importance of having the eco-system that the product will be in be central to the development and decision-making process of the product (Van Roon, & Knight, 2004) and once again highlights the importance of collaboration between disciplines when it comes to sustainable development (Bruce et al. 2004).

For example, Nike's innovative shoe, the ZVEZDOCHKA (see figure 1.0) simplified the manufacturing process, by using interlocking pieces or plastic, allowing the shoe to be free of adhesives and a range of unrecyclable materials used in traditional shoes (Nike, 2014). This innovation emerged by cross-pollinating technologies, processes and materials from different industries and disciplines (Nike, 2014).





Figure 1.4 - ZVEZDOCHKA by Nike (Nike, 2014)

## Addressing weaknesses in sustainable product development strategies

This section acknowledges the problems found with development of sustainable solutions and provides possible solutions to those problems.

Five key issues were identified while exploring different sustainable development strategies which appear to lead to the current flaws found in sustainable products;

These were:

- Lack of a sustainable vision and definition.
- Poor self-belief regarding sustainable values.
- Poor use of behaviour and strategies for sustainable development.
- Lack of actual sustainability (underlying issues).
- Lack of customer desirability.

The strategies and methods below address these issues aiming to encourage positive sustainable mindsets for product developers, a holistic understanding of the problems the product must deal with and an empathetic understanding to ensure it meets customer's desires.

### **Lack of a sustainable vision and definition.**

Sustainability may be complex, but it does require a clear direction and vision which could positively influence mindsets and strategies used within product development teams (Bonini & Kaas, 2010, see also Rand & Greene, 2017, p1).

Ehrenfeld & Hoffman, authors of Flourishing propose the actionable vision of what sustainable development should try to achieve is:  
 “The possibility that humans and other life will flourish on the Earth forever” (2003, p. 17).

The word Possibility creates a vision of what could be, even if it has never existed. While Flourish emphasizes the living conditions that should be expected, which is not just to live or get by, but to thrive (Ehrenfeld, Hoffman, 2013). This vision introduces the idea that a product needs to provide a sense of being, place and meaning and most importantly provide a sense of fantasy, of what could be (p.18).  
 The key word forever demonstrates the need for a mindset that looks at long-term solutions, not just short term and most importantly addresses the need to change workplace mindsets. By using an actionable defined vision ensures that action is taken as it is not passive and defines what a company must do, unlike the current undefined definition for sustainability.

**Poor self-belief with regards to sustainable values.**

Kanter’s theory of empowerment states that individuals feel empowered to do a task when their needs are supported by the information and equipment required to complete the task (Kanter, 1977). Mitchell’s thesis builds on Kanter’s theory by stating that employee empowerment is at its best when an employee’s willingness and want levels mirror the empowerment levels that are given to them (Mitchell, 2016). Mitchell laid out four key pillars that increase empowerment (see table 1.0).

Term	Meaning	Synonyms
Pillar one: <b>Autonomy</b>	Freedom to decide how to do one’s work. Involves control over one’s environment, tasks and how work gets done.	Freedom, control, leeway, choice.
Pillar two: <b>Influence</b>	Providing a voice or input to the organisation. Having impact in one’s job, department, community, or customers.	Ideas, impact, influence, input, voice, contribution.
Pillar three: <b>Decision making power</b>	Having power or authority to make decisions or solve problems without going through management.	Decision, solution, authority.
Pillar four: <b>Ownership</b>	Having responsibility or accountability for a project.	Accountability, own, mine.

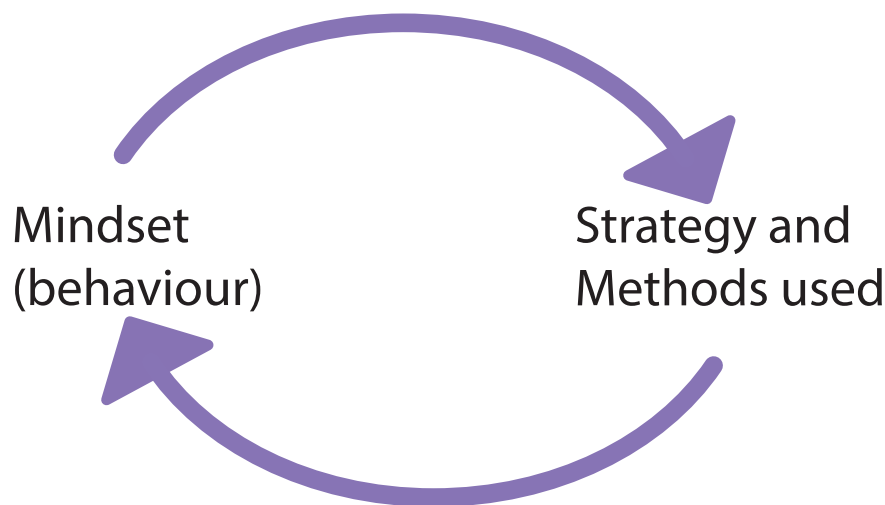
**Table 1.0 - Kanter’s theory of empowerment**

By providing tools to encourage these four pillars, development teams can feel empowered creating better integration and relationship between them and sustainability (Genc & Di Benedetto, 2015). Additionally, by adding tools that make the job fun and allowing personal development, this relationship can also be positively encouraged (Ryan & Lowry, 2011, p. 106).



### **Poor use of behaviour and strategies for sustainable development**

The mindset of dealing with problems by minimising them rather than dealing with them directly appears to be an automated habit and encourages the use of eco-efficiency and vice-versa (see figure 1.5).



**Figure 1.5 - Influence cycle model**

Habits allow the brain to take shortcuts when thinking by encoding complex actions and behaviours (Dickinson & Balleine, 2002). However, this allows negative habits to be in control of a product development team (Eyal, 2014, p.12). With no conscious thought being done during an action, there is no way for individual to reflect on the implications of the actions they have made (Walker, 2006, p.84).

Giddens's theory of structuration states that the internal and external structures (triggers) of a team or individual encourages specific behaviours, if repeated over and over they can become automated habits (Giddens, 1984). Giddens's theory provides two solutions to discourage the use of minimisation mindsets and the eco-efficiency strategy. The solutions require either reflecting on the action made or by changing the underlying structure that the habit was made for. However, with reflection of an automated action appearing to be too difficult to guarantee (Walker, 2006, & Boehm-Davis & Remington, 2009) the proposed solution is to change the underlying structure and in turn encourage new and preferred behaviours.

Dr Fogg, Director of the Persuasive Technology Lab at Stanford University, has

highlighted three factors that drive an individual's ability to react to internal and external triggers and perform an action:

- 1- The user has an appropriate amount of motivation.
- 2- The user can complete the action.
- 3- A trigger must be in range to call the user to action (Fogg, 2013).

Motivation can be increased by making it easier to do the action or behaviour required (Eyal, 2014), all it takes is eliminating the steps between performing the action and getting the job done until the simplest process is found (Hauptly, 2007). Fogg lists the steps that can be removed to decrease or increase the difficulty of a behaviour and an action:

- Time – How long it takes to complete an action.
- Money – The fiscal cost of taking an action.
- Physical Effort – The amount of labour involved in taking the action.
- Brain cycles – The level of mental effort and focus required to take an action.
- Social Deviance – How accepted the behaviour is to others
- Non-routine – According to Fogg, “how much the action matches or disrupts existing routines” (Fogg, 2013).

Increasing the effort and steps can discourage development teams from completing a minimisation behaviour or strategy, such as eco-efficiency. By supplying tools (Cagan & Vogel, 2002) and methods that support better strategies and mindsets it also makes it harder for development teams to continue using a minimisation driven mindset.

Product development teams should also be given variable rewards when key mindsets and strategies are followed correctly motivating them to repeat the desired behaviour and actions (Eyal, 2014).

### **Lack of actual sustainability (underlying issues).**

The Eco-effectiveness strategies are best employed though within a larger picture that considers carefully the whole process. Importantly, true sustainability requires a lot of different knowledge. Collaboration with different disciplines is required (McLennan, 2004, p. 210) to develop an in-depth holistic understanding of the environmental implications created by current and possible product solutions (Reay, McCool, Withell, 2013, p. 42); allowing for effective decision making (Guzzo and Dickson 1996 & Williams and O'Reilly 1998). The need for collaboration highlights a bigger challenge; to engage different disciplines. Studies showed that though collaboration was important for

creating a holistic product, collaboration between external disciplines can negatively influence the development of innovations (Riordan and Shore 1997 & Baugh and Graen 1997, see also Knippenberg & Schippers, 2007). It was revealed individuals preferred to interact with those they could familiarise and connect with (Kramer 1991 & Jehn et al. 1999, see also Byrne 1971). Without this familiarisation and connection, studies showed individuals kept key information to themselves (George, Chattopadhyay, 2009, p.365) as they preferred social validation from the rest of the group rather than destabilising the group with the information they had (Hinsz et al, 1997).

By cross-training individuals in different disciplines, not only do they develop a better holistic understanding but also creates empathy and respect for other disciplines encouraging healthy collaboration (Susman & Dean, 1992). Companies such as Apple have created a mindset and culture within its employees of the importance of collaboration and a sustainability philosophy. This removed barriers such as internal and external resistance, enabling Apple to work faster and more effectively (Bonini & Kaas, 2010)

### **Lack of customer desirability**

#### ***Designs role in making sustainability desirable to a wider audience.***

When addressing desirability, the strategies of sustainable design are best employed. Design is the signal of human intention to do better (McDonough, 2001). In fact, design that does take into account the environment is out of touch with reality (MIO – creative director Jaime), concluding that the environmental crisis is really a design crisis (McLennan, 2004, p.5 see also Borsboom, 1991).

Design also provides the opportunity to redesign, replace or change ineffective systems, strategies, methods and products that create unsustainability or discourages sustainability (McLennan, 2004, p. Xxiv). There are many design practices that incorporate sustainability including green design, eco-design and sustainable design, eco-effective, holistic and environmentally friendly design, which all encompass a similar meaning (McLennan, 2004, p. 4). However, much like eco-efficiency and eco-effectiveness they often only consider the environmental impact of a product and not the impact for the customer.

#### ***Empathising and appealing to the customer***

Intense consideration needs to be taken regarding how design decisions that deal with environmental implications of a product will impact the customer's overall experience and their needs regarding the support they are given (Sherin, 2013). By providing customers with solutions that provide support rather than compromise (McLennan, 2004, p. 183) motivation to buy sustainable products can be increased (Ryan & Lowry,



2011) strengthening the relationship between customer and sustainable products (Mclennan, 2004, p. 183). Similar to motivating a product development team, the easiest way to increase a customer's motivation to use a product is to provide support by cutting the steps needed (Hauptly, 2007). Eliminating steps could be simple and clear labelling on packaging (O'Connor, 2015), or developing sustainable products with aesthetics that not only appeal to eco-minded customers but the wider market as well (Mclennan, 2004, p.226). Aesthetics can also trigger emotions causing preconceived perceptions around sustainable products to change (Ryan & Lowry, 2011, p. 212 & p.183).

### ***The relationship between Sustainability and design***

Sustainable design expands the wider set of issues that designers must consider (Mclennan, 2004 & Signer, 2011). Understanding that products must benefit people and that customers should not be made to compromise to use sustainable products (Mclennan, 2004, p. 47).

Sustainable design is a philosophy that focuses on maximising the quality of the solution while minimizing or eliminating any negative impact to the natural environment (Mclennan, 2004, P.5 – p.6). This is the key difference between sustainable design and all other sustainable design practises and processes. Sustainable design also puts a sense of responsibility and purpose into design as it provides not only for the present but for “future generations” (Mclennan, 2004, p. 7). Of the strategies addressed sustainable design puts the focus on the customer and creating good designs, while appearing to be a strong base for future strategies.

### **Giddens's theory of structuration – A possible overall solution**

Giddens's theory provides the opportunity to link all the strategies mentioned above together so that they reinforce and encourage the use of each other. Eco-effectiveness and sustainable design demand the use of empathy to address customer needs and collaboration to deal with environmental implications. These methods demand the need for a mindset that sees collaboration and empathy as important which further reinforces the use of eco-effectiveness and sustainable design. Adding the actionable vision provides direction and an objective further encouraging the use of collaboration, empowerment, environmental and customer needs (see figure 1.6).

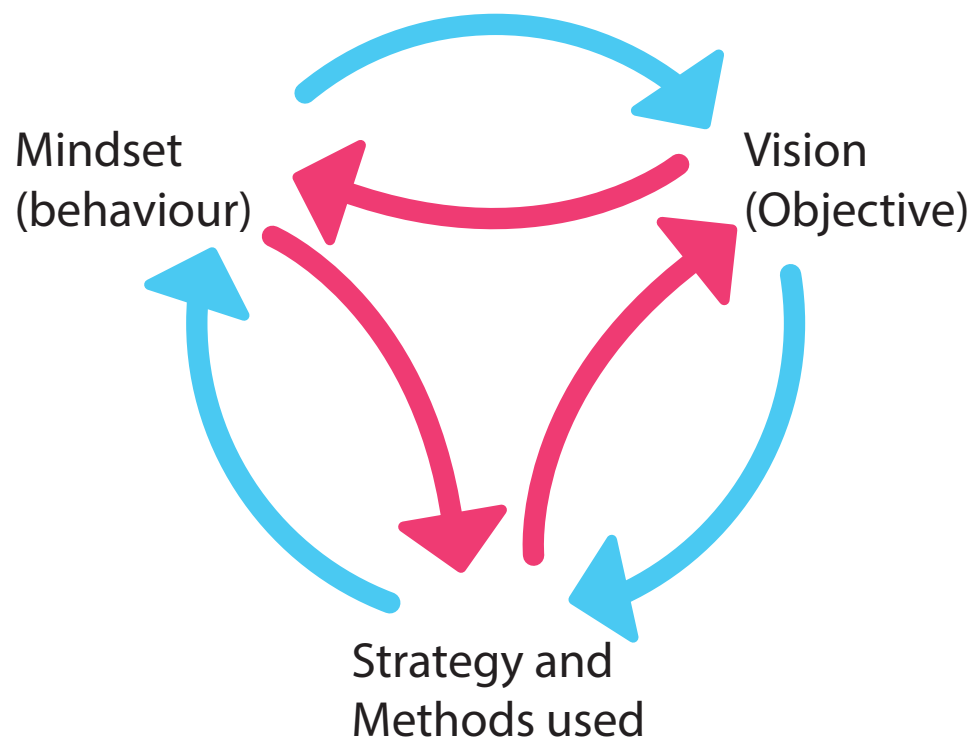


Figure 1.6 - Proposed Influence cycle model



# Core traits of successful products

Though it is agreed that there is no magic bullet for success, there does appear to be core traits to improve the likelihood of it (Adams, 2010, p. 2 & Maurya, 2010, p. xxvi). This section assumes that success in addition to disruption can be manufactured which is also proposed by Paul Paetz in his book *Disruption by Design* (2014). This section presents the identified key traits within products that make them more desirable to customers and successful, each trait identified is supported with a case study and has been analysed to understand how to create the trait. Strategies and methods are then recommended that should create the data needed to develop these key traits.

## Core traits

According to Marty Neumeier in his book *The Brand Flip*, for a product to be successful it needs to provide five traits to the customer.

A product must:

- Makes the customer feel in control
- Reduce the customer's fear of making mistakes
- Simplifies the decision process for the customer
- Offers the customer clear and immediate emotional benefits
- Frees the customer of obstacles (Neumeier, 2016, p.80).

Neumeier's conclusion resonates with the research collected by this literature review which found the overall experience of the product for the customer dictates its success (Better by design<sup>3</sup>, n.d). A product must support and empower the customer allowing them to tell their own story and live their own life the way they wish they could (Neumeier, 2016 & Goffin, Lemke, see also Koners, 2010). The product cannot be developed in isolation but as a part of the overall experience with every touchpoint between brands and customer reflecting this better life (Better by design<sup>4</sup>, n.d). Ideally, it is about providing a solution that has vision (Ryan & Lowry, 2011, p. 138).

## The four attributes to a successful story

- 1- Supports and empowers a customer by providing a better life
- 2- Supports and empowers a customer's identity
- 3- Supports and empowers the customer to complete the task the solution is needed for
- 4- Provides a unique meaningful difference that adds value to the customer and their experience



### ***1- Provides a better way of life***

A product needs to provide the right emotional and social experiences desired by the customer (Christensen, Anthony, Berstell, & Nitterhouse, 2007 & Cagel & Vogel, 2002) and therefore what the customer is wanting and expecting from the product (Ryan & Lowry, 2011, p. 101). A product can surpass these expectations by indulging their fantasies of what their life could be like by supporting and empowering them emotionally and physically (Goffin, Lemke, & Koners, 2010 & Cagel & Vogel, 2002).

#### ***Case Study:***

Apple is a great example of showing the customer how good their life could be (Bajarin, 2012). Though Apple isn't always first at providing useful or usable innovations, Apple succeeds at this by ensuring it understands what their customer loves (Prigg, 2012) and what experiences they could and currently have (Marketing minds, 2016). This understanding of the customer allowed Apple to offer the best customer experience (Elmer-DeWitt, 2013 & Lee, n.d.) when compared to its competitors (Molloy & Griffin, 2015 see also Scheidies, 2011) as it knew how to support customers and ease their anxieties (Kahney, 2002). This builds a long-term relationship on the trust that Apple will provide the customer with a better life.

### ***2- Provides a sense of identity***

Products must provide customers with a clear sense of who they are, their lifestyle (Cagel & Vogel, 2002), and the values they live by (Goffin, Lemke, & Koners, 2010, p.5). There must be a balance between reflecting a customer's individuality and personality, ability to fit among yet show its difference when compared to its competition, while also being easily identifiable to other products within that brand (Goffin, Lemke, & Koners, 2010, p.64).

#### ***Case Study:***

Lewis Road Creamery provided a lifestyle of luxury and self-worth, it reinforced this image by connecting to customers on an emotional level in two ways: provided a sense of quality, identity and emotion in the chocolate milk category by connecting to customers through Facebook (Car, 2007).

- Facebook users would boast about drinking Lewis Road Creamery chocolate milk causing their friends to want to try it out to feel socially accepted (Car, 2007). This created a chain reaction of posts to the point that over half the posts on Facebook in New Zealand were Lewis road Creamery related (New Zealand Herald, 2015).
- Every post on the Lewis Road Creamery Facebook page (Mandow, 2015) would receive a personalised reply making customers feel valued and appreciated as an individual (New Zealand Herald, 2015). Connecting on such an individual level built



long-term loyalty by providing a sense of identity to the customer (Cagel & Vogel, 2002).

### ***3- Provides control to the customer***

Successful products remove obstacles such as anxieties between a customer and what they want, providing the needed support and empowerment to increase a customer's control and freedom over their life (Neumeier, 2016).

This can be done by:

- Humanising products to ensure the experiences are easy and enjoyable for the customer (Hui, 2017).
- Ensuring new products are easy to transition to and use (Ryan & Lowry, 2011, p. 98). For example, a product provides forgiveness tools such as an undo button for when a customer makes a mistake (Eyal, 2014).
- Providing clear simple information so customers know what product best suits them. Clear information can reduce anxiety and regret about their decision later (Schwartz, 2005, see also Kahney, 2002).

#### ***Case study:***

A set of Whittaker's ads (Whittakers, 2010) responding to Cadbury's palm oil fiasco, decrease of quality and product size were simple and honest while reinforcing Whittaker's transparency, honesty and their goal of putting the customer first rather than profits unlike Cadbury. Whitakers understood that their personal problem of balancing the price of sourcing ingredients was not the same problem the customer had. Instead, unlike Cadbury Whitakers continued providing customers with what they wanted, control over the quality of their chocolate.

### ***4- It provides a unique and meaningful difference***

75% of the typically 15,000 products stocked in supermarkets are ignored (Schwartz, 2005). By providing a product that is not only desirable but has noticeably different meaningful value compared to its competitors (Ryan & Lowry, 2011, see also Neumeier, 2016, p.85) a product has a better chance of standing out and being successful. Instead of another 'me too' product (Goffin, Lemke, & Koners, 2010, p. 228) a successful product needs to have 'onlyness' (Neumeier, 2016, p.58). Being the only in a product category allows a brand to define the criteria of purchase, essentially naming the tune that the following competitors must dance to (Neumeier, 2016, p. 57). The business model can provide a key difference between a new entrant and its competitors (Osterwalder & Pigneur, 2010, p. 244) as it both reflects the story being framed for the customer and the different value proposition being provided to them (D Trubridge,

personal communications, September, 20, 2016, see also Bonini & Kass, 2010). With no difference between competitors, feature (Adams, 2010, p. 74) and price wars are created (Paetz, 2014, p.52) which compete away prices (Neumeier, 2016, p.58). Authors of Creating Breakthrough Products Jonathan Cagan and Craig M. Vogel point out seven areas where unique value can be added to creating 'onlyness' and causing competitors to follow:

- 1- Emotion
- 2- Aesthetics
- 3- Identity
- 4- Ergonomics
- 5- Impact
- 6- Core technology
- 7- Quality (2002, p.62).

#### ***Case study one:***

Apple's iMac G3 broke away from the dull grey computer forms and provided Emotion, aesthetics, identity and impact to the customer, which caused competitors to quickly follow (Cagan & Vogel, 2002, p.248).

#### ***Case study two:***

The Nintendo Wii provided a new way to play games which not only added a new level of playability and enjoyability but allowed a new customer segment who were never thought to be gamers to game. Providing a new core technology created meaningful identity, impact and emotion that competitors had not (Norman & Verganti, 2014, p.86). Competitors followed suit, Sony with the Playstation Move and Microsoft with the Kinect (Tassi, 2015).

#### ***Case study three:***

Lewis Road Creamery's original goal was to own 5% of the New Zealand flavoured milk market. However the added sense of quality, identity and emotion provided to the customers gave Lewis Road Creamery 34% of the flavoured milk market (Car, 2017). Within eight weeks, demand drove production up from 1000 to 31000 litres per week (Dunn, 2015). Puhoi Valley Brand (Fahy, 2015) and Fonterra (Read, 2016) quickly attempted to replicate Lewis Road Creamery success to claim some of the growing market share of premium flavoured milk.



## **Developing the four story areas**

The four areas can be developed with insights from market validation and understanding the customer. However this insight only provides a snapshot in time, and be different tomorrow, and therefore require continuous assessing (Cagel & Vogel, 2002, p.62)

### ***Market Validation***

A difference is defined as something the market isn't supplying. A meaningful difference then is providing something that the market is not offering but the customer is needing consciously or subconsciously (Adams, 2010). The reasons why Apple, Lewis Road Creamery, and the Nintendo Wii succeeded was because they researched, watched and gained knowledge about the customers' needs allowing them to recognise a gap in the market which they could provide the customer with a meaningful difference. To expand a product development teams knowledge, customer needs (Goffin, Lemke, & Koners, 2010) and the market landscape (Kahn, 2012) need to be recognised, understood, respected and addressed (Adams, 2010). Market validation should be used to locate these gaps between what the market is offering and what customers are needing (Cagel & Vogel, 2002). Gaps can be found by finding markets where customers choices are limited (Schwartz, 2005, p.3) because competitors usually treat their market like a commodity by supplying products that aren't much different to each other (Ryan & Lowry, 2011, p. 6). A quick analysis of your competitor to understand what they are missing, are not providing or overlooking can provide key insight (Better by Design3, n.d). Another method for identifying gaps is to understand whether customers are using compensating behaviours as the current product is limited causing customers to find alternate ways to get the result they desire (Christensen, Anthony, Berstell, & Nitterhouse, 2007, p. 44). Those who are limited in their choice are typically searching for a company or product to support and empower them and their identity (Neumeier, 2016, p.42). All of this market validation requires the ability to research and understand your customer however.

### ***Understanding the customer***

A great overall experience comes from a clear point of view (Ryan & Lowry, 2011) which is created by focusing on a customer segment and understanding what their needs as well as what their behaviours are (Frog Design3, 2017 & Osterwalder & Pigneur, 2010), and then developing a unique solution that competitors cannot compete with (Maurya, 2010). There are two extremes of the segmenting spectrum however, too focused and

a brand will become niche, too broad and it becomes too generalised with no unique difference (Maurya, 2010, p. 30).

### ***Methods to segmenting the market***

The knowledge above indicates that a market should be segmented by identity (Neumeier, 2016) emotions (Goffin, Lemke, & Koners, 2010) and lifestyle (Cagel & Vogel, 2002) to provide the correct meaningful difference, support and empowerment.

### ***Demographic segmentation***

On the other hand, companies typically play it safe and target large and generalised markets (Cagel & Vogel, 2002, p.70 & Adams, 2010, p. 49). It is then assumed everyone within this generalised group are all the same (disruption by design. P, 113). However, in reality customers do not behave in large and predictable groups (Cagel & Vogel, 2002, p.42 & disruption by design, p.116). Segmenting by demographic is a poor indicator of customers' behaviours and needs (Christensen, Anthony, Berstell, & Nitterhouse, 2007, p.1) and therefore develops 'me too' products that are unfocused, generic, and do not differ from their competitors (Maurya, 2010, p.145). The issue with demographic segmentation is that

"customers' buying behaviors change far more often than their demographics, psychographics or attitudes . . . Demographic data cannot explain why a man takes a date to a movie on one night but orders pizza to watch a DVD from Netflix Inc. the next" (Christensen, Anthony, Berstell, & Nitterhouse, 2007, p.1).

### ***Task segmentation***

Segmenting by task means a product does not have to worry about the customer but rather the task they find themselves needing to do (right job) and the expected results (disruption by design). Developing a product purely on the task it needs to get done and the expected results it should create acts as a compass, directing customers to the product (Paetz, 2014, p.159).

However, this segmentation method ignores who the customer wants to be and how they want to live their life which reduces the meaningful value a product can provide to them making and can make them feel less satisfied with the overall experience them (Ryan & Lowry, 2011).

### ***Tribe segmentation***

Segmenting by tribe and communities focuses on those who share common interests, attitudes and lifestyles and acknowledges firstly, that customers want meaningful products that support and empower them. Secondly, it acknowledges that the relationship between brand and customer is a partnership, and by supporting the customer, customers support the brand (Neumeier, 2016 & Di Bitonto, 2017).

Tribe segmentation groups the market by personal identity, beliefs, aspirations and values so that the product provided provides a framework which supports and empowers their identity, life and aspirations (Ryan & Lowry, 2011).

For example, Nike frames its customer to be the hero, not from an external foe, but the internal one, because Nike understands one's internal self is the real barrier allowing Nike to emotionally connect to the customer's thoughts and feelings (602 Communications, 2017, see also Cagan & Vogel, 2002, p.59).

Tribe segmentation also recognises that customer's needs are continuously developing and changing requiring companies to continuously update their understanding of the customer through research (Neumeier, 2016). Therefore, continual customer understanding and product development is needed as a brand must continue to supply an engaging dynamic narrative to frame the customer's life (Signer, 2011 & Neumeier, 2016, p.105). Continuous feedback loops between the brand and customer can ensure an updated understanding of who the customer is and what their needs, wants, and desires are (Cagel & Vogel, 2002, p.206 & Maurya, 2010, xxiii).

### **Understanding the tribe**

Understanding customer's needs and desires can be a struggle because they are typically unable to explain what want (Prigg, 2012). Jony Ive, Vice President of Apple industrial Design department, highlighted this issue, mentioning customers are unaware of the opportunities of tomorrow and live within the context of today (Prigg, 2012). Therefore, listening to customers can create the past so product development instead needs to be customer inspired, rather than customer led (Ryan & Lowry, 2011, p.143). In an interview, McNeece a cruise ship designer also pointed this issue out saying that:

"If Henry Ford canvassed people on whether or not he should build a motor car, they'd probably tell him what they really wanted was a faster horse" (Miller, 1999, p.67).

Ash Maurya, author of Running Lean highlights that though customers may have asked for faster horses, they were really asking for something faster than their current solution which happened to be horse (2011, p.xxii). Murya goes onto say that it is not the customer's inability to describe what they want but the inability of traditional research methods used and that with the right context and analysis customers can clearly describe what they want. This is because most approaches reflect common knowledge and keep customers at arm's length (Goffin, Lemke, & Koners, 2010). The



key then is to use approaches that can provide deep insights about customers through what they do or say (Adams, 2010 p.95).

## Interviews to better understand the scope of sustainable development

To supplement the secondary research several expert interviews were conducted. The aim is to build on the existing research presented in the literature review by interviewing those who deal with the theoretical and applied sides of sustainable product development. The insights created by the combining the research will be used to propose a new sustainable product development strategy (SPDS) encouraging key factors needed when developing a desirable and sustainable product.

### **Interview Guide**

The interview process involved speaking to experts in three core areas regarding the development of sustainable products and their end life cycle.

The core areas covered were:

- Theoretical sustainable development
- Applied sustainable development
- End of product life (collecting and recycling)

Interviews were loosely structured with questions supplied only if the conversation was drifting away from the topic or to change the topic. By letting the interviewee talk freely, their annoyances and passions around sustainable products, material systems and life-cycles appeared to come out providing vital information.

### **Participants**

Individuals were chosen on their experience and position and categorised into groups:

#### ***Lecturers who teach the theoretical ideas and physical implications of sustainability:***

This group offered insight into theoretical ideas surrounding sustainability and developing physical sustainable outcomes. Due to their experience, they could speak to sustainability's strengths and weaknesses.

#### ***Matthijs Siljee***

Assistant Head of School of Design at the College of Creative Arts, Massey University, Siljee supervises Master Design students, lectures in design business and practice while also running the industrial design studio. His past projects include spatial, social and



industrial design in corporate, public and private settings. Currently he teaches the importance of the integration of sustainability and design.

***Fabricio Chicca***

As a Senior lecturer at Victoria University of Wellington, Faculty of Architecture and Design, Chicca lectures sustainability, behaviour and psychology in architecture and the built environment. His PHD on sustainability in urban areas follows on from his professional career as urban designer and architect leading multinational teams for international companies.

***Designers who integrate the ideas of sustainability into their products:***

This group gave insight into how theoretical sustainability is applied and affects product development including opportunities, threats, weaknesses and strengths sustainable development can create.

***Peter Haythornthwaite***

Peter Haythornthwaite studied Industrial Design at the University of Auckland and the University of Illinois. After working in the USA, he returned to New Zealand to teach Design at the University of Auckland. After leaving AUT to set up his design consultancy he continued to work with tertiary institutions including the Design Schools at VUW Unitec and the Auckland University of Technology.

When he returned to NZ he set up Peter Haythornthwaite Design. Over his career he has started several businesses including Artifakts (desktop stationery products), Studio Stoves (Wood burning stoves), Ipso Facto (self start projects), and Gesundheit (creating and marketing design events).

Internationally known, Peter is best known for his Splife design, Artifakts stationery and his work with tertiary institutions providing him with an honorary PHD from Victoria University of Wellington.

***David Trubridge***

After spending several weeks in Antarctica, which provided him the troubling insight of how delicate the eco-system we live in can be. David Trubridge's design company focuses on providing not only environmental, cultural and emotional nourishment as well as connection but also developing sustainable products. The company is dedicated to using sustainable materials, specializing in bamboo wood and a flat-packed distribution system.



## ***End of life materials***

### ***Dean Martin***

National Sales & Marketing Manager of Fullcircle a business unit Oji Fibre Solutions. Oji Fibre Solutions sort Wellington's kerbside recycling materials. Dean provided background information regarding the implications surrounding the reuse of certain of materials.

### **Procedure for interviews**

Individuals were interviewed using a semi-structured interview format. Two interviews were done face to face, one over Skype and the other through email. These interviews on average took one and a half hours which allowed ample time to cover all key points and do in-depth follow up questions. Participants were emailed first with the research intention. Participants were also sent the interview questions a week before the interview so they could prepare and give informed consent. Afterwards participants were sent a transcript of the interview, and given the opportunity to edit their responses, which one participant did. All participants gave consent for their names and positions to be used.

### **Analysis of Literature and Interview findings**

The findings from the interviews have been compared to the key findings of the literature review, with additional themes from the interviews being put last.

### ***Method of analysis***

A deductive thematic analysis was done on the interview transcripts and findings from the literature review. This involved synthesising the current data looking for agreements and disagreements between the interview transcripts and the findings of the literature review with the goal of identifying surface level issues and the underlying reasons for those issues. Firstly, the findings from the interviews are presented below with the underlying reasons for them being presented in table 1.1.

### **Interview findings**

#### ***Lack of a Sustainable development definition***

Trubridge calls out the lack of a fixed definition for sustainability as it has made the values of sustainable development very hard to communicate, easy to fault and allows for poor strategies and mindsets as the poor definition for sustainability is easy to abuse.

The implications of a lack of definition was highlighted as a key barrier to the integration of sustainability into the workplace (McLennan, 2004) and a better-defined

direction would provide a clear direction and vision for the workplace encouraging positive strategies and mindsets (Bonini & Kaas, 2010, see also Rand & Greene, 2017) rather than ones that abused the values of sustainability (Datschefschi, 2001, p. 56).

### ***Influencing a positive mindset***

Haythornthwaite expanded on Trubridge's point above that a lack of definition allows for poor strategies by talking about the importance of structure within a product development team and how it ensures productivity and the development of successful products. Poor structure influencing poor strategies and behaviour was highlighted as a critical barrier to successful and sustainable products in the literature review (Braungart, McDonough, Bollinger, 2006).

Haythornthwaite also talked about the importance of thinking with an open mind, empowering individuals creativity in turn increasing innovation. The importance of self-empowerment is mirrored by Mitchell, Genc & Di Benedetto (Mitchell, 2016, see also Genc & Di Benedetto, 2015). A key technique to allow for this type of creativity and innovation in the product development team is to ask the question "How else could people do the job you are designing for?" as it helps individuals understand that the current product used is only current and may not be the same in the future says Haythornthwaite (P. Haythornthwaite, personal communications, February 18 2017).

### ***Sustainable strategies still create waste***

Chicca and Trubridge both pointed out that using minimisation to solve environmental problems is limiting.

Chicca states that strategies like eco-efficiency will never create sustainability as minimising an issue will never make it go away. Eco-efficiencies inability to create sustainability is shared by Cradle to Cradle authors (Braungart, McDonough, 2002).

### ***Sustainable strategies can limits innovation***

Trubridge adds that a focus on minimising problems rather than solving them severely limits the opportunity for developing innovative sustainable solutions in addition to reducing the meaningful difference, value proposition and experiences for the customer.

Trubridge points to his Floral, Coral and Kina lighting systems which re-imagined how lights could look by innovating on how lights could be made and in turn created an entirely new look which was sustainable, aesthetically pleasing and price competitive (see figure 1.3) (D. Trubridge, personal communications, September, 20, 2016).

The literature review also highlighted that a key issue with eco-efficiency was its ability to handicap the development of innovation (Braungart, McDonough, & Bollinger, 2006).

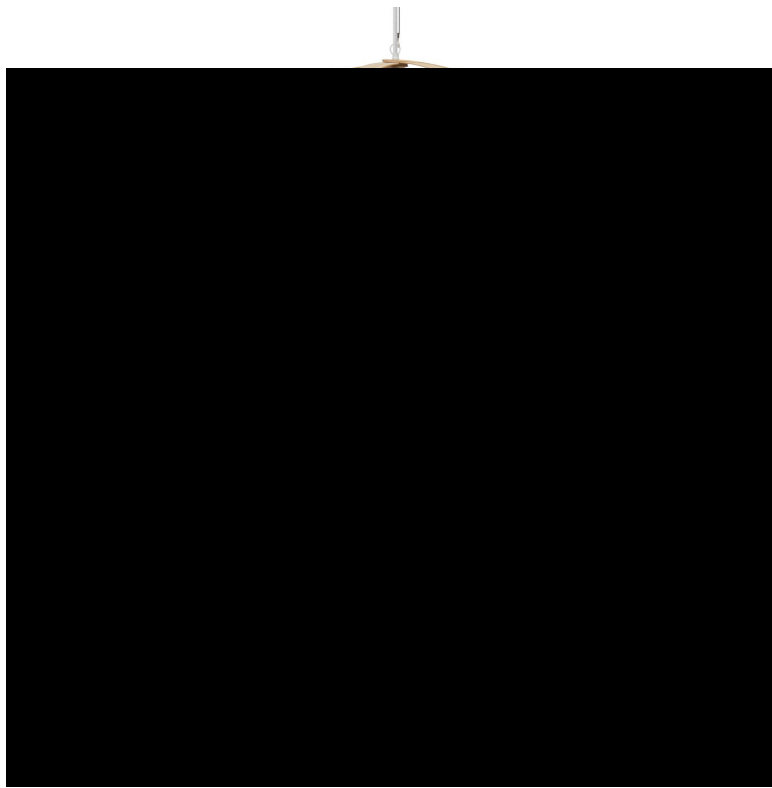


Figure 1.7 - Coral (DavidTrubridge, 2017).

***Sustainability does not consider the recollection and reuse of a product and its materials***

Siljee brought up his concerns with eco-efficiency and its inability to encourage product developers to consider how certain materials and manufacturing processes limit a products ability to be recycled and the material reused. He also points out that unlike eco-effectiveness, eco-efficiency encourages the perspective that plastics are bad. However, plastic is reusable unlike most natural materials and can resist degradation in environments most natural materials are unable to. (M. Siljee, personal communications, September, 29, 2016).

Martin expands on the implications of recycling by highlighting that processing materials for recycling is a costly business, the value of material can fluctuate significantly in international markets. If materials collected lack the demand from buyers or cost more to process than they are worth, they could be sent to the landfill (D Martin, personal communications).

Siljee's and Martin's statements reinforce the findings from the literature review which criticise eco-efficiency inability to both resolve the linear material flow and encourage design thinking that allows for materials to be recycled and reused (Braungart, McDonough, & Bollinger, 2006, & Sherin, 2013 see also Ryan & Lowry, 2011).

***Moral implications***

Trubridge discusses the moral implications of using different materials and manufacturing processes. For example bamboo is seen as 'the' sustainable material however, the manufacturing processes used are both limiting and very unsustainable

due to the chemicals used. In the end bamboo currently provides the lesser evil due to the environmental impact it has when thrown out compared to plastic (D. Trubridge, personal communications, September, 20, 2016).

The wider implications of materials and manufacturing processes is also highlighted in the literature review highlighting the need for a holistic understanding of these implications (Reay, McCool, Withell, 2013, p. 42) and the need for transparency communication about these implications to the customer (Sherin, 2013, see also Ryan & Lowry, 2011).

### ***Poor customer understanding and focus***

Trubridge and Chicca both outlines the importance the customer focus and that all design decision in response to the environment needs must assessed for the impacts they could create for the overall customer experience when using the product. Considering how each design decision impacts both the environmental and customer needs without compromising the other was also highlighted as a key factor when developing sustainable and successful products in the literature review (Sherin, 2013).

### ***Transparency***

Trubridge reiterated the importance of being honest about a sustainable product's limitations rather than the typical approaches which mislead customers into thinking sustainable products are perfect. Ultimately misleading customers can lead to disappointment breaking down the relationship between sustainability and customer. The literature review signalled this issue by proposing sustainable products need to be honest and transparent when being sold to the customer to avoid the creation of a negative image (Sherin, 2013, see also Ryan & Lowry, 2011).

### ***Lack of value proposition***

Haythornthwaite reiterates the importance of developing a difference in value proposition that matters to the customer, a difference that can't be compared to (P. Haythornthwaite, personal communications, February 18 2017).

This insight mirrors the literature review findings which highlight the importance of providing a radically different meaningful value compared to its competitors (Ryan & Lowry, 2011, see also Neumeier, 2016, p.85).

### ***Overall experience***

Haythornthwaite discusses the importance of creating a meaningful difference for the customer by developing a dynamic narrative that frames the customer's lifestyle and identity through every touchpoint between them and the product. This understanding is shared by Ryan & Lowry founders of Method (Ryan & Lowry, 2011).

## Cost

Chicca and Trubridge reinforce Sherin's belief that the cost of sustainable products are the biggest barrier to their desirability for customers (Sherin, 2013) but expand on it by proposing that innovation is the key factor when driving down cost of sustainable products.

## Sustainable paradox

Chicca brings up an interesting paradox that customers feel justified in making less sustainable choices if they make a few sustainable purchases during their day as they cancel each other's environmental impacts out. He goes on to say that customers need to be educated on the real implications of these decisions (F. Chicca, personal communications, October, 14, 2016).



## Consolidation of problems

Issues with sustainable products	Root Problems
<ul style="list-style-type: none"><li>- Products developers see sustainability values as invasive</li></ul>	<ul style="list-style-type: none"><li>- Poor self-belief regarding sustainable values</li><li>- Poor creative confidence</li><li>- Lack of definition and vision</li></ul>
<ul style="list-style-type: none"><li>- Workplace mindset focused on break down the problem into smaller ones</li></ul>	<ul style="list-style-type: none"><li>- Poor use of behaviour and strategies for sustainable development</li></ul>
<ul style="list-style-type: none"><li>- Poor lack of focus on customer</li><li>- Lack of value proposition</li><li>- Poor overall experience</li><li>- Cost</li></ul> <p>Sustainability paradox</p>	<ul style="list-style-type: none"><li>- Lack of customer understanding</li><li>- Poor customer education regarding sustainability</li><li>- Poor communication with the customer</li></ul>
<ul style="list-style-type: none"><li>- Flawed sustainable solutions</li></ul>	<ul style="list-style-type: none"><li>- Lack of holistic understanding of environmental implications</li><li>- Poor behaviour and strategies used for sustainable development</li></ul>

**Table 1.1 - Current issues with sustainable product development**

## Sustainable Product Development Strategy (SPDS)

Based on the findings from the thematic analysis this thesis proposes a Sustainable Product Development Strategy (SPDS) which combines the identified strategies into an overarching strategy. The SPDS takes developers through a process which addresses three core domains where key root problems occur. Each domain will help develop products which are successful and sustainable. Figure 1.8 adds to the previous findings identifying current strategies to address the issues and then grouping them together to create an overarching strategy (see Appendix).

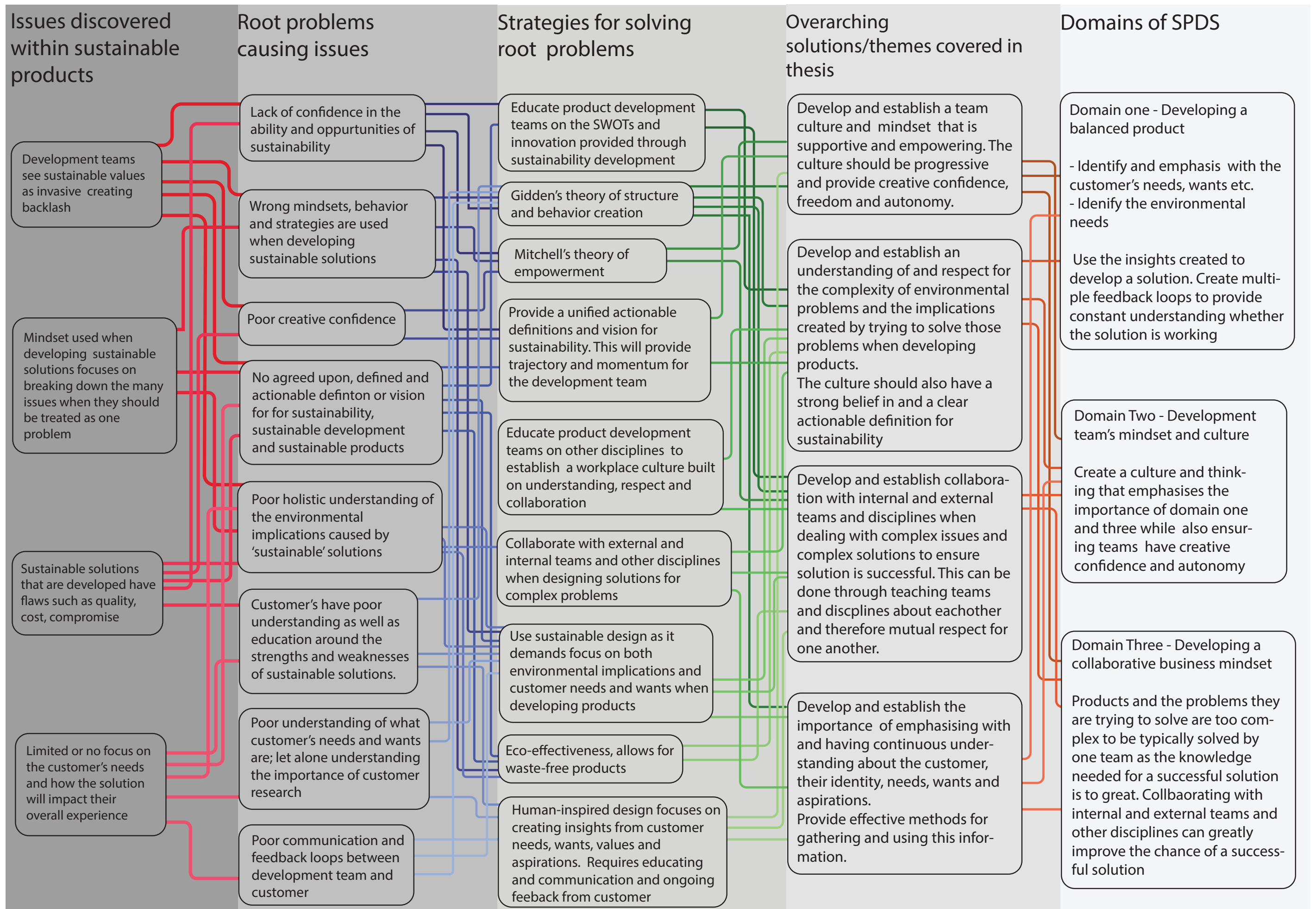


Figure 1.8 - Sustainable product issues vs SPDS



## **Domain one - Developing a balanced product**

Customer and environmental needs are often given different levels of importance depending on the company's perspective and development strategies used. Most of the time the environmental impact is not even considered and when it is, the reduction in environmental impact comes at the cost or disregard of the customer needs as typical strategies like 'eco-efficiency' place the customer needs as a subset of the environmental needs. The SPDS stresses the importance of balancing both environmental and customer needs while ensuring each one does not compromise the other when making design decisions.

### ***Identifying customer needs, wants and desires***

This research recommended several methodologies to identify not only customer's needs, wants and desires but also who they identify, as what their life is like and how they wish them and their life to be. These methodologies include human centred design and sustainable design which focus on identifying these factors allowing the development team to empathise with the customer which provides insight into how they can be empowered and supported.

Tribe segmentation provided a method to market validate and segment a market by identifying a group who share similar beliefs, life problems and desires, providing deeper support and empowerment to their identity and their life. These needs and demand for particular solutions can then be validated easily.

### ***Identifying the environments needs***

To identify the environment's needs, the research recommends several strategies which require a holistic understanding of the implications created by current and possible products. These strategies include an actionable definition of what sustainable products provide:

"The possibility that humans and other life will flourish on the Earth forever" (Ehrenfeld, Hoffman, 2013).

The benefit of an actionable goal is that it does not have to define the complexities of sustainable development but rather focuses on the end goal.

Eco-effectiveness inspires and demands a holistic understanding of the implications and innovative solutions so that a circular flow of materials is assured.

Sustainable design ensures that the implication created by the products do not compromise both the environment or the customer's experience. It understands that though a sustainable product's objective is to create a better impact on the environment, it won't better anything if it does not appeal to the customer.



## **Domain Two - Development team's mindset and culture**

A team needs to have creative confidence and feel that their decisions matter and therefore require an individual sense of autonomy and empowerment. Fostering a mindset that encompasses and encourages these traits will help individuals feel they have the power to make a change as well as further strengthening the relationship between product development team and sustainable strategies and values.

As discussed in the company behaviour section of the literature review, it is important that the team feel empowerment which can be achieved by encouraging autonomy, influence, decision making power and ownership. These mindsets can be strengthened using many strategies. For example, making openly available the tools and resources needed to complete job, gives people autonomy as mentioned in Gideon's theory of structuralization. Motivation can be increased or decreased by changing the number of steps needed to perform the action (Eyal, 2014).



## **Domain Three - Developing a collaborative business mindset**

Products are now so complex it is important to acknowledge and expect that collaboration with external expertise will be required to coherently address the interwoven needs of the customer and environment as it is unlikely internal teams will have the expertise required, nor the time to learn it. However, external collaboration can be resisted by current business practice due to the many intellectual property considerations and mindsets. This research proposes that overall the benefits will outweigh the risks, if careful memorandums of understandings are signed. Intellectual Property can be hugely beneficial for the protection of innovations and as a revenue stream, nevertheless it can create a barrier of sustainable growth if sustainable innovations are protected. Instead it is recommended that intellectual property around innovations that can support growth should be shared with other sustainability driven companies motivating further sustainable development growth. Business mindsets in addition to workplace culture and mindsets provide additional market share protection as they lead to strategic advantage and innovative solutions by that fostering collaborative, holistic, empathetic and innovative products.

Strategies that are recommended to encourage cooperation and collaboration both externally and internally revolve around educating team members of these other disciplines. This education instils mutual respect and trust for external teams ensuring collaboration. Further encouragement of external collaboration can be driven using similar mentioned behavioural strategies used to create a development team's culture and mindset.



# PHASE TWO

Applying the SPDS to the development of a sustainable  
toothbrush



## Scope of Phase two

Phase two focuses on the conceptual development of a sustainable toothbrush using the SPDS proposed in phase one.

Firstly, the New Zealand toothbrush market landscape was analysed to provide a snapshot of the current barrier and opportunities. This involved a thematic analysis of secondary research as well as a competitor and product analysis.

Secondly, using the SPDS endorsed methods and strategies information was gathered and analysed to provide an understanding of the environmental and customer needs which would need to be considered for the further development of a toothbrush.

These two needs are separated into two sections and use a thematic analysis on secondary research which include websites, blogs, company and material reports, journals and books. Using a tree analysis allowed the breakdown of tasks of customers and the life cycle of materials and products providing holistic insight. Expert interviews provided insight into business models, design needs and opportunities. Customer surveys provided in-depth insight into their needs, life, identity and desires.

Thirdly, the findings of the thesis are discussed and reflected upon addressing how the findings impact both the toothbrush and the SPDS feasibility. Conclusions are then presented within a business case which proposes the new product and business model. The thesis is then concluded, with key findings and conclusions being summarised.

## Methodology

The methods below are sorted into categories. Aside from the methods used for market exploration, the methods were chosen based on their ability to help gather information for the SPDS domain they have been grouped under.

### **Review of oral care market**

#### ***Competitor analysis***

Competitors in both the New Zealand and an international setting were researched to understand their target market, value proposition, strengths and weaknesses, sustainable development efforts, support provided to the customer and their business strategy being compared. This snapshot of the current market provided insight into the opportunities and threats for a new entrant (Osterwalder & Pigneur, 2010, p. 216). This analysis provided insight into current product offerings, business strategies, what competitors focused on when marketing and who they targeted.

SPDS research approaches:

### **Domain One - developing a balanced product**

#### ***Design as research***

Design methodologies were a key component of this research, strategies of design thinking and human centred design were primarily adopted as they ensured that during the development of the sustainable toothbrush, the environmental and customer needs were being addressed without compromise to each other.

There has been much debate over design and its relation to research and like many disciplines there are multiple schools of thought, one view this thesis agreed with is that design is a “hybrid of science, mathematics and art” (Christopher, 1992, p.10). Most areas of research focus on the present and past. However, design allows for a present and future focus when developing products allowing the researcher to understand the changes that were needed to get to that a future toothbrush concept (Christopher, 1992).

#### ***Design Thinking***

Tom Kelley founder of IDEO and creator of the term Design Thinking (D School, 2017), describes the strategy as a blend of heart, head, and hand; This research followed this process by starting off with heart; a passion to make a sustainable future, which continued into an understanding of what was wrong with current sustainable products in particular a conventional manual toothbrush. Using this design thinking strategy encouraged collaboration with external disciplines focused on the development of sustainable product to create an holistic and empathetic perspective. Design Thinking requires collaboration to develop meaningful solutions (D School, 2017) that solve multifaceted issues (Signer, 2011).

Design thinking has a very similar underlying structure to the decision-making process created by Herbert Simon in 1969 *The sciences of the Artificial* (as cited by Dam & Siang, 2017) which is best presented by the process used by the Stanford Design School in 5 distinct phases:

- 1- Empathise**
- 2- Define**
- 3- Ideate**
- 4- Prototype**
- 5- Test**

Though listed as steps, the process was not linear and was treated as spaces that could be looped back through (D School, n.d, p.1 see also Brown & Wyatt, 2010).

This research primarily focused on empathising and defining the problems that a sustainable toothbrush would have to address. The Empathise stage looked at observing, engaging and immersing into the lives, behaviour and experiences of customers to create an in-depth understanding of their problems, feelings, needs, wants, and desires (D School, n.d, p.1). This stage defined the current customer and environmental problems which helped build the context of the problem and framed it in a way that provided direction for further research and development of the sustainable toothbrush (Norman & Verganti, 2014, p.89).

The Define stage (D School, n.d, p.2) concentrated on integrating the findings to create an overview of the problem and empathise stages findings to create a meaningful problem which inspired and empowered the researcher to develop a concept that could provide to both the needs of the environment and the customer. The product development team providing the direction for the development of the project.

### ***Identifying Environmental needs - Material analysis***

Materials were analysed to determine what materials were most sustainable and customer friendly. Their sustainability was determined by understanding their life cycle, reusability and easiness at being collected and recycled. By understanding the manufacturing capability of products and their comfortability the materials customer desirability was assumed. Material analysis involved secondary research, interviews and a tree analysis. The analysis was done in conjunction with competitor analysis findings; providing insight around the implications a material has on the customer experience, environmental impact and material reusability of a product.

### ***Identifying customers need wants and desires***

#### ***Human centred design***

Design Thinking encouraged a human-centred design approach when considering the development of the toothbrush in addressing customers' needs and overall experience regarding design considerations developed around the environmental needs.

Empathy is the heart of human centred design and required a deep engagement with the problems of the customer from the researcher by framing the customers issues through the researcher's eyes (D School, n.d, p.1). Human-centred design also ensured that the researcher acknowledge that a sustainable toothbrush was at the end of the day for a person, not the environment and encouraged interaction with the customer through observation and listening to them.

A limitation of human centred design was its iterative process known as hill climbing which incentivises iteration of the current product until it has reached the highest point

of the hill. However, even though the highest point is found, it may not necessarily be the highest hill (Norman & Verganti, 2014, p.78). The literature review highlighted that the importance of being customer inspired rather than led as their focus is on what is current and can be obliviousness to what is possible. The researcher debugged this issue by creating a broad understanding of the wider issues the product would need to solve and then detached themselves from the customer allowing for the brainstorming of creative and innovative solutions (Norman & Verganti, 2014, p.96).

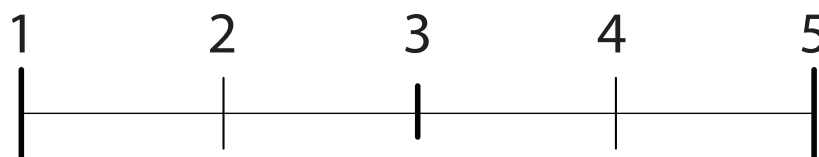
### *Surveys*

Semi structured surveys were the main source of customer information producing data that could be easily analysed and coded. All questions were first tested on colleagues to gain feedback and to assess the survey's ability to generate answers. The semi structured surveys included multi-choice and open answer questions which sprouted the opportunity for discussions between the researcher and the participants. Surveys were generated using findings, insights and questions gathered from the surveys before them.

Surveys contained several techniques to provide a better understanding of the respondents. These were:

#### *Kano model*

Kano model is a prescribed Likert scale and was used to understand what features of a toothbrush customer thought were not needed, expected, needed, and desired (Goffin, Lemke, & Koners, p.10, see also Rafinejad, D. 2007). Scales were iterated through the surveys to be even numbered which ensured the customers had to pick a side. Respondents were provide with a 1-5 scale to gage how they felt about the particular topic of the question (see figure 2.0).



**Figure 2.0 - Kano scale**

Percentages and analysing of the scaled questions was done by grouping numbers:

1 – 2 = Negative feelings

3 = Neutral

4 – 5 = Positive feelings

#### *Relationship letter*

This was presented to all stage four and five respondents as an extra question that they could do in their own time due to the longer time it would take. The idea was

that the customer could write about their relationship with their toothbrush providing insight into opportunities for a new toothbrush. Unfortunately, no respondent participated in this.

#### *Time-aware research*

The goal of this approach was to catch the respondent in the head space that they generally have when doing a certain activity such as thinking about buying a toothbrush or other products within the workshop with the hope new insights would be provided.

#### *Five whys*

This approach quickly found the root reasons behind answers to survey questions by continually asking why to the answer the customer had just provided until they were unable to explain further (McLennan, 2004 p. 220). This technique ensured shallow and quick replies were not mistaken for the true root issues and influences (Rafinejad, D. 2007, p.339).

#### *Projection techniques*

The idea behind projection techniques was to provide the customer with no perception on what an expected answer should be or what the intention of the question asked was. This encouraged customers to create deeper answers by projecting their own meaning and feelings which provided the root issues and influences (Goffin, Lemke, & Koners, p.44).

### **Surveys done**

#### *Survey one - 105 respondents - (appendix A)*

Stage one had the goal of generating a foundation of quantitative data for further qualitative data generation. Ultimately it was about producing more understanding around the expectations of toothbrushes, what worries and what appeals to customers. It focused on questioning customers as they walked through supermarket lobbies over the course of six days spread over three weeks. The survey focused on short answers and took three – five minutes covering the respondents thoughts and preferences on toothbrush features, brands, needs, desires, price and sustainable alternatives.

**How:** Customers on their way out of the supermarket were asked if they wanted to complete a survey for research exploring current and future toothbrush products.

**Where:** Supermarkets around Wellington

**Who:** Anyone who was interested in taking part in the survey (convenience sampling).



### *Survey two – 100 respondents - (appendix A)*

Stage two mirrored stage one regarding the objective and questions used but was distributed online through a Wellington Sales Facebook page. Working off Stage one, an additional question was added to understand the time generally taken when browsing the toothbrush aisle for a new toothbrush.

**How:** Customers on their way out of the supermarket were asked if they wanted to complete a survey for research exploring current and future toothbrush products.

**Where:** Supermarkets around Wellington

**Who:** Anyone who was interested in taking part in the survey (convenience sampling).

### *Survey three – 2 respondents*

Stage three focused on an increased qualitative orientated goal, with the findings from Stage one and two University students were targeted with screening questions by asking them if they were university students. Stage three also focused on timed interruptions by talking to students just as they had picked a toothbrush off the shelf to better understand their thinking behind why they picked that particular toothbrush. However, this survey ended up being cancelled and the data not being used due to the poor volume of respondents which was thought to be due to the combination of the scopes.

Through stage three failed in its goals, it provided key insights. Firstly, time-aware surveys though perhaps beneficial did not make best use of time and secondly, that the supermarket may not be the most suitable area complete surveys with university students.

**How:** Customers were approached and asked as they grabbed their toothbrush. Customers were first selected by their visual age and then asked if they were a university student before the survey was attempted.

**Where:** Supermarkets around Wellington

**Who:** University students who had just picked up a toothbrush in the supermarket aisle and interested in taking part in the survey. Students were chosen as a consumer group that provide multiple opportunities and strengths for a new toothbrush. Choosing an untargeted and unique group such as University students also supports the need for a wider variety of different sustainable alternatives for different consumer markets as mentioned in the introduction of this thesis.

### *Survey Four- 19 respondents - (appendix B)*

Stage four focused on qualitative data with questions demanding more detailed and



comprehensive answers compared to past surveys causing each survey to range from 10 – 15 minutes resulting in a decrease in completed surveys.

Stage four took place at Victoria University's Kelburn campus over the course of a week with attention being on the students' lives, brushing routines and personal opinions on their ability to brush their teeth.

**How:** University students were approached on University grounds and asked if they wanted to take part in a survey.

**Where:** Victoria University of Wellington, Kelburn campus

**Who:** Any student who was interested in taking part in the survey.

## **Domain Two - Mindset of Development team**

### ***The importance of seeing failure as a positive to build empowerment***

It was important that fear of failure during the research did not get in the way of developing creative or innovative ideas and inhibit new ways of seeing the problem (Goodman, 2012). This was solved by trying to fail with ideas and letting them develop through those failures (Kelly, 2017). This helped create the mindset that failure was good as it helped with learning and allowed creative confidence to be created which was crucial when trying to develop innovative solutions (Brown, 2009).

### ***Sustainable mindset***

Understanding the importance of sustainable development and how certain behaviours, strategies and methods impacted both the sustainable and desirable aspects of a product, helped keep an open mind to the importance of the environmental and customer needs.

## **Domain Three - Developing a collaborative business mindset**

### ***Interviews***

Interviews were done with key stakeholders identified through the stakeholder map and included two key areas of interest:

- 1- Dentists
- 2- Material sorting stations

Those working in these key areas were contacted by emails initially. Interviews were then planned with questions being sent a week before. Distribution stakeholders such as supermarkets were not identified as important as initial findings highlighted the need for a new distribution channels.

### ***Dentists***

Dentists provided critical insight into toothbrush design, customer behaviour and competitor understanding. Only two dentists agreed to be interviewed despite many others being invited to participate. These Dentists wished to remain anonymous and therefore will be referred to as Dentist 1 and Dentist 2 with no extra information provided.

### ***Material Sorting stations***

*Dean Martin*

National Sales & Marketing Manager of the Oji Fibre Solutions who collect and sort the loads of recycling picked up within the Wellington region. Dean provided critical information regarding the implications surrounding the reuse potential of certain of materials and product design requirements.

### **Data analysis; a thematic analysis of secondary research**

Secondary research consisted of collecting and synthesising current data (Universal methods of design, p. 154) and is critical in the research phase as it provides facts, context and paved the groundwork for future research (P. Haythornthwaite, personal communications, February, 18, 2017. See also, Universal methods of design, p. 112). Websites, blogs, academic papers, company and material reports, journals, articles and books surrounding the topics of toothbrushes, the toothbrush market, material and business model designs were analysed for recurring themes generating key insights.



## Review on oral care market and environmental implications

### **Market Research**

This section thematically analyses secondary and primary research New Zealand's, America's and Australia's toothbrush market to create insight into the future of New Zealand's toothbrush market. Secondary and primary research includes: current competitors, their target market, value propositions and product offerings.

### **Analysis of Market landscape: Trends and Life Cycle**

#### ***New Zealand oral care market landscape***

New Zealand's oral care industry experienced growth of 4% in 2013 and 2014 created by segmentation and new formulas in the toothpaste category (Euromonitor International, 2016). Examples include Colgate Optic White toothpaste which is harnessing the customers desire for professional cleaning but for the minimum price possible and at home (Newman, 2009 & Decker, 2012).

Private labels have increased their shares of the oral care market over the past few years as they target unmet needs with cheaper alternatives. (Euromonitor International, 2015 & Euromonitor International 2016). Secondary research highlights opportunities lie in meeting the needs of the ageing population, as Denture care sales grew by 5% (Euromonitor International, 2015).

#### ***Australia oral care market landscape***

Australia's oral care market landscape is slowing down as most households contain oral care products. Opportunities are with the ageing population who are willing to buy premium products for more reliable product products that supply better results (Euromonitor, 2016).

#### ***America oral care market landscape***

America's oral care industry has stagnated due to near universal penetrations of oral care products with Americans already brushing, flossing and using mouthwash leaving no extra room for additional product add ons (Nanninga, 2016). Opportunities lay in developing products and services for Hispanic, children and the elderly (Nanninga, 2016). It is also recommended to focus on improving customer education about proper oral care (Nanninga, 2015). Through better education new and more complex oral care routines can be influenced (Elani, 2014, Decker, 2012) to encourage customers to buy more expensive oral-care products. Private labels are bringing more features and benefits to the marketplace for less cost causing customers are expecting more from their oral care products (Mendieta, 2013).

### ***Global oral care market landscape***

The global oral care market is predicted to reach \$19.2 billion in 2021 (Mordor Intelligence, 2016) with toothbrushes and toothpaste having the fastest growth (Decker, 2012) accounting for 97% of the oral care industries revenue (IBIS World, 2015).

It is likely New Zealand's oral care industry will follow the same oral care market lifecycle as Australia and America as the same five core competitors are present and the key future opportunities (focus on older generation, upselling and segmenting toothpaste market) appear to be the same. In 2007 Colgate claimed to launch 772 new products yet the fact that most of them were tweaks or new flavours and packaging rather than actual innovations. Though Companies claim growth and differentiation it appears this may not be the full truth. These tweaks also only provide gains in the short term (Barbalova. 2009). The oral care industry has been reduced to a feature and price battle. The oral care industry has matured and stagnated as it struggles to create any real meaningful products and innovations to boost growth (Newman. 2009). Current focus appears to be on developing countries as these emerging markets are generating the biggest revenue for oral care companies (Trefis Team, 2015), consolidating brands to create wider targeting brands and a brand image centred around clinical and professional cleaning (Barbalova. 2009).



### **Competitor analysis**

Competitor analysis showed that there were two groups of competitors, each with similar value propositions, product offerings and customer focus. The two groups were sustainable toothbrushes and conventional toothbrushes. Only Freshbrush seemed to be unique with its sustainable yet fun and stylish value proposition.

### ***Customer segment***

Conventional competitors appeared to be focused on differentiating their product offerings by price and features, which creates four different focuses in the markets product offering.

- 1-** Cost
- 2-** Overall mouth clean by using assistant products (e.g. mouthwash)
- 3-** Specific oral needs (e.g. sensitive teeth)
- 4-** Convenience (higher tiered products for a better clean)

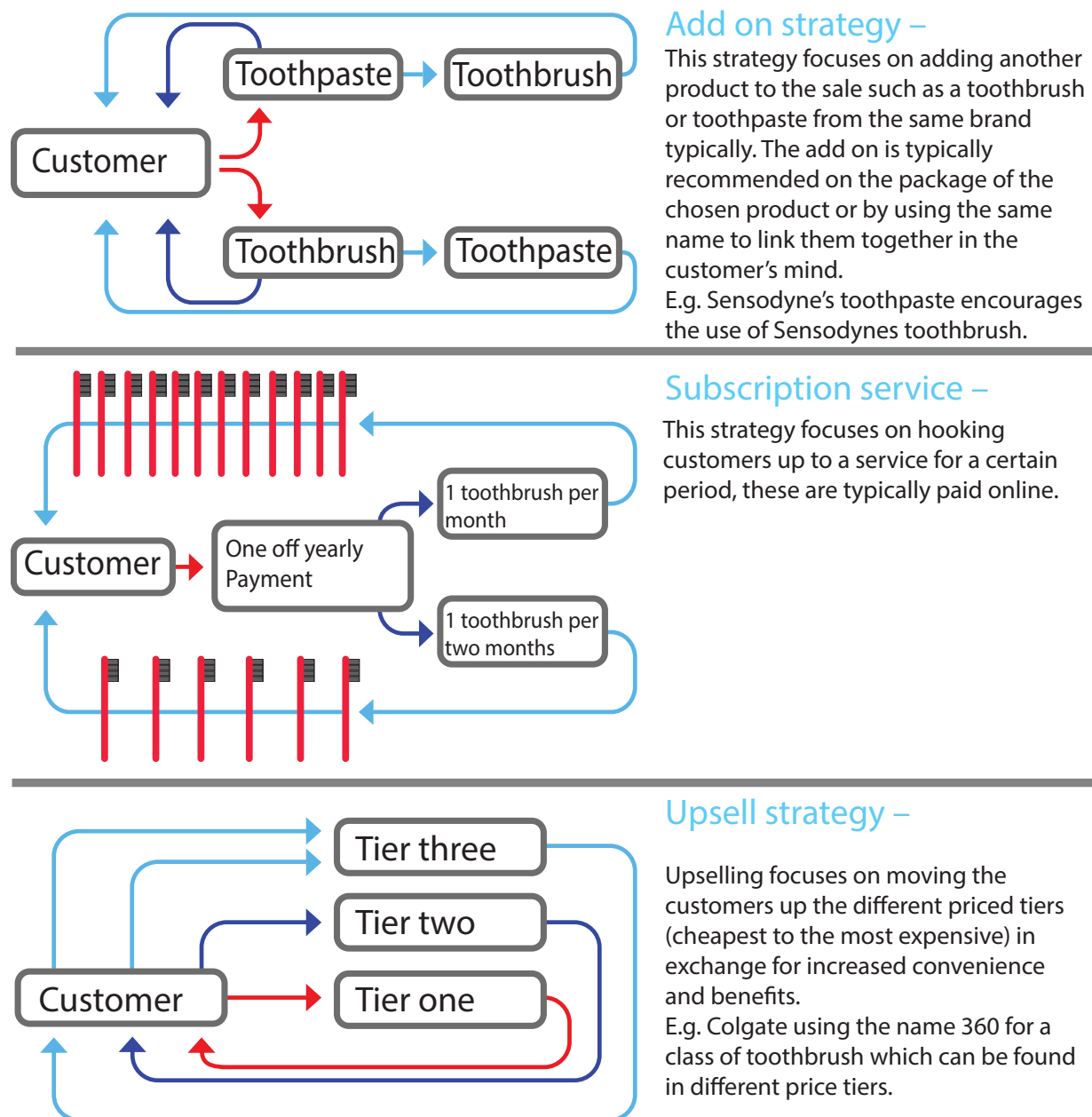
There also appeared to be a strong focus on children as they provide competitors the opportunity to gain a long-term customer as well as customers who have spendable income and can be up-sold to a pricier toothbrush.

These product offerings all focus on consumers that have spendable income or those

that will provide long-term gain and leaves a huge section of the consumer market (those who are not interested in complicating their oral cleaning routine or moving up to higher priced alternatives).

Three core business strategies were identified within the New Zealand toothbrush market (refer to figure 2.0).

### *Oral care business strategies*



**Figure 2.1 - Business Strategies in the New Zealand toothbrush market**

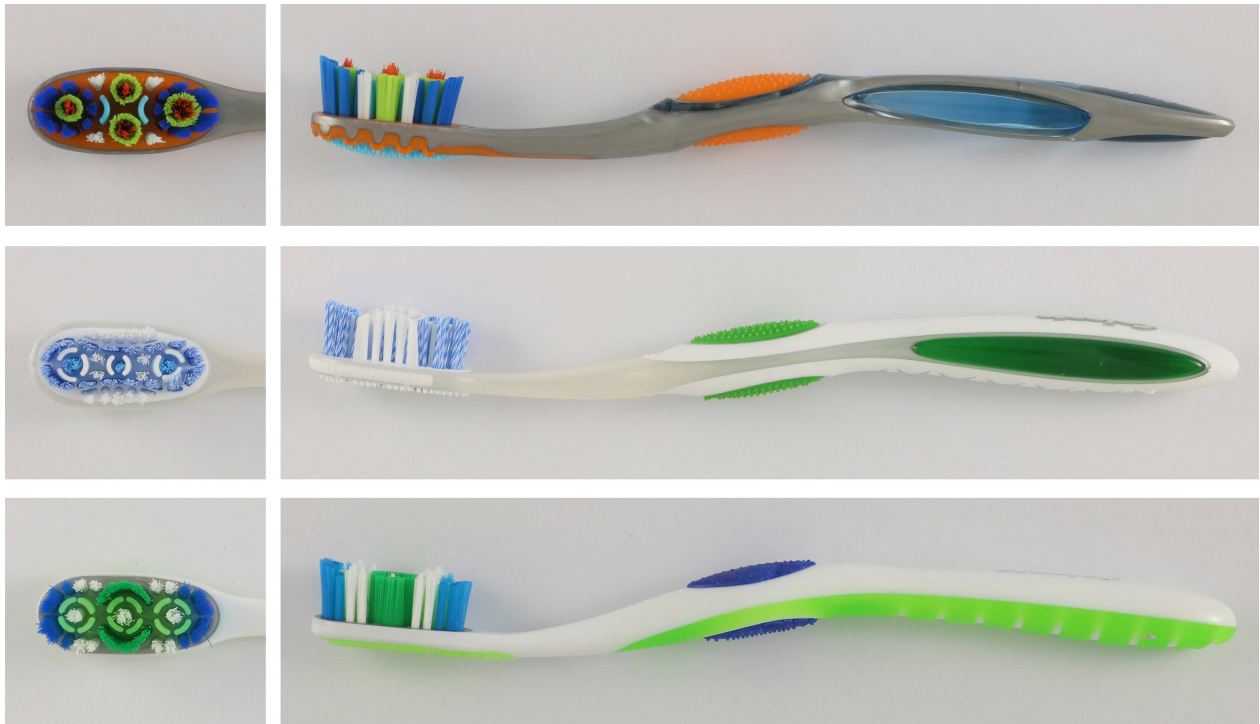


### ***Competitor product offering analysis***

Current competitor offerings found within New Zealand supermarkets were found to be quite similar. Not only was there a severe lack of difference between toothbrushes in similar price tiers but lower tiered toothbrushes were typically found to share the same features as their higher priced counterparts. For example a \$1.89 toothbrush has a similar tongue cleaner, bristles and grip than a \$6.89 toothbrush (see figure 2.2 ).



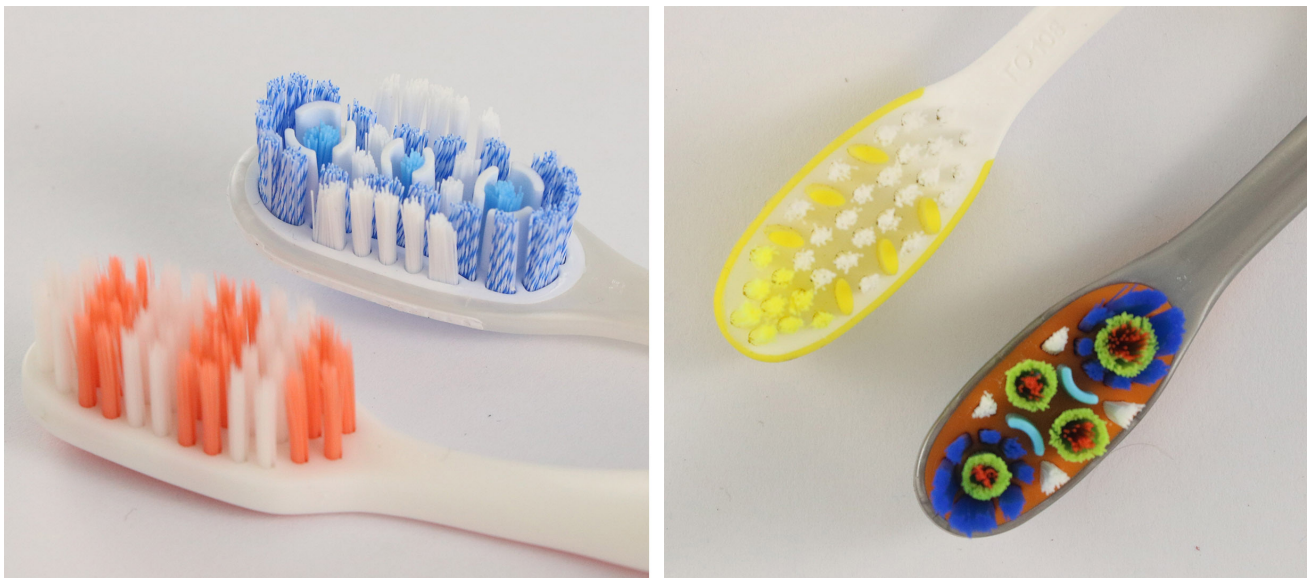
**Figure 2.2 - \$1.89 toothbrush vs \$6.89 toothbrush**



**Figure 2.3 - From top to bottom, \$6.89 Colgate 360 vs \$5.50 Colgate 360 vs \$3.50 Colgate 360**

Even Colgate's 360 range which are placed throughout the price spectrum share similar aesthetics and features, however this could be to encourage the customer to upsell to the more expensive toothbrush, then again, this could strategy could also back-fire with customers buying the cheaper toothbrush as they see no real difference between the two (see figure 2.3).

The only real difference that competitors seemed to focus on were the overall aesthetics and bristle layout between price tiers (see figure 2.4), but even these can be relatively similar to each other (refer to figure 2.3)



**Figure 2.4 - From left to right, \$1.89 toothbrush vs \$5.50 toothbrush & \$1.50 toothbrush vs \$6.89 toothbrush.**

### ***Business model development***

Research of current toothbrush business models showed limited or no circular economy strategies to return materials back to the company for reuse. Most companies say goodbye to the responsibility of their product once it leaves the supermarket. The New Zealand company Freshbrush uses a subscription service to deliver its toothbrushes straight to the customer's house. Preserve and American company was the only toothbrush company to have any take-back program which allowed customers to send back in used toothbrushes for discounts off their next Preserve toothbrush. However, this strategy did not guarantee all Preserve toothbrushes were recollected after use.

### ***Circular economy business model***

Preserve an American toothbrush company uses a take-back programme which rewards customers who send back their used toothbrushes by providing them with



a \$6 Preserve voucher when they send back six used toothbrushes (see figure 2.4). This voucher is enough for two Preserve toothbrushes on their online store providing significant motivation for customers to send back their used Preserve toothbrushes; allowing the materials to be reused (Preserve, 2014). However, this program does not guarantee the return of used toothbrushes for recycling and reuse will be sent back and the material reused.

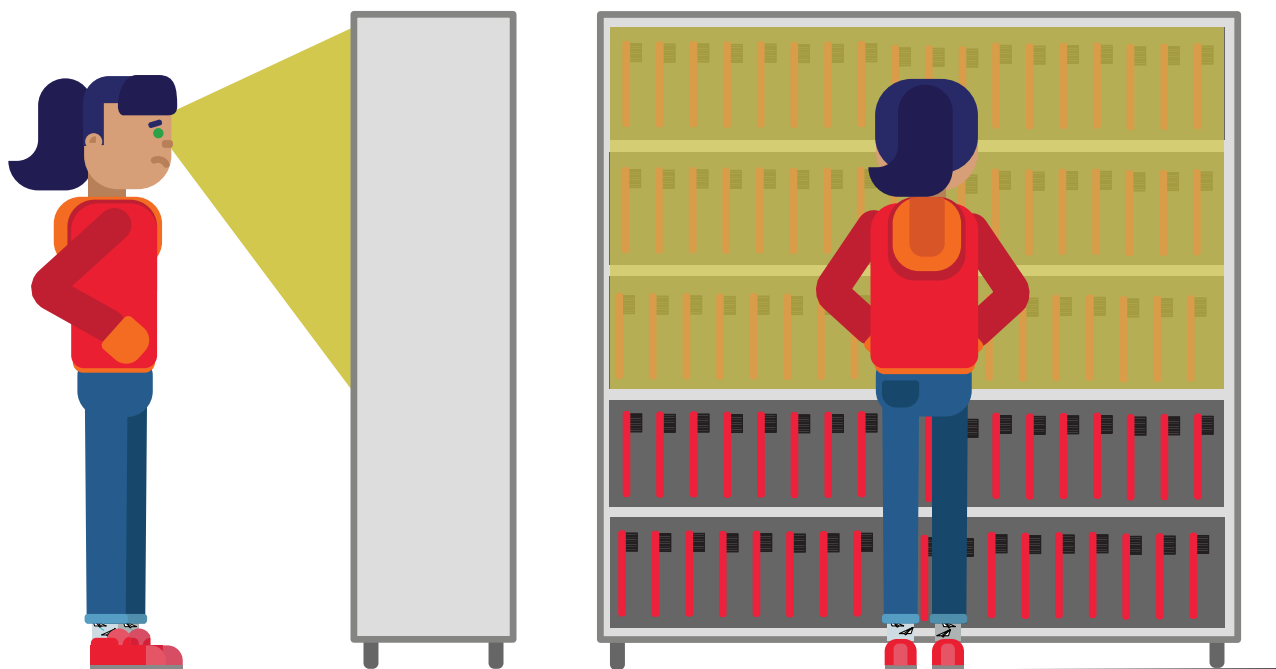


Figure 2.5 – Preserve takeback programme (Preserve, 2017).

#### Supermarket distribution

Supermarkets within New Zealand are owned by one of two supermarket chain giants (Wilson, 2013). This can put pressure on new entrants due to the monopoly created. There have been allegations that supermarkets mark-up products for more money and that supermarkets commonly promote their own private labels over new entrants with shelf placement and pricing (Wilson, 2013). New entrants within supermarkets must battle against more well-known brands which are sat at eye-level on supermarket shelves (Hubbard, 2013) (see figure 2.6).

There is also the “buy me, buy me, because I am . . .” war products have with each other to stand out. Dr Mike Lee, a senior lecturer in marketing at Auckland University stated (Hubbard, 2013) 75% of products stocked at supermarkets are ignored by customers due to this overwhelming variety of options (Schwartz, 2005). Dr John Guthrie, a senior lecturer in marketing at Otago University says that with so much choice, most people don’t look forward to going to the supermarket (Hubbard, 2013). In terms of using a supermarket as channel for take-back programs, the founders of Method have attempted and failed with refill stations, trying to remind customers to bring their empty bottles with them to save plastic and money hasn’t worked. “How many times have you forgotten your reusable shopping bag? And then end up buying a new one” Asking customers to put in extra effort is not worth the risk (Ryan & Lowry, 2011, p. 98).



**Figure 2.6 – Advantage of being at eye level**

### ***Subscription model***

Freshbrush's business model of a subscription service acknowledges that most people forget to replace their toothbrush every 3 months which results in degrading toothbrush bristles and poor quality cleaning. Freshbrush therefore developed a subscription service to send a customer a toothbrush every month to ensure they were using an effective toothbrush (Denizen, 2016). Annabel Hurman, founder of Freshbrush says the benefits of a subscription service is that "you make one decision and then you can forget about it and get on with more important things" ("The environmentally friendly toothbrush," 2017). This removal of effort for customers has caused Freshbrush to expand to over 4,000 subscribers throughout New Zealand (Mack, 2017). Though not typically used for a take-back program.

### ***The power of the locally owned brand***

While going through secondary research of different business models, secondary research highlighted the power of locally owned brands and that they should not be underestimated (Better by Design3, n.d) as they provide unique benefits and opportunities provided to locally owned businesses.

During an interview Dave Bibby a Auckland University of Technology advertising and marketing senior lecturer pointed out that New Zealanders tend to favour brand New Zealand as it appears more trustworthy and likeable than brands from overseas (Radio New Zealand, 2012).

One reason speculated for Lewis Creamery's success was its New Zealand image,

especially as it was trying new things with the aim to disrupt (Strang, 2017). In Europe private labels make up 14% of the oral care market share according to Kantar's Global Footprint report as cited by (Morgan, 2015). However, currently private oral care companies within the New Zealand oral care market landscape have yet to take a noticeable market share (Euromonitor, 2015). Looking at overseas trends private labels in New Zealand could see their market share grow.

Lastly, new private companies are not shackled by the constraints of already existing infrastructure, procedures, marketing team, finance department, and the boardroom (Quib, 2017) allowing for freedom with how they start and do their business.

New entrants are not bound by the long-term relationships and contracts that current competitors are which they have created for a competitive edge in manufacturing and distribution but have ultimately made them slow to or unable to change in response to shifting markets or competitors (Colgate-Palmolive, 2015).

### Summary of market research findings

With an apparent saturation of similar features throughout the price tier spectrum, large and dominating competitors, slowing market growth and close to full household penetration the New Zealand toothbrush market appears to have matured (see figure 2.6). Consolidations, mergers and expansion into developing countries and markets are also indicators of a maturing industry.

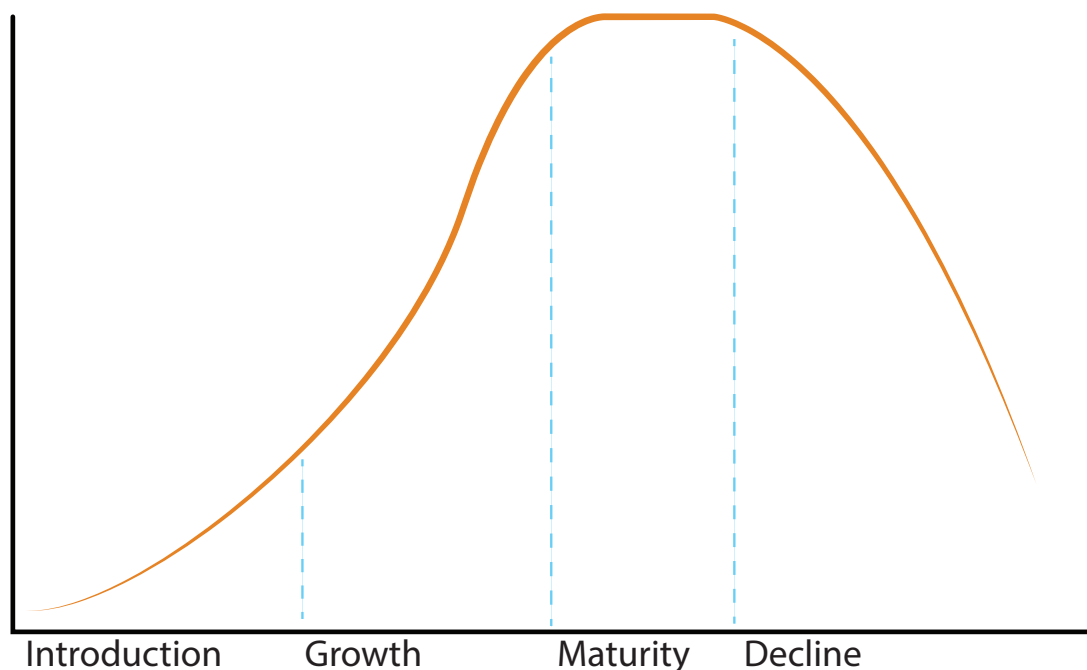
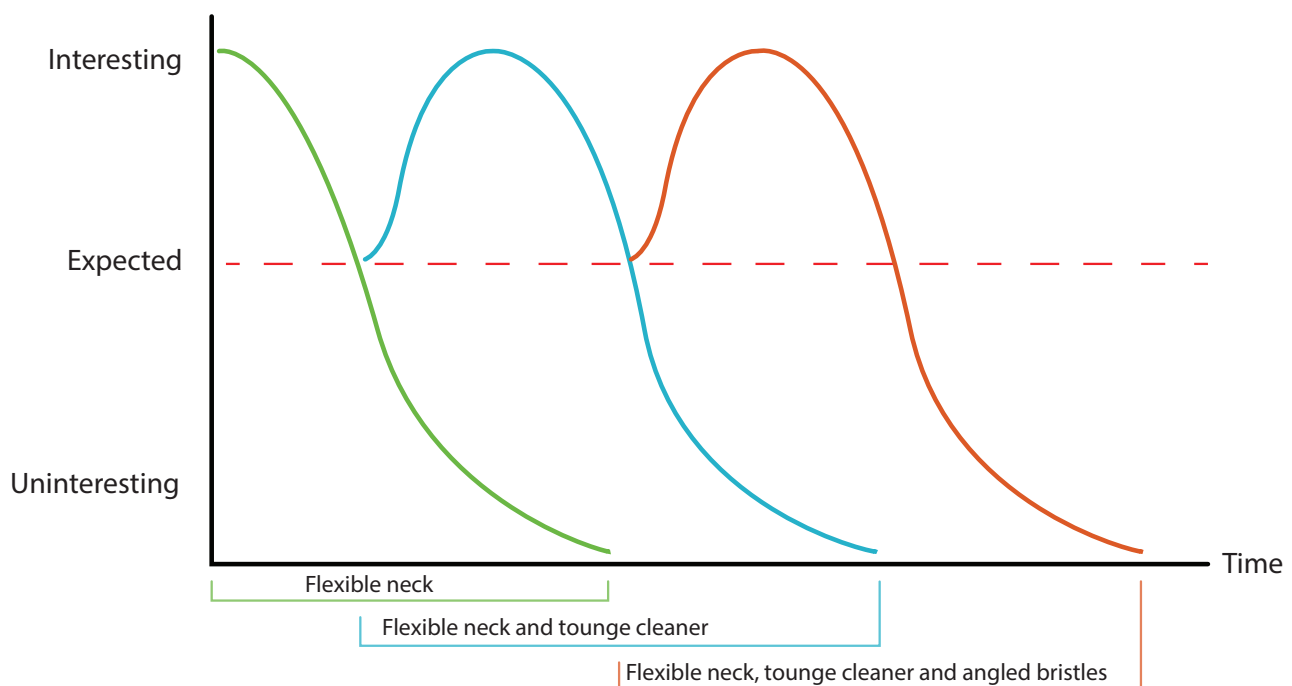


Figure 2.7 – Market lifecycle

### *Similar features*

Though incremental innovations have continued and there are differences between competitors and their product offerings they can easily blur together on the supermarket shelves. Each competitor is trying to stand out from the other by price and features, which ironically enough makes them appear even more similar. The need to stand out through unique features seems to have created an unsustainable feature cycle, where new features are created to create this difference but are then quickly copied by other competitors; saturating the market with the feature causing the new feature to no longer be a novelty (see figure 2.8). E.g. tongue cleaner (see figure 2.2) With different price tiered toothbrushes also sharing similar features, it becomes harder for competitors to justify to the customer why their more expensive toothbrush is better.

There could be significant opportunity to provide something more than just features and price to customers such as support and empowerment (refer to literature review). A unique value proposition would also help a new entrant stand out from the crowd as well.



**Figure 2.8 - The loss of interest in new features**

### *Distribution channels*

Supermarkets as a distribution channel appear to be the fuel behind this feature and price war as competitors are forced to stand out from one another. There is also the risk that competitors can easily steal another competitor's customer as all offerings are

there for the picking.

A subscription service distribution channel seems to remove the need for supermarkets, removing the risk that other competitors can steal customers because they have signed up to a yearly subscription service and no longer need to look at the different toothbrushes as one is delivered to them every couple of months.

A subscription model also removes the steps a customer must take to get and use a toothbrush making it harder for customers to go back to their old routine of probing the toothbrush aisle for a new toothbrush.

Compared to Preserve's and supermarket's take back programs that make the customer do most of the work to return their used products, a subscription model makes it easy for a customer to send back their toothbrush by supplying them with an envelope and an easy swap of the new toothbrush with a used one.

### ***Locally owned***

Being locally owned and supplying a unique value proposition compared to the rest of the market also appear to provide an opportunity to appeal to the New Zealand population.



## Product Research

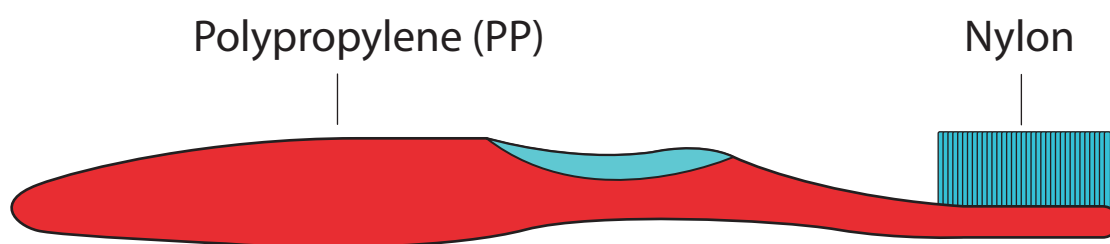
This section focuses on domain three of the SPDS by understanding both the environmental needs and customer needs that are required when developing a sustainable and successful toothbrush. Both secondary and primary research are used to provide a better understanding of these areas. Current materials and business models are researched and assessed on their environmental implications while design considerations for the toothbrush are explored through secondary research, competitor analysis, Dentist interviews and customer surveys. Finally, the customer's lifestyle is looked at to understand how meaningful value in addition to extra support and empowerment can be provided to them.

### Material analysis

New Zealand is in a difficult position when it comes to collecting, recycling and reusing plastics because it has only been recently that New Zealand has had the compatibility to recycle plastics, and even now it is done on selected materials, regions and small volumes. Flight Plastics for instance are taking in the PET that is collected within New Zealand (Flight Plastics Ltd 2017). However, other plastics are collected and shipped to overseas buyers (Recycle, n.d) and in turn dictating what plastics are collected within New Zealand with only the plastics that overseas buyers want being collected (Napier, 2014).

This section covers the materials used within both unsustainable and sustainable toothbrushes and the wider implications they may have in terms of environmental impact, customer experience and reusability.

#### *Material composition of conventional toothbrushes*



**Figure 2.9 - Simple toothbrush material composition**

Conventional toothbrushes (refer to figure 2.9) are generally made of Polypropylene, Rubber Inlay (Handle and neck) and 100% nylon filament (bristles) (Isaac, 2011). These materials are thermoplastics allowing them to be recycled over and over as they melt quickly and no chemical reactions happen when the plastic is cured unlike Thermoset

plastics (Recycle, N/A). However, as these materials are injection moulded together makes it impossible for them to be separated from one another and voiding their ability to be recycled and reused.

### ***Nylon***

Nylon is used for toothbrush bristles due to its unique strength, durability, wear and chemical resistance compared to other alternatives (Pang, 2014). Nylon can be injection moulded and extruded easily (Creative Mechanisms, 2017). Nylon also holds die well (Bennett, 2014) allowing for fun and unique colourisation.

#### ***Creation process***

Every 1kg of nylon created generates up to 6.4 kilograms of carbon dioxide (Berners-Lee, 2010 & Plastics Europe, 2014). For context wool has a similar carbon footprint (Berners-Lee, 2010). but, unlike wool, nylon can be reused over and over. However, due to the small amount of nylon waste that is collected within New Zealand and around the world it is not typically collected, recycled or reused.

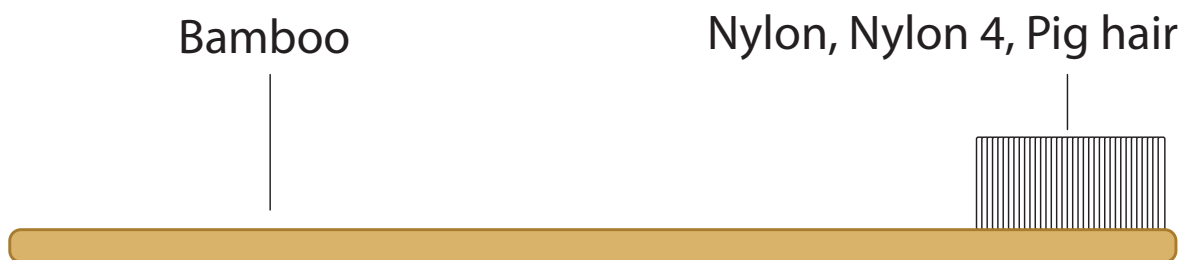
### ***Polypropylene (PP)***

Polypropylene is cheap, strong, resistant to acids, and other harsh chemicals (Pang, 2014). This is useful due to toothpaste's acidic levels. However, multi injection moulding these plastics fuse them with other materials ensuring they will be thrown out rather than recycled and reused.

#### ***Creation process***

Polypropylene is created by polymerisation of propylene gas with a catalyst system (Sato & Ogawa, 2009) generating 3.5kg per 1 kg of polypropylene made making it a plastic with one of the lowest carbon footprints (Intertek, 2011).

### ***Material composition of sustainable toothbrushes***



**Figure 2.10 - Bamboo toothbrush material composition**

Sustainable toothbrushes are typically made out of materials that cause less damage to their environment, are naturally made and can biodegrade when thrown out (refer to figure 2.10).

#### ***Nylon 4***

Laboratory tests have shown nylon 4 biodegrading in soil within 4 months, or 24 hours when introduced to specially bred strains of activated sludge which produced aminobutyric acid (GABA) (Yamano, Nakayama, Kawasaki, Yamamoto, & Aiba, 2008. See also Hashimoto, Hamano and Okada, 2009). This acid is also found in tomatoes (Park, Mirabella, Bronstein, Preston, Haring, Lim, Collmer, & Schuurink, 2010). However, lab conditions do not realistically reflect actual environmental conditions that the nylon 4 will come across when thrown out. Nylon 4 is also stiffer compared to standard nylon causing it to be harder on gums when brushing making it uncomfortable for the user (Terry, 2011).

#### ***Pig hair***

Pig hair is the only true biodegradable material currently used for bristles. However, bristles made of pig hair bristles like other natural materials have also been found to be too harsh for teeth (Quib, 2016).

#### ***Bamboo***

Bamboo has a strong environmentally friendly reputation due to its quick growth and quick harvesting making it a rapidly renewable source. Bamboo absorbs four times as much carbon and generates 35% more oxygen than other plants and has little need for pesticides or water (Bardelline, 2009). Though typical bamboo toothbrushes still use nylon, the absence of polypropylene makes it a significantly better product for the environment (Liese, 1985).

Bamboo has significant wider environmental implications however which include:

##### ***Growth methods***

Contrary to public belief bamboo plantations require the clearing of native and natural forests and unsustainable amounts of fertilizers and pesticides despite claims that bamboo does not need them (Bowyer, Fernholz, Frank, Bratkovich, & Pepke, 2014, see also Norbord, 2014).

##### ***Unsustainable harvesting methods***

Due to high demand, bamboo is grown closer together to increase volume causing monoculture plantations (Yiping and Henley, 2010 & Telegraph, 2011). Monoculture plantations cause a loss of biodiversity (Bowyer, Fernholz, Frank, Bratkovich, & Pepke, 2014, see also Gallagher, 2011), soil nutrients and creates erosion (Keenan, 2011 & Norbord, 2014). An eleven-yearlong study showed monoculture crops have a 25%



decline of productivity in the long-term (Yiping and Henley, 2010). Constant cutting of these plantations can also result in slower regrowth (Bardelline, 2009).

#### *Manufacturing methods*

Bamboo is not used as a raw material but rather goes through intensive chemical processes to become the cellulose fibres used in a product (Telegraph, 2011), the glue and sealing chemicals is also questionable (Keenan, 2011).

#### *End of life cycle*

Companies that make bamboo products recommend putting their used bamboo products in household composts or sending them to compost facilities. However, Firstly, not everyone has or can have a compost. They can also take considerable work to maintain their efficiency at breaking down organic material (Wellington City Council, 2014). Secondly, it is not encouraged to compost bamboo at home (New Plymouth District Council, 2017) because home composts are very different and ineffective compared to commercial composting facilities (Biomass Packaging, 2014). Thirdly, New Zealand commercial composting facilities do not accept bamboo as green waste due to bamboos fibrous structure and it is therefore recommended that it should be sent to the landfill (Wellington City Council, 2014). Fourthly, landfills lack the microbes and oxygen needed to break down bamboo effectively and are designed to store waste, rather than break it down (Rathje, & Murphy, 2001 see also Ashford, 2010) with studies finding twenty-five year old organic material mummified rather than biodegraded (Beaudry, 2016 & Biodegradable Products Institute, 2017). Unfortunately, these studies show that bamboo will not composted but instead be thrown into landfills where it will be unable to bio-degrade.

### ***Aluminium - An Alternative material***

Aluminium was researched as it is collected within New Zealand and has surprising strength and a very low density (Olivia, 2011), occurs naturally in water, soil and air and is non-toxic (Agency for Toxic Substances and Disease Registry, 2007). It can be easily transported for recycling as it is light and easy to crush (Recycle, n.d).

#### *Creation process*

Aluminium is not found in pure form but mixed within other materials (Leggett, n.a). Therefore, aluminium requires a process that separates it which in turn generates three tonnes of waste material for every tonne of aluminium while toxifying the mined area and creates perfluorocarbons which are 9,200 times more harmful to the environment in causing climate change than carbon dioxide (Leigh, 2010).

### *Recycling process*

The benefits of Aluminium is its reusability which only uses 5% of the energy needed to create virgin aluminium (Brennan, n.a & The Economist, 2007). This cost saving alone pays for recycling, collection and transportation of used aluminium (Leggett, n.a).

## Findings and analysis of interviews, competitor product analysis and surveys

### **Interview on end of product life collecting and recycling**

To better understand why plastics such as nylon were not collected or sold to overseas buyers for recycling, an external expert was consulted.

#### ***Interview with Dean Martin***

Dean pointed out that nylon is not collected through kerbside collections within New Zealand in high enough volumes which results in less opportunities to sell the material received. For nylon to be collected, sold and recycled, 50 – 100 tonnes would be needed for international buyers to be interested to buy from New Zealand, most districts would struggle to accumulate a tonne or two over a month. Plastics that are collected are those in demand or are perceived to a tangible benefit, while plastic that has little demand or is not produced in high-enough volumes are destined for the landfill.

Dean further pointed out:

- Nylon also needs to be cleaned before recycling as it melts at a lower temperature than what bacteria is killed at providing further work for the recycler.
- An alternate solution is to create a recycling stewardship program making the manufacturer responsible for the materials not commercial waste collectors to ensure nylon is collected and reused.

Dean also shed light on the concept of an aluminium toothbrush, saying that it would need to be bigger than a coke bottle lid for it to be diverted into its correct grade for further processing. Any smaller and the materials would fall through the gaps into waste containers depending on the type of sort lines used in each region within New Zealand.

### **Toothbrush design specifications**

Once current and alternative materials were considered, it was critical to understand design considerations needed when designing a toothbrush. Quip an American toothbrush developed through design research, highlights the importance of a cylindrical handle as it is easier for manoeuvrability in the hand as the user brushes around the mouth. An ergonomic toothbrush on the other hand forces the customer to hold the toothbrush in a certain way making it uncomfortable to use in some situations (Quip, 2016). Consumer reports highlights the key to an effective clean is not the toothbrush but rather the technique and routine used (Consumer Reports, 2016).



## **Interviews with Dentists around toothbrush design and cleaning effectively**

### ***Handle considerations***

Both Dentists highlighted the importance of a toothbrush handle being comfortable so that it was easy to hold and manoeuvre. Dentist two added by saying the more a design can encourage the user to brush for longer the better and therefore the comfort of the brush is critical.

### ***Features***

Both Dentists shared their scepticism over the features found on toothbrushes, Dentist 1 pointed out that toothbrushes found in a supermarket must compete in feature battles otherwise they lose out on customers, by having the new gimmick the brand maintains their market share.

Dentist 1 highlighted the importance for a long neck and small head so they can reach areas of the mouth typical toothbrushes do not.

Both Dentists did however, agree on benefit of a tongue cleaner had in removing excess bacteria from the tongue.

### ***Bristles***

#### ***Bristle hickness***

Both Dentists strongly pointed out the importance for soft bristles as medium and hard bristles not only are they unable to get between the gum and tooth line where plaque can grow but harder bristles can also cause gums to recede revealing areas of the teeth that do not have enamel. Both cause teeth to grow plaque and decay over time. Dentist 1 goes on to say that educating customers is needed as the majority used medium and hard toothbrushes.

Dentist 2 highlight the issue with soft bristled toothbrushes is that they wear out faster and therefore need to be replaced more often.

#### ***Bristle layout***

Dentist 1 discussed their gripe with current toothbrushes in supermarkets, commenting on the bristle layout as they look complex insinuating a better clean when in fact they do not. Instead the reason new designs come out every few months is to stand out from their brethren. Developing toothbrushes seems to be more about form than function.

### ***Teeth cleaning routine***

Both dentists claimed that the most important thing to ensure clean teeth was a consistent brushing technique and routine because plaque should be broken up every 24 hours to avoid it hardening, the key they reinforced was to clean twice a day.

## ***Marketing***

Dentist 1 discussed that partnering up with dentists by designing a toothbrush with them was important as those dentists would then recommend the toothbrush to their clients. They went on to say that having Dentists explain the design consideration during marketing campaigns such as “90% of Dentists would get behind a toothbrush with a smaller head than those available in the supermarket” would help influence customers to buy the new toothbrush.

## **Competitor product analysis**

Analysis showed no consistent pattern between handle (refer to figure 2.11) and bristle layouts (refer to figure 2.12) between brands and within the brand range themselves leading to the assessment that there may not be a perfect toothbrush. Another key finding was the differing claims each toothbrush seemed to make, multiple sharing a similar claim with different features adding to the analysis that the features may not provide what they advertise.



**Figure 2.11 - Toothbrush handles**





**Figure 2.12 - Toothbrush bristle layout**

## **Customer Surveys**

Once the design specifications from dentists and secondary research was found it was important to understand what the customers opinions were on what was important or expected from a toothbrush.

### ***Survey one and two***

Surveys one and two provided a general idea about customer's expectations and wants from their toothbrush. Questions focused on what customers thought about features, brand loyalty, price and environmental products and desires. All up 205 people took part in these two surveys.

### ***Key Findings from surveys 1 & 2***

#### ***Overall aesthetic appearance***

**60%** of respondents attributed aesthetics to why they choose a specific toothbrush over another.

**28%** of respondents related the look of the toothbrush to how it would perform (aesthetic = quality clean). Comments included:

"Must look like it will be strong and durable" and "Must look like it will clean well"

**24%** of respondents highlighted colour as a key aesthetic as it made them stand out from the rest. Comments included:

"Colour gives a toothbrush a fun personality and individuality" and "The more colourful the better"

Overall colour, simplicity, cleaning quality and durability were the most popular aesthetic features brought up and asked for within the survey.

### ***Expected and desired toothbrush features***

The percentages used here are small, as only a small proportion of respondents wrote down features that they expected or wanted. However, we could see those who didn't expand on what features they wanted as neutral while those who did comment as passionate on what features they wanted.

**12%** respondents mentioned the importance of a good toothbrush handle, a further **8%** mentioned that a bad handle can easily "ruin" a cleaning experience.

**27%** respondents said that they were sceptic about toothbrush features and their ability to provide a more effective clean. A further **12%** had been let down by the claims of a particular feature as the reality did not live up to expectations.

**19%** highlighted their preference of tongue cleaners and expected their toothbrush to have one. Comments included:

"My mouth doesn't feel clean if my tongue hasn't been cleaned"

**17%** of respondents signalled the importance of bristle layouts on their toothbrush and how they related to effective teeth cleaning.

Overall bristle layout, handles and tongue cleaners were the most expected feature on a toothbrush. There was also hard scepticism around the actual ability of toothbrush features.



### ***Toothbrush brands and the loyalty they have***

**24%** of respondents only brought well-known brands as they saw them guaranteed quality toothbrushes which provided better cleaning ability.

**32%** of respondents repeatedly brought Colgate toothbrushes because of their trusted reputation.

However, **17%** of customers outlined cost as more important than brand

### ***The importance of price***

**70%** of respondents saw price as the most important factor when buying a toothbrush.

**80%** of respondents were happy to pay between **\$2 - \$4**. The overall average that respondents expected to pay for their preferred toothbrush was **\$3**.

Time spent choosing what toothbrush to get

**84%** of respondents did not have a predetermined toothbrush in mind when going to buy one.

The average time a respondent took when looking for a new toothbrush in the aisle



was 2.5 minutes. However, these were estimations given by the respondents and not actually timed.

Both findings show the room available for competitors to steal consumers from other brands.

### ***Environmental considerations***

**40%** of respondents did not consider the implications their toothbrushes had on the environment with some stating that there was no point due to the:

“minimal impact a toothbrush could have”

**10%** of respondents mentioned that they were unaware that there were sustainable alternatives to conventional toothbrushes.

**30%** of respondents said they would happily support an environmental toothbrush.

**46%** of respondents said they would buy and use sustainable toothbrushes as long as the quality and price was competitive compared to current toothbrushes.

Overall, it is sad to see the response that there is no point buying a sustainable toothbrush as it has a minimal impact. However, if everyone used a sustainable toothbrush the impact would be hugely increased. There is also a perception that sustainable products aren't as good as conventional ones.

### ***Survey four***

Survey four acknowledged the toothbrush market has become commoditised. Current competitors compete on features and form. There is potential opportunity to stand out by providing meaningful value through additional support and empowerment.

Currently toothbrush competitors appear to segment the market into three sections targeting, children, hoping that they will become lifelong customers, those with high disposable income, who can afford high tiered products, and everyone else.

Research in phase one and so far in phase two highlights the opportunity by targeting a customer group that is currently ignored by current competitors. We see this opportunity with the Nintendo Wii who targeted consumers who Sony and Xbox had ignored as they assumed gaming consoles only appealed to the hardcore gamers and not everyone else. We also see this effect when Lewis Road Creamery created high end flavoured milk in New Zealand and went on to redefine the flavoured milk industry. Both examples show the potential opportunity of providing a product that enables a previously ignored customer segment or industry.

In phase one we discussed the opportunity of targeting a tribe and provide a framework of support and empowerment of their shared similar identities, beliefs, aspirations and values.



The research conducted targeted University students who were between 18-25 to establish if a tribe was present or not. It is assumed current competitors do not focus on University students as they lack spendable income to upgrade to higher priced and more complicated cleaning routines. However, university students still buy toothbrushes, though the profit margin may not be as big by directly targeting them there is opportunity to capture a large market share. Other advantages include:

- Students are now in control of the purchasing decisions. Therefore, although the competitors may think they have built a long-term relationship with the consumer when they were a child there is an opportunity to replace their current provider and establish a new relationship with the student.
- Leaving home and being at University is a period where people are discovering and defining their identity making them easily influenced by companies that embody their values and their peers.
- Being at University is a time where mundane tasks are given little time as they come second to university, working and friends, so they are easily swayed by systems that make life easier, or faster.

Targeting students also means value propositions that go beyond feature or price are likely to have greater impact. The cost for this market segment is also a large motivator that can be addressed in unconventional solutions providing greater accessibility and support to them.

Survey four approached students while at university to ask about their morning rituals, lifestyle and anxieties around cleaning their teeth.

### ***Key Findings from survey four***

#### ***Students hectic lifestyle and cleaning their teeth***

With a student's busy day, attempting to balance, university, work, hobbies and socialising **90%** of respondents were unable to finish their days to-do list.

**75%** of respondents felt that they were always rushed for time.

**47%** of respondents said they frequently ran out of time to brush their teeth in the morning because it was typically the last thing they would do before leaving for university in the morning.

**45%** of respondents pointed out the importance of a consistent cleaning routine was yet were unable to keep a consistent cleaning routine however.

**37%** of respondents mentioned that they normally had to stop cleaning their teeth before the recommended two minutes as they had run out of time.

**32%** of respondents multitasked when brushing their teeth to save time.

These findings highlight how personal health such as cleaning teeth takes a back seat



in students everyday lives and the opportunity to provide students with a solution that makes cleaning easier or faster.

### ***Tooth brushing routine***

**60%** of respondents were unable to remember exactly how they brushed their teeth as they went on 'autopilot' (see figure 2.13).

**84%** of respondents believed they could be brushing more effectively but did not know how.

**53%** of respondents believed they frequently missed places when brushing their teeth.

**63%** of respondents used additional teeth and mouth cleaning products (**31%** flossed and **37%** used mouthwash) to provide a better overall clean

**79%** of respondents believed their teeth were clean when their teeth felt smooth.

**79%** of respondents saw tooth brushing as an activity that was neither dull nor fun but was instead a purely functional activity that had to be done.

Overall these findings provide great insight into a student's experience when cleaning teeth. Most go on auto-pilot which could reflect their neutral pleasure at cleaning teeth. Students also used feeling as a key indicator whether their toothbrush was cleaning effectively and whether their mouth was clean.



### ***What matter's most to a student?***

Students were then asked to rank following attributes out of four (four being very important and one being not important)

Quality of the overall clean was rated at **3.5**

How comfortable the toothbrush felt was rated at a **3**

How enjoyable the task of cleaning teeth was rated at **1.89**

Overall by comparing the importance of enjoyment while cleaning teeth and the enjoyment usually felt when cleaning teeth that enjoyment is an odd factor for students to consider as was found to throw off many students when asked. Is enjoyment such an odd feeling to have when cleaning teeth that students struggle to imagine it? If SUPER was able to explore this factor more insights on the importance of fun and the overall experience could provide key insights while developing and testing its toothbrush.

### **Brief summary of Product Research:**

There appears to be a disconnect between:

**1-** What makes a toothbrush effective and what competitors actually offer.

Competitors find it easier to appeal to consumers through new features and aesthetics even if they don't provide a more effective clean. Because educating consumers is harder than creating new visuals, consumers do not know what makes an effective toothbrush and therefore unknowingly buy toothbrushes that look good but may not provide a better clean.

**2-** What materials are perceived by society and competitors to be sustainable compared to the materials that can actually supply a sustainable system.

Sustainable toothbrushes are mistakenly thought to be better for the environment. Though bamboo creates less damage in the environment it is disposed in, it encourages poor treatment of the landscape it was gathered from, difficult to manufacture with, takes a long time to bio-degrade and is unable to be recycled and reused in a new product. Plastic on the other hand is the best sustainable material but is seen as the environmental monster as it is let down by the linear material systems society uses for waste-material and current product development mindsets.

**3-** What companies assume customers are wanting compared to what customers are actually wanting and concerned about.

Current toothbrush offerings advertise sustainability or new features that provide a more 'effective' clean. However, University students seem to be more concerned with

more simple and personal issues such as their worries around using poor technique and routine.

Additionally, University students are in a period of their life where they are wanting to define their identity by buying products and using brands that embody their values and aspirations. However, current toothbrushes appear to not fully utilise this opportunity.





## Discussion

The findings from phase two helped guide the development process and highlight key areas to consider. Below the findings are consolidated and their implications considered

### **New Zealand's poor recycling system**

New Zealand has limited recycling capability meaning that most plastics are being sold to off-shore buyers, resulting in just the collection of materials that are both in high demand and have high volumes.

### **The advantage of products being New Zealand-owned**

Reviewing existing research showed that New Zealanders see New Zealand-owned products as more trustworthy.

### **The advantage of going against the grain**

Reviewing existing research showed that New Zealanders favour brands and products that try new alternative solutions.

### **Similar product offerings**

Reviewing existing market research showed that competitors are focused on differentiating by price and features, which creates four differences in current products available:

- Cost
- Overall mouth clean by using assistant products (e.g. mouthwash)
- Specific oral needs (e.g. sensitive teeth)
- Convenience (higher tiered products for a better clean)

There also appeared to be a strong focus on children as they provide competitors the opportunity to gain a long-term customer as well as customers who have spendable income and can be up-sold to a pricier toothbrush.

These product offerings all focus on consumers that have spendable income or those that will provide long-term gain and leaves a huge section of the consumer market (those who are not interested in complicating their oral cleaning routine or moving up to higher priced alternatives).

### **Commoditisation and unsustainability of the toothbrush market**

A heavy focus on developing product offerings based on features and prices have



caused most competitors and their products offerings to be similar. Other focuses could be on supporting the customer to clean their teeth more consistently and effectively for example.

With so much similarity between competitors an unsustainable feature cycle has arisen which drives the creation, normalisation and saturation of features and innovations. To outdo each other, competitors have saturated both low and high tiers of the toothbrush product range with similar features. This causes a price war as they fight for competitive advantage.

With a lack of difference and new innovations, the toothbrush market appears to have matured and stagnated.

### **Potential disadvantage of selling through supermarkets**

Supermarkets are saturated with products, with so much competition and the need to stand out, a focus on features and price is created.

### **Alternate business models**

#### ***Circular economy***

Provides a sustainable approach to using plastics, however it requires effort from customers to work correctly.

#### ***Subscription model***

Provides a distribution channel that stays away from the feature and price war that supermarkets create. It also potentially makes lives easier for the target customer.

### **Environmental considerations**

#### ***Plastic***

Plastic turns out to be one of the most sustainable materials currently on the market, if the right processes are used to ensure collection, recycling and reuse.

#### ***Bamboo***

Bamboo may have a better carbon footprint than plastic, but can only be used once, and takes a long time to bio-degrade due to its fibrous material composition.

Bamboo is limited with how it can be manufactured, reducing the overall form and freedom of the product.

### **Current manufacturing processes**

Materials that are injection-moulded together are unable to be separated and recycled.



## **Multi-material products**

Products manufactured by injection moulding different materials together are not recycled as the cost of separating them is more than the materials can be worth.

## **Implications for Toothbrush design**

### ***Nylon***

Reviewing material attributes showed that nylon is currently the only unreplaceable material within a toothbrush due to its unmatched strength and softness.

## **Expert interviews**

Talking to dentists about toothbrush features revealed that:

### ***Small toothbrush head***

A small toothbrush head allows for more effective clean.

### ***Soft bristles***

Soft bristles provide a better clean as they do not damage gums, and they get in between the gum and tooth line where plaque usually builds up.

### ***Cylindrical handle***

Reviewing existing research indicated that cylindrical toothbrush handles allows for easier and more comfortable gripping when cleaning the mouth.

### ***Importance of brushing technique and a consistent brushing routine***

Reviewing existing research and talking to dentists proved that the key to effective tooth brushing is technique, not just the toothbrush itself, while a consistent routine ensures plaque cannot build up and harden.

## **Overarching customer needs – Supporting a customer's lifestyle and identity**

Research showed how customers are continuously looking for products that empower their identity and support their lifestyles and could apply to the toothbrush market.

### ***Tribe findings***

Talking to students showed that:

#### ***Poor technique***

They typically go on auto-pilot when brushing their teeth, they believe they not only miss places but could do better when they brush.

#### ***Poor routine***

Their busy lives cause them to have inconsistent brushing routines as they do not brush for long enough or do not brush at all.



### ***Compensating behaviours***

They are not getting an effective clean from their toothbrush, as they believe they are missing places, which sometimes causes them to use additional products such as chewing gum and floss.

### ***Neutral experience when brushing teeth***

They typically see tooth-brushing as a purely functional task and neither enjoy nor dislike it but rather see it as something that needs to be done.

Lack of indifference to a more enjoyable experience

They are unable to see the point in a more enjoyable tooth-brushing experience.

## **Consolidation of findings**

The above findings can be grouped into three sections for use in further development of a sustainable toothbrush in the New Zealand market:

### ***Market Validation and development***

#### ***Current state of the toothbrush market***

The market lacks variation and focus, creating commoditization and generalised product offerings with no real meaningful value propositions or support towards the customer's identity and lifestyle.

#### ***Broad and ignored customer segments***

With a key focus on customers with a high disposable income and children, 'everyone else with a mouth' appears to be put into one overarching customer segment and given less attention.

#### ***Customer segment findings***

Students who are a part of this overarching customer segment are not supported in their needs, including potential anxiety of poor brushing technique and routine. Their busy lifestyle causes them to either forget or do not have enough time to brush their teeth.

### ***Implications for Product validation and development***

#### ***Current product offerings***

Toothbrush development appears to focus on features and price to appeal to customers rather than designed to provide an effective clean.

Current sustainable toothbrushes are not a truly sustainable solution.

#### ***Providing additional support***

There needs to be more support towards a customer's brushing technique and consistent routine.

Toothbrushes ideally need to be constructed using one material for simple recycling.

### ***Material consideration***

Nylon is the critical material, yet it is not collected in enough volume to be purchased by recyclers and recycled into new products.

### ***Design specifications***

Small head, soft bristles and a cylindrical handle provide the necessary features for an effective clean.

### ***Implications for Business model design***

#### ***Need for a new value proposition***

With the saturation of similar brands and products throughout the price tiers, it would be irrational to provide a toothbrush with additional features. Instead competitive advantage needs to be need to be created in other ways. These could include:

#### ***Circular economy***

With New Zealand's poor recycling system, the need for nylon to be used for the bristles requires a system which ensures the adequate collection and reuse of it.

#### ***Subscription model***

A subscription model cuts out competitors, while making it easier to provide customers with a sustainable option and a potential method of getting the used toothbrush back. A subscription model is potentially the easiest method to address a circular economy and the product offering saturation found in supermarkets.



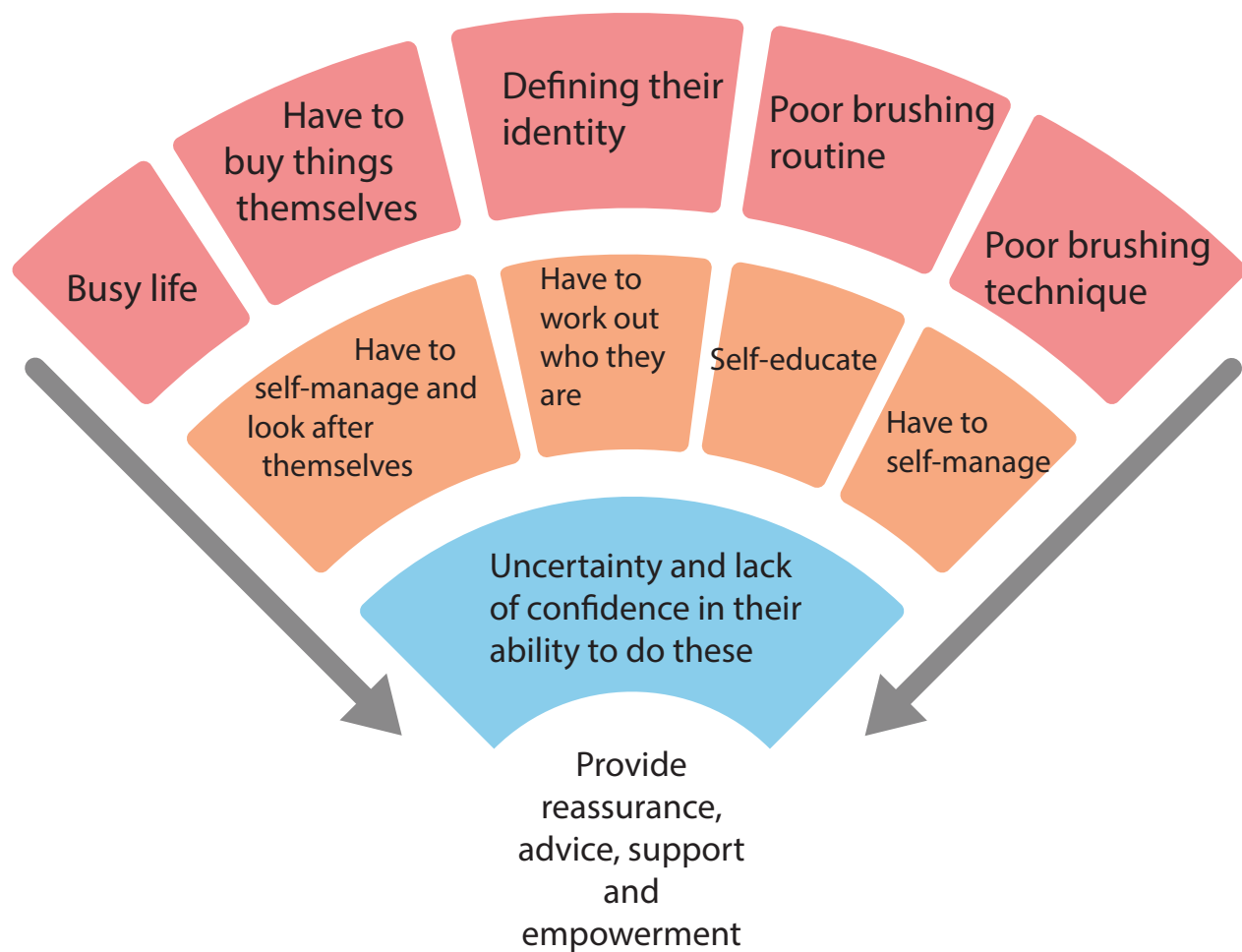
## Application of findings to Concept development

### **Tribe insight**

University students, especially those in their first year face many challenges. They must learn to manage and balance their life around university, work, socialising, fitness and hobbies, down-time and sleep. They must also start buying all the products that their parents would typically buy for them. When it comes to toothbrushes, university students are provided with hundreds of options, not only are they unsure on all the features, they also worry about the extreme cost of toothbrushes. Most importantly university students are worried about:

- Defining their identity with only generic toothbrushes to choose between.
- Poor brushing routine as university students have inconsistent daily routines and while trying to balance all facets of their life can run out of time or forget to brush their teeth.
- Poor brushing techniques as University students aren't sure what are the most effective brushing techniques or whether they are even cleaning correctly.

University students do not help their worries by using compensating behaviour and going on auto-pilot while brushing as they find the task unstimulating and unenjoyable. When we want things, we get worried that we won't get them, this exists with our most basic want is to be accepted. We want to be recognised as an individual, respected and to be a part of something. All the worries or problems mentioned above all orbit and centralise around this core need. In figure 3.0 we see how their problems are related to their worries which in turn is connected to their need and the solution of providing them support, advice and empowerment. Student's have so much to worry about, buying and regularly brushing their teeth with effective techniques are the least of their concern. Student's may worry about brushing as they understand that they must now look after themselves or need to look good amongst their peers; but all they really want is to not have to stress, feel that they are doing well and feel accepted. A student in their first year at university especially can feel unsure and vulnerable. Any reassurance, advice, ease, support and empowerment SUPER can provide to them will be extremely beneficial. Students also want to create their own identity, SUPER can help with that to.



**Figure 3.0 - Customer problems, their worries and what they really need**

### **Product concept**

Nylon is currently the only materials that is durable and soft enough to provide effective and comfortable clean over a long period of time. However, nylon cannot be collected in New Zealand at the low volume it is produced at. The concept that is starting to form is a subscription service that doubles as a circular economy business model, customers receive a new toothbrush in the mail, the customer then puts their old toothbrush in the envelope to send it away back to SUPER who collects it and gets it recycled. The envelope itself inside could have visual diagrams on it explaining how to effectively brush your teeth empowering the customer with this knowledge reducing anxiety (see figure 3.1).

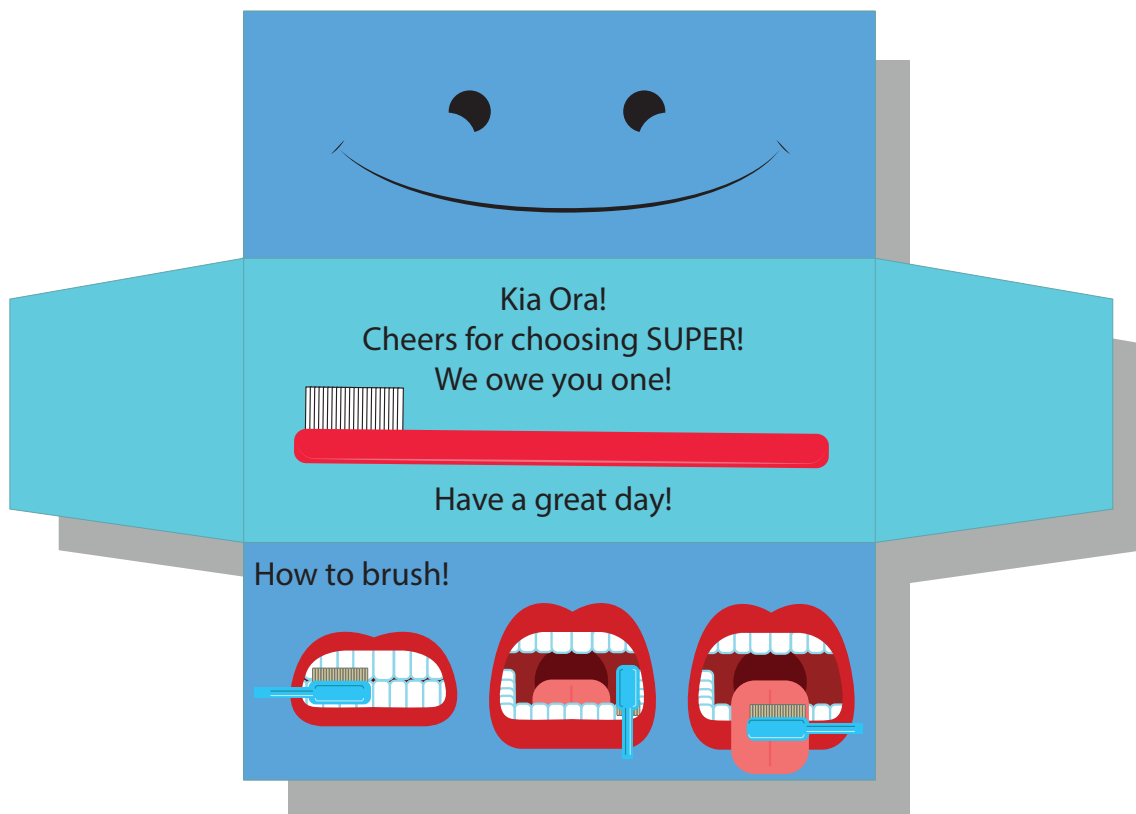


Figure 3.1 - Envelope concept with how to diagrams

### Business model concept

The insights from this research indicate a business model and sustainable toothbrush very different from current competitors in the toothbrush market. Findings lean towards a subscription service where customers are posted new toothbrushes. The envelopes used to send the customer their toothbrush can also be used as a circular economy or cyclical material strategy by inserting the old toothbrushes and sending them back (see figure 3.2). However, these findings should be seen as a snapshot (Maurya, 2010) of the current market landscape and could become outdated within the next year. This business model concept could be what initiates and accelerates change because it solves the nylon bristle issue all sustainable toothbrushes face as the nylon is unable to be collected and therefore must be thrown out. Sending the old and used toothbrush back allows for a toothbrushes nylon bristles to be recollected, recycled and reused. Haythorthwaite briefly hypothesised the idea of a future sustainable toothbrush, he started by saying that toothbrushes are only the current way of brushing teeth, this is not a fixed solution and may be very different in the future (P. Haythorthwaite, Personal communication). Clearly this vague concept requires further development and discussion to some of the further implications created by the findings and other similar products and past research.

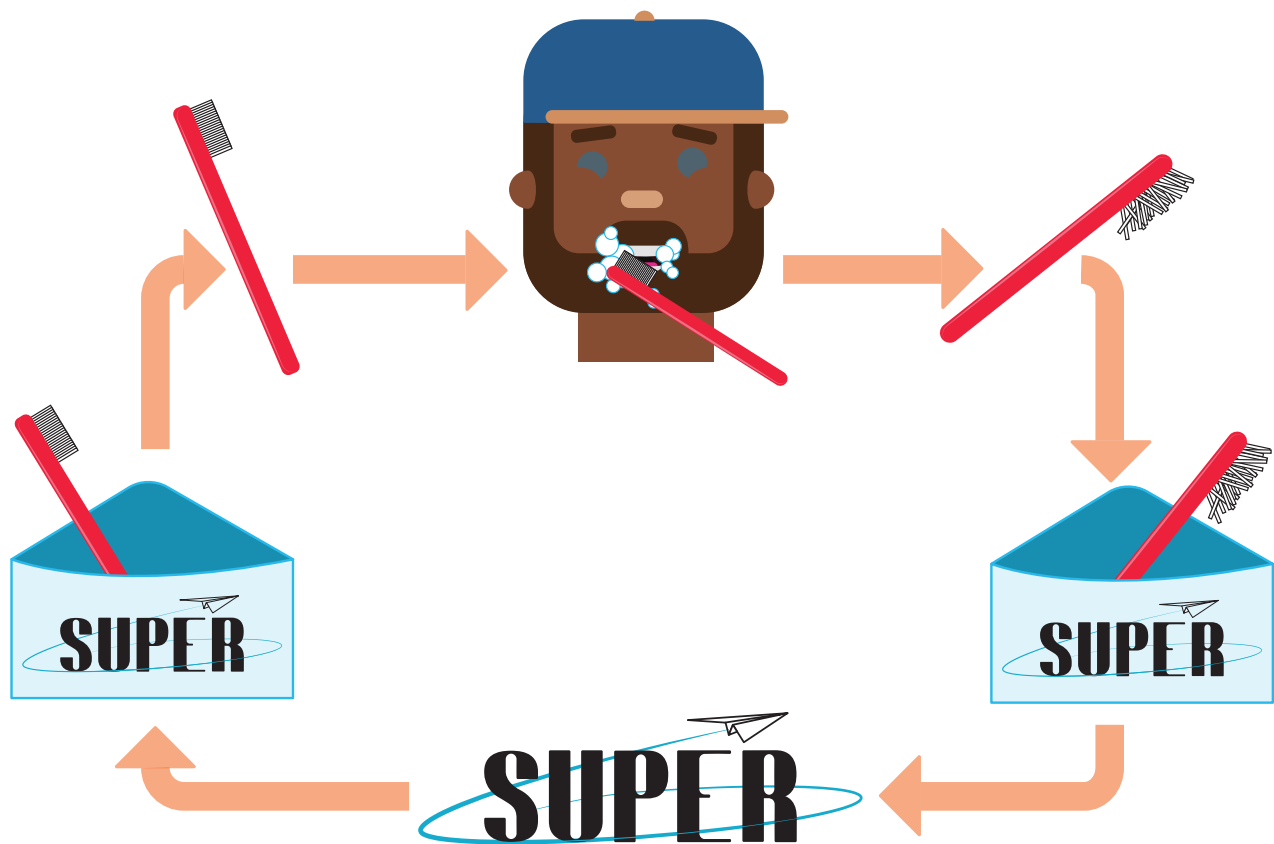


Figure 3.2 - Subscription service and takeback program hybrid business model

## Applying findings to SUPER

### Market validation and development

Further support and empowerment of the customer's lifestyle and identity are needed, as though the subscription model adds value, it is not original. There is also no possible way for SUPER to have an in-depth relationship with its customers.

### Providing Identity

Identity can be created empowered by making the envelope personalised such as having the customer's name inside of it or featuring a personalised greeting (see figure 3.3).

The circular economy concept requires the customer to send back their used toothbrush to work. Therefore, motivation needs to be increased to send the toothbrush back by radically decreasing the effort required so it feels effortless. This can be achieved by cutting down the steps currently required, resulting in an increase in motivation (Hauptly, 2007 & Fogg, 2013).

Firstly, by making the envelope pre-paid all a customer must do is put the envelope with the used toothbrush in a post-box and it will find its way back to SUPER (see figure 3.4).



Figure 3.3 - Envelope personalisation

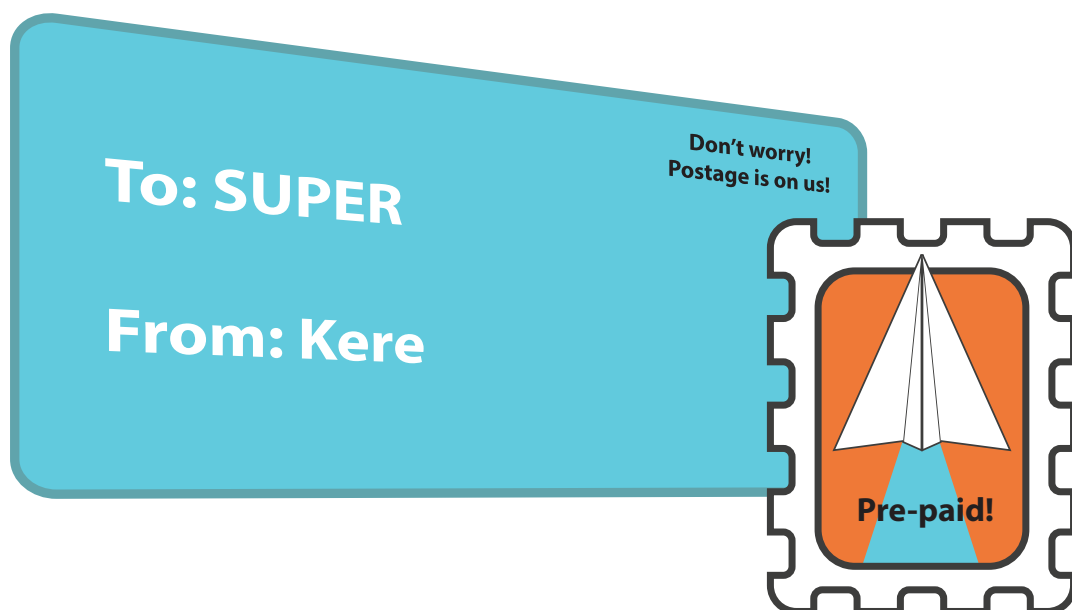


Figure 3.4 - Prepaid envelope



Secondly, a point system could be initiated, this gamifies the effort. By sending back the toothbrush, the user gains points which adds a sense of fun and competition to the mix. Points could be used to level-up and allow for the customer to get variable rewards (Eyal, 2014) increasing their motivation to return their used toothbrushes. Acknowledgment of their continued effort with awards and perks can provide a sense of identity for the customer as they are being rewarded for their actions (see figure 3.5).

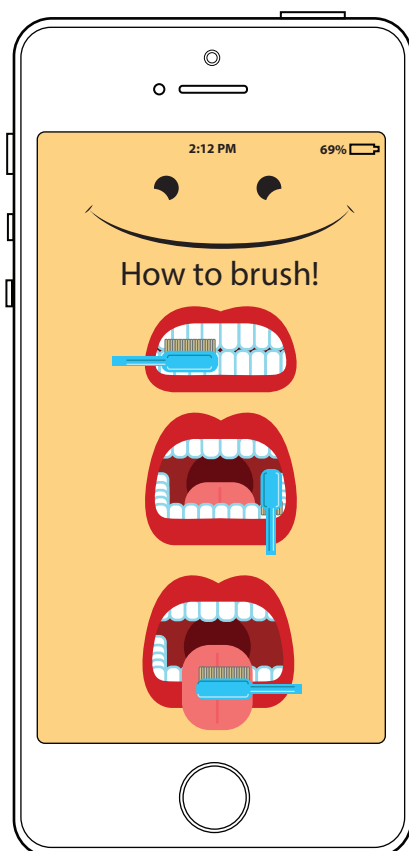


Figure 3.5 - Level-up and point system

### ***Support***

Though there will be plenty of encouragement currently to read what is on the envelope of how to brush one's teeth, it was speculated that there will be no support for the customer in how to effectively brush their teeth, once they had sent their envelope back. It was also feared that these simple, but clear diagrams, would not provide enough support to reduce their concern of not brushing effectively by ensuring the customer that they were brushing effectively. The current concept also did nothing to promote a consistent tooth-brushing routine.

The proposed solution is a tooth-brushing assistant app, which provides both a reminder to brush one's teeth in the morning and at night and provides videos and further diagrams about how to brush one's teeth effectively (see figure 3.6).



**Figure 3.6 - How to brush app**



**Figure 3.7- Timer**

A key issue identified in the research (refer to survey four) was how students went on autopilot when cleaning their teeth, and therefore could not remember specifically how they cleaned their teeth. By providing a timer on the app a brush, an alarm will go off every 30 seconds to alert the brusher to go to a new part of the mouth and keep them aware while they are brushing (see figure 3.7).

There is a concern that the app would not be used by most customers and therefore its attempt to create a consistent brushing routine and an effective brushing technique would be hindered. Encouraging the use of the app by advertising it on the envelope, and providing a QR code easier downloading and log in could increase motivation to use it. To promote consistent use the app could be integrated into the level-up point system, with continual use, customers are given more points. The app could also record their personal stats and provide information on their brushing routines etc. Extra data like this builds on the relationship that a customer has with the brand. Most importantly by gamifying and rewarding a consistent brushing routine we can imbed a healthy teeth cleaning routine into student’s lives. Additional support could be supplied through the potential variable rewards given such as discounts at dentists etc.

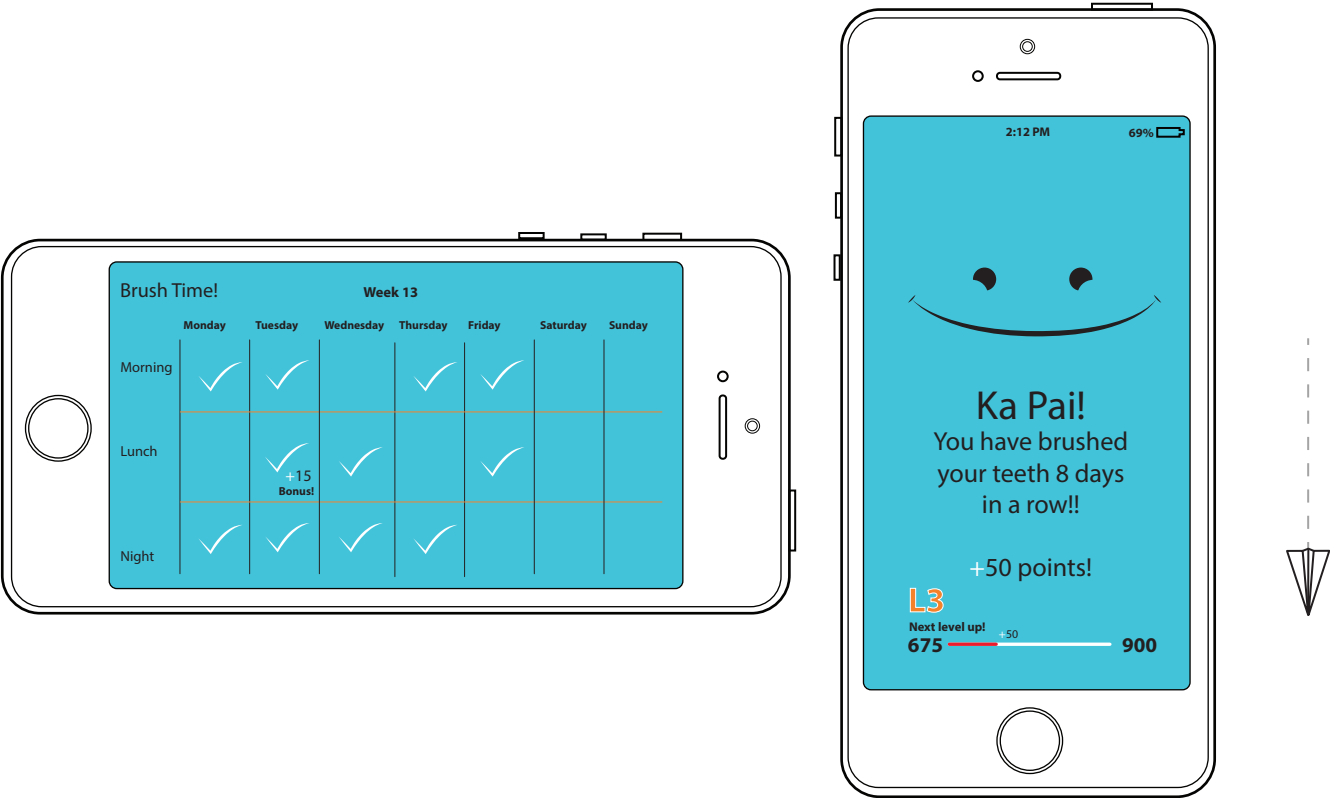


Figure 3.8- Rewarding a consistent brushing routine

**Product validations and development**

The current concept of the toothbrush is a nylon head with an aluminium handle which will be kept by the customer. The reasoning is that with a detachable head and the higher volume of nylon used will allow for easier collection. The handle is cylindrical for better comfort and manoeuvrability (Quip, 2016), it has a small head allowing for an easier clean of hard-to-reach places, and soft bristles to allow the areas between teeth and gums to be cleaned without causing damage (see figure 3.9). A tongue cleaner (see

figure 3.10), in addition to a variation of colours (see figure 3.11), will be provided to meet the expected needs of customers (refer to survey one & two).

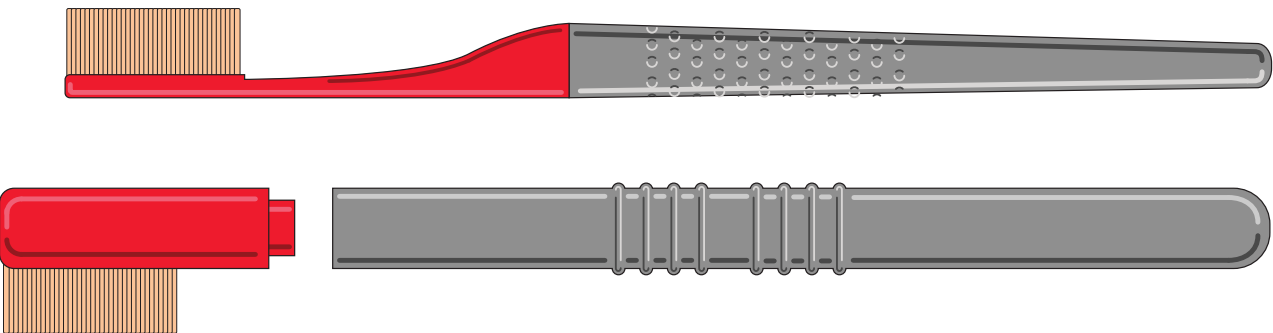


Figure 3.9 - Detachable head concept

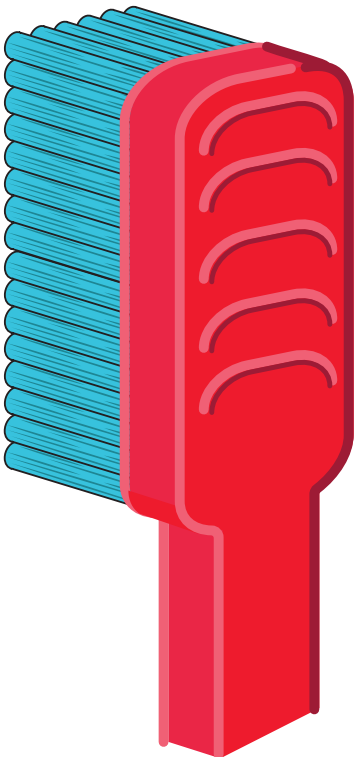


Figure 3.10 - Tongue cleaner

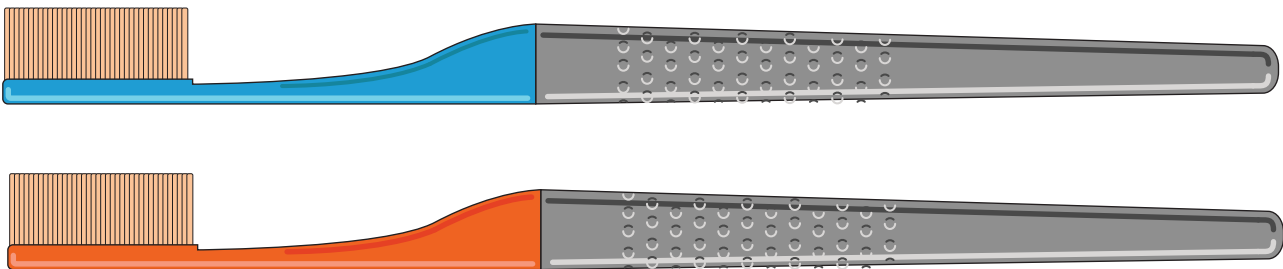
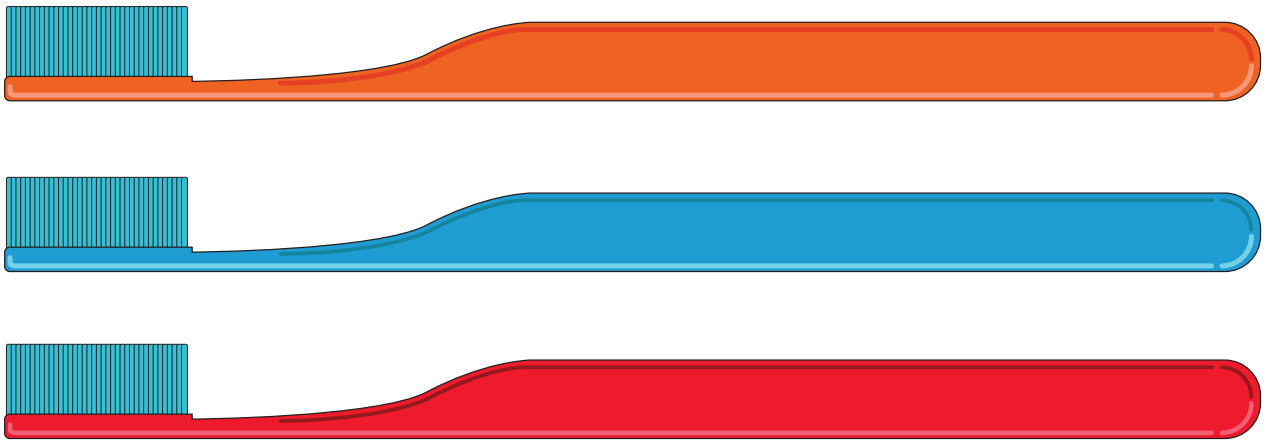


Figure 3.11 - Variation of colours

### ***Multi-material***

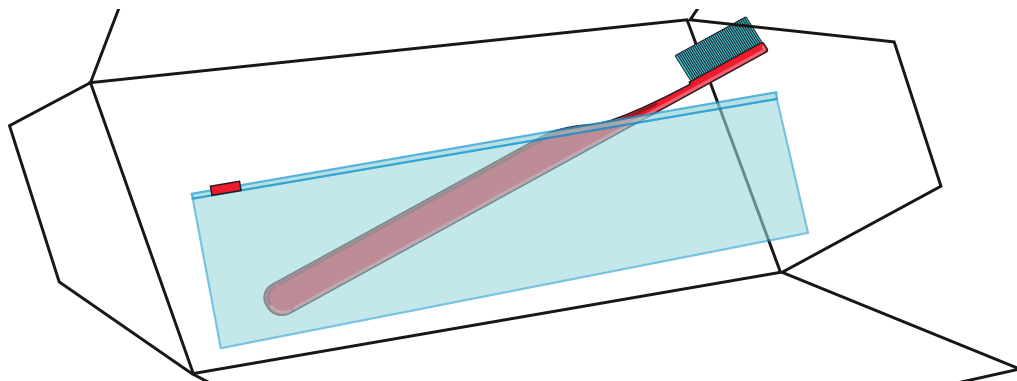
Many implications arose due to the aluminium and nylon material combo, though aluminium could be easily recycled and the nylon recollected for recycling. For example, if the handle is lost, how does a customer get a new one? If the customer gets a new handle to replace an old one, can SUPER guarantee that it will be recycled? With many uncertainties, it is proposed that the aluminium should be removed altogether and replaced with an entirely nylon-made toothbrush. This makes for simple, easy, cheap and guaranteed recycling due to using a singular material (see figure 3.12).



**Figure 3.12 - 100% Nylon toothbrush concept**

### ***Envelope design considerations***

There is intense pressure for the envelope to work as intended, as it is the primary touch point between customer and SUPER. The envelope must be specially designed to display important information, such as diagrams, The customers current point rating etc. Another implication was what if the customer sends their used toothbrush back and is still moist from the last use. This unhygienic and damp environment could damage the envelope. An additional resealable and reusable envelope could be used within the personalised and recyclable envelope to alleviate this issue (see figures 3.13 & 3.14).



**Figure 3.13 - Dampness proof concept**



Figure 3.14 - Current envelope concept

## Business model design

### *Customer growth*

Currently, this potential product is targeted at university students, most of which have busy lives. However, this lifestyle is not just shared by university students, but potentially everyone who is rushed in the morning or have poor brushing technique and routine. This notion allows for huge growth by targeting customers who are also caught up in a busy lifestyle.

### *Recycling process*

With no nylon recycling facilities in New Zealand and the ability to send the little material we have of nylon overseas unviable, the only visible solution currently is for SUPER to either fabricate or purchase its own recycling machine. This would require the purchase of:

**Size reduction machines** – Cuts down nylon into smaller pieces for further processing.

**Washing equipment** – Removes the nylon of bacteria and dirt.

**Pelletizing machines** – Turns the pieces of nylon into pellets allowing for later

use in an injection moulding machine (ThomasNet, 2017). These pellets could be then shipped to a 3rd party injection moulding machine, unless SUPER purchases its own one so all recycling and reuse processes are done in-house.

### ***Cost implications and viability***

Cost implications are considerable, as initial investment would require a particular volume of nylon to be purchased, an injection mould to be designed and purchased, and the equipment needed for shredding, cleaning and pelletising of the collected nylon.

It also needs to be understood that at any one time, at least half of the materials will be at SUPER, the rest will be in the hands of customers or in transit. Development costs will also need to be understood including the design and testing of the toothbrush and app, however, as most of the work done will be in-house, cost could potentially be kept low.

Another implication is the amount of time these machines and equipment will be unused because SUPER would only send toothbrushes out monthly, it is assumed the machines would only need to be used in the last week of the month because toothbrushes are only sent out at the end of each month, essentially leaving the equipment idle for the other weeks. This could be solved as SUPER designs more products utilising the hybrid business model of a circular economy and a subscription service. SUPER could also encourage other companies to take on this business model by recycling their used products, for additional income. The overall cost of the equipment and set-up of it can be split over other products and businesses, it is still a considerable barrier for initial start-up of this kind of business model.

Another issue that needs to be considered is the cost of a toothbrush. Surveys (refer to survey one & two) showed a preference of \$3, but did not show how often they purchase toothbrush. The \$3 cost would need to cover equipment costs, postage, manufacturing, electricity, recycling and rent etc.

Compare to previous research and similar products

Contrasting the current concept development with implications from research and current toothbrush offerings, further insight is provided into the feasibility and development of the toothbrush concept.

### **How previous research influence concept development**

#### ***Compromising for the environment***

Previous research indicated the increased environmental awareness, yet decreasing sales of sustainable products (Townsend & Niemtzow, 2015). This decrease in sales was



blamed on customers' unwillingness to compromise on their overall experience for the environment (IISD, 2013 & StopPress, 2010, & Sherin, 2013, see also Ryan & Lowry, 2011). This thesis sides with the research which criticises the blame which is put on customers, saying that it is unfair to make customers compromise (Christopher, 1992, p. 40) and that instead the effort required by customers to buy and use sustainable products should be decreased (Stevens, 2016 & McCullough, 2014). These needs were addressed by the addition of a prepaid envelope and a point system, which gamifies the circular economy, by adding a sense of fun and increasing motivation.

### ***Support and empowerment of one's identity, and lifestyle***

Research showed the importance of supporting and empowering the customer, as the relationship between customer and company is a partnership, each supporting the other (Neumeier, 2016, p. 129). This support was addressed by developing multiple touch points such as the app to encourage better brushing techniques and routine, as well as providing customers with a sense of identity, due to the personalisation of the envelope.

### ***Feedback loop***

Acknowledging the importance of understanding the customer, and that their needs and desires are continuously changing, requires a continuous feedback loop between SUPER and the customer (Cagel & Vogel, 2002, p.206 & Maurya, 2010, xxiii). In response, the concept has been further developed so that both the envelope and App have areas to place feedback which earns further points, this reinforces the customer's sense of empowerment as they see themselves as an important piece to SUPER's development. Surveys supplied through the app for further understanding on key points.

Another addition could be using the app and envelope to sign customers up to test-betas of new products for user testing (see figure 3.15).

### ***"Onlyness"***

Research showed the importance of onlyness (Neumeier, 2016, p.58), by providing a radically unique and tailored experience a new entrant could stand out from the crowd. SUPER's concept has 'onlyness' it provides an unmatched amount of support and identity to its customers within a heavily commoditised market.





### Compare to key competitors

**Colgate**

Colgate is the world's leading toothbrush brand with the biggest share and an image that has become synonymous with oral care, which has been through Colgate's extensive and pervasive marketing campaigns, which has included promoting community support and targeting young children (Euromonitor International, 2016 & Morgan, 2015).

However, in terms of sustainable development, Colgate has followed an eco-efficiency mindset, by reducing materials and increasing the amount of recycled material used in its products (Mohan, 2014 & MacKerron, 2014). Using recycled materials in products that cannot be properly recycled again, does nothing for the long-term or underlying issues of material use however.

Colgate's use of recycled materials to make 50% of its products (Mohan, 2014 & MacKerron, 2014) and its partnership with Terracycle to recycle its unrecyclable multi-material products (Colgate, 2015) miss the mark for a sustainable development; recycled material are unable to be recycled again due as they are infused with other materials, while the recycling programme in partnership with Terracycle melts different plastics together creating a hybrid and lesser quality material.

The proposed concept, on the other hand, uses a singular material and a prepaid subscription service to allow for 100% of the material to be recycled repeatedly.

### ***Freshbrush***

There is concern that the proposed toothbrush subscription model will be likened to Freshbrush, and that their toothbrush will be seen as the true sustainable toothbrush as it is made of bamboo.

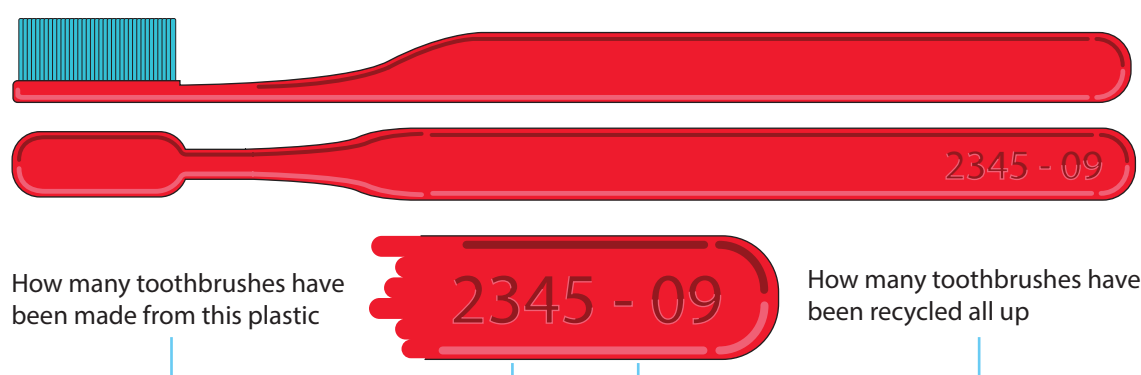
To change this preconceived idea of what is sustainable, mass education to target markets will be needed on the benefits of a subscription model and a circular economy and why plastic is best when the processes are correctly set-up and used.

Freshbrush yearly subscription fee is \$25 for a toothbrush every two months and \$40 for every month. This results in a toothbrush costing between \$3.13 and \$4.16 each (FreshBrush, 2017). However, when it is paid up front, students who are price-sensitive may be discouraged to sign up to Freshbrush. SUPER could offer a monthly payment system, motivating students to subscribe.

### ***Preserve***

While Preserve offers a reward system for sending in used toothbrushes (Preserve, 2014) it does not guarantee the return of these toothbrushes. The proposed concept addresses this by removing the steps needed to send the toothbrush back and further motivates the customer by creating a point system. However, there was concern that toothbrushes may still be thrown out in some circumstances. A solution is to create a process which numbers each toothbrush sent out so data can be collected on what is leaving and coming back again. This data could show which customers are failing to send back their used toothbrushes, they can then be contacted to address the issue allowing for further development and improvement of a guaranteed circular waste free business.

If a number was stamped on the back of each toothbrush, customers could understand how many times the toothbrush materials have been recycled, adding to their overall experience of a circular economy (see figure 3.16).



**Figure 3.16 - Serial number tracking**

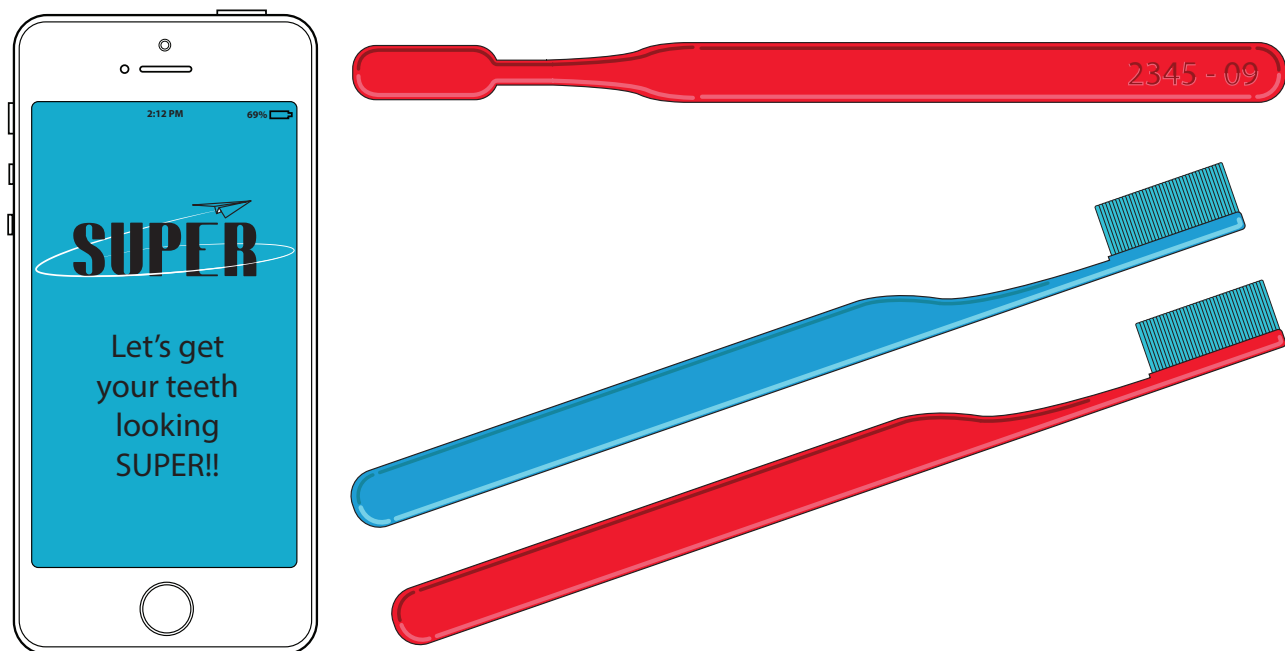


Figure 3.17 - Final initial concept

## Evidence-based reflection on the feasibility of a new toothbrush product

Assessment of the development of the conceptual toothbrush in response to the findings, current competitors and other researches and the implications they created shows that though opportunities far outnumber the barriers, the barriers are considerable.

### *Opportunities*

Opportunities	Evidence	Feasibility	Next steps required
Creates a waste free system	<ul style="list-style-type: none"> <li>- Circular economy</li> <li>- Subscription model</li> <li>- Point system</li> <li>- Prepaid envelope</li> </ul>	High – needs to be able guarantee that it is waste free however.	1.Small mock-up of system for testing  2.Test and assess system
Desirable sustainable toothbrush	<ul style="list-style-type: none"> <li>- Removes steps making it easier that most sustainable and current products</li> <li>- Offers more support than all current competitors</li> </ul>	High – needs to show that it is actually something customers would like	1.Customer testing  2.Customer feedback
Students as customer segment	Busy lives, anxious over their ability to clean their teeth	High – Toothbrush concept should provide enough support for students	1.Customer testing  2.Customer feedback
Disrupt competitors	<ul style="list-style-type: none"> <li>- Different payment mechanic that Freshbrush</li> <li>- More accessible than Gobamboo</li> <li>- Provides more support than all competitors</li> </ul>	High – Will require educating the customer segment before hand	1.Education campaigns  2.Customer testing  3.Customer feedback

**Table 3.0 - Oppurtunities**

## ***Barriers***

There are two clear barriers to the initial setup of the circular economy-integrated subscription business model, which focuses on supporting and empowering the customer which this research has generated.

### ***Initial setup investment***

For such a business model to work correctly, significant investment will be needed to initially purchase and set up the equipment needed, this cost will not be made off quickly with toothbrushes which sell for \$3 each. If this concept had 4000 subscribers like Freshbrush, this would equate to gross revenue of \$42,000 year minus expenses. This is not viable (refer to business case).

However, the more customers, the more market share, and the more profit, charging other companies to use this equipment could also supply additional revenue. If SUPER's intentions are to create their own product line encouraging the use of a circular economy, and zero waste values, the equipment would allow for just that with the initial costs being split up between new product lines. However, new materials will not have to be brought unless consumer demand goes up, as the materials are continuously recycled and reused.

### ***Customer perception***

There is cause for concern that customers will reject the support and empowerment which the concept provides as they are so unused to it, especially in a market which is commoditised and seen as purely functional.

However, companies such as Method (Kurtzjan, 2013), Lewis Road Creamery (Car, 2017) and Freshbrush have provided experiences that go against the grain of current business strategies and have been rewarded for it. These companies have proved that sometimes you just need to show customers what they have been missing out on even if they were unaware of it (Schwartz, p.3) by giving them new and radical value propositions.

Further concern is the current perception of what is 'sustainable' which is currently seen as bamboo. This will require intense and clear communication to educate consumers on the benefits which a circular economy and plastic allow for.



## **Summary of opportunities and barriers**

These barriers present a significant challenge to the creation of a circular economy toothbrush and makes it very easy to seemingly dismiss the feasibility and validity of the concept.

A calculated risk is needed to compare the risk of creating such a circular economy subscription business model and the consequences of not taking it (Rafinejad, 2007). There are still many design and system considerations that can only be really found and understood by prototyping and user-testing the product and hybrid business model. The concept is still in draft form but creates the opportunity for a waste-free society with smart products, materials and systems, that allow for a sustainable and desirable future.

### ***Possible wider implications of project:***

Setting the bar for all new products both sustainable or unsustainable

A product that proves it can be sustainable and successful has considerable power and influence over what should be expected from both sustainable and unsustainable products.

#### ***Supermarket decline***

If subscription business models are the way of the future, supermarkets could see decline in sales. In response, they may start delivering the subscription products as they already deliver goods from their stores.

#### ***Material purchasing decline***

If materials are continuously being reused by businesses, material purchasing will decrease putting significant pressure on those who make these materials. A decrease in demand could cause material prices to rise as material manufacturers need to make up for the decrease in materials. Another possibility is that material manufacturers create a service where businesses rent materials off them rather than buy allowing them to charge per use rather than in one payment.

#### ***Effect on customer***

Customers will feel more confident in their ability in cleaning and keeping a routine.

They will be more attentive while cleaning and hopefully find it more enjoyable.

Additionally, customers will bond better with their toothbrush brands as they will embody their personal identity and values more. Lastly, with sustainable behaviour being positively encouraged and effortless, customers may look for more sustainable alternatives for the products and services they use throughout their day.

### ***Shift of focus in value proposition***

If customers become more confident in their cleaning routine and technique as well as better educated in effective oral cleaning, companies may change their value propositions. Rather than offering value propositions such eye-catching visual attributes, encouraging higher-priced products and more complex cleaning routines, competitors may shift towards providing additional support and empowerment such as education.

### **Summary of discussion**

It is clear that the toothbrush and most importantly the business model that have been developed over the second phase of this thesis offers the unique opportunity for a sustainable future by ensuring used products are reused for the next wave of products. The toothbrush and business model clearly offer a unique value proposition over the competitors in the New Zealand toothbrush market. However, further research and development such as prototyping, customer testing and iteration is needed. The additional research and development needs to be approved and will provide better understanding on the appeal such a toothbrush and business model concept will have with students and other potential tribes. Insights learnt will help further develop these concepts and help fully understand the SWOTs of launching them.









**August 2017**

## **Internal Business case:**

A proposal for assessing the opportunity of a sustainable toothbrush concept and a cyclical subscription service business model.

**Status: For review**





## Executive summary

SUPER's vision and mission focuses on encouraging the growth of the sustainable product industry by setting the bar for what is expected from both sustainable and unsustainable products. SUPER acknowledges that society is in an awkward time where the need for sustainable development and products has never been higher yet there is resistance to sustainable products as they are not desirable to most customers. This business case proposes a sustainable toothbrush and a subscription and circular economy led business model that SUPER intends to develop. The intention is to have the sustainable toothbrush be SUPER's flagship product setting the bar for a new generation of sustainable products, while the business model intends to be the crucial framework to ensure all of SUPER's future products will remain waste-free.

Current products use multiple materials and manufacturing processes which stop their materials from being reused and instead build up in the landfilled. The solution is to stop and replace the linear material flow which sends reusable materials to the landfill. By ensuring that at the end of a product's lifecycle is recollected so its materials can be recycled a cyclical material system can be created reducing significant waste.

The business model and product show intense promise in their ability to be both sustainable for the environment and desirable for the customer. An issue with the proposed business model and toothbrush is that by themselves are not viable due to the initial set-up cost and the subscribers needed to break even. However, when used in tandem with future SUPER products or other companies' offerings, the initial equipment set-up cost needed could even out and allow for a profitable, desirable and sustainable business model and product offering.

The overall recommendation is to allow for further research, prototyping of both product and a small-scale subscription service to provide a better understanding of the opportunities, barriers and overall feasibility of such a business model and sustainable toothbrush.



## Introduction

This business case proposes the development and prototyping of a new sustainable toothbrush and waste free business model. This proposal is in response to society's unsustainable consumption and SUPER's passion to develop a sustainable future. This report makes a case for the opportunities that a cyclical material business model and toothbrush offer. This report covers both the wider and finer problems in the sustainable product industry in addition to New Zealand's toothbrush market landscape. The solution will then be presented including how it was developed in response to market and product research done in the encompassing thesis.

## The problem

### **Wider Environmental issues**

We live in a society with an unsustainable population growth rate, an economic system that is fuelled by unsustainable consumption and a linear material flow which sends reusable materials to the landfill. In 2011, 2.461 million tonnes of general waste was disposed into New Zealand landfills; equivalent to 560 kg per New Zealander (Ministry for the Environment, 2012). Additionally, it is estimated that for each tonne of product that reaches the consumer, 30 tonnes of waste are generated to manufacture it. To avoid certain environmental disaster, all current products and processes that create this present unsustainability need to be replaced with sustainable alternatives. However, sustainable solutions are often niche industries and markets, hold a poor societal opinion about them, and are typically not that much better for the environment than conventional products.

### **Environmental implications of the New Zealand toothbrush market**

Conventional manual toothbrushes are made from several thermoplastics allowing the materials in theory to be reused forever.

However, these materials are irreversibly fused together by injection moulding making them unable to be recycled, and are therefore thrown out. An alternate method is to recycle these plastics into a hybrid plastic, however the quality and reusability is decreased to a point that the plastic is unable to be reused again. 3.5 billion conventional manual toothbrushes are made annually, with an average weight of 30 grams, and a life expectancy of 3 – 4 months results in 91,000 tonnes of landfill every year.

## **Sustainable product overarching implications**

### ***Customer disinterest***

Most sustainable products are unable to compete with their unsustainable counterparts (McCullough, 2014). Research has shown that though customers are aware of the environmental situation, (Townsend & Niemtow, 2015) they are also unwilling to compromise in price and quality (McLennan, 2004, p.188) which sustainable products normally require. When it comes down to it customers will rarely pick the environment over their own satisfaction.

The objective then, is for sustainable products to be developed without their seemingly inherent flaws so that they can outcompete their unsustainable counterparts. Current sustainable toothbrushes are made of bamboo limiting their form, comfort and material reusability. Nylon bristles are also typically swapped out for more environmentally friendly materials which are rougher on the gum.

### ***False sustainability***

Most sustainable products are developed with the goal of minimising the materials used within them and therefore the environmental impact the product produces (Braungart, McDonough, & Bollinger, 2006). However, the development strategies used ignore how a products materials will be recycled and reused. Even with less material wastage, waste is still generated.

Sustainable toothbrushes are made of bamboo, which though unable to be reused is bio-degradable are not accepted at commercial composting facilities due to its fibrous structure (Wellington City Council, 2014). Bamboo must either then be composted at home which is not encouraged as it will take so long to break down (New Plymouth District Council, 2017) or be thrown out where it ends up in a landfill which does not provide enough air and microbes to break down organic material (Beaudry, 2016 & Biodegradable Products Institute, 2017).

The nylon bristles are encouraged to be pulled out and either thrown out as waste or recycled, however with such a small volume recycling is not guaranteed.

## **Proposed solution**

A customer signs up to SUPER's toothbrush subscription service where they receive a new toothbrush every two months. When a new toothbrush arrives, they put their old one into the resealable prepaid envelope and send it back to SUPER. SUPER can then recycle the toothbrush and reuse its nylon material to manufacture the next toothbrush.



## Proposed toothbrush

The entirety of the toothbrush is made from nylon as it is the one materials that is irreplaceable in the design of the toothbrush, this allows for easy recycling of the entire toothbrush as its materials do not need to be separated beforehand.

The toothbrush has a cylindrical handle to provide a comfortable grip no matter how the customer holds it as they clean their teeth. A small head allows the bristles to get into areas that other toothbrushes are unable to. Soft bristles ensure plaque which can grow between the teeth and in the gum line is effectively removed without damaging gums.

The toothbrush has a unique code indented into it, allowing SUPER to keep track of toothbrushes that go out or in. Tracking individual toothbrushes does two things:

- 1- Ensures all toothbrushes are sent back to SUPER guaranteeing a waste free product and business model.
- 2- Allows the customer to see how many times the material has been reused adding a sense of accomplishment.

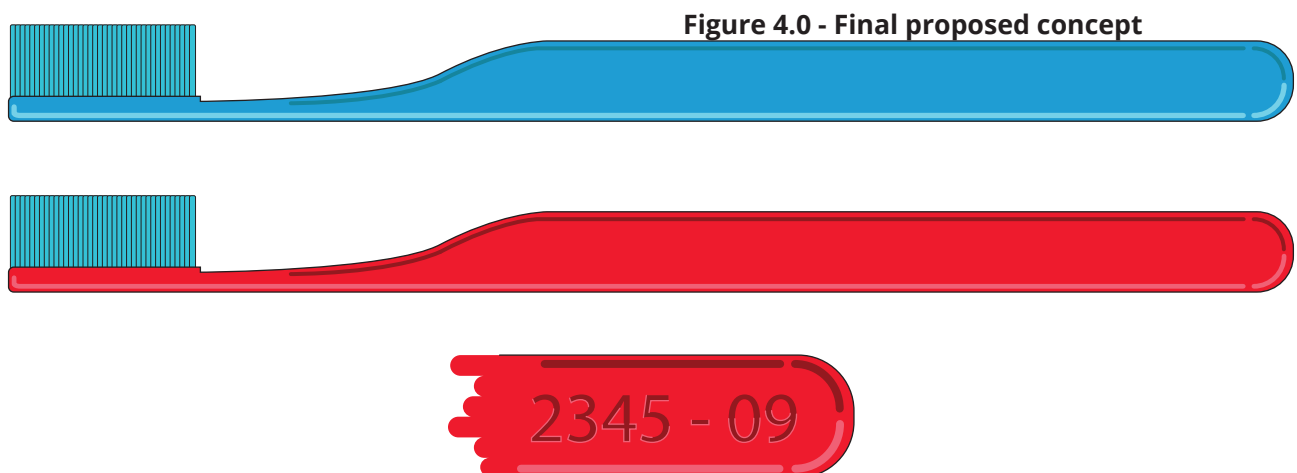


Figure 4.0 - Proposed concept: Toothbrush

## The envelope

The toothbrush is the key touchpoint between the customer and SUPER. The envelope is unique to the customer as it records their history with SUPER displaying how many toothbrushes they have returned, their points and the materials they have saved from going to the landfill etc.

The envelope also contains clear instructions on effective brushing techniques along with an area that encourages feedback. These features support and empower the customers sense of self-worth, ability at brushing, strengthening the bond between

them and SUPER.

Then envelope provides the customer with an easy and waste-free way to get rid of their used toothbrush, by having the envelope reusable, sealable and prepaid, all the customer must do is put the used toothbrush in the envelope and put the envelope in a post-box. The toothbrush is then sent back to SUPER for allowing the nylon to be reused, making it a zero-waste product.



Figure 4.1 - Proposed concept: envelope

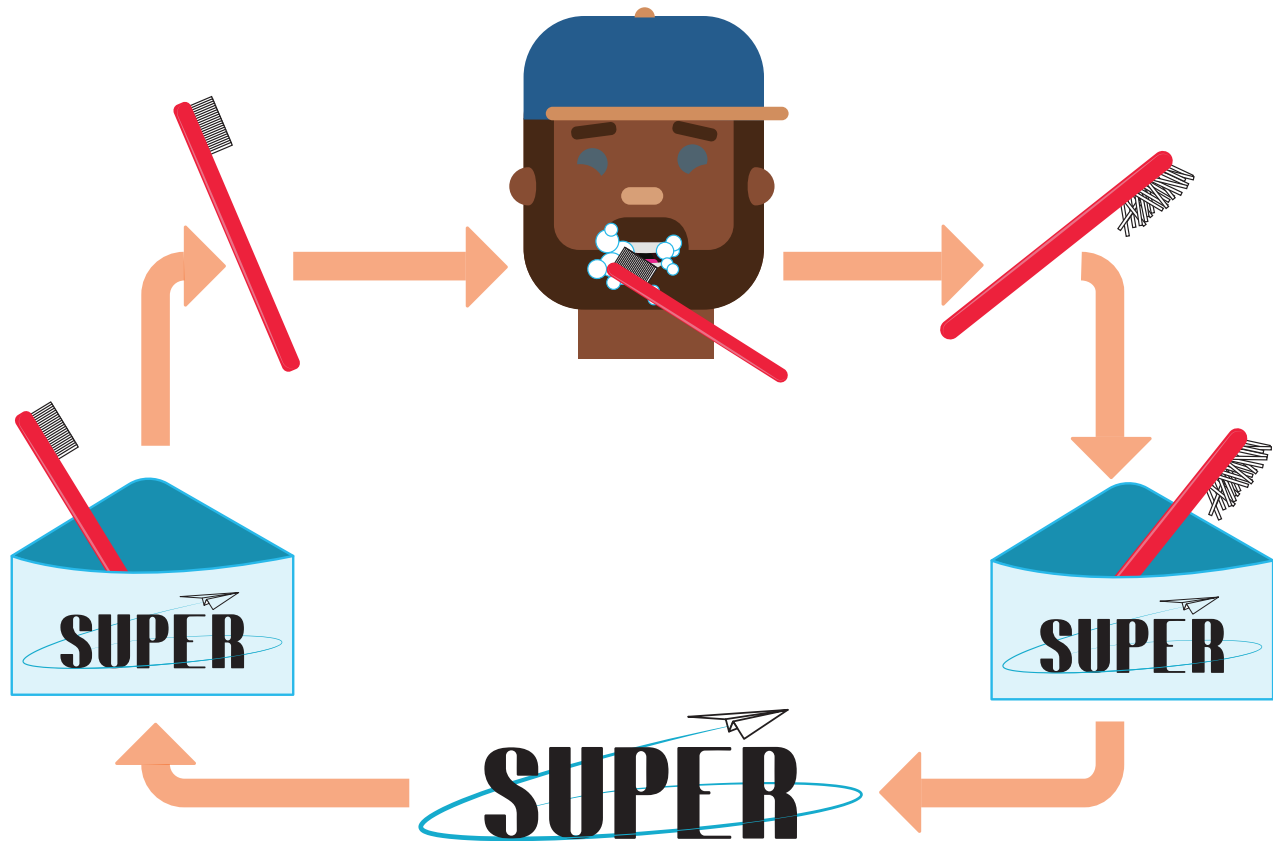
### *The circular economy/subscription service hybrid business model*

Hacking a subscription service and adapting it as a circular economy strategy allows for an effective take-back system. The customer is an integral part of the cyclical material strategy as the customer, therefore the customer needs to find it effortless, motivating and enjoyable for the strategy to work correctly. Techniques have been added to encourage and motivate the customer to send back their used toothbrush with:

- A prepaid envelope,
- Individual stats and a point system which rewards them when they do.

Counter-measures have also been put in place which are able to notify SUPER if toothbrushes are not sent back and who has not been sending them back. The

customer is then contacted by SUPER to understand how it can make the take-back program easier for the customer, ensuring a waste free product.



**Figure 4.2 - Proposed concept: Business model**

### **The app**

An app can be easily downloaded through a QR code on the envelope, the QR code also automatically signs the customer into their profile making it easier to setup and use. The app contains techniques to aid the customer in effective cleaning techniques. The app can also remind the customer to brush their teeth, rewarding them with points when they do. The app also encourages customers to place feedback and complete surveys which allows SUPER to understand its customer's ever-changing needs, wants, lifestyle etc.

### ***Points and levelling up system***

SUPER gamifies and encourages the continual return of toothbrushes, a regular cleaning routine, customer feedback and answering of surveys from customers by providing them with rewards, points and levelling up. This point system adds a new experience to brushing teeth.



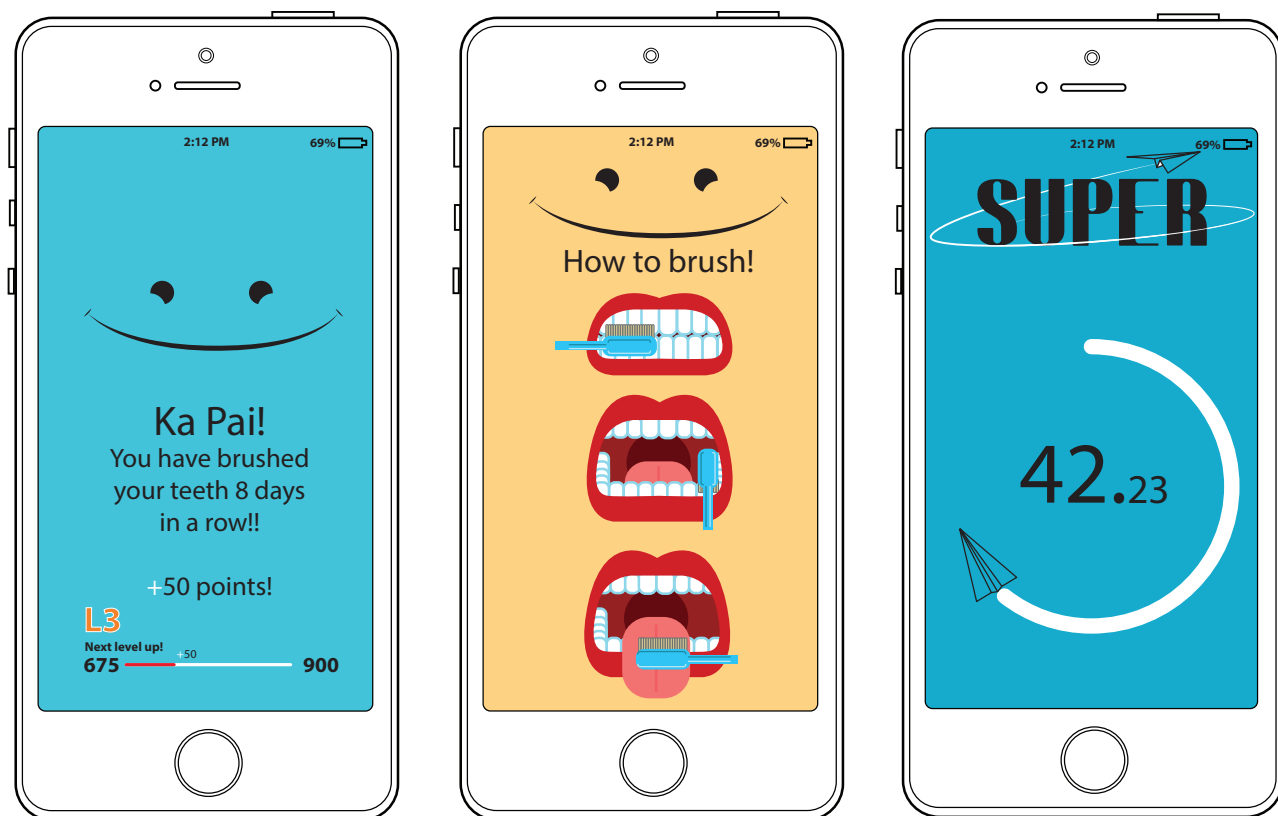


Figure 4.3 - Proposed concept: App

### How the business model and product aligns with SUPER's vision and mission

The sustainable toothbrush and hybrid business model incorporate both SUPER's vision for a sustainable waste free future and mission to create revolutionary waste-free products that are desirable and sustainable while also setting the bar for all future products.



Findings of encompassing thesis which shaped the proposed solution  
This section of the business case is intended to highlight all key findings that provided opportunity for a new sustainable toothbrush in addition to how the business model and toothbrush developed around the key findings from the encompassing thesis research (refer to Phase Two Findings & Analysis).

## **Market Validation and development**

### ***Maturing market***

Findings showed that the New Zealand oral care market is maturing and its innovations stagnating following the rest of the world's developed countries toothbrush markets including Australia (Euromonitor<sup>1</sup>, 2016) and America (Nanninga, 2016).

### ***Lack of variation***

This maturation in the toothbrush market is caused by saturation and full market penetration of toothbrush products. Competitors also provide very similar value propositions and toothbrushes to similar customer segments, this causes both competitors and their toothbrushes to blur together. From the customer's perspective there is nothing new colourful and stylish or unique currently in New Zealanders toothbrush market except for Freshbrush's new colourful and stylish subscription service (Denizen, 2016).

### ***Feature and price focus***

The saturation and lack of difference is being blamed this on competitors' focus on features and price which has:

- Segmented the toothbrush market by price and feature,
- Produced products that are solely based on features and price.

This focus can entrap all competitors into a feature race and price war.

### ***Narrow customer focus***

Research by the thesis shows two key customer groups toothbrush companies appear to focus on were children and those with a spendable income; children provided a possible life-long customer and those with a spendable income provided the opportunity to up-sell them to a more expensive product.

### ***Supermarkets as a distribution channel***

Supermarkets were considered by the research to be a key culprit in the commoditisation of toothbrushes and encourager of feature and price wars as each product must naturally fight one another for the customer's attention. These superficial value propositions may be aesthetically catching to the customer but provide no further depth to the product in terms of supporting and empowering the customer and

does nothing to create or strengthen the relationship between brand and customer.

### ***Lack of support and empowerment***

Support and empowerment are funny things to talk about when discussing a commoditised market, but they provide significant opportunity to disrupt a commoditised market by offering customers something they never knew was possible through buying a toothbrush (Schwartz, 2005, p.3).

### **Opportunity of the market**

With competitors offering similar value propositions and entrapped in the supermarket battlefield; forced to fight the war of features and price, there is huge opportunity to stand out from the crowd by offering customers something new and refreshing while providing them with further support and empowerment of their identity and ability to clean their teeth effectively and consistently.

### ***Customer segment opportunity***

Currently competitors segment the market into three sections targeting, children, hoping that they will become lifelong customers, those with high disposable income, who can afford high tiered products, and everyone else. This research highlights the opportunity to target a customer group that is currently ignored. For example, students 18-25 were specifically targeted during research as they provide several advantages: Firstly, unlike children they are often in control of the purchasing decisions, so although the competitors may think they are building a lifelong customer at a young age, when students move out of home there is a possible opportunity to attract new customers and build a relationship with them. Secondly, student age is a period when mundane tasks are given a little time, so they are easily swayed by systems that make it life easier, or faster. Thirdly, being a student is a period in life where individuals are redefining their identity, allowing them to be influenced by peer-to-peer marketing. Sustainable behaviours can be developed at this age by providing products that support and empower their identity and lifestyle. Fourthly, competitors focus on those with money who will buy the higher-tiered toothbrushes and therefore are not interested in students who may not have as much spendable income.

### **Product design considerations**

#### ***Material and manufacturing implications***

Briefly mentioned in the introduction of this report was how the use of multiple materials and fusing them together with fabrication methods such as multi-injection moulding made them impossible for the materials to be separated, recycled



individually and reused again. Further research revealed that the only critical material that made up a toothbrush was nylon as no other material could match its strength, durability for repeated cleaning (Pang, 2014) and gentleness on a customer's gums (Quib, 2016).

Organic materials such as bamboo were found to be limited in how they could be shaped, unusable after their initial use and took a long time to break down in a landfill (Biomass Packaging, 2014 & Ashford, 2010).

### ***Subscription model***

Research showed how a subscription service cuts down the steps for a customer to replace their toothbrush making it severely easier for take-back program to be created.

### ***Design specifications***

Research from both secondary research and interviews with dentists highlighted the importance of an effective cleaning technique and consistent brushing routine for clean and healthy teeth (Consumer Reports, 2016).

Other critical design specifications were:

- A cylindrical handle to ensure a comfortable handle that allowed free movement of the hand when trying to navigate the mouth (Quib, 2016).
- A small toothbrush head allows for bristles to reach hard to reach places typically missed when using bigger heads.
- Soft bristles ensuring bristles could get in between teeth and the gum and tooth line without damaging the gums causing them to recede and revealing unprotected areas of teeth.

Only two competitor toothbrushes matched 2/3 of these design specifications, none of them provided the additional support of encouraging effective brushing technique and consistent brushing routine.

### ***Key customer segment findings***

Surveys showed that colour, aesthetics, bristle layout and tongue cleaners were the most important and expected features on a toothbrush.

Further research into how students could be better supported and empowered by SUPER in their lifestyle and cleaning ability. Surveys revealed that nearly half of students' regular do not brush their teeth in the mornings as they are rushed for time forget and that 84% of students believed they did not do a good enough job at brushing their teeth with 53% believing they frequently missed places when cleaning. Research also seemed to show that students were unable to imagine their toothbrush experience to be enjoyable as they saw it as a purely functional exercise.

### **Opportunities created by proposed toothbrush design**

A toothbrush entirely of nylon allows for easy recycling of the product while the subscription model drastically reduces the steps and effort needed for a customer to send back their used toothbrushes. A subscription service also keeps the customer away from competitors in the supermarket aisle.

The design specifications including the small head, soft bristles and cylindrical handle provide a chance to supply a toothbrush that no other competitors provide in terms of effective and comfortable cleaning.

The key importance of a consistent routine and effective technique which is also lacked by most students provides the key opportunity to provide significant follow over competitors by providing support and empowerment to the student in their ability to keep a consistent brushing routine and effective technique.

### **Resource requirements and returns for proposed solution**

This section highlights cost requirements for further development and set-up of the proposed toothbrush and business model. This data is integrated into one table for easy visualising. Details and a timeline for further research and development are not set because further research is needed to create a proper understanding of how big and long the project will be. However, this further research and development should be started relatively soon as the findings from the encompassing thesis only provides a snapshot in time with potential opportunities and barriers changing over time (Osterwalder & Pigneur, 2010, p. 216).

### **Initial development**

As it stands the current concept for the toothbrush and hybrid business model requires further research, firstly to ensure such a solution is wanted by the customer and secondly to understand if the business model will work effectively. However due to most customers having the inability to truly understand what they want until it's put in front of them (Miller, 1999 & Prigg, 2012), prototypes of the toothbrush and the subscription service are needed for testing by potential customer for key data needed for further research to be collected.

#### ***Additional notes:***

- To save money, it is recommended for this first stage to not buy the equipment needed to recycle the used toothbrushes but rather allow them to build up to be then recycled after the initial testing.
- For the small-scale test batch, customers will be approached rather than have



them sign up online, saving the cost of building an initial website typically needed for a subscription service.

### *Resources needed for development stage*

**Designers**- To interact with customers, further design and develop the toothbrush, app, subscription service testing and envelope. Brand development, etc.

**Equipment** - For generating prototypes E.g. 3d printer.

**Tooling** - For moulds to be made for injection moulding

**Injection moulding** - Cost of manufacturing a small batch of toothbrushes.

**Custom Envelopes** - Will need to be designed and printed off.

**Postage** - **To send the toothbrush to the customer and then back to SUPER.**

**Small-scale test run** - Of subscription service for at least six months to generate clear data to validate assumptions and find key issues that need to be addressed (see table 4.0).

### **Initial setup**

The data created from the development stage will provide the information needed to decide whether this stage will be approved or not. This stage will look at the set-up of a full-scale subscription service which customers can sign up to through a website. Because it is unknown what will change to the business model and toothbrush during the development stage, the resources and prices suggested are only estimates and should only be used as a guide for future investing.

### *Resources needed for Initial set-up stage:*

**Renting** - Of industrial space for the recycling, and packing processes.

**Equipment** - For shredding, cleaning and pelletising the nylon for future reuse.

**Utilities** - E.g. Power and Internet.

**Outsourcing** - Of the manufacturing of toothbrushes.

**Custom Envelopes** - Will need to be designed and printed off.

**Postage** - To send the toothbrush to the customer and then back to SUPER.

**Employees** - To use the recycling machines, sort incoming and outgoing toothbrushes and envelopes e.g. packing toothbrushes within envelopes.

**Software** - For database management.

(See table 4.1).

	Discription	One-off costs	Fixed costs (monthly)	Variable costs
Initial Development Stage	Designer		\$25/hour x 15 hours a week = \$1500	Designer is founder of SUPER and will do this for free as investment into company. = \$0
	Equipment for prototyping. E.g. materials and 3d printer	\$1000		
Small scale testing	Designer		\$25/hour x 15 hours a week = \$1500	Designer is founder of SUPER and will do this for free as investment into company. = \$0
	Tooling	\$2000		
	Injection moulding	60 x Toothbrushes = \$200		Because it is a small batch, it should be expected that each unit will be more expensive.
	Printing of envelopes	60 x \$0.5 = \$30		
	Postage	2 x \$0.61 (bulk buy) = \$1.22 x 60 = \$73.2		Standard postage is \$1 per envelope, but brought in bulk can reduce it to \$0.61 per envelope.
Initial development and small-scale testing of business model and product = <b>\$3303.20</b>				

Table 4.0 - Initial development and small-scale testing costs



Initial set-up	Discription	One-off costs	Fixed costs (monthly)	Variable costs
	Designer		\$25/hour x 15 hours a week = \$1500	Designer is founder of SUPER and will do this for free as investment into company. = \$0
	Employee wages		\$25/hour x 5 hours a week = \$500	
	Renting of 50-100m2 of industrial space		\$150/week = \$600	
	Equipment for recycling	\$15,000		
	Potential new tooling	\$2000		
	Utilities		\$600	
	Injection moulding of toothbrushes			X number of toothbrushes x \$0.10
	Printing of envelopes			X amount of envelopes x \$0.30
	Postage			2 x \$0.61 (both-ways) = \$1.22 x X number of toothbrushes sent
Initial set-up cost (first month) = >\$ 18700				
Every month after initial first month = >\$ 1820				

Table 4.1 - Initial set-up costs



<b>Cost per toothbrush (including shipping to and from the customer)</b>	
<b>Price per unit</b>	<b>\$3 - \$2.42</b>
<b>Labour costs</b>	<b>\$0.52</b>
<b>Material/Processing costs</b>	<b>\$1.90</b>
<b>Overall cost</b>	<b>\$2.42</b>
<b>Overall profit</b>	<b>\$0.58</b>

**Table 4.2 - Overall cost per toothbrush**

### **Returns**

To break even on the \$40703 spent for the development, small-scale subscription service, initial set-up and one year of operating costs 70, 178 units would need to be sold in a year, requiring 11697 yearly subscribers (Ministry of Business, Innovation & Employment, 2017).

Compared to Freshbrush, who has at least 4000 current subscribers (Mack, 2017) which has been built over two years of business, this amount of customers seems highly unfeasible.

The approximate number of University students at Victoria exceeds 21,000 and 177,000 within New Zealand (Universities New Zealand, 2016). For SUPER's product and business model to break even %56 of Victoria students or %15.2 of all of New Zealand's university students would need to be yearly SUPER subscribers.

### **Cost considerations**

The biggest cost for the toothbrush is the \$0.61 cost to send an envelope, because the business model works by sending and receiving the toothbrush, \$1.21 of the overall cost of the toothbrush is due to the postage of the toothbrush.

To increase profit margins, this issue will need to be solved; with insights on how to do this possibly being created during the initial development stage.



### ***Other revenue streams to increase revenue (Possible explorable options)***

As deliberated in the encompassing thesis (see discussion), solutions to the initial set-up cost can be considerably off-set by developing further products that use the same machinery, space and power.

In addition, other companies could be interested to either own a share of the recycling machine or pay for key materials to be recycled. This cuts down the initial cost of buying the machine and provides SUPER with an additional revenue stream.

Alternatively, the recycling equipment needed could be fundraised through a kickstarter website, allowing New Zealanders to feel apart of the SUPER and its mission.

## **Benefits and Risks to SUPER for next stage of development**

This section will bullet point the key benefits and risks associated with approving the further development and potential prototyping and testing of a subscription service.

### **Benefits**

#### ***Brand image***

Developing a waste free sustainable and desirable business model and product will help build SUPER's image as a leader in developing a new generation of sustainable products that are both desirable and sustainable.

#### ***Unique Identity***

With an innovative and unique business model and product, further development of the proposed project will help SUPER stand out from the crowd leading to potential investment, partnerships and media advertising.

Provides a first and flagship product

With further development, the sustainable toothbrush can be developed to be SUPER's first and flagship product, instilling what is expected for the future of SUPER's products. The hybrid business model also provides investment into a potential system that could see all of SUPER's future products using

#### ***Future Investment***

Further research and physical development would supply further insight, data and evidence into the feasibility of the business model and product providing hard evidence for future investors or partners.

#### ***Embodies SUPER's vision and mission***

Provides the opportunity for further research and development on a solution that embodies SUPER's vision and mission.

## **Risks**

### ***Loss of initial investment***

With the initial investment for further research, development and testing of a new sustainable toothbrush and hybrid business model an initial loss of \$3303 should be expected if the toothbrush and business model are found to be unfeasible.

### ***Business case concluding recommendation***

Overall the risk of losing the initial investment of \$3303 is highly outweighed by the many benefits and opportunities SUPER could gain from pursuing further research, development and testing of both the sustainable toothbrush and the hybrid business model.

Firstly, further research will provide SUPER with critical insight into the feasibility of the proposed toothbrush and business model through developing an understanding of the barriers, opportunities, weaknesses and strengths.

Secondly, the opportunity that the hybrid business model could create in providing waste free products, and could revolutionise the product industry; setting the bar for future products.

Thirdly, initial investment into a small-scale subscription/circular economy business model could provide a waste free business model that all of SUPER's future products will use or be built off the understanding created by the proposed development stage.

Lastly, the outcomes of the proposed research of the business model and toothbrush will define who SUPER is to the world including the public as well as investors. The potential to develop a product and business model that encompass SUPER's ambitious vision and mission to develop innovative, desirable, unique and sustainable products is more than enough reason to approve further development and testing of the toothbrush and business model.



## The Sustainable Product Development Strategy (SPDS): in retrospect

The purpose of the SPDS is to aid in the development of products that are both truly sustainable for the environment and desirable by the customer by focusing on three domains that were intended to fix the issues found in sustainable product development

SPDS Domains	Domain one: Developing a balanced product	Domain two: Development of Mindset and culture	Domain three: Developing a collaborative business mindset
Core Focus of each domain	Stresses the importance of balancing both environmental and customer needs while ensuring each one does not compromise the other when making design decisions.	Encourages creative confidence and the feeling of empowerment, further strengthening the relationship between the product development team and sustainable strategies and values.	Acknowledges that product development is very complex when considering all the environmental and design implications that must be addressed; external collaboration must be fostered and supported.

Table 4.3 - Core focus of the SPDS

### Reflection:

#### *Did the SPDS achieve its purpose?*

When reflecting on both the development of the toothbrush and business model at its current point, it is comfortable for the researcher to say that the SPDS achieved its purpose. It helped produce a concept that does not compromise the needs of the environment nor the needs of the customer but instead generated an innovative solution where both needs were met. However, it is acknowledged that the product is still in the very early stages and it is difficult to judge the potential the SPDS may have for two key reasons:

#### *Domain Two not fully utilised*

Domain Two with its focus on the development of a team mindset and culture wasn't fully explored or utilised because the development was done by a single researcher. It should be assumed that when using the SPDS with a bigger team, a better reflection on Domain two can be done. A bigger team with its internal collaboration could also

provide a more innovative solution as well.

### ***Narrow research scope***

Though current development shows the SPDS's potential in a positive light, it needs to be acknowledged that the success of the toothbrush and business model cannot be truly realised until further research is done, testing has been done. Even then, the toothbrush and business model's success can only be determined once they have been properly launched. Therefore, reflecting on the potential of the SPDS to create desirable and sustainable products may be fair, its ability to generate success might be premature.

Another factor to consider is that the SPDS has only been tested on the conceptual development of one product in one market and could create a very different desirable and sustainable outcome if used to develop a different product and market.

### ***Further Concerns***

Two main issues with the SPDS effectiveness and usability arose during both the discussion and business case which though had been mentioned in the thesis, had initially been overlooked during the construction of the SPDS. These initial disregarded issues were:

#### ***- Business needs (revenue feasibility)***

Though the SPDS developed a product that entertained both environmental and customer needs without compromise to the other, the SPDS did not consider the profitability of the solution that was being developed.

A lack of focus on the business needs highlights another domain that should be added to the SPDS. However, this addition could create implications as mentioned in the literature review, sustainable strategies including eco-efficiency and the triple bottom line which attempt to balance environmental, social and economic needs (Sherin, 2013) are flawed as the economic needs come first (Braungart, McDonough, & Bollinger, 2006, p. 1341). Allowing business needs to have an equal importance alongside customers and environmental needs could undermine the other needs by limiting the possibility of innovation causing the environmental and customer needs to be compromised.

With no consideration to the business needs, the researcher was free to generate an innovative solution as it was not bound by monetary worries but rather provided the focus of what is morally right for both the customer and the environment.

Of course, a product must be profitable in some way; and a solution to this has been discussed. The researcher recommends that the business needs should be slowly integrated into the development after initial research and conceptualisation allowing



for a head start on innovative and creative solutions.

**- Education of the customer segment.**

If the SPDS continues to generate innovative and unique solutions which are strikingly different from current solutions considerable effort will be needed to educate the customer on the benefits and workings of such a solution. Much like how Domain one focuses on empowering the development team to openly take on sustainable values and new ways of thinking, the same must be done for the customer so that they do not reject a new business model or product because of its difference to conventional ways of doing things. Though it is important that this should not be used as a free pass for bad design.

**Evolved SPDS**

These highlighted concerns have been addressed in the adapted proposed SDPS (see table 4.4).

SPDS Domains	Domain one: Developing a balanced product	Domain two: Development of Mindset and culture	Domain three: Developing a collaborative business mindset
Core Focus of each domain	Stresses the importance of balancing both environmental and customer needs while ensuring each one does not compromise the other when making design decisions.	Encourages creative confidence and the feeling of empowerment, further strengthening the relationship between the product development team and sustainable strategies and values.	Acknowledges that product development is very complex when considering all the environmental and design implications that must be addressed; external collaboration must be fostered and supported.
	Business needs must also be met but not at the initial expense of new innovative and creative solutions being firstly generated.	Encourages the education of the customer regarding new solutions, which might be unconventional are more effective at providing a sustainable and desirable future.	

**Table 4. 4 - Adapted Core focuses of SPDS**

### ***Further additions/ Further development***

A product using the SPDS for development will soon come to a point where the current SPDS do not cover including ideation, prototyping and testing. For a product to be developed and launched, these steps may require more additions to the latest adapted SPDS.

### **Summary of discussion**

Overall the current consensus is that the SPDS though effective, so far, have plenty of room to grow which is fitting as this thesis never considered the SPDS to be an end all solution in developing successful sustainable products. This thesis acknowledged the importance of reflecting, redesigning, and adapting strategies so that they become more effective (McLennan, 2004, p. Xxiv). Therefore, it is important that the SPDS is used in as many product development projects as possible so that further insight can be created, allowing for further reflection and adaptation leading to a more effective sustainable strategy.

### ***The future of the SPDS***

The SPDS is intended to become a key part of SUPER's business plan and identity. It is acknowledged that the SPDS is neither perfect nor finished and is expected to change the more it is used and reflected upon.

It is hoped that the ever evolving SPDS will aid in the development of a new generation of products, ones that are both better for the environment and the customer with the wider hope that it will encourage the replacement of the conventional and unsustainable product industry society has today.

### ***A researcher's afterthought;***

The SPDS or as it has been dubbed throughout discussions with supervisors and friends "SPuDS" will one day find itself a name, but currently the goal is to continue testing, adapting and refining; ever evolving the SPDS. Perhaps a better acronym would be SPEEDS (Sustainable Product Ever Evolving Development Strategy).







# Conclusion

This thesis was a response to the crucial role sustainable products need for a sustainable future to occur, yet sustainable alternatives' current inability to outcompete let alone compete against their unsustainable counterparts in most industries continues to halt this ideal future.

The hypothesis was that the flaws within sustainable products were not inherent, but rather created by poor development strategies. This thesis aimed to propose a new sustainable strategy (SPDS) which would address the areas where these flaws typically arose.

During the research it was revealed that it wasn't primarily the strategies to blame for the flaws typically found in sustainable products but rather the minimisation mindsets that product development teams used when finding solutions to problems. This insight generated a new sustainable strategy which primarily focused on encouraging the way a product development team should think.

This sustainable product development strategy (SPDS) focused on three key findings from the initial research. Firstly, it encouraged a mindset that equally addressed both environmental and customer needs without compromising the other. Secondly, it outlined the critical importance of collaboration with external disciplines when addressing complex environmental implications during sustainable product development. This collaboration would ensure the product really was sustainable. Lastly, the SPDS encouraged a development team's sense of empowerment and autonomy which increased creative confidence, innovative solutions and strengthened the relationship between the team and sustainable values.

While testing the SPDS out through using it to develop a new sustainable toothbrush it was evident the great potential the SPDS could have in developing a new generation of products that were both truly sustainable and desirable. Reflection on the SPDS after the initial trial showed key areas where it needed further development which included considering the needs of the business regarding revenue and profit.

Both the sustainable toothbrush and business model developed provided significant opportunities. The toothbrush has potential to be the flagship product for a new generation of products, setting the bar for all products that come after it. The circular economy/subscription service business model could be a great solution to a waste free product industry.

SUPER design consultancy is determined and excited to further develop the SPDS, the toothbrush and hybrid business model for the opportunity to create a sustainable future.





# Appendices

## Appendix A: Survey for stage one and two surveys

1)- Circle the number that best corresponds with how each factor influences you when buying a toothbrush (explain where asked)

	Not				Very	
Overall look of the toothbrush	1	2	3	4	5	
-----						

What do you like and why?

Special features of the toothbrush	1	2	3	4	5	
-----						

What do you like and why?

Brand	1	2	3	4	5	
-----						

What brand do you prefer and why?

Environ-friendly (effect on the environment)	1	2	3	4	5	
-----						

Why?

2)- What do you like and dislike about your current toothbrush and why?

3)- Do you have any suggestions that you believe would make a toothbrush better?

4)- What are your thoughts o environmentally friendly products?

5)- Would you buy an environmentally friendly toothbrush? Why/Why not?

6)- How long do you typically spend picking what toothbrush you will buy?\*

\*Question was only used for online survey



## **Appendix B: Survey for stage four survey**

Can you easily count the number of tasks you need to do today?

At the end of the day are there any tasks you never got around to doing?

How often does this happen?

Do you feel you have a lot on your plate at the moment?

How often do you find that you are rushed for time?

Do you ever leave the house without cleaning your teeth?

Do you ever go to bed without cleaning your teeth?

Can you describe the lead up to brushing your teeth?

How often do you find you are rushed for time when you are brushing your teeth?

How often do you do other tasks while cleaning your teeth?

Can you walk me through the steps you take to clean your teeth?

How else do you clean your teeth? E.g baking soda rinse or chewing gum, why?

Are there times you have to rush or stop cleaning your teeth due to time?

How do you know if a toothbrush is the right one for you?

Do you buy online? YES NO

What is more important, the toothbrush or the toothpaste? toothbrush toothpaste

How long do you tend to brush your teeth for?

Do you feel you miss places when cleaning teeth?

Do you think the way you clean your teeth is effective at cleaning?

Do you feel you could do a better job at cleaning your teeth?  
How?

Can you tell if your teeth are getting cleaner?

Rate how important these qualities are when cleaning your teeth from 1 (not at all) to 4 (hugely)

Quality	1	2	3	4
Comfort	1	2	3	4
Enjoyment	1	2	3	4
Time it takes (the less time the better)	1	2	3	4



Knowing you are brushing effectively                      1                      2                      3                      4

Do you consider how clean your toothbrush is?

How do you store it?

I will read out a few statements and you tell me which one best describes your cleaning experience:

I find brushing my teeth an annoyance                      ☐

I don't find it annoying or enjoyable (neutral)                      ☐

I look forward to brushing my teeth                      ☐

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Relationship letter

For an extra 3 chances to win one of two \$100 New World vouchers, write a letter to your oral care products explaining what you love and hate about them. A few examples are: Dear toothbrush, I hate how you feel in my mouth, if only were you that much smaller, or Dear Chewing gum, I am scared I will swallow you and you will stay in my stomach for 7 years (fake news btw) The more detail and examples the better. Thank you!

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