



Moana Surfboard Fins: The resurrection of plastic

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Abstract

Title: Moana Surfboard Fins: The resurrection of plastic

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The impact of plastic waste on the natural environment has been increasingly alarming and largely acknowledged as potentially irreversible. Nonetheless, entrepreneurial endeavours can actively change the synergies of the plastic industry that partly hold sway over the global economy.

The aim of this dissertation is to investigate how the birth of Moana, a Portugal-based start-up that produces 100% recycled-plastic surfboard fins, can contribute to the collective effort towards influencing the plastic industry synergies at a micro-level by implementing an artisan business model.

To control for its viability as an alternative approach to producing environmentally friendly surfboard fins, customer segments are defined by means of a survey analysis, competition is examined on a comparative basis and a technologically singular production process are explored.

Subsequently, results provided valuable insights on Moana's feasibility. Competition is rather mild, and the technology used for production is economical and user-friendly. Additionally, proximity to the customer base is of utmost importance to ensure that sustainable oriented surfers are offered the knowledge and the sense of community required to root awareness and change their perception on plastic waste. In conclusion, Moana proves to be an achievable endeavour as a start-up rich in potential. If executed diligently, it may become a leading example and eventually offer the opportunity to replicate its business model in future entrepreneurial undertakings in numerous industries.

Keywords: Plastic Recycling, Circular Economy, Environmental Impact of Plastic Waste, Entrepreneurship, Surfboard Fins

Resumo

Título: Moana Quilhas para Prancha de Surf: A ressurreição do plástico

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O impacto dos resíduos plásticos no ambiente tem sido cada vez mais alarmante e reconhecido como potencialmente irreversível. Não obstante, tentativas empreendedoras podem mudar ativamente as sinergias da indústria do plástico que, em parte, dominam a economia global.

O objectivo desta dissertação é investigar como é que o nascimento de Moana, uma *start-up* portuguesa que produz quilhas para pranchas de surf totalmente de plástico reciclado, pode contribuir para influenciar as sinergias da indústria do plástico a nível micro, implementando um modelo de negócio artesanal.

Para controlar a viabilidade deste conceito em alternativa à produção de quilhas ecológicas para prancha de surf existente, segmentos de clientes foram definidos através de uma análise de questionários. Com o mesmo propósito, foi feita uma análise comparativa da concorrência e foi explorado um processo de produção tecnologicamente único.

Posteriormente, os resultados forneceram informações crucias sobre a viabilidade da Moana. O nível competitivo não é agressivo e a tecnologia usada para produção é económica e fácil de utilizar. Além disso, a proximidade para com os clientes é vital para garantir que os surfistas com práticas sustentáveis recebam o conhecimento e o espírito de comunidade necessários para criar consciência e mudar a sua percepção sobre o plástico. Em conclusão, a Moana demonstra ser viável como uma *start-up* repleta de potencial. Se executado com empenho, pode vir a ser um exemplo de liderança e, eventualmente, oferecer a oportunidade de replicar o seu modelo de negócio em futuras tentativas empreendedoras em inúmeras indústrias.

Palavras-chave: Reciclagem de Plástico, Economia Circular, Impacto Ambiental de Resíduos de Plástico, Empreendedorismo, Quilhas para Prancha de Surf

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List of acronyms

BBBW	Better Business Better World
CBM	Circular Business Model
CE	Circular Economy
MS	Market Segmentation
PD	Product Differentiation
SC	South Carolina
SCSGC	South Carolina Sea Grant Consortium

1. Introduction

1.1 Context and background

The first decades of the 20th century have been marked by numerous technological revolutions, from the discovery and increasing use of combustion engines to the widespread implementation of electrical systems. Yet, due to its vital role in our societies, one great advance of the last century that tends to be overlooked and taken for granted was the discovery and development of plastic in all its forms. Plastic has entered every part of our daily life, the best example of which is plastic bottles replacing glass bottles for everyday use. However, the scientific pioneers that changed the face of the earth for the better, so they thought, had not anticipated one of the most destructive issues of the late 20th and early 21st centuries, waste. Indeed, to date, 8.3 billion tonnes of virgin plastic have been produced since its conception and introduction in industries. Of those 8.3 billion tonnes, 6.3 billion have turned into waste (i.e. not in use anymore). Out of the latter, 9% have been recycled, 12% have been incinerated (creating harmful gas emissions, which transfers the ecological weight onto another environmental problem) and the remaining 79% have landed in landfills or in the natural environment (oceans, lakes, forests and so forth) (Trowsdale, Housden, & Meier, 2017). The sheer resistance of polymers varies amongst different types, but they are generally forecasted to take centuries before disintegrating into the natural environment. Regrettably, the completion of the disintegration process is usually preceded by the emergence of microplastics from larger pieces. These are harmful to every stakeholder group of the marine life as they are easily ingested and constitute a potential menace to humans since microplastics can be found in edible tissues of commercial fish (Trowsdale, Housden, & Meier, 2017).

1.2 Challenge

Whilst waste constitutes one of the most significant issues of modern times, plastic is one of its most pernicious faces and it has become widely accepted that its use for everyday disposable items is a threat to life on earth. Alas, the global production of plastic shows little sign of slowing down. Meanwhile, many economists, scientists and political movements in the making have generated a plethora of approaches to combat waste. From more efficient economic models to radically new political systems, there is no shortage of ideas. As a result, some governments and international institutions have increasingly taken environmental issues into consideration and subsequently acted, as illustrated by instances such as Rwanda's

implementation of a nationwide ban on the use of plastic bags in 2008 (United Nations Environment Programme, n.d.) or Goal 14 of the United Nations' Sustainable Development Goals aiming to protect the oceans (United Nations, 2015). Even more recently, the European Parliament voted a complete ban on single-use plastics (cutlery, plates, cotton buds, straws and so forth) to reduce pollution of the oceans. The European Union *“hopes it will go into effect across the block by 2021”* (BBC, 2018). Nevertheless, one may hastily argue that such reforms and objectives are but a drop in the ocean and that the answer lies beyond institutional amendments. In this regard, one possible response, which has gained in reputation during the past decade and seems to be an adaptive approach to today's state of affairs, is what is referred to as the Circular Economy. As defined by Geissdoerfer et al. (2017, p.6):

‘the Circular Economy [is] a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.’

As such, entrepreneurial endeavours are prevailing in many parts of the world as a response to ecological concerns. Numerous projects have been created in the past two decades in order to alleviate the impact of plastic on the natural environment and most of those usually act in accordance with the Circular Economy's philosophy. One famous instance is the organisation *4Ocean*, founded by two surfers who were exasperated by the ocean plastic pollution, of which they were daily witnesses. They decided to sell recycled plastic bracelets to finance the cleaning of beaches and shore waters. Another solid project is the initiative *Precious Plastic*, founded by young Dutch designer Dave Hakkens, which developed a simplified – yet marvellously functional – plastic recycling station to share its blueprints and techniques with the world and encourage individuals or organisations to recycle plastic to meet any type of need. Through educational videos and tutorials, any passionate entrepreneur can learn to create their own recycled product.

1.3 Relevance

The Circular Economy may be considered one of the best models to remedy environmental problems since it can adapt and thrive within our capital-driven economic system. In this regard, this dissertation assumes that entrepreneurship constitutes a viable approach to triggering environmental change. Thereby, I shall give birth to *Moana*, a Portugal-based start-up that

produces surfboard fins created from 100% recycled plastic. To do so, I intend to use the *Precious Plastic* station combined with a personalised business model. The name *Moana* means *ocean* in Hawaiian, the native language of the islands where surfing was born and practiced by the ruling class as an art (Britton, n.d.). Interestingly, *Moana* also translates to *broad, wide, extended, expansive, spread out* (Hawaiian Dictionary, 2018), evoking the vastness of the ocean and the opportunities that lie within.

As plastic is virtually impossible to get rid of in an environmentally clean fashion, Moana focuses on the reuse and recycling aspects of the Circular Economy's definition by giving a new life to plastic waste. Additionally, the Moana fin conveys a substantial emotional value. The surfboard fins market consists of surfers, evidently, and surfers tend to be very attached to the natural environment as it is their "playground". Moreover, the ocean in particular is generally the milieu in which plastic is most visibly devastating. These two surfer-specific factors combined with the universal awakening concerning plastic waste constitute a strong qualitative indicator that offering recycled products to such individuals could be appealing and profitable. Furthermore, only one other producer of recycled-plastic surfboard fins is present on the Portuguese market. Combined with numbers from the *International Surfing Association* reporting that there were 35 million surfers worldwide, of which 4.5 million are located in Europe and 200,000 in Portugal (Surfer Today, 2018), this makes the Portuguese market very attractive for Moana.

1.4 Problem statement

Whilst the worldwide impact of plastic waste and its spread across the natural environment has been largely acknowledged, measures in place are too limited to bring about real change. Ecological businesses following the Circular Economy's philosophy (i.e. decoupling the use of environmental resources from economic growth) could alleviate the lack of change by modifying the way we produce and consume. In this regard, Moana aims to contribute to the collective effort by producing surfboard fins from 100% recycled plastic.

1.5 Research questions

1. Which are the ideal customer segments for Moana?
2. Is Moana attractive to its potential customers?
3. How would Moana be affected by the competition?
4. Which low-cost technological process exists would to render Moana viable?

1.6 Thesis structure

The thesis is divided as follows: Section Two consists of a literature review which examines the general impact of plastic on the natural environment, the Circular Economy and its benefits and the principle of market segmentation. Section Three describes the methodology implemented to collect data used in the next section. Through a data analysis, Section Four provides a discussion of the different areas of the business model, such as a value proposition, customer segments, costs, revenue, key sources and distribution channels in order to offer an analytical and factual overview of Moana. Finally, Section Five draws key conclusions and identifies the potential limitations of the business model.

2. Literature review

2.1 Plastic waste

Plenty of literature has been written on plastic waste and its effect on the natural environment. This section attempts to highlight the main findings about the impact of plastic waste, both numerically and factually.

The issue of plastic waste in its current state is not Manichean in nature. Indeed, the corporate world at large has already awakened, and numerous corporate giants have subsequently taken measures. The latter focus predominantly on packaging as it consists primarily of single use items (see figure 1). For instance, “Starbucks has invested \$10 million into developing a fully recyclable cup and lid within three years” (Morgan Stanley, 2018) and Unilever intends to use 100% recyclable materials by 2025, just to name a few. However, according to Morgan Stanley’s report *Peak Plastic? A Focus on Single Use Plastic* (Morgan Stanley Research, 2018), the quantity of plastic produced is forecasted to double in the next two decades, specifically for single use items due to short-term incentives within the petrochemical industry. The same report estimates that, every minute, one million plastic bottles are bought, and more than one million plastic bags are used for an average “usage life” of fifteen minutes. As a result, up to 13 million tons of plastic end up in the world’s ocean. Additionally, 74% of Europeans are worried about the impact of plastic on their health and 87% dread the long-term impact on the natural environment (Morgan Stanley Research, 2018).

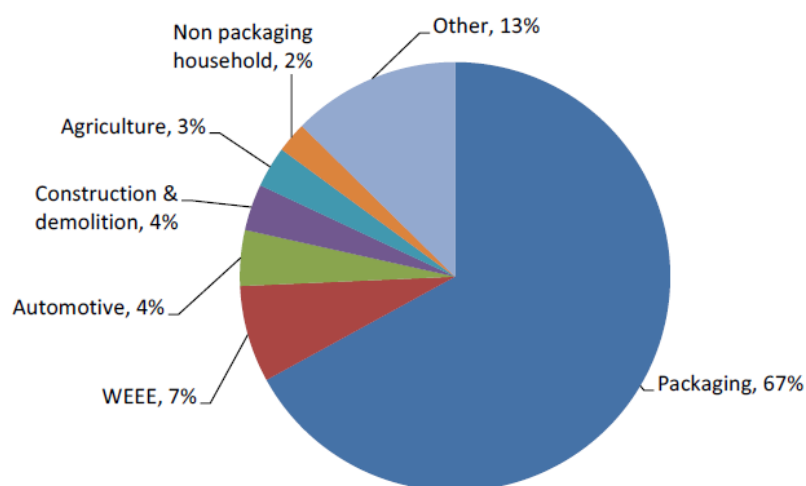


Fig.1: Sources of plastic waste in the UK. Note: packaging amounts to 67%, supporting the idea that changing the way corporations use packaging can have a real impact. Source: WWF report: *A Plastic Future: Plastics Consumption and Waste Management in the UK* ((Eunomia Research and Consulting Ltd, 2018, p.2)

Though spread across virtually all parts of the natural environment, plastic is undeniably most destructive when it lands in the waters of the Earth. In a primary phase, plastic items eventually fragment into small flakes, endangering fish, grass shrimp and other small creatures that inadvertently eat them. Thereafter, the remaining flakes will break down into much tinier pieces, invisible to the human eye. The latter can then be ingested by microscopic organisms. Furthermore, S.C. Sea Grant Consortium's report *The Global Plastic Breakdown: How Microplastics Are Shredding Ocean Health* defines these tiny pieces, named microplastics, as “pieces smaller than 5 millimetres in diameter, or about the diameter of a pencil eraser” (S.C. Sea Grant Consortium, 2014, p.4). Researcher John Weinstein from the SCSGC stated: “My analogy is that we’re sweeping these plastics under the rug. We can’t see them anymore, but they’re still there”, illustrating the problematic mentality that has been present when tackling plastic pollution. Furthermore, microplastic particles attract other chemical contaminants that occupy the oceans whilst simultaneously releasing their additives. As a result, the infamous giant plastic gyres created by ocean currents and wind patterns (see figure 2) have become highly concentrated in chemical contaminants-carrying particles, aggravating further the issues outlined so far (S.C. Sea Grant Consortium, 2014, p. 6-8).

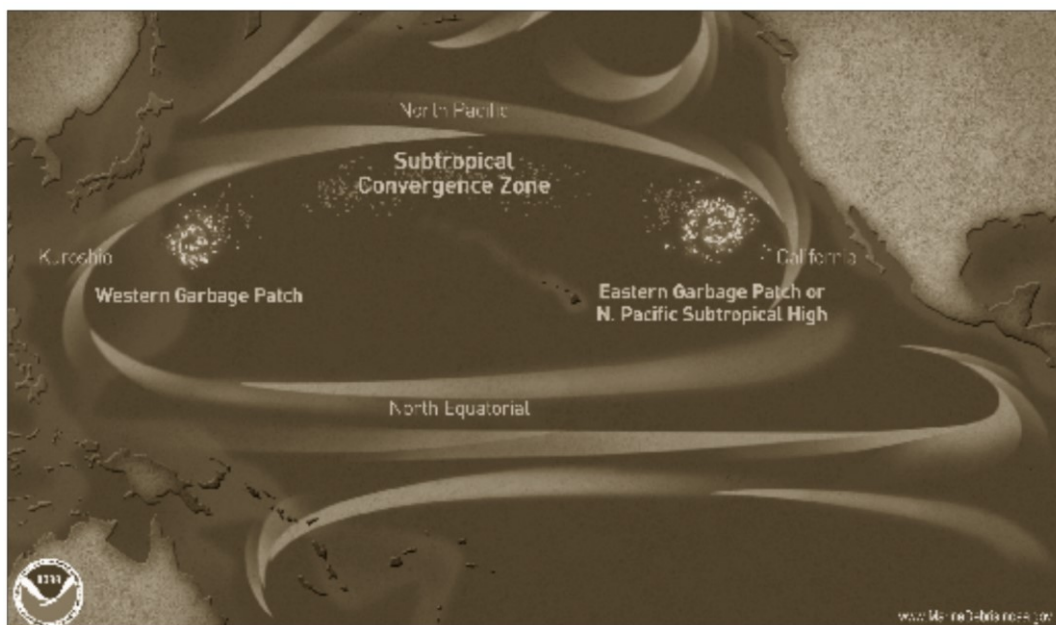


Fig.2: Ocean gyres of plastic waste, massive spiralling plastic patches created by the ocean currents and winds that gather plastic pieces from all parts. Source: S.C. Sea Grant Consortium’s report: The Global Plastic Breakdown: How Microplastics Are Shredding Ocean Health (2014, p. 8)

2.2 *The Circular Economy (CE)*

Contemplating numbers and facts from the last section, it is clear that the battle against the use of harmful plastics is torn between social anguish and economic interests. Yet, circular models seem to offer an opportunity to satisfy both ends of the rope in this vain societal tug-of-war.

Indeed, Ghisellini et al. state: “*In CE, products and processes are redesigned to maximize the value of resources through the economy with the ambition to decouple economic growth and resource use*” (Ghisellini et al., 2016), which suggests that the long-lived principle of extracting environmental resources to generate economic growth is now questioned and must be effectively discredited. Circling back to the definition of CE, Accenture’s report *Circular advantage* adds that “*in a [CE], growth is decoupled from the use of scarce resources through disruptive technology and business models based on longevity*” (Accenture Strategy, 2014). Thus, it is evident that decoupling is the fundamental goal of disseminating circular models across today’s economy.

Furthermore, an important indicator must be taken into consideration: it is now undeniable that the Circular Economy has been increasingly attractive during the past few years, as supported by several academic articles (Lewandowski 2016; Geissdoerfer et al. 2017; Ghisellini et al. 2016). In fact, there are substantial future opportunities involved in circular processes, as demonstrated by the Business & Sustainable Development Commission in their report *Better Business Better World* (Business & Sustainable Development Commission, 2017). BBBW analyses the relationship between the implementation of the United Nations’ Global Goals (or Sustainable Development Goals) and their economic prospects. For instance, they identified 60 ‘hotspots’ that represent the largest market opportunities related to the Global Goals, which clearly feature circular models. Additionally, circular economy manufacturing is ranked 6th on the ‘*12 largest business themes in a world economy heading for the Global Goals*’. While the report mostly focuses on automotive manufacturing and electronics when pointing out Circular Economy opportunities, it nonetheless validates the current economic outlook by displaying an increasing credibility of circular models. Moreover, Lewandowski asserts that in order to successfully achieve the Circular Economy transition, small-sized businesses must also change their processes, thereby emphasising the relevance of circular models at the micro-level (Lewandowski, 2016).

Despite conditions for an active implementation of CE looking promising, there remains yet another constraint to transitioning, known as the Triple Fit Challenge (see figure 3). A business model traditionally seeks a ‘fit’ between its costs structure and its revenue streams and between the value

proposition and the customer segments so as to generate value. In the case of CE, an additional one is required, which is the fit between the changes towards a circular model and the adoption factors (Lewandowski, 2016). That is to say, change may only occur if the conditions are favourable. While this may sound like a hollow statement, it is nonetheless crucial since it entails multiple factors such as collective perceptions, institutional dispositions and economic conditions. This is supported by Ghisellini et al. (2016) and in Viscusi, Huber & Bell's *Promoting recycling: private values, social norms, and economic incentives*. The latter asserts that in order for recycling to become an active part of waste management, private values, social norms or economic incentives must drive change, ultimately aligning with the other two factors (Viscusi et al., 2011).

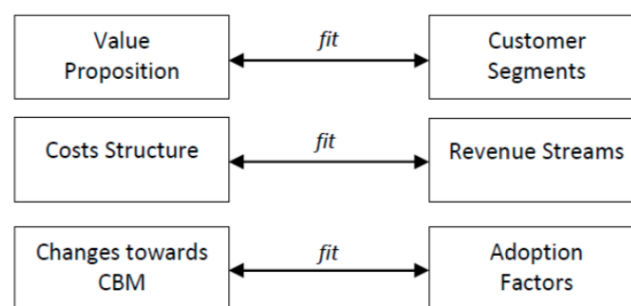


Fig.3: The Triple Fit Challenge, visualised. CBM stands for Circular Business Model. Source: *Designing the business models for circular economy – Towards the conceptual framework* (Lewandowski, 2016, p. 22)

Thanks to such insights on CE, it seems reasonable to argue that Moana embodying a circular model could benefit its own growth and contribute to environmental change.

2.3 Market segmentation

First and foremost, the very term “market segmentation” must be clarified so as to better assimilate its implication in modern marketing. Furthermore, relevant segmentation approaches ought to be identified.

Market segmentation as it is taught in classrooms is universally defined as “*dividing a market into distinct groups of buyers with different needs, characteristics or behaviour who might require separate produces or marketing mixes*” (Kotler, 1999). However, understanding market segmentation entails delineating its inextricable relation to the concept of “product differentiation”. As recalled by Dickson and Ginter (1987), the first and plainest interpretation of product differentiation “*described it as meeting human wants more accurately than the*

competition". However, further discussions differed when defining the relationship between market segmentation (MS) and product differentiation (PD). Indeed, some authors theorised that MS and PD were complementary when others suggested that they were alternatives of one another. As a result, confusion arose due to numerous divergent uses of the term "market segmentation". Whilst there have been little further advances in disentangling both concepts, MS may generally be viewed as the core process of recognising that multiple demand curves exist in a market and subsequently formulating a strategy, whereas PD functions similarly but rather focuses specifically on customers' wants (Dickson and Ginter, 1987).

In order to alleviate the issue of confusion when discussing market segmentation in theory, Guzmán's *Teaching market segmentation* offers an eight-step process to apply MS to real world cases (Guzmán, 2015). The article aims to provide a strategic tool to better design the way a company segments the market in which it operates as the process recommends seeking deep insights about their potential customers. When this approach is overlooked, companies traditionally focus on differentiating their products and therefore function with a somewhat weaker foundation regarding their segmentation strategy. The article essentially underlines the importance of market segmentation as the basis for all subsequent activities that attempt to respond appropriately to the wants of diverse customer types (Guzmán, 2015).

In addition, behavioural segmentation may be taken into consideration when examining a market for a product that conveys emotional value such as environmental concern. In this regard, Cobanoglu et al. distinguished four profiles in their research on the "recycle-reuse-reduce" behaviour, which is characterised by consumers "*reducing [their] consumption, reusing and recycling products*" and is known as the 3Rs (Cobanoglu et al., 2013). The first profile is the "*genuine green*", who is a true believer of recycling and actively participates in recycling. Then, the article identifies the "*follower*", who displays the same opinions and behaviour as the genuine green but thinks that recycling is bothersome. The third profile is the "*indolent*", who is conscious of the benefits of recycling but does not actively act accordingly. Finally, the "*apathetic*" profile is similar to the indolent but additionally does not believe in government support whilst the indolent does (Cobanoglu et al., 2013).

In the case of environmentally friendly businesses such as Moana, it seems pertinent to simultaneously consider the economic side of segmenting a market with the appropriate set of

tools but also to complement the analysis with a psychographic approach to fully comprehend the attractiveness of a product to potential customers.

3. Methodology

The methodology revolves around both primary and secondary data in order to answer the research questions throughout the paper. The aim of the primary data consists in obtaining reliable first-hand information to support what has been explored in the secondary data and what has been posited.

3.1 Primary data

First, a survey was designed and conducted to consult the surfing community on multiple aspects that relate to surfboard fins in general and subsequently to Moana fins in particular. This allows for a better comprehension of the needs and wants of surfers and the desirability of plastic-recycled fins. Essentially, respondents were asked demographic questions (such as age and gender), surfing experience and level estimates, several product-specific questions concerning willingness to pay and usual purchasing prices. Also, they were asked to assess their concern for the impact of plastic waste on the environment. Ultimately, the survey ended with a final “*Would you be interested in purchasing Moana fins?*”. The survey was posted on numerous Facebook pages and groups, both in Portuguese and English. Additionally, it was shared with surfer acquaintances and successively circulated. By the end of the survey phase, 64 respondents had completed the questionnaire. Furthermore, interviews were conducted with existing companies that produce recycled surfboard fins. Australia-based Five Oceans uses waste from Indonesia to recycle it and produce surfboard fins and upon request, was keen to share valuable information on its products, on the challenges encountered since its inception, about its philosophy and how it came to be.

An additional esteemed interviewee was Erwan Gallais-Hamonno, former informatician, now passionate entrepreneur in recycling solutions who focuses mostly on developing the francophone community of Precious Plastic while simultaneously participating in a multitude of initiatives. He shared his conception of the realisation of recycled-plastic surfboard fins on a rather technical level and provided crucial insights on the sourcing of plastic waste.

3.2 Secondary data

The secondary data used in this paper are principally composed of academic and news articles that present manifold arguments and facts, particularly relating to the impact of plastic waste on the natural environment and to managerial theories. Likewise, key data were collected from

competitors' websites in order to figure out which position should Moana occupy on the market as well as to consider realistic pricing strategies. Initially, information on Moana's main competitor Marlin Fins was intended to be primary data through an interview similar to that of Five Oceans. Yet, after repeated vain attempts to contact the company, a competitor analysis was conducted on a secondary data basis. Furthermore, information from Precious Plastic's website, its tutorials on plastic recycling and its downloadable building kit provided insightful material to better appreciate the feasibility and costs structure of Moana.

4. Data analysis

4.1 Value proposition

Moana surfboard fins are locally produced hand-crafted recycled-plastic surfboard fins designed to be low-priced simple polyvalent fins, priced at 20 euros. The fins are to be sold by sets of three fins, as it is the most common package purchased by surfers. Although sets of four and five could be considered in a later stage, they are rather more specific and would therefore be targeted at another sibling group of Moana's main customer segment. They are targeted for casual surfers who have an intermediate level of surfing who are concerned by the impact of plastic on the natural environment (the latter being an extremely common trait among all stakeholders of the surfing community). Such segment of surfers usually gives little importance to the quality of their fins as long as they are reliable. This allows Moana fins to offer a low-priced, environmentally conscious and stylish product, which are three attributes that are sought specifically by this category of surfers and surfers in a more general sense. Price is the first argument of almost every transaction so being exceptionally competitive, Moana fins are accordingly a leading choice. As they are 100% recycled from plastic waste, they appeal to surfers who have to witness the plastic saturation of the oceans and beaches on a regular basis. Purchasing Moana fins allows them to actively contribute to the collective effort to streamline use of resources at their own individual scale. Finally, the process of transforming plastic to produce fins offers the opportunity to mix different coloured plastic and create innovative, psychedelic and colourful styles of fins.

A unique characteristic of Moana that distinguishes its fins is the hand-crafted making process used to produce them. Indeed, hand-crafting is present at all levels of the production, from the transformation process of plastic waste to the creation of recycling and moulding equipment. In turn, this allows Moana to drastically reduce its production costs whilst conveying a green and user-friendly image. Ultimately, Moana aims to embody a modern version of artisan work.

Complementarily, workshops will be organised to further increase awareness about the impact of plastic and grow the community of sustainable oriented surfers who long for durable solutions. The workshops would take place on a regular basis in Moana's production factory, inviting surfers to observe and learn about the transformation process of plastic. Additionally, they are encouraged to bring their own plastic waste items (with appropriate instructions to ensure proper choice of plastic type). Subsequently, the participants are taught in a playful way

to produce their own surfboard fins, choosing the colours and styles they wish to create. Participation is free of charge but a small fee of 10 euros is charged for surfers wishing to produce their own set using Moana's installations. On top of fins production, Moana therefore sells an experience where surfers are offered to "come and create their own fins".

4.2 Competition

4.2.1 Traditional brands

The vast amount of different surfboard fin types is extraordinary. However, getting a clear picture of the mainstream fins found online and in stores can be narrowed down to some archetypal examples. Let us take two surf stores that offer both local and online sales: 58 Surf Shop, a store located in Peniche, and Rocha Surf Shop, located in Portimão. Both display a decent array of brands and categories of surfboard fins and qualify as typical surf shops. The first striking observation is the recurrence of a handful of brands, each offering a declination of fin types. It therefore seems reasonable to examine these specific brands. The most visible one is FCS (Fin Control System), an Australian brand, which also happens to be one of the most widespread brands worldwide. The plentiful types of FCS fins derive from the ever-growing technicality of surfer needs. The latter are met by the numerous shapes of fins that allow surfers to adapt their fins to their style and to the surfing conditions. For each surfing style, producers need to create specific blends of chemicals to alter the resistance or flexibility of the fin. In this regard, FCS has diversified extensively, trying to capture as many profiles of surfers as possible, from the most mainstream to the most technical. All of these factors mostly explain their wide price range, which is typically between 15 and 190 euros for a set of fins. A second unmissable brand is Futures, a Californian company that operates similarly to FCS, with a generous array of fin styles, equally complex composites and a similar price range. However, Futures has differentiated itself in one regard. It has designed low-priced *reclaimed wood composite* (RWC) fins, which consist of 30% reclaimed (i.e. reused) wood that was bound to end up in landfills. Therefore, those 30% of the blend do not require new trees to be cut down. While they are not entirely *eco-fins* and fall into the semi eco-friendly surfboard fins category, they constitute the most similar endeavour to Moana from large fin producers. Finally, several other remarkable companies such as Creatures of Leisure or Feather Fins share a comparable profile to that of FCS and Futures.

For each brand, the sets of fins that are most commonly purchased are of quality and resistant but generally allow for flexibility of style and surfing conditions and so remain quite generic. The latter is due to the fact that most surfers tend not to switch fins regularly. Fins belonging in this category are commonly priced between 60 and 80 euros.

Whilst these brands offer a rather dissimilar value proposition, they still represent the core of Moana's indirect competitors and hence require monitoring as there is a possibility that they would launch directly competitive eco-friendly surfboard fins.

4.2.2 Eco-fins producers

The main direct competitor of Moana is Marlin Fins, a recycled fins producer based in Peniche, Portugal. Marlin Fins offers a medium array of low-priced fin sets, also directed at a rather homogeneous group of surfers as their different types of fins do not vary much. Prices fluctuate between 15 and 37 euros, according to the type of fins. Their process of transformation is done in exploiting industrial equipment as the very existence of Marlin Fins is the result of a partnership with Peniche Surf Shop and J. Caiado Moulds, a 40-year-old enterprise specialised in injecting polymers. While Marlin Fins claims to produce recyclable surfboard fins, it is unclear how they source their plastic raw materials with the exception that it is, as stated on their website, "recycled and reused material".

Whereas Marlin Fins' seemingly well-tailored business model appears to be fruitful with growing distribution in a multitude of stores across Portugal (enigmatically enough, only one is located close to Lisbon in Lufisurf Co on the Costa da Caparica), it appears to suffer from visibility issues. Indeed, in the survey conducted, when asked "do you know of any other plastic-recycled fins?" and asked to mention the brand if they did, only 25% of Portuguese respondents knew about Marlin Fins, most of them regular surfers with an intermediate level (thus likely to know about fin brands). Comparatively, only 9.1% of all European respondents (who are likely to visit Portugal to surf, especially around the Peniche area) knew about the brand. Additionally, Marlin Fins' website somewhat lacks explanations on the transformation process, presentations of their products and information on the plastic impact on the natural environment. Thereby, it misses the opportunity to captivate the attention of its potential customers and manifestly fails to make enough "noise" to increase its visibility.

In this regard, Moana would occupy a very different position (see figure 4) on the recycled-plastic surfboard fin market. First, Moana differentiates itself with its hand-crafting know-how, home-made style and emphasis on raising awareness on the impact of plastic and the processes that exist to change the way we produce. The latter is achieved through a pleasant website describing how accessible plastic recycling is. Also, there is a section displaying recent events such as policy and technology advances regarding plastic. Secondly, Moana intends to be *very* local, located near a beachfront close to Lisbon in order to maximise its visibility not only through traditional promotion but also by giving to surfers and other curious minds the opportunity to observe and learn the process of transformation within Moana's local factory. Finally, in the same vein, Moana will organise productive workshops to further increase wakefulness in a playful fashion.

	<i>Moana Surfboard Fins</i>	<i>Marlin Fins</i>
<i>Method of production</i>	Hand-craft using home-made injecting equipment	Industrial injecting equipment
<i>Location</i>	<ul style="list-style-type: none"> • Lisbon area • Local outreach 	<ul style="list-style-type: none"> • Mainly Oeste intermunicipal community and throughout Portugal • Low presence in the Lisbon area
<i>Target segments</i>	Casual sustainable oriented surfers who have an intermediate level of surfing	Casual sustainable oriented surfers (no data about level)
<i>Average price of polyvalent fins</i>	€20	€27
<i>Variety of fins</i>	Casual surfing only	Limited to casual surfing and longboard surfing
<i>Visibility and promotion</i>	<ul style="list-style-type: none"> • Appealing and informative website • Presence in several local stores around the Lisbon area • Interactive & productive recycling workshops 	<ul style="list-style-type: none"> • Basic website • Presence in many reputable stores throughout Portugal and some in the rest of Europe

Fig.4: Comparative table of Moana Surfboard Fins and Marlin Fins. Source: Marlin Fins' website and online information (Marlin Fins, 2018)

Although eco-fins producer Five Oceans could theoretically be considered as a direct competitor, their activities and headquarters are located in Eastern Australia. Accordingly, they will be disregarded as a competitor since their chances of establishing a presence in Europe in the near future are extremely low.

4.3 Customer segments

First, surfers as a group are examined to emphasise their intricate connection to the environment. Subsequently, an analysis of the survey provides an in-depth definition of the typical surfer profile that would be interested in Moana fins.

4.3.1 Surfers

According to Silva & Ferreira's *The social and economic value of waves: An analysis of Costa de Caparica, Portugal* (2014), the number of surfers who practice surfing at least once a week revolves around 50 000 to 70 000. This number is particularly interesting – and not to be confused with the aforementioned estimate of 200 000, which includes surfers that practice at all levels of frequency – as it narrows the number of surfers that require more recurrent purchasing of equipment. Furthermore, the authors highlight that '*surfers fit in a special category with strong cultural passion, sense of ownership and protection for surf spots*', which underlines the importance of preservation amongst the surfing community. Therefore, recalling Cobanoglu et al.'s four profiles from the market segmentation section of the literature review, it seems reasonable to assert that on average, surfers either fall into the "*genuine green*" or "*follower*" categories.

Consequently, the combination of surfer concern for the natural environment and their significant presence in Portugal suggests a substantial opportunity for Moana to flourish.

4.3.2 Survey analysis

Though not necessarily different than those of traditional brands, Moana's target customers are definitely expected to be more sensitive and concerned by environmental issues and more specifically by the impact of plastic on the natural environment, as Moana conveys emotional value regarding nature and its conservation. This can be confirmed by examining the results of the survey conducted across the surfing community, in which 83% of respondents claimed to be interested in purchasing Moana fins. Out of the interested respondents, 49% declared to be *very concerned* and 51% *extremely concerned* by the impact of plastic on the environment (see figure 5).

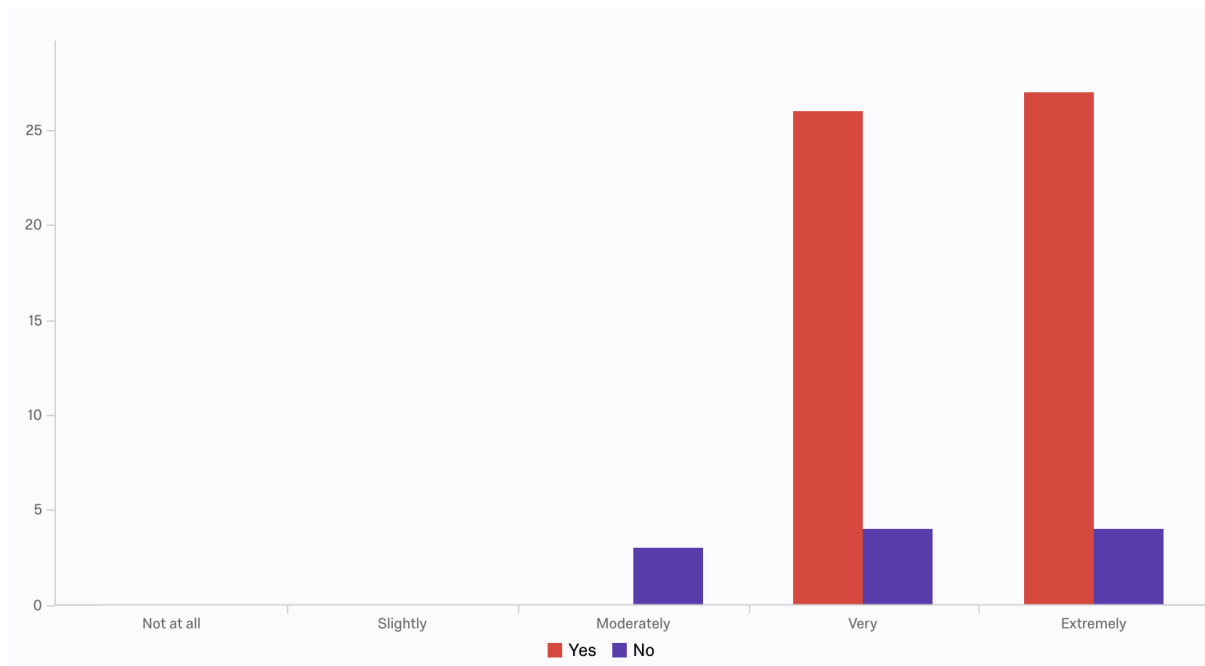


Fig.5: The x-axis depicts the degree of concern about the impact of plastic on the natural environment. Responses in red show respondents who were interested in purchasing Moana fins, purple responses show those that were not. Source: Moana Surfboard Fins survey (Qualtrics, 2018)

Furthermore, when asked about the frequency of surfing sessions, the three largest response groups that were interested in purchasing Moana fins were respondents that go surfing *more than once a week* (28.3%), *once a week* (18.9%) and *more than once a year* (34%). When we merge the two first groups into one that practices *at least once a week* (47.2%), we see two profiles appear: **local surfers** that have the opportunity to go surfing regularly and **tourist surfers** that likely go surfing occasionally during holidays or on weekend trips.

Next, let us investigate the level of surfing of respondents and its relationship with the interest in purchasing Moana fins. When asked to assess their level of surfing, 6% of all respondents described it as *beginner*, 56% as *intermediate*, 30% as *advanced* and 8% as *expert*. In order to explore the relationship in depth, linear regression models were run. The first one uses a variable named **interest** (in purchasing Moana fins) as dependent variable and **level** (which contains all level responses) as explanatory variable. Levels *beginner* (statistically significant at the 90% level) and *intermediate* (statistically significant at the 99% level) were found to be the most significant variables, indicating that Moana fins are likely to be more attractive to people with a *beginner* level but even more so to those with an *intermediate* level since beginners only accounted for 6% of respondents and are therefore not strongly representative

(see figure 6). This seems sensible as Moana fins are designed to be low-priced simple polyvalent fins to be used by casual surfers.

```
lm3.yes <- lm(interest ~ level, data = moanatest.data)
stargazer(lm3.yes, type = 'text', no.space = TRUE)

##
## =====
##                               Dependent variable:
##                               -----
##                               interest
## -----
## levelBeginner                 0.368*
##                               (0.201)
## levelExpert                   0.168
##                               (0.183)
## levelIntermediate             0.285***
##                               (0.103)
## Constant                      0.632***
##                               (0.084)
## -----
## Observations                  64
## R2                            0.125
## Adjusted R2                   0.081
## Residual Std. Error           0.364 (df = 60)
## F Statistic                   2.856** (df = 3; 60)
## =====
## Note:                         *p<0.1; **p<0.05; ***p<0.01
```

Fig.6: Linear regression model using variable **interest** as dependent and **level** as independent. Source: R-studio output

Respondents that assessed their level as *expert* also seem to have a positive impact on the interest in purchasing Moana fins but the variable **levelExpert** is not statistically significant and therefore cannot be trusted. In addition, only 8% identified as experts so it seems reasonable to reject that specific group of surfers. Intriguingly, surfers that assessed their level as *advanced* have been excluded from the model when they nonetheless represent 30% of the total sample. Consequently, a model was run using **interest** as dependent variable and **advanced** as binary (1 if respondent chose advanced, 0 if other) explanatory variable. The model found a slightly negative statistically significant (99% confidence level) influence of *advanced* level on the interest in purchasing Moana fins (see figure 7). This result also appears logical as respondents who evaluated their level of surfing as *advanced* represented 63.6% of the respondents who asserted that they were not interested in purchasing Moana fins (see figure 8).

```
lm3_1_1.yes <- lm(interest ~ advanced, data = moanatest.data)
stargazer(lm3_1_1.yes, type = 'text', no.space = TRUE)
```

```
##
## =====
##                               Dependent variable:
##                               -----
##                               interest
## -----
## advanced                      -0.280***
##                               (0.099)
## Constant                      0.911***
##                               (0.054)
## -----
## Observations                  64
## R2                            0.115
## Adjusted R2                   0.100
## Residual Std. Error          0.361 (df = 62)
## F Statistic                   8.024*** (df = 1; 62)
## =====
## Note:                         *p<0.1; **p<0.05; ***p<0.01
```

Fig.7: Linear regression model using variable **interest** as dependent and **advanced** as independent. Source: R-studio output

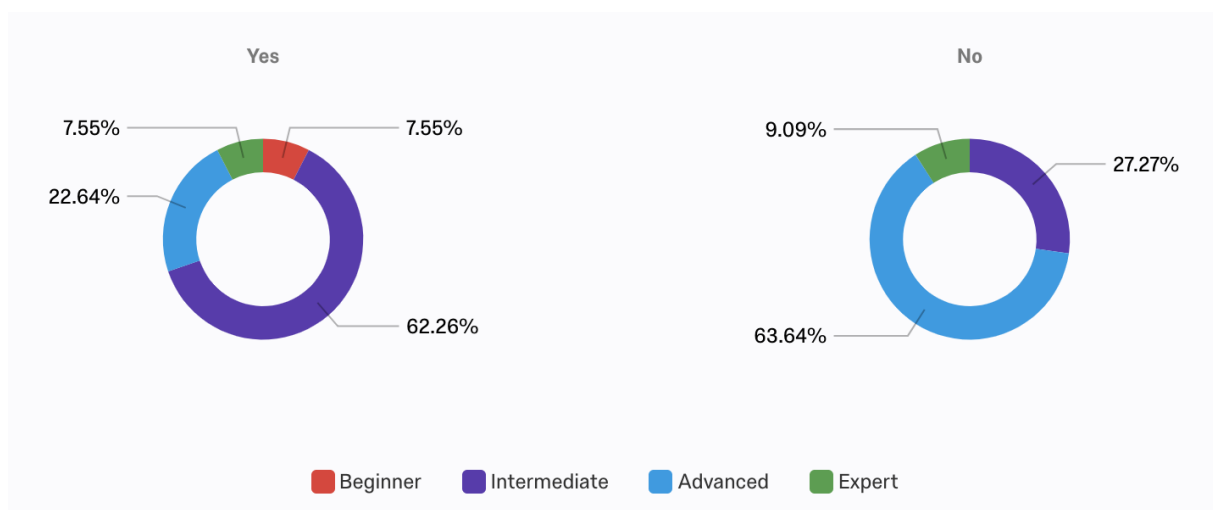


Fig.8: Pie charts of both **yes** and **no** responses to the question “Would you be interested in purchasing Moana fins?”, broken down by assessment of surfing level. Source: Moana Surfboard Fins survey (Qualtrics, 2018)

Finally, 82.8% of the total sample claimed to be interested in purchasing Moana fins, generally denoting a predominantly favourable view on recycled-plastic surfboard fins.

In conclusion, Moana's customer segments consist of local and tourist surfers that are both concerned by the impact of plastic on the natural environment and that have an intermediate level of surfing. The importance of environmental concern was confirmed through the interview conducted with Australian eco-friendly fins producer Five Oceans, as co-founder Luise Grossmann responded "the sustainable oriented surfer" to the question "what is your target market?".

4.4 Technology and key resources

Based on information from the Precious Plastic platform, community and on the expertise of Erwan Gallais-Hamonno (who is a dedicated participant of the development of Precious Plastic in France), the technology required to create recycled-plastic fins and the transformation process are first described. Next, various sources for the appropriate types of plastics are explored.

4.4.1 Process

Typically, any recycled-plastic item has undergone the very first step, which is the process of shredding. That is, before being moulded into a new object and regardless of the transformation method, plastic waste must be teared (shredded) into pieces small enough to work them. Subsequently and more specifically, the recycled-plastic surfboard fin is obtained through plastic injection (see figure 9). The process consists in injecting (i.e. pushing under pressure) melted plastic into a mould that is shaped like a fin with the aid of a lever arm (see figure 10). There are three parts to the injection process: plastic, an injection machine and a mould. The injector, as prescribed by Precious Plastic and its Do-It-Yourself (DIY) kit, can be hand-built using several elements that can be either bought off of Ebay or in scrapyards.

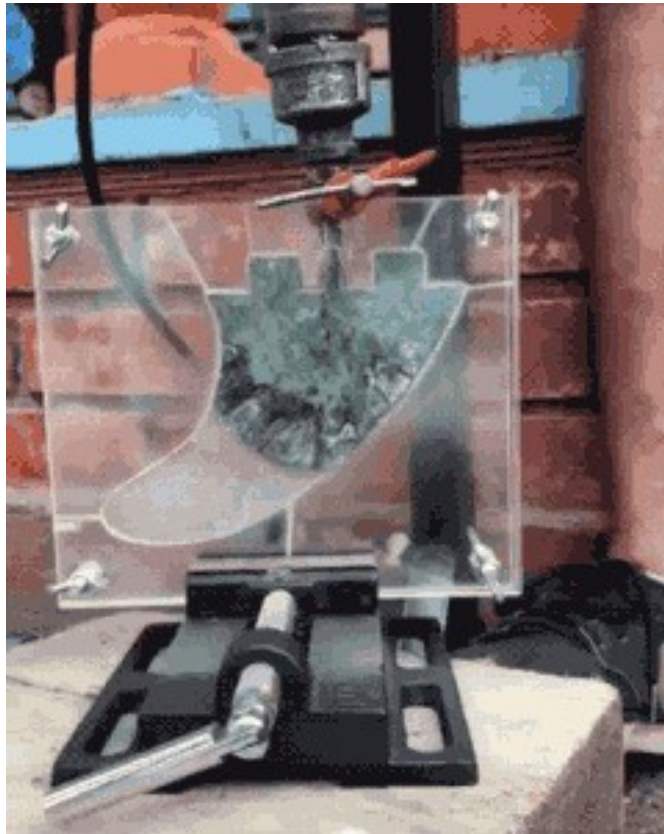


Fig.9: Example of the injection process of a recycled-plastic surfboard fin. Note that the mould here is made of acrylic and is therefore transparent for visual purposes. Source: Dave Hakkens community (Hakkens, 2018)

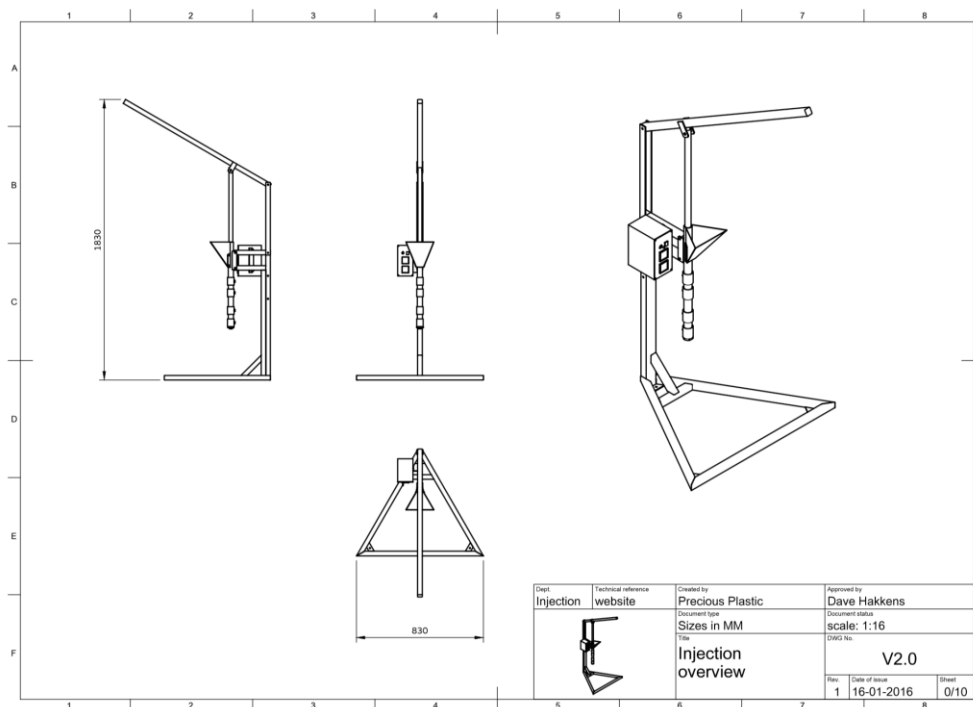


Fig.10: Overview of an injection machine. Note the lever arm used to inject melted plastic into the mould, which must be placed at the bottom end of the central heating tube. Source: Precious Plastic's downloadable construction kit instructions (Precious Plastic, 2017)

Moulds can either be industrial (numerically milled into blocks of aluminium or steel) or hand-crafted in a foundry. On the one hand, an industrial mould's price can vary dramatically depending on its complexity and durability. Though generally in the thousands of euros, an average price for a decent usually reaches an approximate 10 000 euros. On the other hand, a hand-crafted mould can be extremely cheap as it can be home-made. With a 3D printer (around 300 euros) and a home-made aluminium casting station (around 100 euros), a mould can be produced from waste items, which were already cast aluminium (such as scrap auto engine parts). This totals a comfortable approximate 500 euros (including some reserves for aluminium parts). The substantial downside of a hand-crafted approach is the significantly poorer quality of the plastic items cast in the mould and the shorter life of the mould as it will suffer much earlier from regular use than an industrial one. However, the more time is spent on refining the mould by sanding and polishing it the more quality increases (though the wear of the hand-crafted mould will not decrease by refining it). Consequently, the decision on which mould to choose is an almost cliché "time versus money" dilemma if wear does not represent too large a problem. Furthermore, as mentioned in the competition section, a large proportion of surfers tend to use rather generic fins since they do not switch or replace them very often. Also, the customer segment analysis showed that Moana's customers are more likely to have an intermediate level and thus have a lower interest in diversifying their equipment. As a result, only one shape of mould would be initially necessary for Moana, incentivising it to use a hand-crafted mould.

As for the plastic component of the injection process, there are various types that can be used and need testing to create suitable surfboard fins. First, plastic is generally divided into 7 categories (which can be found on plastic items inside a triangle of arrows, indicating which category it belongs to). In order from 1 to 7, the categories are as follows: *polyethylene terephthalate* (PET), *high-density polyethylene* (HDPE), *polyvinyl chloride* (PVC), *low-density polyethylene* (LDPE), *polypropylene* (PP), *polystyrene* (PS) and *others* that include all other plastics, which account for approximately 20% of all plastics (Precious Plastic, 2017). Each category of plastic presents different properties that alter the density, elasticity and thermal resistance of the item (see appendices A and B). In this regard, there are multiple sensible ways of producing recycled-plastic fins and it is therefore worth investigating different categories. Erwan Gallais-Hamonno identified PET (category 1), HDPE (category 2) and PP (category 5) as the most appropriate types for recycled-plastic surfboard fins, as they are the easiest and least toxic to work with. Moreover, they are the most common type and found in quantity in everyday

garbage. Typically, PET is used to produce plastic bottles and HDPE for bottle caps and hygiene bottled products (such as shampoo, soap and so forth). Out of the three types, PP is the category found in most ordinary items, from plastic buckets and chairs to industrial bricks or medical syringes. Thus, it seems reasonable to focus on utilising PP to produce Moana fins as it is the most convenient and accessible type. Additionally, eco-fins producer Five Oceans has shared that their chosen material was indeed PP (in spite of the fact that they add fibre glass for performance purposes). However, one might want to conduct tests with PET and HDPE to control for resistance, quality, usability in the injection process and subsequently compare it to PP, in the interest of rigour.

4.4.2 Key resources

Collecting plastic can be done under various strategies. The first one consists in picking waste plastic on beaches. While it is common knowledge that most beaches and shores are overflowed with plastic waste and such an approach would likely be beneficial to the image of the start-up and its communication strategy, “beach-picking” is the most cumbersome method. Indeed, identifying to which category of plastic each item belongs would prove rather difficult and usually only fragments can be found, lengthening substantially the duration of each picking to obtain a certain quantity. The second strategy aims to “hack” the domestic waste collection and recycling cycle. Indeed, working directly with waste management enterprises or institutions (such as ValorSul in the Lisbon and Oeste regions of Portugal) is virtually impossible as such institutions already exist for the very purpose of recycling. Therefore, collaborating with start-ups such as Moana is nothing but counterproductive for them. Accordingly, the “hacking” approach aims to intercept plastic waste before it enters the recycling system. However, this also proves difficult as economic creativity is required to setup new streams so as to rely on these sources on the long-term in a stable fashion. Finally, the third and most convenient strategy targets industrial waste. Many enterprises that use plastic or generate large quantities of plastic waste are commonly inclined to find ways that are environmentally friendly to get rid of it. Therefore, they represent a valuable source of raw materials for Moana, either by donating it or by selling it at very low prices. More specifically, companies that are willing to collaborate present two main advantages on top of being both a low-cost and convenient option. First, it is a prodigious communication and reputation asset at very low costs as they are mostly logistic (even though one may argue that since such a collaboration carries substantial emotional value, managers that feel concerned by the environmental issue at hand would disregard any monetary transaction further than a symbolic one, dropping purchasing costs close to zero). The positive

communication and reputation benefits are also true of the buyer side (i.e. Moana in this case). Second, sourcing plastic from stable and healthy organisations means steady flows of raw materials each period. Solid examples include restaurants and supermarkets that use plastic baskets or trays that they receive through delivery of fresh products (see figure 11). The latter are usually disposed of right after delivery, especially in restaurants. Additionally, the baskets are also used on a more long-term basis in supermarkets for display. They nonetheless end up broken after some time and become waste. Lastly, the baskets are predominantly made out of pure PP and are consequently a blessing for the transformation process. In conclusion, the third strategy thus constitutes the most reliable and steady source of plastic and alleviate the problems encountered in the first and second strategies. In this regard, Moana could envisage collaborating with enthusiastic and eco-friendly restaurants that value local productions. Though potentially more difficult to convince, supermarkets such as Continente also constitute a serious option for extensive production as the quantity of plastic baskets circulating throughout their stores is more constant, much larger and where broken items are more abundant.



Fig.11: On the left, standard fresh products baskets used for delivery. On the right, display baskets inside a Continente supermarket. Source: Distribuição Hoje, 2017

4.5 Costs and revenues

In order to make the Moana project viable, costs and revenues must be outlined in a simplified way to grasp the basics at stake.

First, sales are detailed. Though the survey conducted showed an average willingness to pay of 64.5 euros for a set of fins, they are priced at 20 euros for accessibility purposes and in order to compete on price with Marlin Fins. This is only possible thanks to the low costs of the hand-crafting production approach. Sales of fin sets are forecasted seasonally. In this regard, the table in figure 14 has been presented in quarters for costs and revenues. For instance, in Q1 of the first year, only 10 sets of fins are expected to be sold, resulting in revenues of 200 euros. Growing every year, sales are expected to peak considerably in Q2 and especially in Q3 as they include the tourist season (tourists being one of Moana's customer segments). Simultaneously, estimates are shown for the number of surfers interested in participating in the workshops and building their own set of fins for a fee of 10 euros. Similarly, forecasts are estimated to grow overtime and peak in Q2 and Q3.

Second, fixed costs are comprised of equipment such as the two essential machines that are derived from the *Precious Plastic* recycling model as a way to minimise costs (see figure 12 and 13), the shredder and the injection machine. If built as prescribed, it is encouraged to maximise reuse of components to build the workstation to dramatically reduce costs (also rendering the station almost completely carbon neutral). These cost 180 and 131 euros, respectively, and are depreciated on a three-year straight-line basis. In addition, a hand-crafted mould required some equipment for its fabrication and costs 500 euros, depreciated in the same fashion. Furthermore, a monthly rent expense of 150 euros and a website investment of 1500 euros with monthly maintenance of 5 euros are incurred. Finally, raw materials are free as they are the result of a communication and reputation partnership with a philanthropic enterprise producing large quantities of plastic waste.

Third, variable costs are indirectly linked to production (illustrated by sales). Charges follow the seasonal trends of production but are not numerically tied to production as production is not the only source of energy required and monthly contracts are included. Likewise, marketing expenses are increased in Q2 and Q3 to optimise visibility during the tourist season. They nonetheless increase overtime as visibility must not only be established but maintained, so the higher the sales, the more important the continuity in public visibility.

Computing totals, the net income shows a lean breakeven by year two. However, year three illustrates the true beginning for Moana’s profits with a yearly profit of 2258 euros.

Finally, VAT and taxes would have to be accounted for in a more refined analysis of costs and revenues. However, Moana is a fairly small-scaled start-up and is therefore likely to be sensitive to numerous minor factors (either positively or negatively) such as “show-up” rates in the factory or seasonal weather impacting directly the inflow of tourists. Hence, this financial breakdown is chiefly aimed to represent a neutral situation for Moana’s development.

Bill of materials shredder

Description	Material	Details	Quantity	Where to get it	Remarks	Price
Machine parts						
3mm sheet	steel	cutted	1x	Scrapyard/Hardware store	optional stainless steel	30
5mm sheet	steel	cutted	1x	Scrapyard/Hardware store	optional stainless steel	40
6 mm sheet	steel	cutted	1x	Scrapyard/Hardware store	optional stainless steel	40
● Hexagon bar	Steel	27M	32cm	Metal shop		15
L Angle profile	Steel	30x30x3mm	100cm	Scrapyard		10
Mesh	metal	150x180x1.5mm		Scrapyard	perforated sheet or drill holes yourself	2
Sheet metal	Steel	1mm		Scrapyard		7
Electronics						
Motor	-	+/- 2kw	1x	Scrapyard	preferable +/- 70 RPM	30
Power switch	-		1x	Scrapyard/Hardware store		3
Led indicator	-	220V	1x	Hardware store		3
Powercord	-		5 M	Scrapyard/Hardware store		
				Total		€180
						<small>Price varies depending on where you live</small>

Fig.12: Example of a bill of materials for a Precious Plastic shredder, highlighting the exceptionally modest budget required. Note that most components can be found in scrapyards, illustrating the opportunities for reused materials. Source: Precious Plastic’s downloadable construction kit instructions (Precious Plastic, 2017)

Bill of materials injection

Description	Material	Details	Quantity	Where to get it	Remarks	Price
Machine parts						
- Strip	Steel	20x3mm	18cm	Scrapyard		2
- Strip	Steel	30x4MM	152.5cm	Scrapyard		5
• Round bar	Steel	26x680MM	58.5cm	Metal shop	accurate and smooth from the inside	10
□ Square tube	Steel	30x30x3MM	569.1cm	Scrapyard		30
○ Tube	Steel	34x26x4MM	53 cm	Scrapyard/ Metal shop		1
L Angle profile	Steel	30x30x3mm	16cm	Scrapyard		2
Wooden base	Wood	18mm		leftover	Can also use another material	0
Sheet metal	Steel	1mm		Scrapyard		5
Electronics						
PID Controller	-	0-400 Degree	2x	Ebay		20
SSR	-	2-24 V	2x	Ebay		8
Thermocouple	-	Type K	2x	Ebay		15
Bandheater	metal	35x45MM	4x	Ebay		25
Power switch	-	220V	1x	Scrapyard/Hardware store		3
Led indicator	-	220V	1x	Hardware store		3
Powercord	-		5 M	Scrapyard/Hardware store		2

Total		€131 <small>Price varies depending on where you live</small>
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Fig.13: Example of a bill of materials for a Precious Plastic injection machine. Source: Precious Plastic's downloadable construction kit instructions (Precious Plastic, 2017)

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sales												
Fins per Qr.	200 €	600 €	800 €	400 €	400 €	400 €	1 400 €	600 €	1 000 €	1 400 €	2 000 €	1 400 €
Fins per Yr.	2 000 €			3 400 €	3 400 €			5 800 €				
Workshops revenue per Qr.	80 €	80 €	100 €	80 €	80 €	80 €	110 €	80 €	80 €	100 €	120 €	100 €
Workshops revenue per Yr.	340 €			350 €	350 €			400 €				
Total Revenue				2 340 €			3 750 €				6 200 €	
Fixed Costs												
Shredder	131 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Injection Machine	180 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Hand-crafted mould	500 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Depreciation and Amortization (shredder, injection machine and mould)	68 €	68 €	68 €	68 €	68 €	68 €	68 €	68 €	68 €	68 €	68 €	68 €
Rent	450 €	450 €	450 €	450 €	450 €	450 €	450 €	450 €	450 €	450 €	450 €	450 €
Plastic raw materials (industrial waste from partners enterprise)	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Website	1 500 €	15 €	15 €	15 €	15 €	15 €	15 €	15 €	15 €	15 €	15 €	15 €
Total Fixed Costs	2 829 €	533 €	533 €	533 €	533 €	533 €	533 €	533 €	533 €	533 €	533 €	533 €
Variable Costs												
Charges (mainly electricity, includes other minor charges)	210 €	250 €	290 €	230 €	230 €	280 €	320 €	250 €	250 €	310 €	350 €	280 €
Marketing (Online adds & flyers)	15 €	20 €	30 €	15 €	20 €	30 €	50 €	50 €	100 €	120 €	200 €	200 €
Total Variable Costs	225 €	270 €	320 €	245 €	250 €	310 €	370 €	300 €	350 €	430 €	550 €	480 €

	Year 1	Year 2	Year 3
Revenue	2 340 €	3 750 €	6 200 €
Fixed costs	4 428 €	2 132 €	2 132 €
Variable costs	1 060 €	1 230 €	1 810 €
Total costs	5 488 €	3 362 €	3 942 €
Net income	-3 148 €	388 €	2 258 €

Fig.14: Complete costs and revenues table including net income. Source: Author's own calculations

4.6 Distribution channels

When asked about the location where they bought their surfboard fins, 25.8% of respondents answered that they did so online. The remaining 74.2% claimed to buy fins in local stores. This finding seems sensible as local stores are important to surfers for numerous reasons. Surfers go to stores to buy all sorts of other equipment items that are as trivial as surfboard fins that do not require long shopping time, which does not particularly incentivise them to switch to online shopping. Additionally, *local* stores, as indicated in their denomination, are usually situated very close to shores where they go surfing, further increasing the likelihood of surfers choosing local stores rather than online stores. Furthermore, salesmen in local stores are customarily experienced surfers and chatting about products is a valuable advantage of shopping in local stores. Though designed to improve convenience, in the case of surfers, online shopping is reserved for those who know rather precisely what they seek or for products that are cheap enough to risk purchasing them.

In this regard, Moana must unquestionably be present in local stores, especially in those located around Lisbon so as to reinforce the sentiment of “localness” of the product. Plus, Moana would benefit from the “touch and feel” effect where surfers actually see the product and assess its quality and style for themselves. Indeed, Moana fins are plastic-recycled and is therefore likely to raise suspicion regarding their performance attributes. Through “touch and feel”, shoppers are thus more likely to be tempted to buy. Collaboration with local stores is expected to be relatively easy as Moana fins are low-priced products and the owner would not incur high risks of loss. In addition, owners are likely to be aware of the environmental issues related to plastic and would be prone to sell eco-friendly products in their stores, as it also enhances their stores’ reputation. While emphasis has been placed on local store sales, it does not mean that online presence should be overlooked, to the contrary. Moana must strongly rely on word-of-mouth processes in the first period of its existence, and an attractive and pleasantly designed website is the perfect solution to capture this group of interested customers. The website would not only serve as an online store but also as a platform to share Moana’s philosophy, ideas, production processes to further increase consciousness about a product’s origin and news on the global advances apropos the issue of plastic waste management. Also, by means of a few clever search engine tricks, the website can be used to promote Moana fins as well as raise awareness concerning the impact of plastic on the natural environment to the general public. Last but not least, many local stores have their own online shop (such as Rocha Surf Shop, for instance) where customers can directly buy products they already know. Should Moana fins sell in these

stores, it would be an additional online presence with purchasing options. Likewise, Moana could actively sell on larger online sport stores, further growing its reach and visibility. In addition, Five Oceans claimed to sell both online and in local stores, reinforcing the strategy of establishing an appropriate mix of both channels for Moana.

5. Conclusion and limitations

5.1 Conclusion

This dissertation endeavoured to present a span-new method to recycling plastic in Portugal. Through a hand-crafted approach to producing recycled-plastic surfboard fins, Moana manages to reduce its costs to the lowest and yet offer reliable fins, whilst simultaneously position itself in close proximity with its customer base and the general public so as to spread the word in a wholesome fashion. Per a data analysis operated with information from the survey that was conducted to consult the surfing community, it was found that the most fitting customers and most likely to be attracted to Moana are both local and tourist surfers that present an intermediate level of surfing, indicating their casual practice of the sport. Consequently, Moana is viable throughout the year with a remarkable rise in sales and production during the warm touristy months from May to September. Additionally, Moana's potential customers are unquestionably environmentally driven. That is to say, they are specifically concerned by the impact of plastic on the natural environment. The latter being a common trait amongst the surfing community, the stability of a customer base is guaranteed for Moana for as long as surfers will surf. Furthermore, Moana proudly defines itself as an artisan factory, emphasising the localness of its production and doing so by organising workshops in its premises to reinforce the sense of community amongst environmental "do-gooders". Since Moana targets sustainable oriented surfers, displaying such an image is bound to bolster their attraction to Moana.

Although it uses a different strategy and conveys a somewhat soberer and less explicit image, Marlin Fins is Moana's main and only eco-fin competitor in Portugal. While it is direct competition, it does not represent that much of a threat for multiple reasons. First, it is geographically located around Peniche whereas Moana focuses on Lisbon and its surroundings. As both productions are rather low-scaled, overlap is likely to be limited in local sales. Second, Moana aims to produce artisanal products, thereby attracting surfers who are more devoted to understanding their products and buy more consciously, whereas Marlin Fins are hardly proactive beyond the fact that they produce their fins out of recycled plastic. Finally, through a technologically innovative hand-made approach (many derived from the Precious Plastic model) to most of its processes, Moana is defiantly competitive on costs.

5.2 Limitations

Whilst the survey conducted among the surfing community provided key insights and a healthy sample, the fact that only 64 respondents completed the questionnaire remains a weak point for the analysis that was subsequently drawn.

Furthermore, one might tarnish Moana's philosophy of contributing to the cleaning of the planet by arguing that fins occasionally fall off from a surfboard and end up in the ocean, which is a repetition of the problem it is trying to solve. While this argument is undeniably sound, incidents of the like are quite infrequent, and it is thus a risk worth taking to "boycott" the use of virgin plastic. And as cofounder of Five Oceans Luise Grossmann replied when confronted with the issue, *"this is a risk no-one can avoid, the amount of waste from drink containers is far more than we could ever produce"*.

While it is not necessarily noticeable by the average surfer when it comes to performance, producing fins that 100% recycled plastic induces a lower quality of the product, presenting a higher risk of breaking than traditional fins.

Besides, surfers may be seen as or may become competitors to Moana as its know-how is openly available through the workshops and mostly based on open-source Precious Plastic technology and practices.

Finally, contact with Marlin Fins was never established and it is very likely that information and insights would have been absolutely more helpful than data gathered from outside investigation. Consequently, the competitor analysis would have plausibly been more accurate.

5.3 Final note

Considering the challenges faced nowadays by the world's humongous surplus of plastic waste floating and lying around, combined with the continuing production of virgin plastic, numerous proposals and initiatives are being rolled out to combat this human issue. From international multilateral policymaking to micro-entrepreneurial activities, it is the collective effort that will lead the way to environmental redemption. Implementing solutions and spreading innovation on every rung of the global ladder could indeed moderate the distortions inflicted to the cycle of nature in the hope of eventually restoring it.

“The travels and the little silver lining on the horizon: Almost everywhere you go, you can see the consequences of pollution, and researching more about it makes it even worse. But with more knowledge and understanding things can change. The fact that no matter where the project will end up, at least we tried. And who are we not to try.”

Luise Grossmann, *Cofounder ecoFin / FiveOceans*

“It is fair to say that in our quest for modernity, we have demonstrated considerable ignorance concerning the impact of our inventions.”

Gunter Pauli, *The Blue Economy 3.0*

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7. Appendices

Appendix A: List of interviewees

<i>Name</i>	<i>Affiliated Organisation</i>	<i>Position</i>	<i>Date interviewed</i>	<i>Medium</i>
Luise Grossmann	ecoFin / Five Oceans	Cofounder	22/11/18	Email
Erwan Gallais-Hamonno	Francophone Precious Plastic Community	Organiser and moderator	04/12/18	Discord platform, email

Appendix B: Visual properties of plastic



Visual properties

Type		name	properties	common uses	burning
PET		polyethylene terephthalate	clear, tough, solvent resistant, barrier to gas and moisture, softens at 80°	Soft drink, water bottles, salad domes, bisquit trays, food containers	yellow flame little smoke
HDPE		high-density polyethylene	Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, softens at 75°	Shopping bags, freezer bags, milk bottles, juice bottles, icecream containers, shampoo, crates	difficult to ignite smells like candle
PVC		polyvinyl chloride	Strong, tough, can be clear and solvent, softens at 60°	Cosmetic containers, electrical conduit, plumbing pipes, blister packs, roof sheeting, garden hose	yellow flame green spurts
LDPE		low-density polyethylene	Soft, flexible, waxy surface, scratches easily, softens at 70°	Cling wrap, garbage bags, squeeze bottles, refuse bags, mulch film	difficult to ignite smells like candle
PP		polypropylene	Hard but still flexible, waxy surface, translucent, withstands solvents, softens at 140°	Bottles, icecream tubes, straws, flower-pots, dishes, garden furniture, food containers	blue yellow tipped flame
PS		polystyrene	Clear, glassy, opaque, semi tough, softens at 95°	CD cases, plastic cutlery, imitation glass, foamed meat trays, brittle toys,	dense smoke
OTHER		all other plastics	Properties depend on the type of plastic	automotive, electronics, packaging	all other plastics

Appendix C: Physical properties of plastic



Physical properties

Plastic Abbreviation - Brand name	Thermal Properties				Strength		Density
	Tm	Tg	Td	Cte	Tensile	Compressive	
	°C	°C	°C	ppm/°C	psi	psi	g/cc
PET - Polyethyleneterephthalate	245	73	21	65	7000	11000	1.29
	265	80	38		10500	15000	1.40
LDPE - Low density polyethylene	98	-25	40	100	1200		0.917
	115		44	220	4550		0.932
HDPE - High density polyethylene	130		79	59	3200	2700	0.952
	137		91	110	4500	3600	0.965
PP - polypropylene	168	-20	107	81	4500	5500	0.900
	175		121	100	6000	8000	0.910
PVC - polyvinylchloride		75	57	50	5900	8000	1.30
		105	82	100	7500	13000	1.58
PS - polystyrene		74	68	50	5200	12000	1.04
		105	96	83	7500	13000	1.05

Tm - crystalline melting temperature (some plastics have no crystallinity and are said to be amorphous).

Tg - glass transition temperature (the plastic becomes brittle below this temperature).

Td - heat distortion temperature under a 66 psi load.

Cte - coefficient of linear thermal expansion.

Tensile Strength - load necessary to pull a sample of the plastic apart.

Compressive Strength - load necessary to crush a sample of the plastic.

Density - aka specific gravity mass of plastic per unit volume.