

Mapping Economic, Behavioural and
Social Factors within the Plastic Value
Chain that lead to Marine Litter in
Scotland

Crisps, snack and sweet wrappers report

The Scottish Government

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Commercial confidentiality

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Executive Summary

Aims and approach

In the context of growing public concern around marine litter and a fast moving policy landscape of measures to address marine litter and plastic waste, this research sought to understand opportunities within the plastic value chain to help tackle marine litter. The factors and decisions that lead to marine litter in Scotland were researched with a focus on four products that are not fully addressed by current or planned marine litter and plastics waste policy measures. These four product categories were:

1. Commercial fishing gear
2. Crisps, snack and sweet wrappers
3. Artificial grass pitch
4. Menstrual products

The research findings are presented in six documents as follows:

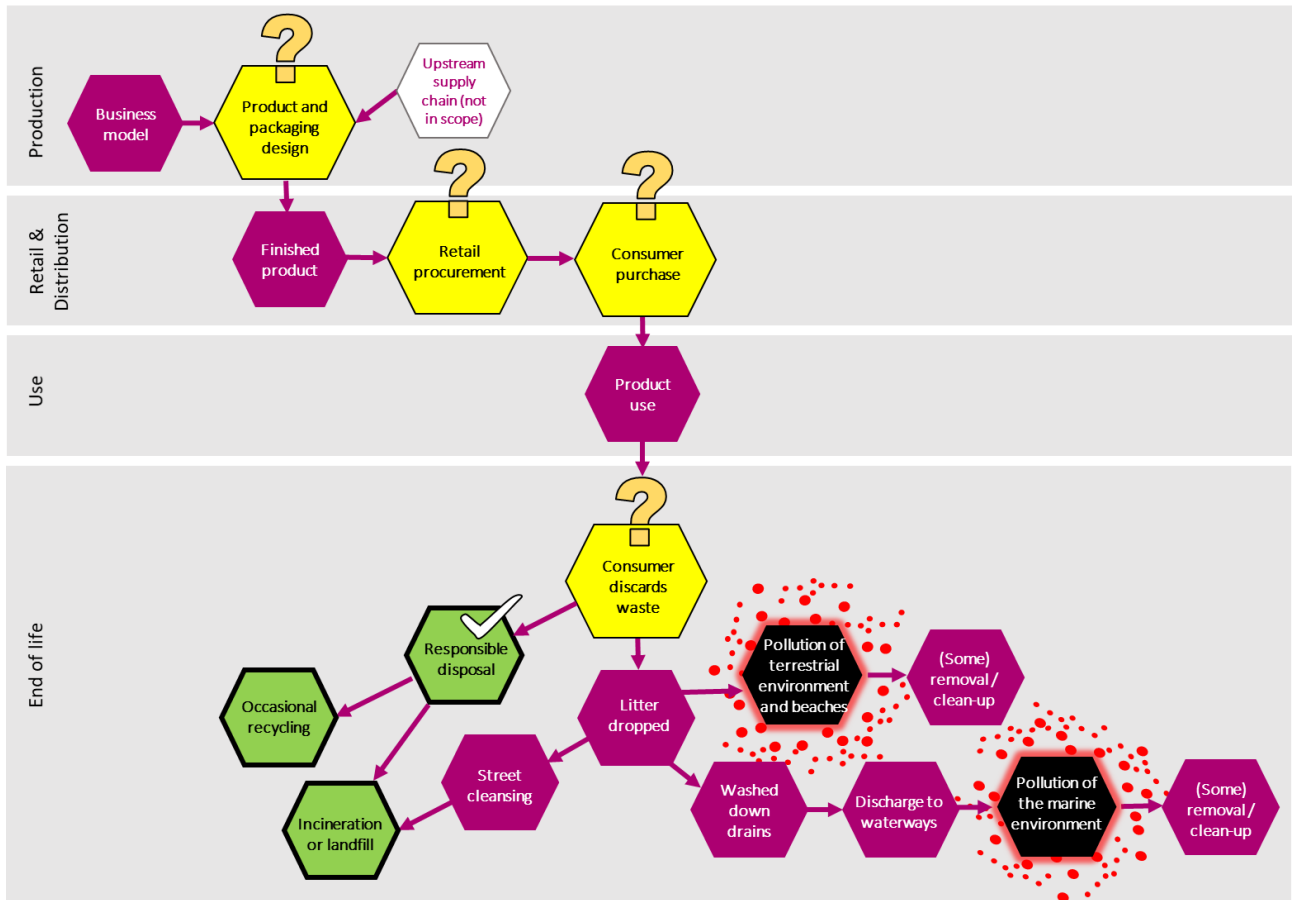
1. **Summary report**
2. **Commercial fishing gear**
3. **Crisps, snack and sweet wrappers**
4. **Artificial grass pitch**
5. **Menstrual products**
6. **Literature review**

This document is the *Crisps, snack and sweet wrappers report*. Key findings for are introduced below. Recommendations are presented for the Scottish Government. The recommendations presented have different potential efficacy, costs and timescales, and to some degree the likely impact is related to the resources and support invested in any single measure.

Crisps, snack and sweet wrappers

Crisps, snack and sweet wrappers are packaging items littered on land, a proportion of which are washed down drains and transported to the marine environment, and some are dropped directly on beaches. Marine litter pathways and key decision points are illustrated in Figure E1. Key decision points explored in this research are highlighted in yellow. Business models are not highlighted and explored in detail due to a lack of examples to draw upon. Such business models are potentially inhibited by incompatibility with current systems optimised to deliver single-use packaging products, but there may be opportunity to support such models in the future.

Figure E1: Crisps, snacks and sweets - Marine litter pathways and key decision points



During the research, only one product was identified as being specifically designed to limit impacts when littered (replacing plastic with a paper wrapper). Undoubtedly further product design and business model solutions are possible and design and materials innovation will be underway in industry. Action could be delivered through voluntary agreements or policy measures such as EPR or a deposit return scheme. Table E1 presents an analysis of where potential solutions may have the most influence in relation to key decision points from Figure E1. Solutions will have varying degrees of impact, which will also be affected by their design and implementation. Litter education is also part of the solution, although traditionally delivered by NGOs rather than value chain actors.

Table E1: Crisps, snack and sweet wrappers - where solutions can most influence key decision points

Life cycle stage	Key decision point	Voluntary agreements	Packaging innovation	Recycling	Extended Producer Responsibility	Deposit Return Scheme
Production	Product and packaging design	✓	✓	✓	✓	✗
Retail	Retailer procurement	✓	✗	✗	?	✗
Use	Consumer purchase decision	✓	✗	✗	✗	✗
End of life/recovery	Consumer discards waste	✗	✗	?	✗	✓

✓ = Yes, ✗ = No, ✓ = Yes - if solution designed with this in mind, ? = Unknown

Further research into the nature of the problem is needed: what brands, products and formats are most littered, and how much is whole wrappers versus torn corners and what their impacts are in the marine environment. This information should inform further consultation with industry to spur on value chain solutions.

On the basis of the research findings, the following recommendations are made for the Scottish Government and the private sector to tackle marine litter from crisps, snack and sweet wrappers:

1. Better understand the nature of this item in litter
 - a. Publish brand and product litter survey
 - b. Research relative litter abundance of whole wrappers and packets versus pieces
2. Industry workshop for solutions
3. Product design change assessment

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1 Introduction

Whilst there is significant activity on reducing marine litter in Scotland, there are some products which cause marine litter that are not fully addressed by current activities. The aim of this research study was to identify these problem products and investigate opportunities throughout the value chain to tackle marine litter issues, with Government support or interventions where necessary.

The research findings are presented in six documents: an overarching summary and discussion, a separate report for each of the marine litter product groups researched in detail, and a literature review. The list of six report documents is as follows:

1. **Summary report**
2. **Commercial fishing gear**
3. **Crisps, snack and sweet wrappers**
4. **Artificial grass pitch**
5. **Menstrual products**
6. **Literature review**

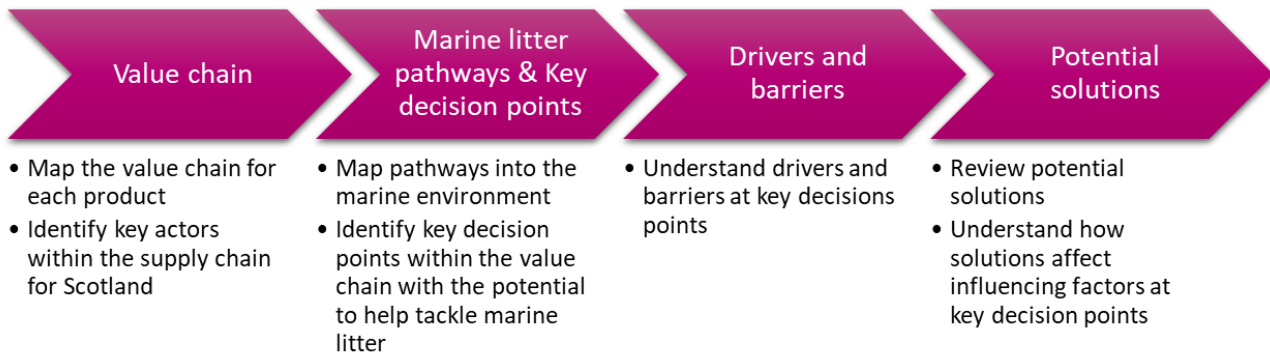
This document is the *Crisps, snack and sweet wrappers report* and is structured as follows:

- **Methodology** - section 2
- **Introduction to product and marine litter issue** - section 3
- **Value chain and stakeholder engagement** - section 4
- **Marine litter pathways and key decision points** - section 5
- **Drivers and barriers** - section 6
- **Potential solutions** - section 7
- **Recommendations** - section 8

2 Methodology

Over the product life cycle, materials and products pass through multiple actors in the Scottish economy, from raw materials extraction and product manufacturing to the point when products are discarded and recycled or disposed of. The pathways a specific product takes are dictated by decisions taken by the actors in the value chain. This raises an important question: why do some products become marine litter, i.e. what decisions have been made and by whom, *throughout* the product's value chain, that result in 'leakage' into the marine environment? To answer this question, it is necessary to understand decision making in the value chain. Whilst actors may already be aware of marine litter issues and may want to address them, there may be barriers or more dominant drivers that dictate how key decisions are currently made. With an understanding of key decision points in the value chain it is possible to consider how potential solutions can affect decision making to help tackle marine litter. This is the basis of the research framework used in this study, as summarised in Figure 1. The research framework is reflected in the structure of this report and referred to throughout.

Figure 1: Outline of research framework



The framework above outlines the approach taken within the research. To gather this information to inform the study, research activities were conducted in three stages:

1. Scoping study
2. Literature review
3. Interviews

Products made from bioplastics were considered out of scope in this research. Research and innovation in material science is leading to the development of many new polymers marketed as biodegradable plastics. However, there is ongoing debate over the efficacy of these polymers to biodegrade in the marine environment over short enough timescales to reduce the impacts of marine litter. This is a complicated subject worthy of a dedicated research project, and so was considered outside the scope of this study to assess. Instead, the research scope starts after polymerisation at the point in the value chain where plastic products, or semi-finished products, are manufactured.

The main product life cycle stages are used as the structure for value chain analysis, to represent and understand the sources of marine litter, marine litter pathways and key decision points within the value chain. This enables a clear and consistent structure for analysis and comparison between products that have different value chains and marine litter pathways. The stages in the product life cycle described in this research are:

- Raw materials
- Production
- Retail & distribution
- Use
- End of life/recovery

Further details on the methodology and engagement approach are given in the *Summary report* document for the study as a whole.

3 Introduction to product and marine litter issue

Crisp, snack and sweet production is a significant market in the UK, and there is a healthy export market of UK brands¹. Brands such as Mackie's of Scotland, Tunnocks and Nestlé have a manufacturing presence in Scotland, with Mackie's having a 15% market share for snacks manufactured in Scotland², Tunnocks producing an annual turnover of £58.1 million³, and Nestlé manufacturing 90% of their products for the home market in the UK⁴. Marine litter and litter in general have the potential to negatively impact the image of this industry, with movements such as #isthisyours⁵, the #breakfreefromplastic brand audit⁶, and Leithers Don't Litter's brand shaming exhibition⁷ working to name and shame brands in an attempt to make them accept more responsibility for litter. Examples of common wrapper types are shown in Figure 2, however there have been some recent design innovations seen in this industry, with Nestle producing a recycled and recyclable paper packaged product⁸.

¹ Eurostat, Database, <https://ec.europa.eu/eurostat/data/database>

² The Press and Journal (2016), Plough to pack: Behind the scenes at Scotland's only crisp maker, <https://www.pressandjournal.co.uk/fp/business/farming/828707/plough-pack-behind-scenes-scotlands-crisp-maker/>

³ The Herald (2019), Tunnock's toasts 25% surge in overseas sales, https://www.heraldscotland.com/business_hq/17384452.tunnocks-toasts-25-surge-in-overseas-sales/

⁴ Confectionary News (2016), Nestlé confectionary division 'remains under pressure', <https://www.confectionarynews.com/Article/2016/10/25/Nestle-confectionery-division-remains-under-pressure>

⁵ Huffington Post (2019), Litter pickers are tweeting total rubbish and asking brands: #isthisyours?, https://www.huffingtonpost.co.uk/entry/people-are-tagging-brands-in-photos-of-litter-online-with-the-hashtag-isthisyours_uk_5c6aa3a7e4b01757c36dc439

⁶ #breakfreefromplastic (2018), The Brand Audit Report, <https://www.breakfreefromplastic.org/globalbrandauditreport2018/>

⁷ Leithers Don't Litter (2016), Crapitalism, A Rubbish Exhibition, <https://www.leithersdontlitter.org/crapitalism-a-rubbish-exhibition> (2018),

⁸ Evening Standard (2019), Snack bar wrapper made from sustainable paper hailed as recycling 'world first', https://www.standard.co.uk/news/uk/snack-bar-wrapper-made-from-sustainable-paper-hailed-as-worldfirst-technological-breakthrough-a4180861.html?utm_source=Greenhouse+Morning+News&utm_campaign=6e632796e8-Greenhouse+Morning+News+GMN+3rd+July+2019&utm_medium=email&utm_term=0_e40c447c1a-6e632796e8-123999109

Figure 2: Example of typical crisps, snack and sweet confectionery packaging⁹



While actors in the crisp, snack and sweet industry appear aware of the marine litter issue, and with producers and retailers members of the UK Plastics Pact¹⁰, there are barriers to acting on the issue (discussed in section 6), as well as unintended consequences from actions which have been taken¹¹.

This industry is a contributor to marine litter. Statistics vary, but food wrappers including crisp, snack and sweet wrappers are consistently one of the top categories identified in marine litter surveys. Also, people commonly tear corners off packets to open them, and these small pieces are commonly littered¹² and would contribute to the plastic/polystyrene pieces (0-50cm) category which was the most collected item during MCS beach surveys in 2018¹³. To understand this issue, the value chain for crisps, snacks and sweets and pathways to the environment are outlined in the sections 4 and 5, respectively, alongside the key decision points. The subsequent sections analyse the drivers and barriers (section 6) and potential solutions (section 7), consistent with the research framework set out in Figure 1.

⁹ The Mirror (2015), Sweets through the ages timeline shows how treats have evolved over 10,000 years, <https://www.mirror.co.uk/news/uk-news/sweets-through-ages-timeline-shows-6882741>

¹⁰ WRAP (2019), The UK Plastics Pact Members, <http://www.wrap.org.uk/content/plastics-pact-members>

¹¹ The Guardian (2017), The plastics problem: are natural alternatives doing more harm than good, <https://www.theguardian.com/business-to-business/2017/oct/31/the-plastics-problem-are-natural-alternatives-doing-more-harm-than-good>

¹² Keep Britain Tidy (2012), The little book of litter, https://www.keeptidytidy.org/sites/default/files/resources/KBT_Little_Book_of_Litter_2012.pdf

¹³ MCS, 2018 (<https://bit.ly/2rdV4vj>)

4 Value chain and stakeholder engagement

The following sections discuss the value chain and the specific stakeholders engaged within this study. This is the starting point of the research framework, shown below.



It must be noted that the findings for the crisp, snack and sweet industry are preliminary – results for this category were gathered in the initial stage of research and informed by literature review, one interview with a trade body and another from a recycling company in which the other three products assessed in this study were also discussed. The recycling company has experience of difficult to recycle and low value items that present similar challenges to crisps, snack and sweet wrappers.

This product group was not taken forwards for further interviews and workshops as the initial research stages identified fewer opportunities for Scottish Government to act on marine litter originating from this industry. There are relatively few manufacturers present in Scotland, and international brands are less likely to voluntarily modify product design to suit one market, which prompted the decision to focus on the three other products as a more efficient use of resources.

4.1 Value chain

The value chain for crisp, snack and sweet wrappers starts with raw materials producers, mostly plastics and a small amount of metals required for the composite metallised plastic film used for crisp packets. Bespoke equipment is used for packing and filling products, normally at scale. The product dictates the type of wrapper used, and often regarding crisps, are sealed in a protective atmosphere. The products are then procured by the retail sector, who in turn sell to consumers. At end of life the waste packets are disposed of by consumers, primarily in public litter bins and household waste bins. Waste packaging is typically placed in the residual waste stream but may be occasionally recycled or littered (both intentionally and unintentionally). If disposed of responsibly this waste is managed by local government and waste management companies. There is not an established recycling system for these products, however some items may be processed through schemes such as those run by TerraCycle¹⁴, which effectively down-cycles the material into lower value products such as park benches. This is therefore not a solution for every increasing consumption, and as the material is small and low weight it may be unlikely to be separated for recycling by most consumers even if such schemes became more widely available. If it is littered some will eventually be collected by local government street cleansing teams or voluntary clean-up activities, and then passed to waste management companies. The value chain actors are mapped on to the product life cycle stages in Table 1.

¹⁴ TerraCycle (2019), The crisp packet recycling scheme, <https://www.terracycle.com/en-GB/brigades/crisppacket>

Table 1: Crisp, snack and sweet wrappers - mapping actors within the value chain onto life cycle stages

Life cycle stage	Value chain actors
Raw materials	Producers of plastic pellets/film, metals and other raw materials
Production	Manufacturers of machinery for packaging and filling products Crisp, snack and sweet manufacturers
Retail & distribution	Retailers
Use	Consumers – general public
End of life/recovery	Waste management companies (possibly via councils or volunteer groups)

Key private sector organisations for Scotland in the role of manufacturing and retailing crisps, snacks and sweets identified in this research are listed in Appendix A.1.

4.2 Stakeholder engagement

As discussed above, only two interviews covered issues around crisp, snack and sweet wrappers and it was decided not to take this product group forward for further interviews or a workshop. Nonetheless, the information gathered in the interviews conducted has proved valuable for this analysis, and both stakeholders seemed fully engaged and were aware of the issue. One stakeholder was an industry trade association and the other a recycling company. The trade association expressed interest in coordinating industry to work collaboratively on sustainability issues.

The trade association suggested that changing packaging is very expensive due to the cost of the bespoke equipment required and the potential need to also change recipes, as different oils react differently with different packaging materials. Packaging changes are therefore not made lightly or often. As such, many factors should be considered at once – for example addressing marine plastics, food waste and obesity. However, changes should not be expected too rapidly – many manufacturers buy packaging a year in advance, and would not want to waste this stock. There would also likely be resistance to changing packaging design as customers recognise key aspects - first shape, then colour, then logos and as such manufacturers are unlikely to change packaging in a way which would impact product recognition and the brand loyalty these aspects enable. The preliminary research did not find any estimates of the amount of packaging made in Scotland.

Both stakeholders indicated that change is likely to originate with large producers. The trade association suggested big brands would be the first to act, having the finances and capacity to make change, which small companies lack. This is backed up by the recent innovation released by Nestlé¹⁵. The recycling

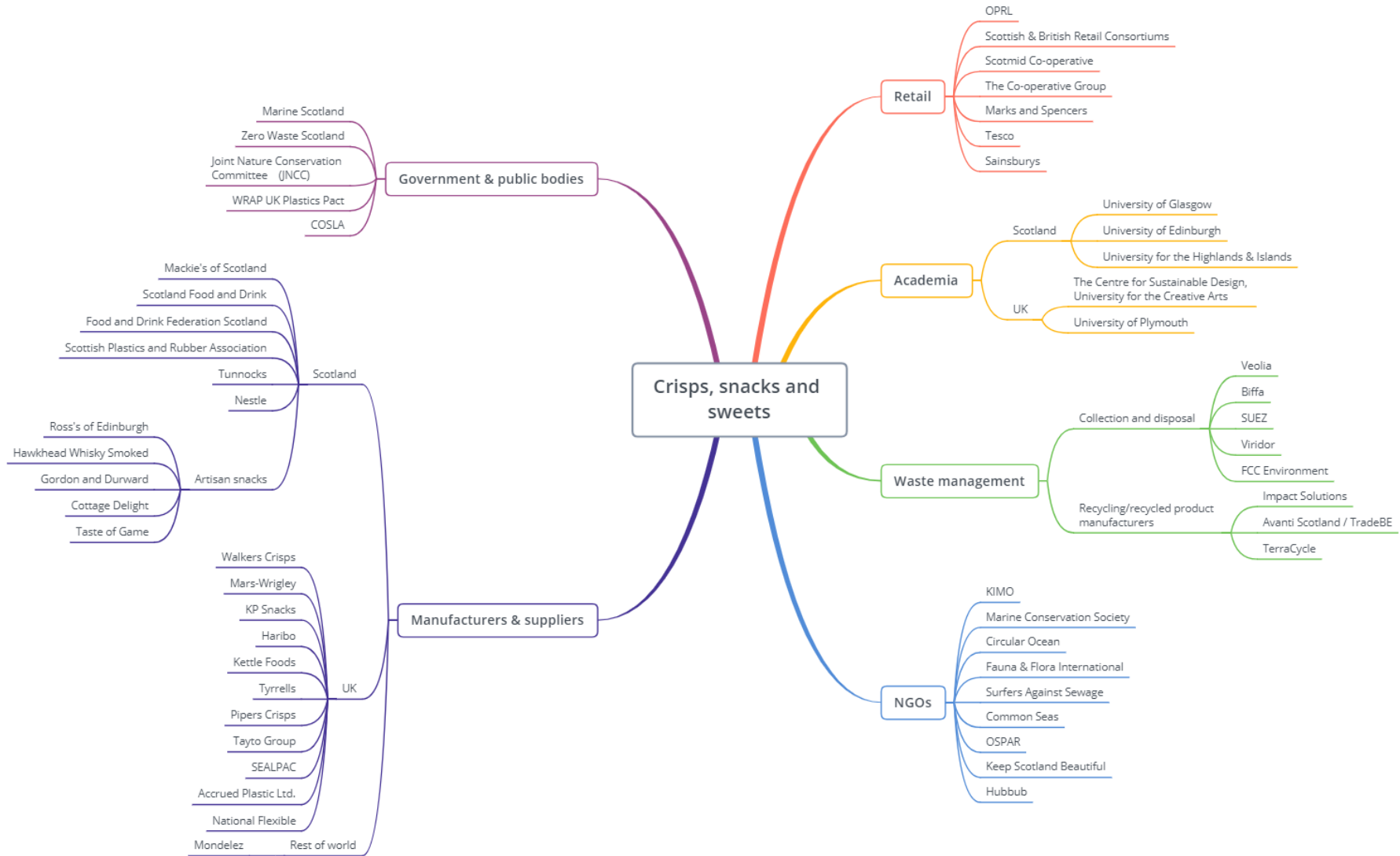
¹⁵ Evening Standard (2019), Snack bar wrapper made from sustainable paper hailed as recycling 'world first', https://www.standard.co.uk/news/uk/snack-bar-wrapper-made-from-sustainable-paper-hailed-as-worldfirst-technological-breakthrough-a4180861.html?utm_source=Greenhouse+Morning+News&utm_campaign=6e632796e8-

company suggested that, for the materials they work with, the cost of the recycling process is often more than the end material is worth. As such, schemes only work if brands are willing to sponsor the recycling programmes. It is assumed that, as finances are limited for smaller companies, it will be bigger companies acting as sponsors.

Many stakeholders outside of the value chain for crisps, snacks and sweets are engaged or affected by the marine litter issue. This includes Government and public bodies, academia, and NGOs. A mapping of the wider stakeholder groups relevant for Scotland is shown in Figure 3.

[Greenhouse Morning News GMN 3rd July 2019&utm_medium=email&utm_term=0_e40c447c1a-6e632796e8-123999109](https://www.greenhouse-growth.com/news/gmn-3rd-july-2019?utm_medium=email&utm_term=0_e40c447c1a-6e632796e8-123999109)

Figure 3: Crisps, snacks and sweets - stakeholder mapping



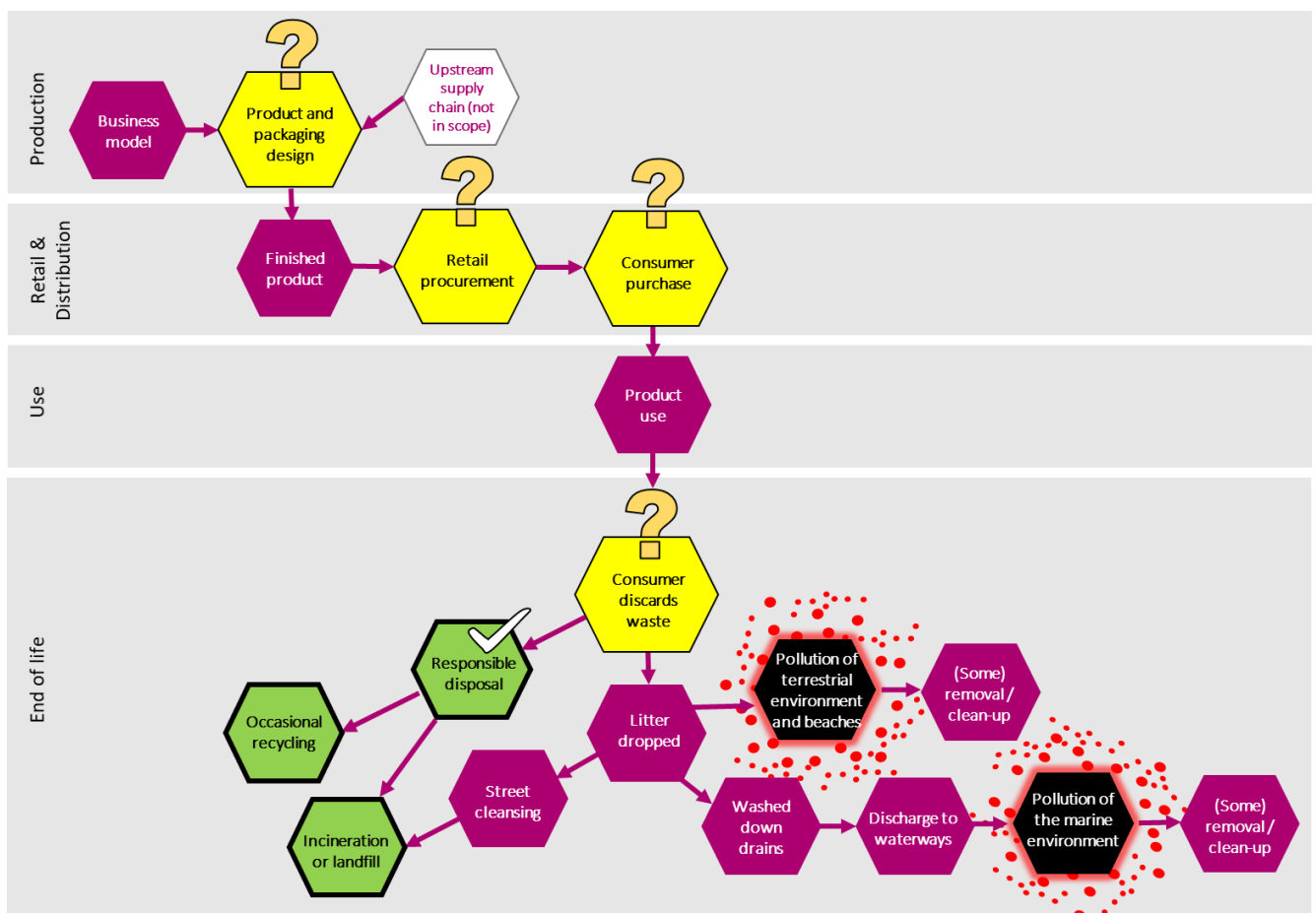
5 Marine litter pathways and key decision points

The following section discusses the marine litter pathways and key decision points, as per the second stage in the research framework, shown below.



The marine litter pathways for crisps, snack and sweet wrappers was investigated in the literature review process and during initial stakeholder engagement. Figure 4 shows how these pathways stem from key decision points. For example, when a packet of crisps, snacks or sweets has been finished, the consumer must decide how to manage that waste. In simple terms, if they are consuming on-the-go, they can either store the waste on their person until they can dispose of it at home, dispose of it responsibly in a public litter bin or litter the wrapper. If consuming at home, it is very unlikely that the wrapper will become marine litter.

Figure 4: Crisps, snacks and sweets - marine litter pathways and key decision points



It is recognised that certain business models have the potential to help tackle marine litter. However due to the lack of relevant examples found it was not possible to explore this in detail. It will be important to consider how best to support beneficial new business models as they emerge in this context.

Generally, the large crisp, snack and sweet companies operate using a business model of manufacturing to sell to retailers, whether this be retailers or eateries. As such, the manufacturers do not retain ownership and therefore hold no responsibility for the product once it is sold on. Manufacturers thus have little incentive other than public pressure¹⁶ to develop their products in a way which reduces littering. Some manufacturers sell direct to consumers, using an online ordering system to deliver snack-boxes to customers as regularly as they wish¹⁷. This home or workplace delivery system may mean consumers are less likely to be consuming on-the-go, thereby reducing opportunities for littering.

Brands and manufacturers are the key actors in product and packaging design, although they often respond to the needs of consumers and requirements of Government. This is a highly competitive industry, primarily driven by the need to make products which are more attractive to consumers than those of competitors. Innovation in this market is fast-paced, with over 300 new products entered for the National Confectioners Association's Sweets & Snacks Expo's annual Most Innovative New Product Awards in the last two years^{18, 19}.

However, it is packaging design that has the greatest opportunity to influence littering behaviours. A study conducted in Holland showed that bold anti-littering labelling can reduce littering behaviour²⁰, however the potential to include such labelling is limited²¹. Littering behaviour is also impacted by the 'ick factor' – where people desire to be rid of packaging they feel is dirty or unclean or that might soil their clothing or bags with food and oil²². Food wrappers are included in the items affected by this factor²³, suggesting that wrappers which are resealable are less likely to be littered than those which aren't. It has also been found that in some places, if people litter accidentally – i.e. an item blows away from them, they will not retrieve

¹⁶ Huffington Post (2019), Litter pickers are tweeting total rubbish and asking brands: #isthisyour?, https://www.huffingtonpost.co.uk/entry/people-are-tagging-brands-in-photos-of-litter-online-with-the-hashtag-isthisyour_uk_5c6aa3a7e4b01757c36dc439

¹⁷ Business Model Zoo (2016), Graze Product Model, <http://www.businessmodelzoo.com/exemplars/Graze>

¹⁸ Confectionery News (2018), Ferrero, Hershey, Nestlé and more: NCA names most innovative new candies and snacks of 2018, <https://www.confectionerynews.com/Article/2018/05/24/NCA-names-most-innovative-new-candies-and-snacks-of-2018>

¹⁹ Sweets and Snacks Expo (2019), 2019 Most innovative new product award winners announced at sweets and snacks expo, <https://sweetsandsnacks.com/press-releases/2019-most-innovative-new-product-award-winners-announced-at-sweets-snacks-expo/>

²⁰ Wever (2010), Influence of packaging design on littering behaviour, https://www.researchgate.net/publication/27351351_Influence_of_packaging_design_on_littering_behavior/link/02e7e515becb138f42000000/download

²¹ Interview with a company operating a labelling scheme

²² Zero Waste Scotland, Rapid evidence review of littering behaviour and anti-litter policies, <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>

²³ Zero Waste Scotland, Rapid evidence review of littering behaviour and anti-litter policies, <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>

it²⁴, suggesting that particularly wrappers with tear off strips, or which the consumer has to tear a corner off to open the packet, run a higher risk of having these small portions of the wrapper littered²⁵.

Retailers choose their stock based on a number of factors, some of which may be able to influence decision points up or down the value chain. Currently, retailers use some retail models which don't support consumers in reducing material consumption, this is particularly the case for meal deals, where it is cheaper to buy three items rather than two, and offers on multipacks makes buying lots of small bags cheaper than buying a large share bag. The public has been shown to believe that retailers hold a share of responsibility for marine litter²⁶, suggesting they expect action from this part of the value chain. However, there are limited options for retailers currently: very few products have been identified which aim to tackle litter and marine litter impacts. There is also little evidence to show mass consumer uptake of such options. If evidence of such behaviour change were available, it might act to incentivise retailers.

Retailers have pick and mix options, or the possibility of promoting healthier snacks such as fruit and veg. However, this has limited applicability and impact, particularly as the whole system, including transport, is designed around single use packaged items and as such would require a whole system redesign. This provides a major barrier to reuse and refill packaging models. Such a barrier provides difficulties for new entrants as a change in operating systems requires new infrastructure, pricing, consumer understanding and acceptance, thereby increasing the cost. This system change would also require motivating users to carry and clean their own containers, making sure that the dispensing system is easy, safe and mess-free, and lives up to any expected brand experience²⁷.

Another potential option for retailers is to sell large packs alongside reusable containers, however there are risk of unintended consequences around unhealthy eating at a time when many brands are downsizing packages to tackle the obesity crisis²⁸. While this Food and Drink Federation report²⁹ states that the obesity crisis is the trigger for downsizing packaging, as many of these companies are selling food items that are causing the obesity crisis, this could be argued to instead be caused by increasing costs of raw materials, pressures to increase brand range to capture more of the market than competitors, as well as government policy on reformulation. Nonetheless, innovation is first required from brands.

²⁴ Zero Waste Scotland, Rapid evidence review of littering behaviour and anti-litter policies, <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>

²⁵ Wever (2010), Influence of packaging design on littering behaviour, https://www.researchgate.net/publication/27351351_Influence_of_packaging_design_on_littering_behavior/link/02e7e515becb138f42000000/download

²⁶ Hartley et al. (2018), Exploring public views on marine litter in Europe: perceived causes, consequences and pathways to change, https://www.researchgate.net/profile/Thomas_Vlachogianni/publication/325788416_Exploring_public_views_on_marine_litter_in_Europe_Perceived_causes_consequences_and_pathways_to_change/links/5b276877aca272277fb740e6/Exploring-public-views-on-marine-litter-in-Europe-Perceived-causes-consequences-and-pathways-to-change.pdf

²⁷ Ellen MacArthur Foundation (2019), Reuse: Rethinking Packaging, <https://www.newplasticseconomy.org/assets/doc/Reuse.pdf>

²⁸ Food and Drink Federation (2018), Feeding Change, https://www.fdf.org.uk/corporate_pubs/feeding-change-report.pdf

²⁹ Food and Drink Federation (2018), Feeding Change, https://www.fdf.org.uk/corporate_pubs/feeding-change-report.pdf

While not related to procurement, retailers could participate in takeback schemes for wrappers, offering customers the opportunity to return their packaging to be recycled while contributing to the charity of the retailers' choice³⁰.

6 Drivers and barriers

The following section discusses the drivers and barriers, as per the third stage in the research framework, shown below.



6.1 Product and packaging design

The literature review process and initial stakeholder engagement highlighted product design and packaging as the key decision point in the value chain for crisp, snack and sweet wrappers. The considerations for crisp, snack and sweet wrapper design can be broken down to packaging design, labelling and manufacturing, as discussed below.

Packaging design has historically focussed on marketing the brand, however now brands are also considering recycling, littering and the impact of the 'Blue Planet II' effect on their consumers³¹. Packaging is an important role of the brand image. Consumers recognise the shape, then colour, then logo and finally the information on the packet. Pringles is a prime example of this being used to create a distinctive brand³², and can be assumed is unlikely to change from its recognisable format despite the packaging being incompatible with household recycling collections in the UK³³. Consumer priorities of reducing plastic packaging and increasing recyclable packaging³⁴ can conflict with the reasons for individually packaging items – such as preventing mixing of sweets that melt, and portioning as means to tackle the obesity crisis³⁵. Share bags and small portion packaging, which increase plastic packaging use, are increasing on the market^{36, 37}. Multiple packets have easy tear strips or corners for the convenience of the consumer,

³⁰ Terracycle (2019), Public drop off locations, https://www.terracycle.com/en-GB/about-terracycle/drop_off_locations

³¹ Interview with trade body

³² Interview with trade body

³³ Pringles (2019), Our recycling programme, <https://www.pringles.com/uk/recycle.html>

³⁴ The Guardian (2018), Plastic waste set to beat price as UK shoppers' top concern, <https://www.theguardian.com/environment/2018/sep/10/plastic-waste-set-to-beat-price-as-uk-shoppers-top-concern-study>

³⁵ Interview with trade body

³⁶ Packaging News (2017), A fair share of the market, <https://www.packagingnews.co.uk/features/a-fair-share-of-the-market-category-focus-crisps-nuts-and-snacks-10-05-2017>

³⁷ Packaging Digest (2018), Chew on this: packaging trends for new sweets and snacks, <https://www.packagingdigest.com/food-packaging/chew-on-this-packaging-trends-for-new-sweets-and-snacks-2018-05-30>

however these are the parts which are most commonly littered³⁸. Another competing factor regarding packaging design arises around lightweighting. While multiple companies have now lightweighted their packaging, others, particularly those producing niche or artisanal products, opt for thicker packaging to signal to consumers the high quality of their product³⁹.

In terms of labelling, while research has shown that clear labelling can reduce littering⁴⁰, the most commonly used anti-littering label in the UK, the Tidyman logo shown below in Figure 5, while recognised as a packaging logo by more than 90% of people surveyed, was misidentified or misunderstood by 33%⁴¹ despite being in use for over 50 years⁴². Whilst making anti-littering labelling clearer may be more effective at reducing litter⁴³, labelling also needs to be space effective as once statutory labelling and ingredients are including on packaging, there is little room for additional information, and it is important not to overcrowd⁴⁴. No more than 5% of those surveyed linked other common recycling labels (OPRL labelling, Green Dot, Mobius Loop) with littering, however over half could correctly interpret the meaning of the OPRL labels shown in Figure 6. As with packaging design, there are again links to labelling with the health impacts of crisps, snacks and sweets. This year, the Institute for Public Policy Research called for plain packaging for confectionary items, in an attempt to put these snack items on a level playing field with fruit and vegetables⁴⁵.

Figure 5: Tidyman Logo, OPRL



³⁸ Keep Britain Tidy (2012), The little book of litter,

https://www.keepbritaintidy.org/sites/default/files/resources/KBT_Little_Book_of_Litter_2012.pdf

³⁹ Interview with trade body

⁴⁰ Wever (2010), Influence of packaging design on littering behaviour,

https://www.researchgate.net/publication/27351351_Influence_of_packaging_design_on_littering_behavior/link/02e7e515becb138f42000000/download

⁴¹ OPRL (2018), OPRL recycling research.

⁴² Interview with a company operating a labelling scheme

⁴³ Wever (2010), Influence of packaging design on littering behaviour,

https://www.researchgate.net/publication/27351351_Influence_of_packaging_design_on_littering_behavior/link/02e7e515becb138f42000000/download

⁴⁴ Interview with a company operating a labelling scheme

⁴⁵ Packaging News (2019), Think tank calls for sweets, snacks and sugary drinks plain packaging,

<https://www.packagingnews.co.uk/news/markets/drinks/think-tank-calls-sweets-snacks-sugary-drinks-plain-packaging-05-06-2019>

Figure 6: Example OPRL labels



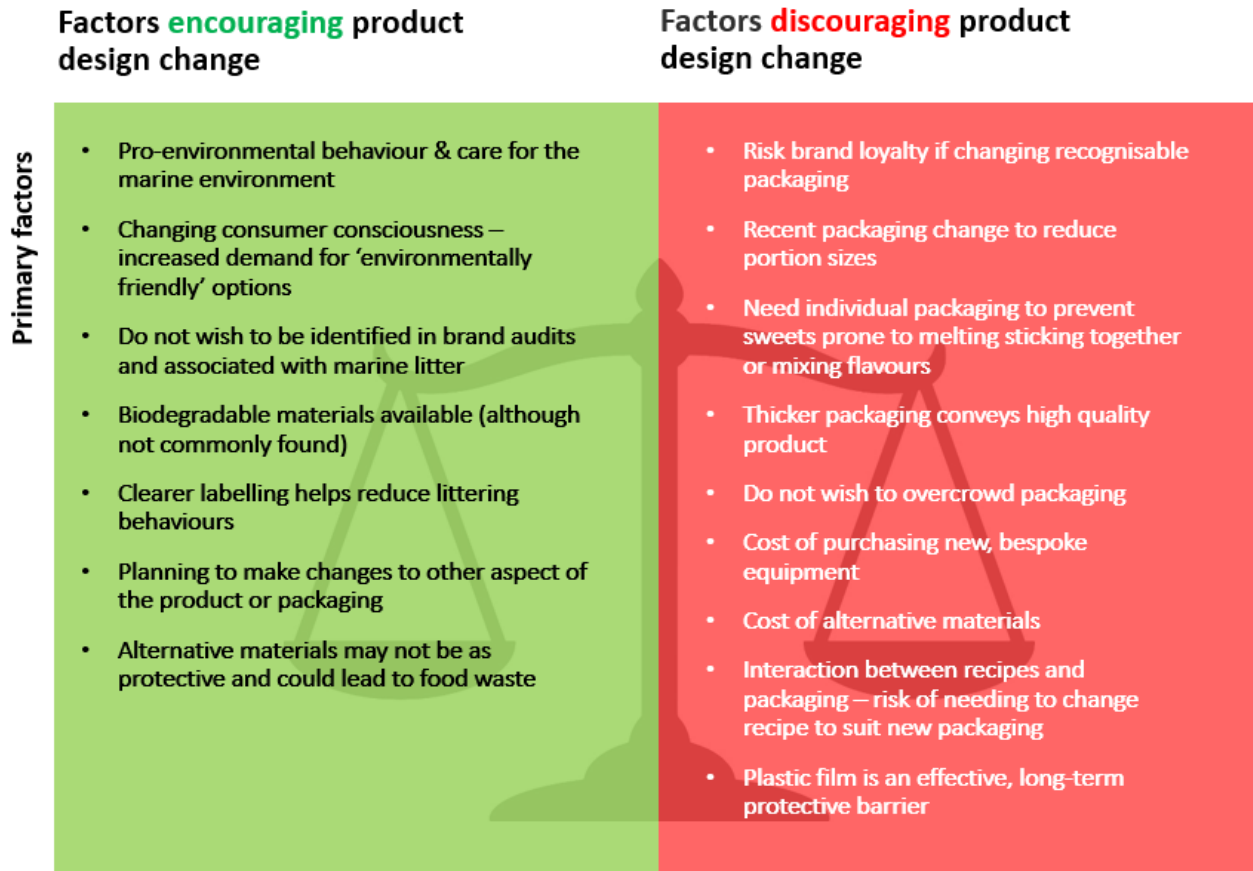
An interview with an industry trade body provided some insight into the packaging process and decision making, as explored in the text below. For manufacturing their product and packaging, producers do not buy off the shelf equipment, but instead purchase bespoke equipment for their specific product, in some cases at costs of £100,000s. As such, if packaging is to change, it is not a simple decision, but one which requires significant investment and process change. Also, while alternative packaging materials could be used, these may be more expensive.

Manufacturers have changed recipes to make their products healthier, however different oils and recipes react differently with different materials. The type of packaging used is designed to match the product being packaged; the packaging has to be adapted depending on the oils used in the food product. Once again, this signposts an area in which to deal with multiple issues holistically. Altering the production process is a large investment which impacts multiple aspects of the product, and as such is an opportunity to make impacting multiple issues brands are facing – recipes could be innovated both thinking around obesity and product reaction with packaging materials whilst changing packaging considering food waste, marine plastics, sustainability, health and marketing. Similarly, when making changes to labelling for health reasons, this provides an opportunity to improve recycling and anti-littering messaging.

Due to the cost of such manufacturing changes, change is likely to originate from big brands who have more funding and human resource capacity than SMEs. The industry is reportedly keen to take action, and their top priority issues are plastic packaging preceded only by Brexit, however producers are limited by whether they have the capacity and resources in terms of financing and staffing. Some manufacturers will also wait to change until the Government position is clear and legislation is set, to ensure they comply exactly with requirements and don't have to change twice. It was also suggested that if legislation were to change, an adjustment period would be necessary as some manufacturers purchase a year's supply of packaging materials and would not want to waste this material.

Figure 7 shows drivers and barriers identified regarding tackling marine litter through product and packaging design change. The information is largely derived from stakeholder interviews. On the left of the figure, the awareness of the negative effects of litter, including marine litter, encourages product design change. On the right, it is acknowledged that changing products and packaging is expensive, and current designs offer benefits for brand loyalty, practicalities and effectiveness of packaging and may have been redesigned already with the obesity crisis in mind.

Figure 7: Drivers and barriers in product design change



7 Potential solutions

The following sections discuss the potential solutions, the final stage in the research framework, shown below.



A number of potential solutions have been identified through the course of this research. They are explored further in sections 7.1 - 7.5, and are linked to key decision points in Table 2. The table shows where the direct impact of each solution will be felt. However, changes to business model, and most important, product design will have knock-on effects, enabling retail and ultimately the consumer to choose products that reduce litter impacts.

Table 2: Crisps, snack and sweet wrappers - where solutions can most influence key decision points

Life cycle stage	Key decision point	Voluntary agreements	Packaging innovation	Recycling	Extended Producer Responsibility	Deposit Return Scheme
Production	Product and packaging design	✓	✓	✓	✓	✗
Retail	Retailer procurement	✓	✗	✗	?	✗
Use	Consumer purchase decision	✓	✗	✗	✗	✗
End of life/recovery	Consumer discards waste	✗	✗	?	✗	✓

✓ = Yes, ✗ = No, ✓ = Yes - if solution designed with this in mind, ? = Unknown

7.1 Voluntary agreements

Voluntary agreements include those such as the UK Plastics Pact. A year in, snack manufacturers have already taken action on disposal messaging and have undertaken lightweighting of their packaging, developed communication and education campaigns and formed partnership with companies such as TerraCycle to ensure their hard to recycle packaging can be recycled⁴⁶. This demonstrates that such voluntary agreements have the ability to affect changes across most of the key decision points identified in section 5, for those leading brands and retailer engaged in the agreement. It appears that most of the organisations which are members of such voluntary agreements are large companies, supporting the suggestion that change would likely come first from big producers⁴⁷. The question is whether these models are environmentally and financially sustainable in the long run and whether leading companies who change then subsequently affect the remaining quarters of the market.

7.2 Packaging innovation

Packaging innovation can change product design and the brands and suppliers have influence. Companies such as TerraCycle are engaging with brands and suppliers on packaging design, zero waste consulting and closed-loop R&D⁴⁸. The innovations could be designed to enable reuse, such as TerraCycle’s Loop⁴⁹; recycling; or to deter littering such is being enforced for plastic drinks bottles to keep their lids attached and not littered⁵⁰. When recycling is considered, this can involve reducing the use of multi-layered

⁴⁶ WRAP (2019), The UK Plastics Pact Progress Report, http://www.wrap.org.uk/sites/files/wrap/The-UK-Plastics-Pact-Member-progress-report-May-2019_0.pdf

⁴⁷ Interview with trade body

⁴⁸ TerraCycle (2019), About TerraCycle, <https://www.terracycle.com/en-GB/about-terracycle>

⁴⁹ GreenBiz (2019), Loop’s launch brings reusable packaging to the world’s biggest brands, <https://www.greenbiz.com/article/loops-launch-brings-reusable-packaging-worlds-biggest-brands>

⁵⁰ EC (2018), Single-use plastics: New EU rules to reduce marine litter, http://europa.eu/rapid/press-release_IP-18-3927_en.htm

packaging where possible to improve recyclability, or possibly compostables – particularly if relevant standards are developed as is intended⁵¹. Packaging innovation is already ongoing, with Nestlé producing a recyclable paper snack bar wrapper which degrades in the marine environment within 6 months, however Nestlé had to overcome 90 challenges to develop the material and adapts its manufacturing machinery⁵², a factor which will be prohibitive for smaller businesses. Bio-based packaging is now available, using materials such as seaweed⁵³ and potato starch⁵⁴. It is a market expected to have an annual growth rate of 18.3% from 2015 to 2020, with demand expected to reach 884,000 tonnes by 2020⁵⁵. To overcome such barriers and give Scottish companies a competitive advantage as the first movers in the market, an innovation fund could be established by the Scottish Government, however any funding should be carefully scoped and a clear steer would be required simultaneously on where future governmental policies on packaging are headed, particularly with regards to bio-based, biodegradable and compostable plastics⁵⁶, as well as reuse business models. As discussed above, some manufacturers will be unwilling to act without such governmental guidance⁵⁷. However, the value chain should also be aware that the EC Single Use Plastics Directive states that for single use plastic products which have suitable, more sustainable, affordable and readily available alternatives should be banned or restricted⁵⁸, which may become true for crisps, snacks and sweet wrappers in time.

This solution also has some impact on consumers, who have been known to express their dissatisfaction with changes to packaging resulting in reversion to original packaging⁵⁹.

7.3 Recycling

Recycling covers some aspects already covered in section 7.2, however this solution could be extended to cover the development of guidance for ‘best in class’ packaging. Such guidance has already been published

⁵¹ Circular (2019), Government to develop standards for alternative plastics,

<https://www.circularonline.co.uk/news/government-to-develop-standards-for-alternative-plastics/>

⁵² Evening Standard (2019), Snack bar wrapper made from sustainable paper hailed as recycling ‘world first’,

https://www.standard.co.uk/news/uk/snack-bar-wrapper-made-from-sustainable-paper-hailed-as-worldfirst-technological-breakthrough-a4180861.html?utm_source=Greenhouse+Morning+News&utm_campaign=6e632796e8-Greenhouse+Morning+News+GMN+3rd+July+2019&utm_medium=email&utm_term=0_e40c447c1a-6e632796e8-123999109

⁵³ Green Biz (2017), This edible packaging will make you reconsider seaweed,

<https://www.greenbiz.com/article/edible-packaging-will-make-you-reconsider-seaweed>

⁵⁴ Wageningen University and Research, Biobased and bio-degradable plastics for packaging,

<https://www.wur.nl/en/testimonial/Biobased-and-bio-degradable-plastics-for-packaging.htm>

⁵⁵ Cerqueira, M. A., et al. (2016), Edible packaging today,

<https://www.researchgate.net/deref/http%3A%2F%2Frefhub.elsevier.com%2FB978-0-12-811516-9.00008-7%2Fref0145>

⁵⁶ Interview with trade body

⁵⁷ Interview with trade body

⁵⁸ EC (2018), Single Use Plastic Directive, <http://ec.europa.eu/environment/circular-economy/pdf/single-use-plastics-proposal.pdf>

⁵⁹ The Telegraph (2010), Biodegradable crisp packets ‘too noisy’,

<https://www.telegraph.co.uk/foodanddrink/foodanddrinknews/8045361/Biodegradable-crisp-packets-too-noisy.html>

by WRAP for rigid plastic packaging⁶⁰. This may increase confidence in producers to make changes to their products, to help overcome barriers to action without legislation.

Current schemes for recycling low value or hard to recycle packaging typically cost more to operate than the end material is worth and as such can only operate with brand sponsors⁶¹. However, if the brands buy back the material to use in their products, it can provide them with a unique selling point enabling them to get more space from a retailer⁶². Scotland is also increasing its reprocessing capacity, with the aim to recycle 90% of Scotland's plastic waste⁶³. Developing guidance for producers to use packaging which can be processed at Project Beacon or via a partnership with TerraCycle could help with the development of this project.

While increasing recyclability is beneficial in that it moves this waste stream up the waste hierarchy, it's impact on marine litter is likely to be minimal, as people that litter are unlikely to be persuaded not to litter by the increased recyclability of what they are littering or increased on the go recycling opportunities⁶⁴. Media attention, such as that surrounding the Walkers recycling scheme, may help raise awareness in the general population and change some behaviour. However, increasing the value of material via recycling may spur increased litter clean up. Also, under the EU Strategy for Plastics in a Circular Economy, 'eco-modulation' of EPR fees based on recyclability⁶⁵, which (if adopted in the UK) may prompt a shift towards more recyclable materials regardless of marine litter impacts.

7.4 Extended Producer Responsibility

The Single Use Plastic Directive has recommended that extended producer responsibility (EPR) is applied to food wrappers⁶⁶, which would include crisp, snack and sweet wrappers. The Directive states that the producers of single-use plastic products listed cover costs including:⁶⁷

- The costs of the awareness raising measures – availability of re-usable alternatives, waste management options, best practices in waste management, and the impact of littering on the environment (in particular the marine environment);
- The costs of waste collection for those products that are discarded in public collection systems, including the infrastructure and its operation, and the subsequent transport and treatment of that waste; and

⁶⁰ WRAP (2019), Design guidance for recyclability of household rigid plastic packaging, <http://www.wrap.org.uk/polymerchoiceguidance>

⁶¹ Interview with recycling company

⁶² Interview with recycling company

⁶³ Zero Waste Scotland, Beacon of Hope, <https://www.zerowastescotland.org.uk/case-study/project-beacon>

⁶⁴ Zero Waste Scotland, Rapid evidence review of littering behaviour and anti-litter policies, <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>

⁶⁵ EC (2019), Circular Economy Package Report: Questions and Answers, [https://europa.eu/rapid/press-release MEMO-19-1481_en.htm](https://europa.eu/rapid/press-release_MEMO-19-1481_en.htm)

⁶⁶ EC (2018), Single Use Plastic Directive, <http://ec.europa.eu/environment/circular-economy/pdf/single-use-plastics-proposal.pdf>

⁶⁷ European Parliament (2019), Texts adopted, http://www.europarl.europa.eu/doceo/document/TA-8-2019-0305_EN.html#title2

- The costs of cleaning up litter resulting from those products and the subsequent transport and treatment of that litter.

And potentially:

The setting up of specific infrastructure for the waste collection for those products, such as appropriate waste receptacles in common litter hotspots.

Such infrastructure could be operated by local authorities, entrepreneurial collectors or recycling businesses.

As discussed in the *Summary report* for the project, EPR is commonly based around one of four different systems:

- Advanced disposal fee
- Takeback scheme
- Modulated fee
- Deposit return schemes

The consultation on reforming the UK packaging producer responsibility system, undertaken jointly by the UK, Scottish and Welsh governments, closed in May 2019 and outcomes are soon to be published. During stakeholder engagement, it was made clear that producers might be unwilling to pay full costs for litter clean-up, as it is the consumers choice, and therefore responsibility, if they litter the wrapper⁶⁸. This will therefore be an important consideration, however connecting producers with the direct cost of litter could create a strong financial incentive for packaging innovation.

7.5 Deposit Return Scheme

During stakeholder engagement, it was suggested that the industry suspects that the current deposit return scheme plans may be extended to cover more product groups⁶⁹. This would influence consumer behaviour and as such have a direct impact on marine litter. It could also provide a homogenous recycling stream with minimal contamination for processing at Scotland's developing reprocessing facilities. There are no known examples of such a scheme operating at present, and as such would require innovation.

8 Recommendations

Only recommendations for future research, shown in Table 3, are made as the research on this product category is preliminary and high-level. Further work is required to engage a much broader range of stakeholders in this value chain outside of Scotland. However, preliminary findings indicate that plastics are a high priority for brands and the industry is reportedly keen to act. They are impeded by multiple barriers including the rapidity of public perception and attitude change, development of new materials and uncertainty in fast-changing legislation, as well as the wider cost to production lines of implementing necessary change. As such, producers are looking for a clear steer from Government before investing in changes and wish to be informed both on priority issues (i.e. marine litter, street litter, recycling, obesity) and solutions (particularly acceptability of bio-based or compostable plastics). This barrier could be

⁶⁸ Interview with trade body

⁶⁹ Interview with trade body

addressed through Government endorsed standards to set functional specifications within which industry can invest with confidence.

Voluntary agreements can be effective, particularly for large companies. However, EPR, as mandated in the Single Use Plastics Directive, would encompass all ‘producers’ in the value chain, including smaller companies and retail, with costs spread in a proportionate manner⁷⁰.

Table 3: Recommendations for future research to address marine litter from crisp, snack and sweet wrappers

Research requirements	Details
1. Better understand the nature of this item in litter	
a) Publish brand and product litter survey	Understand which are the main brands, products and formats found in terrestrial and marine litter.
b) Research relative litter abundance of whole wrappers and packets vs. pieces	To inform solutions –will avoiding ‘tear away corners’ address the problem, or will broader solutions be needed.
2. Industry workshop for solutions	Run workshop with industry, ZWS, NGOs, retailers and other stakeholders around the issue and potential solutions. Understand other pressures on brands and manufacturers, and opportunities to address multiple issues at once.
3. Product design change assessment	Understand the potential changes in packaging design and conduct a horizon scanning assessment for negative unintended consequences, including changes in functionality, shelf life, and waste in the supply chain and home.

⁷⁰ European Parliament (2019), Texts adopted, http://www.europarl.europa.eu/doceo/document/TA-8-2019-0305_EN.html#title2

Appendix A Key organisations in the value chain for Scotland

A.1 Crisp, snack and sweet wrappers

Table 4 outlines key private sector organisations for Scotland in the role of manufacturing and retail of crisps, snacks and sweets, identified in this research.

Table 4: Crisps, snacks and sweets - Key organisations in production and retail/distribution

Key organisations	Location	Role in the supply chain
Mackie's of Scotland	Errol, Perthshire	Producer – sweets and crisps
Tunnock's	Uddingston, South Lanarkshire	Producer – sweets
Nestlé (inc. Rowntrees)	Girvan, Ayrshire	Producer – sweets
Walkers Crisps (PepsiCo)	Leicester, East Midlands	Producer – crisps
Haribo	Pontefract, West Yorkshire	Producer – sweets
Kettle Foods	Norwich, Norfolk	Producer – crisps and snacks
Cadbury, Maynard Bassetts (Mondelez International)	Birmingham, West Midlands	Producer – sweets
Tyrrells	Hereford, Herefordshire	Producer – crisps and snacks
Pipers Crisps Ltd	Brigg, Lincolnshire	Producer – crisps
Mars-Wrigley	Various , UK	Producer – sweets
KP Snacks	Various , UK	Producer – snacks
Tayto Group	Ulster, Northern Ireland	Producer – crisps and snacks
SEALPAC	Poole, Dorset	Manufacturer – global tray sealing machines
Accrued Plastic Ltd	Burnley, Lancashire	Supplier – biaxially oriented polypropylene (BOPP)
National Flexible	Bradford, West Yorkshire	Distributor – polypropylene, laminates and films
Tesco	Various , UK	Retailer
Sainsbury's	Various , UK	Retailer
Asda	Various , UK	Retailer
Morrisons	Various , UK	Retailer
Waitrose	Various , UK	Retailer
Co-op Scotmid	Various , Scotland	Retailer

Crisps, snack and sweet wrappers



Crisps, snack and sweet wrappers

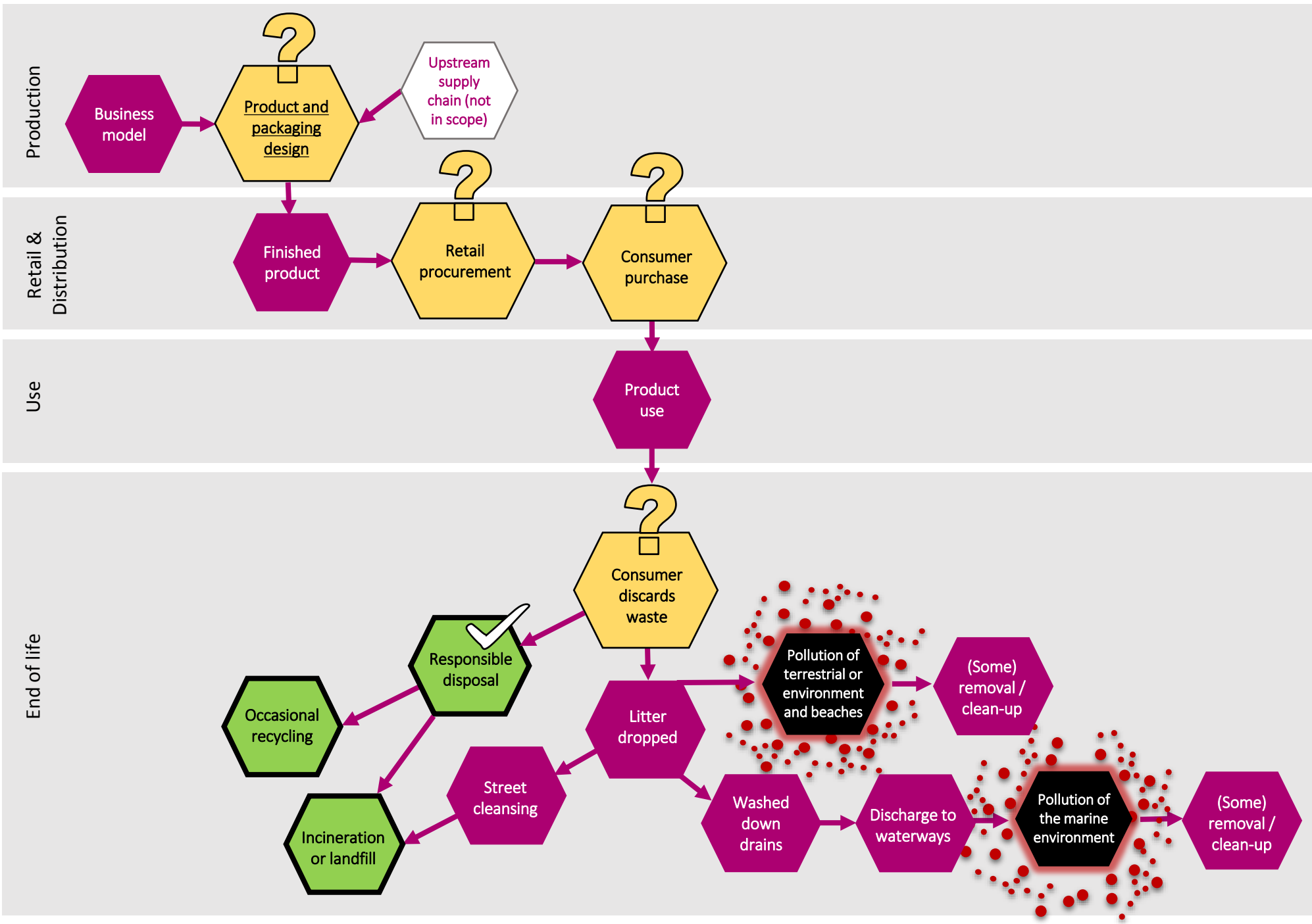
The main pathways to the marine environment are illustrated on the next slide.

Key decision points in the value chain have been identified where there is opportunity to help tackle marine litter.

Click on the yellow decision points to view more, including drivers and barriers and potential solutions.



Images: Crisps, snack and sweet wrappers (The Mirror)





Product and packaging design

Key decision point

Brands and manufacturers design product packaging to be recognisable, convenient and to portray quality in the product. It also must protect the product to prevent food waste and, in many cases, acts to extend the shelf life.

Brands and manufacturers are the key actors in product and packaging design, although they often respond to the needs of consumers and requirements of Government.

Opportunity

There is an opportunity here to address key elements of packaging which encourage or reduce littering behaviours, including anti-littering labels, aspects to reduce the 'ick' factor, and removing tear off strips or corners from packaging designs.

Key actors



Manufacturers



Brands



**Understand the issue
- drivers and barriers**

Drivers and barriers

Factors **encouraging** product design change

Factors **discouraging** product design change

Primary factors

- Pro-environmental behaviour & care for the marine environment
- Changing consumer consciousness – increased demand for ‘environmentally friendly’ options
- Do not wish to be identified in brand audits and associated with marine litter
- Biodegradable materials available (although not commonly found)
- Clearer labelling helps reduce littering behaviours
- Planning to make changes to other aspect of the product or packaging
- Alternative materials may not be as protective and could lead to food waste

- Risk brand loyalty if changing recognisable packaging
- Recent packaging change to reduce portion sizes
- Need individual packaging to prevent sweets prone to melting sticking together or mixing flavours
- Thicker packaging conveys high quality product
- Do not wish to overcrowd packaging
- Cost of purchasing new, bespoke equipment
- Cost of alternative materials
- Interaction between recipes and packaging – risk of needing to change recipe to suit new packaging
- Plastic film is an effective, long-term protective barrier

Potential solutions



Product and packaging design

Potential solutions

Voluntary agreements

- Organisations state the actions they plan to take to address marine litter issues. As these are voluntary, they can involve a variety of packaging design aspects.

Packaging innovation

- Directly impacts packaging design by developing innovative packaging which can address marine litter issues.

Recycling

- Designing for recyclability can raise awareness of waste issues and as such may change the behaviour of some people who litter.

Extended producer responsibility

- Incentivise design which reduces likelihood of littering by making manufacturers responsible for the cost of waste management and clear ups.



Back to start