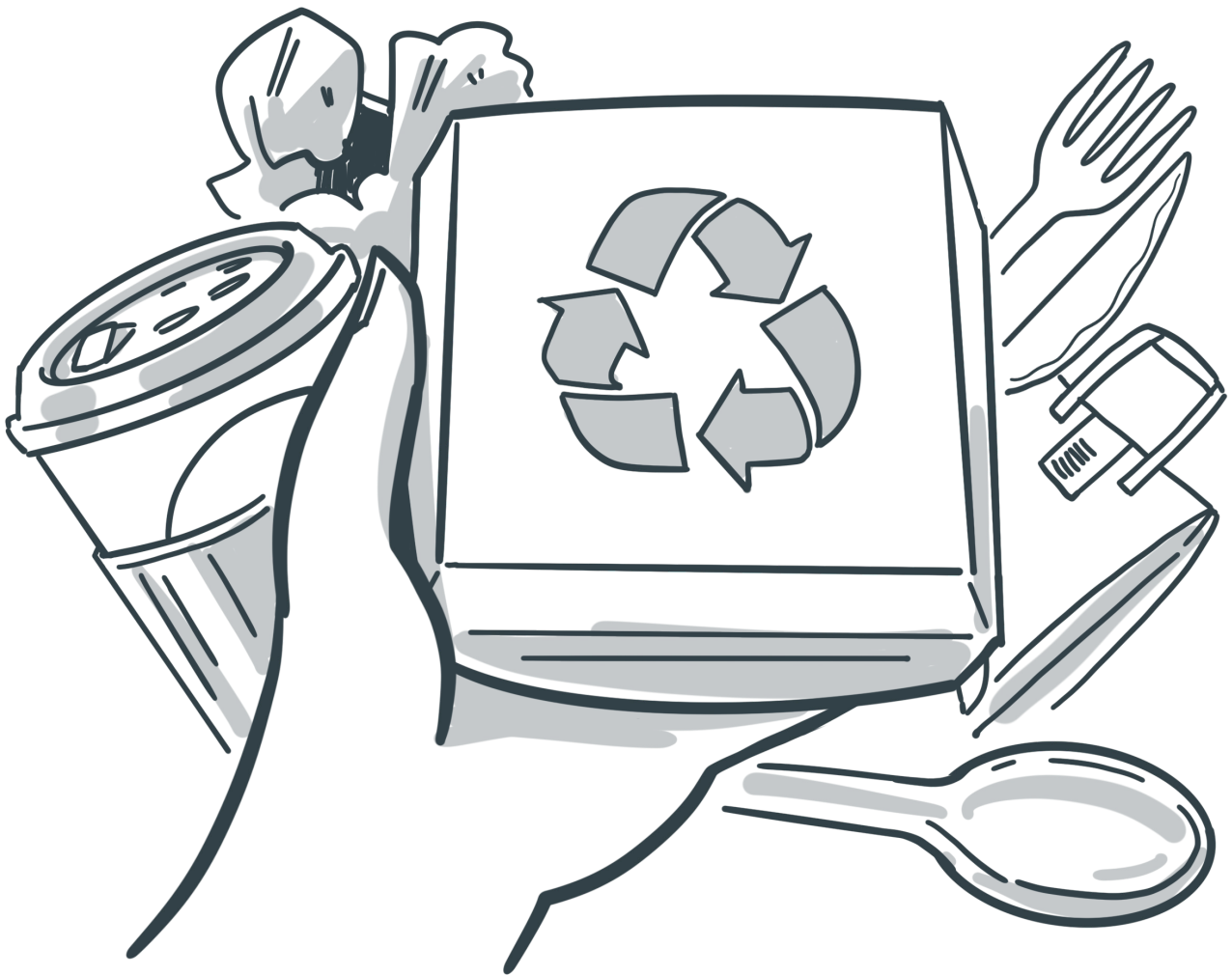


Sustainable Packaging Innovation: Hampered by the Consumer Attitude-Behaviour Gap?



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Our partners



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Glossary

A-B Gap:	(Consumer) Attitude-Behaviour Gap
B2B:	Business to Business
B2C:	Business to Consumer
BEIS:	Department for Business, Energy & Industrial Strategy
DEFRA:	Department for Environment, Food and Rural Affairs
DoI:	Diffusion of Innovation (Theory)
EPR:	Extended Producer Responsibility Scheme
NGO:	Non-government organisation
PIRAP:	Plastics Industry Recycling Action Plan
UKCPN:	UK Circular Plastics Network
WRAP:	Waste Resources and Action Programme

Executive Summary

The plastic packaging research context

Plastic pollution problems continue to increase in part due to extensive reliance on plastic material for packaging in the food industry. Delivering innovative solutions that eliminate problematic or unnecessary plastic waste has grown in importance among food supply chain actors. However, plastic has many advantages, including cost-effectiveness and versatility, that make it a preferred packaging material in food supply chains. This limits the drive towards more sustainable packaging solutions. Against this backdrop, multi-disciplinary research has been undertaken to understand consumer attitude-behaviour (A-B) gaps in relation to the usage and wastage of plastic packaging; and the impact that this has upon sustainable packaging innovation. Specifically, the research discussed in this guidance document sought:

- + To understand the response of multi-tier supply chain actors to customer attitudes and behaviours related to the use of plastic packaging.
- + To start conversations with supply chain actors around the A-B gap, as a mechanism for collaboration across supply chains and sectors to drive change.

Many UK-based pre-consumption supply chain actors are reconsidering their use of plastic in the packaging of food. They have been incentivised by:

- + Moral imperatives such as the Blue Planet effect.
- + NGO influence such as the targets set by WRAP.
- + Board room discussions stimulated by new legislation such as the Plastic Tax.

In this report, we provide guidance on how to fast track sustainable packaging innovation, which significantly reduces plastic pollution. The guidance highlights the opportunities available for key pre-consumption supply chain stakeholders (including, business, government and NGO actors) to provide consumers with more sustainable and attractive packaging alternatives by removing, reducing, or redesigning plastic packaging.

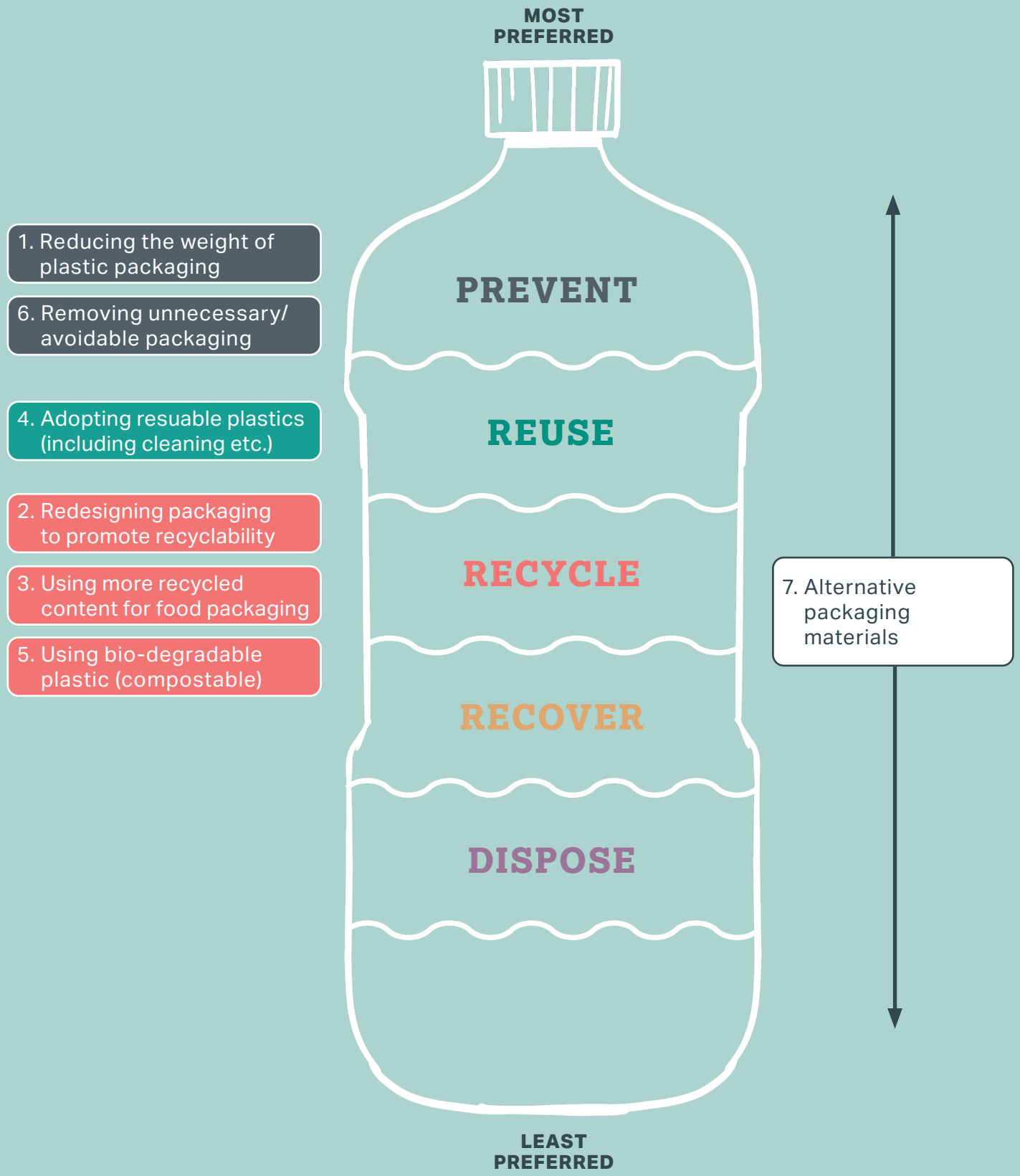
Findings:

Addressing the plastic packaging crisis

Primarily, we look at the impact of the perception of supply chain actors on the attitudes and behaviours of consumers. This is known as the A-B gap, which assumes that the consumer makes the ultimate purchase decisions and hence determines the success or otherwise of an innovation. We find that manufacturers and retailers alike perceive that consumers are increasingly requesting more sustainable packaging, yet not always choosing the more sustainable packaging options available. For example, whilst consumers may indicate that they expect unpackaged vegetables to be cheaper, they then do not pick the wonky vegetables leading to greater food waste (which inevitably increases prices).

Despite such perceptions of an A-B gap, we nonetheless find that pre-consumption supply chain actors are seeking ways to drive change that are not hampered by this potential problem. In doing so, they are also acknowledging plastic packaging waste at various stages in the pre-consumption supply chain. For example, packaging can be removed and replaced simply to change its branding long before the product reaches the final consumer.

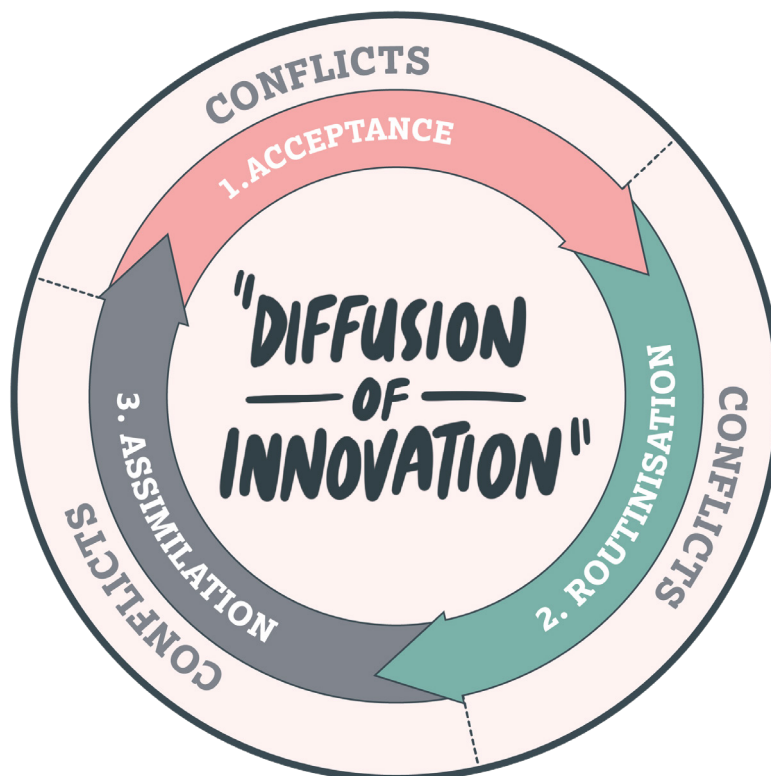
We highlight seven current strategies (see infographic on page 7) being used by pre-consumption supply chain actors to tackle plastic waste in the pre-consumption supply chain. By mapping these onto the 'Waste Hierarchy', we suggest that reducing plastic packaging weight (with thinner and/or smaller packaging) 'prevents' (albeit by reducing) the amount of plastic pollution, and sits at the most preferred position alongside the removal of unnecessary/avoidable packaging.



Redesigning packaging for recyclability and/or replacing virgin plastic with recycled content may be an important complementary strategy, but on its own is inferior to the 'prevent' option. A major barrier in the drive to reduce plastic packaging is a lack of understanding on the implications of alternative packaging types such as glass and cardboard. Whilst these options are being considered, there is a need for greater clarity on whether/when these alternatives might be preferred in the food industry, if at all.

The further widespread implementation of current strategies requires a greater understanding of the roles of all key stakeholders. Our findings provide insights into the perception of supply chain actors on the roles and interests of both internal and external players, including government, the media, and NGOs. For example, we explore the role of both media and NGOs in educating consumers on the end-impact of plastic packaging.

We apply the Diffusion of Innovation (DoI) theory to understand the steps needed to move from a linear to a circular supply chain. Using DoI, we explain the barriers, drivers and conflicts that arise at each of the three stages: (i) Acceptance of an innovation; (ii) Routinisation through adjustments of governance systems and provision of infrastructure; and (iii) Assimilation when a depth and breadth of innovation is achieved across many supply chain tiers. At each stage, conflicts may arise. For example, at the acceptance stage, consumer conflicts may emerge such as between sustainability and convenience, i.e. the convenience of buying packaged goods versus the sustainability of buying loose goods. Seven conflict resolution strategies are considered, including educating consumers on the benefits of alternatives and increasing operator skills within food packaging manufacturers to enable more rapid innovation.



Recommendations

Supply chain actors:

Avoid blaming consumers, as there are instances where the A-B gap has not hampered packaging innovation.

Assess your position within the diffusion of innovation process: to determine barriers, drivers, sources of conflict and conflict resolution strategies.

Influence other stakeholders who are hampering innovation - either individually or collaboratively.

Trial new packaging alternatives - addressing first the highest (remaining) sources of plastic waste supply chain.

Recognise plastic waste as a societal problem: share successes with competitors rather than considering them as a competitive advantage.

Educate, consult and involve consumers - through labelling, advertising and targeted in-store activities by retailers.

Government and NGOs:

Legislate to incentivise change - even if more incremental than advocated by the current Plastic Tax.

Educate stakeholders on the most sustainable current packaging solutions.

Acknowledge realistic short-medium term solutions through policy - such as reduce to thinner/smaller packaging even if still plastic.

Commission regular reviews of alternatives - given that the best solution is likely to remain a moving target.

Use the plastic tax and EPR income to fund solutions, such as improvements in recycling infrastructure, to gain more buy-in from other stakeholders.

Involve end-consumers - to identify food packaging solutions that they will choose and recycle

Expand stakeholder engagement to engender greater circular supply chain collaboration.

Research Background and Context

Plastic pollution problems continue to increase due to extensive reliance on plastic material for packaging in the food industry. Delivering innovative solutions that eliminate problematic or unnecessary plastic waste has grown in importance among food supply chain actors. However, plastic has many advantages, including cost-effectiveness and versatility, that make it a preferred packaging material in food supply chains. This limits the drive towards more sustainable packaging solutions. Against this backdrop, multi-disciplinary research has been undertaken to understand consumer attitude-behaviour (A-B) gaps in relation to the usage and wastage of plastic packaging; and the impact that this has upon sustainable packaging innovation. Specifically, the research discussed in this guidance document sought to:

- + Understand the response of multi-tier supply chain actors to customer attitudes and behaviours related to the use of plastic packaging.
- + Start conversations with supply chain actors around the A-B gap, as a mechanism for collaboration across supply chains and sectors to drive change.

This guidance document highlights the opportunities available for key pre-consumption supply chain stakeholders to provide consumers with more sustainable and attractive packaging alternatives by removing, reducing, or redesigning plastic packaging. The perceptions of supply chain actors on the consumer A-B gaps are examined and the variety of initiatives taken to tackle plastic waste are outlined. In this context, we also provide an analysis of the roles and interests of key stakeholders; and the diffusion of innovation process when transitioning from linear to circular supply chains. Finally, we draw conclusions on how this research aids our understanding of how to rethink the consumer A-B gap. Actionable guidance is provided for key supply chain stakeholders to drive towards cleaner, greener growth while maintaining value for all stakeholders.

Overview of research methods and data sources

The findings and recommendations are based on data from a three-year research project, in which two research methods were used:



INTERVIEWED
34
SUPPLY CHAIN ACTORS

FOLLOWED BY
3
INDUSTRY WORKSHOPS
WITH 19 PARTICIPANTS

10 INTERVIEWEES ATTENDED



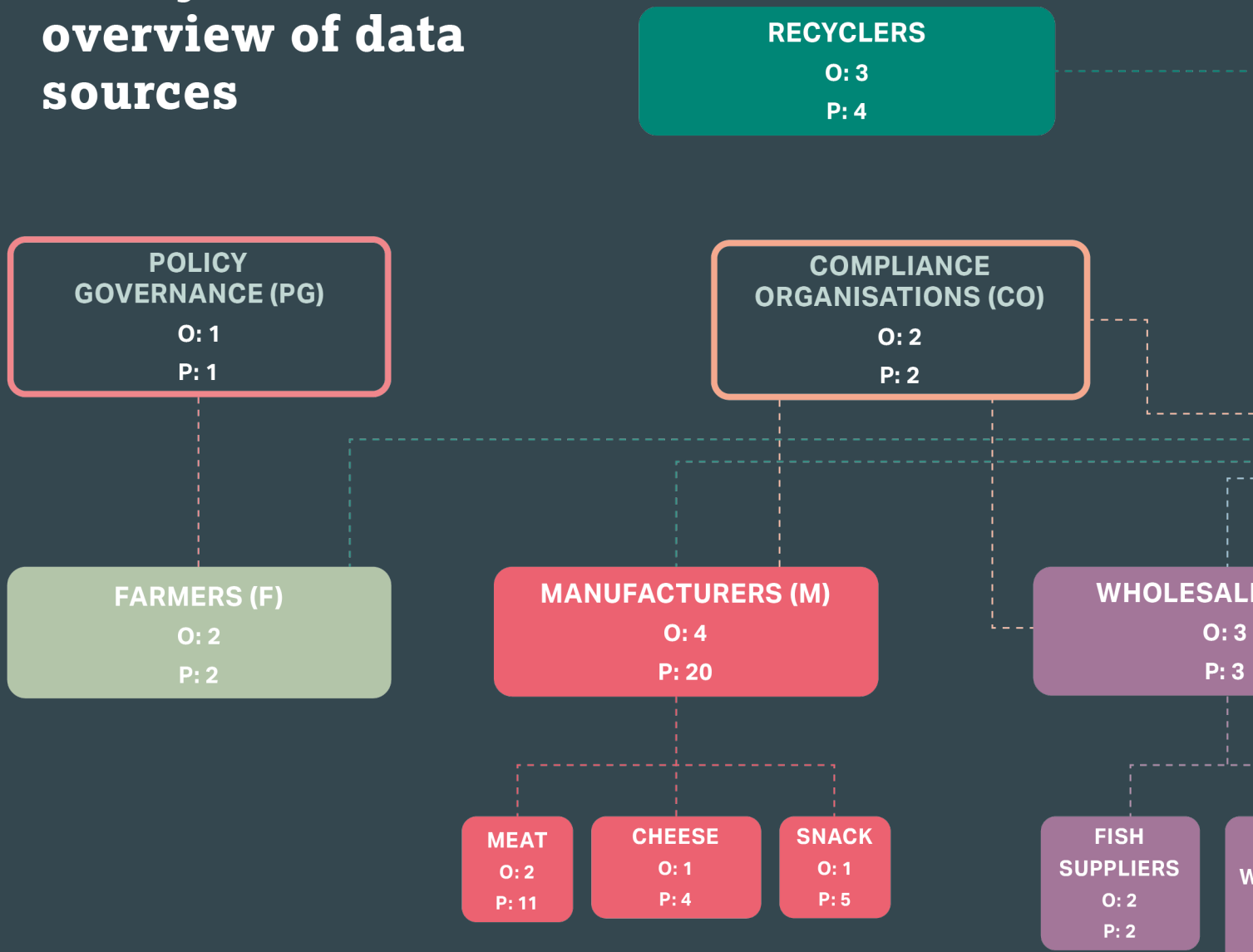
3 MONTHS WITH A CHEESE PROCESSOR
— followed by —
6 MONTHS WITH A MEAT PROCESSOR
— a further —
22 SUPPLY CHAIN ACTORS WERE INVOLVED

Multi-case study research - with 34 supply chain actors interviewed; followed by three industrial workshops with a total of 19 participants (including 10 of the interviewees). The workshops brought together circular supply chain actors and consumers - to further expand, consolidate and verify the multi-case study findings - and enable discussions around supply chain collaboration.

Participatory research - 3 months with a cheese processor; followed by 6 months with a meat processor - to participate in their exploration of strategies to reduce plastic packaging waste in their supply chains, in collaboration with their suppliers and customers. A further 22 supply chain actors were involved in this stage of the research.

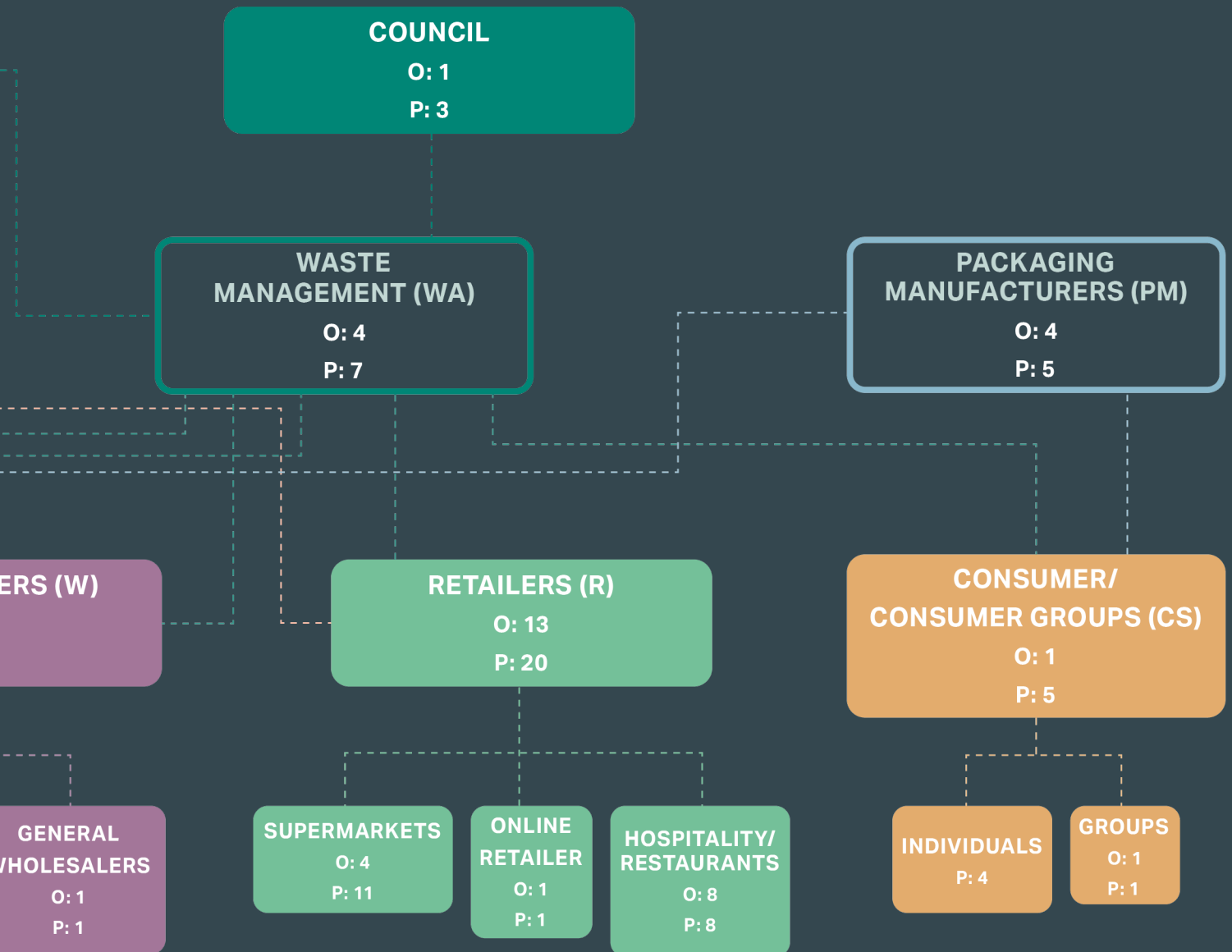
Collectively, these approaches enabled in-depth exploration of the plastic packaging phenomenon, as impacted by consumer attitudes and behaviours. In addition, supply chain collaboration was enabled through facilitated discussion at both the industrial workshops and through the participatory research process.

Anonymised overview of data sources



KEY	TOTAL
O = ORGANISATIONS	34
P = PARTICIPANTS	65

The figure below provides an illustrative summary of the tiers of the supply chain included in the research (see Appendix for further details). In total, 34 organisations and 65 participants were involved.



Consumer Sovereignty: Hampering Innovation?

An initial assumption behind this research project was that supply chain actor understanding of the attitude-behaviour gap (A-B gap) would influence their packaging decisions - so the concept of 'consumer sovereignty' would hamper their packaging innovation. For example, supply chain actors may be apprehensive about the prospects of their packaging decisions given that consumers may "say" one thing, but "do" another when it comes to making purchasing decisions that link to packaging options. On pages 15-19, there is a summary of the research findings related to the A-B gap as perceived by supply chain actors at various tiers of the supply chain.

Implications

- + Supply chain actors are still unsure about the most effective medium to disseminate information on new packaging materials to reach most consumers.
- + Manufacturers are pessimistic about major sustainable packaging decisions because they are concerned that they may encounter a fall in patronage from consumers who associate product quality with the packaging material used.
- + Based on the perception that consumers are unlikely to read the labels of an "already-known" product, the impact of a new recyclable packaging material may be low because its recyclability won't be noticed by many consumers. Hence, they will continue disposing of it in the same way as they disposed of previous material.
- + Packaging decisions are driven by factors including: cost; appeal to the consumer; durability and sturdiness to keep the product safe during transit; shelf life; ease of handling and stacking on shelves; and recyclability. Hence, sustainable packaging innovations can be hampered by a variety of drivers - not by consumer sovereignty alone.
- + Nonetheless, sustainability innovations to reduce plastic packaging can be counterproductive if they don't consider consumer perception of the product and its packaging.
- + Sustainability innovations can be marred by a vicious cycle. For example, companies are stuck on plastic packaging because they assume that is what consumers are willing to accept. The consumers accept plastic packaging because they think supply chain actors know what is best for the product.

Whilst these findings confirm that supply chain actors are wary of the consumer A-B gap, our research also found many other institutional logics at play and concludes that the A-B gap alone cannot be blamed for hindering innovation. Given these other logics, we found examples of packaging

innovation as received by the end consumer, and we also found that pre-consumption actors were concerned by plastic packaging waste that arises before the product is sold to the final consumer. These additional plastic wastes that also need to be tackled in the pre-consumption supply chain are described in section C below.

Summary of supply chain actors' perceptions of the A-B Gap

Farmers

Perception of consumer attitude

Consumers will prefer less plastics on their fresh products.

Perception of consumer behaviour

Consumers buy plastic-wrapped products for longer shelf-life.

"[...] the plastics don't really give longer shelf life because if we're in a wet environment cutting it and we put a wet product into a plastic bag you're keeping water and the moisture inside it. It's far better for it to be in the open air and to learn that if you have a dehydrated leaf on an iceberg lettuce you just take it off, the rest of it is fine." (F1)

"Everybody buys with their eyes, so when you go in for like a lettuce you want it to look green and if you have like a cloudy appearance, they don't pick it up because it's not as bright and you think oh that's a bit older than if there's the packaging around it. But that's exactly the same thing in it it's just sort of perception that its different somehow." (F1)

Processors/Manufacturers

Perception of consumer attitude

Consumers expect fresh and loose products to be cheaper.

Perception of consumer behaviour

Consumers are picky and will reject any warped loose product.

"Yes, loose products tend to be more expensive than prepackaged ones. The reason is because if you imagine like a prepacked bag, it's got like two or three in there that are like wonky or short but these would be left on the shelf if they were not packaged and loose on the shelf, and that's why. It's because they sell more product if it comes prewrapped than if it's loose." (M1)

Perception of consumer attitude

Consumers want more information on packaging waste disposal.

Perception of consumer behaviour

Consumers don't read labels.

"[...] So, we've got our own branded blocks of cheese, they were 200 gram blocks in normal flow wrapped film that we've sold for a few years. And we've got this new line called ABC, and it's the same cheeses but cut differently and packaged in recyclable film. And I think that on its own, they [consumers] probably wouldn't notice [the characteristics of the new packaging material], unless they look at the back of pack. You can imagine the difference this can make based on lot of the cheese [packaging] that we've changed. For example, all our existing cheese packaging wasn't recyclable, and now it is recyclable. But I don't think people would know the difference because it looks the same. It was plastic before, it's plastic now. So, I don't think they would know the difference really, unless they have time to read the back of the pack, which I'm not convinced everyone does. So, I think you have to make it really clear. If you want more people [consumers] to know, I think you must choose another medium to broadcast it beyond expecting them to read the labels." (M3ii)

Perception of consumer attitude

Consumers are concerned about the quality of the products they consume.

Perception of consumer behaviour

Consumers assume the quality of a product is associated with the quality of packaging used.

"[...] people perceive that thinner packaging is not as attractive and therefore the product isn't premium. So, there is a whole education [to do] internally and externally. We're about to take our XYZs packaging and go from 50 micron down to 38 microns and the marketing team are really nervous because they think it depremiumizes the product [loses its prestige among consumers]." (M4i)

Perception of consumer attitude

Consumers demand recycled packaging.

Perception of consumer behaviour

Consumers want shiny looking packaging.

"In the past, we've had people complain about that because sometimes, so they do monitor it closely to try and get, you know, the best finish because it's clear plastic. But sometimes you get little tiny specks inside the plastic. So if you look at it and you know about it, you can see that there is a clear layer on top, because the recycled layer is underneath. But some people won't know that, and they'll think, oh there's like some dirt on my packaging." (M3i)

Wholesalers/Distributors

Perception of consumer attitude

Consumers want recyclable plastic packaging.

Perception of consumer behaviour

Consumers don't recycle plastic packaging.

"I've obviously delved quite a lot into consumer data and sentiment and well, a lot of them say that they want everything to be recyclable whether or not they actually then recycle is a different matter, or whether or not they would be willing to pay more for something that's in r-PET versus just PET, for example. But it's definitely something that the retailers are now pushing on more and more but I'm unsure how many consumers actually take back their flexible packaging to the front of store, even if it's labelled. But I also believe that it's unlikely consumers will clean or want to take back something that still got food and particularly a liquid within it, so the dry products seem like the right place to start on that front." (W3)

Perception of consumer attitude

Consumers are worried about the negative environmental impact of plastics.

Perception of consumer behaviour

Consumers think there are no alternative solutions for some products.

"I mean obviously we're all becoming savvier to plastics and polystyrenes because we know that it's creating a problem across the globe. But the problem is as consumers we don't want wet sodden fish, we want to pick things up in nice clean packaging and put it in our shopping basket and take it home and put in the fridge. We don't have to handle the goods until the point of use. So, until we find something that is a replacement for that, or customers change how they perceive their wish to receive the goods, then I'm afraid that is what we've got at the moment." (W1)

Retailers

Perception of consumer attitude

Consumers hate plastics - considering the impact on the environment.

Perception of consumer behaviour

Consumers want the benefits plastic packaging offers the product (e.g. convenience, cheap, aesthetically pleasing, hygiene especially during the pandemic).

"[...] customers continued to tell us that they wanted us to tackle plastic and remove it. Remove packaging, but plastic in particular. But we found out the sales were completely opposite. Food wastage went up on loose lines. And when we had some packaged tomatoes and the loose equivalent, the same price parity and everything, they would always go for the packaged items. It's a lot to do with the dwell time, so how quickly they come in and out of our shops. People were shopping less frequently. People wanted stuff to last longer. So, you know, customers are fickle, they want something, they don't want to pay for it, but they want convenience at all costs. And unfortunately, when you're buying like loose items, so you've removed packaging, it does take a little bit longer to weigh it, it's just fact. But really, if you push them, they'll crack and they won't do it, because, and they'll blame it back on you ultimately as a retailer for pumping too much packaging. But what you find is what they say and what they do are two very different things quite often." (R1)

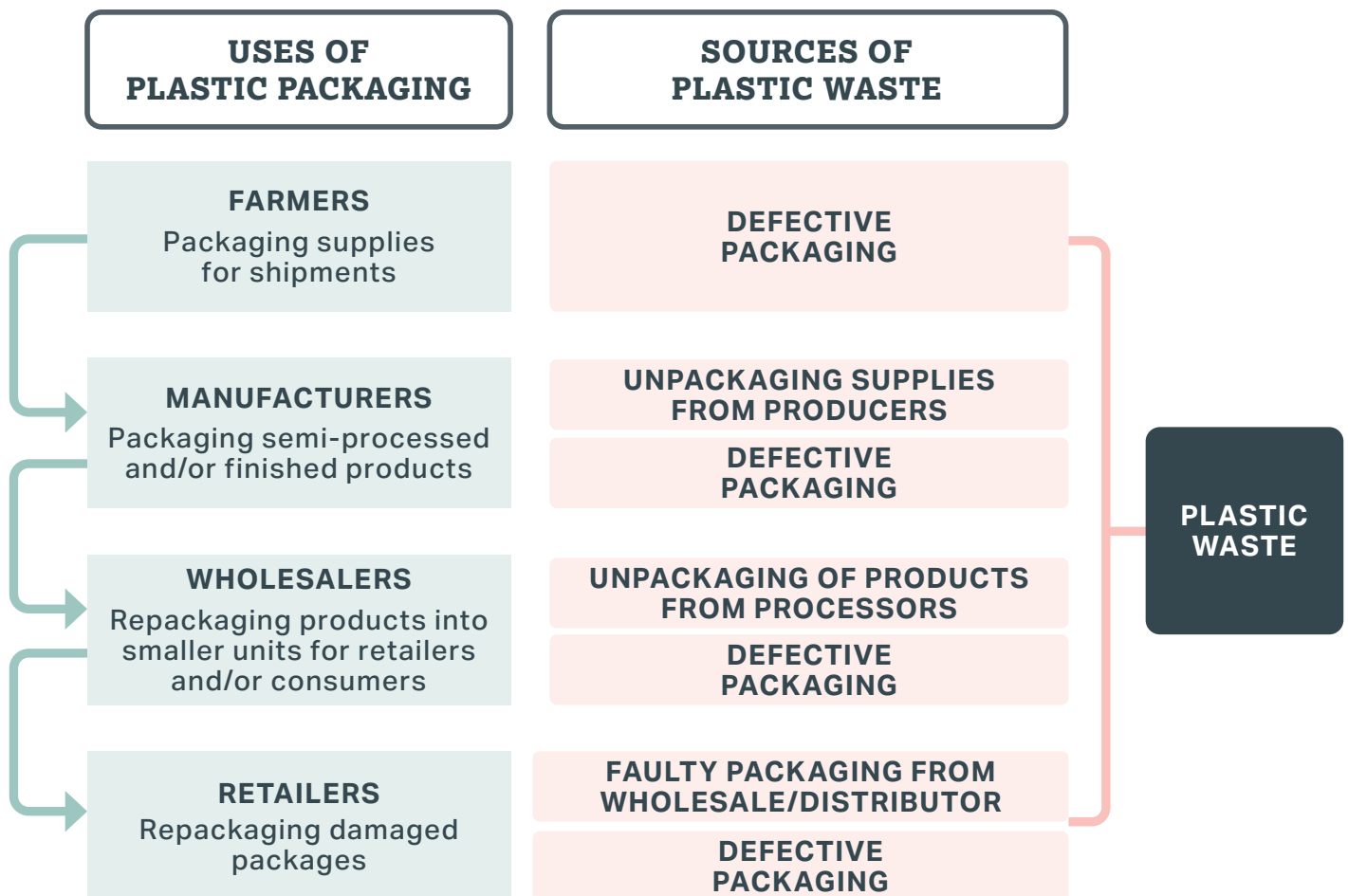
"Produce is always a challenge, people always from a customer perspective they always talk about they like the look of loose, but they want the convenience of prepacked. They don't want to have to pick up five separate apples. They want to pick up a bag with five apples. It's just quicker and more convenient for them." (R2ii)

"So I think for us it's understanding where we can put loose produce in and where customers are willing to accept it. But also then trying to educate our customers as well as to the reasons why we're doing things. And with a lot of the trial work that we did, what we found was where we spoke to the customers and said we're doing this trial, this is the reason why it might look slightly different or why you have to behave slightly differently. Customers went oh OK right, yeah that makes sense and then were just accepting of it. So I think it's having that open dialogue." (R2i)

Sources of Pre-Consumption Plastic Packaging Waste

Huge volumes of plastic packaging waste are generated as products go through various production stages before reaching the final consumer (see figure below). This study explored these waste streams and uncovered the following:

Sources of pre-consumption plastic waste (Adapted from previous research¹)



Multiple cases of “unnecessary or avoidable” transitional plastic packaging.

For example:

- + Some food products don't undergo any further processing between the stages (outlined in diagram). However, the receiving customer removes the supplier's branded packaging and repackages with their label.
- + Most stages after manufacturing (e.g. wholesalers, retailers) only repackage into smaller units to meet the requirements of their customers. This presents an opportunity for the supply chain actors to reduce the plastic volumes entering the environment by prioritising the options that are best for the environment when making inter-firm packaging decisions (see example quotes below).

“[...] we have a lot of customer queries about packaging and a lot of our customers are eco-friendly. Although not everybody thinks about it, we are quite good within our stores and try to work this across our supply chain. We don't package all our products for example vegetables are mostly loose from our suppliers to our shelves. So, there's lots of areas which every retailer can focus on to reduce plastics before reaching the consumer.” (R3vii)

“[...] a lot of the suppliers were nervous of working with a retailer because we have, well retailers have a habit of changing their mind and agreeing something and then doing something else. So, it's a big leap of faith for them, big leap of faith for the retailer. And willingness to collaborate will work. There are obviously the commercial benefits of trying to be first to do it in your market and exclusivity. But that's what you wanted as a retailer, you wanted to be first in the market to reduce plastic packaging even before the consumer. In collaboration, you know we got more innovation out of the suppliers because they trusted us that we'd stay with them.” (R4)

02

Multiple cases of defective packaging contribute huge volumes to the plastic waste generated within the supply chain.

Defective packaging includes wrong labelling, packaging leaks, and flawed packaging seals which are usually rectified by unpackaging the product and repackaging it. In addition, large-sized vac-pouches are sometimes cut to package small-sized orders such that the remaining part is wasted.

"[...] I mean you have to think about it like this, the MD said to us he wants to get different sized bags, which might sound ridiculous, but it probably would work in reducing waste because what they'll do now in there [production floor], they'll vacuum pack it. But when they go to vacuum pack it and there's no bag ... small enough, they'll just cut a bit off the bag and chuck that in the bin. So, having to get different sizes will be great if we are going to stick to it." (M2ii)

"So we have heard complaints about that because people don't understand, they don't know, and that is understandable in itself. But other times, like I said before, you can't tell, it depends as well on our supplier, where it comes from, because sometimes they have better systems in place to make sure that those little tiny specs don't come through to us. But that in itself is a waste because sometimes they will get that and if it gets rejected there, it's a waste isn't it." (M3i)

03

Unallocated waste management responsibilities within firms lowers the recyclability rate.

For the hospitality industry, roles such as the identifying, sorting, and cleaning of plastic waste usually sits between the chefs and the housekeeping department. Hence, plastic waste from the kitchen, which are usually soiled, either end up in the wrong waste stream or contaminate other recyclable plastic wastes.

"My only question sometimes is that it's got meat juice inside it, so how recyclable is that with meat juice in it. I don't know what the process is for recycling a vacuum packaged bag with meat in it. How do you wash them; because at the moment a lot of the work to recycle plastic lies solely with the end user. And that is a lot of labour costs."
(R6)

"[...] to improve the reusability of plastic packaging is definitely something that we want to do with other suppliers, we've just had a bit of pushback from them really - with respect to the cost and labour required." (R9)

04

Supply chain partners also rely on single-use plastic packaging, creating plastic waste

Business to business (B2B) transactions are mostly based on long existing business relationships and products are not stored for long. Most benefits of single use plastics such as durability, prolonged shelf life, consumer appeal etc. are not required.

“But I think we definitely don’t like using plastic. We definitely don’t like seeing mountains of plastic coming in and then mountains of plastic go out the door like literally two, three hours later. Yeah, that’s how quick we add to the global plastic waste problem.” (R7)

“Well, we have a kind of three-day rule that we put on our meat, fish, and other high-risk products to ensure that such products only stay on the shelves for three days. Although, we have suppliers that sometimes send us 15-day shelf life for vac-pouched meat, I’m like, 15 days? It’s going to be rotten by then, or is it going to taste as good as fresh? I do trust the meat supplier, but I don’t trust the 15-day shelf life, so I don’t wait that long. It’s just about knowing the reliability of your suppliers and ordering exactly what you need for 3-5 days at most.” (R6)

05

The lack of uniformity in the waste collection services offered by different councils across the UK hampers the sorting efforts of supply chain actors.

As workers are likely to commute across different councils, there is a high likelihood of unintentionally contaminating the recyclable waste stream. Some councils were opaque in the services offered for commercial clients who assumed there was no need to separate wastes as they were always collected together. Moreover, the lack of a standard labelling system for bins in the UK heightened the chances of contamination.

"I worked in Leeds for a while and the place was a new shopping complex that had restaurants and stuff in it and they wanted to be the only green shopping complex in the country. And they basically had on site, an underground basement dug into the ground, a recycling plant for packaging and all of that whole building was like 90% green. You know like all of our food waste was turned into compost within three hours and then sold to someone else. So, I think it all comes down to councils and what they do and what they're interested in. Some councils get it and some councils don't." (R6)

"One of the things they have, which is like really crazy in London is they have bins that have got like recycling on one side and then normal rubbish on the other side. But there's no definition of what goes into one and what goes in the other. So, every single bin that has a recycling compartment someone will put something wrong in there because it doesn't tell you what you can and you can't. It just has a green side and an open hole. But if you put a coffee cup in there with coffee inside it then now that whole bin is contaminated. So, they don't have any kind of like, I think their green initiative is like a token really, it's not a real thing unfortunately. And until the council wake up to it, and put in some more stringent support then it's going to be a giant waste of time." (R6)

Tackling Plastic Waste: Current Strategies

Seven sustainable packaging innovation strategies

Despite the perceived A-B gap, and given the multitude of plastic waste in the pre-consumption supply chain, our evidence highlights seven practices adopted by different supply chain actors to tackle the plastic waste problem. These seven strategies are defined below. Each strategy is then discussed in turn summarising the related interview evidence and exploring the implications surrounding its adoption. Finally, the seven strategies are compared using the [Waste Hierarchy](#).

USING MORE RECYCLED CONTENT

Use of recycled food-grade plastic, enabled by recent improved clarity on food safety regulations.

REDUCE WEIGHT

Thinner packaging and/or reduced size of packaging (e.g. used for snacks including crisps).

REDESIGN + REPROCESS

Use of mono-plastics, which are easier to recycle and the cleaning of used plastic packaging so that it can be recycled into food-grade plastic again.



ADOPTING REUSABLE PLASTICS

Refill stations in Business to Consumer (B2C) settings and reusable trays etc. in Business to Business (B2B) settings.

USING BIO-DEGRADABLE PLASTICS

Alternatives to fossil-based plastics that decompose more easily under certain conditions.

ALTERNATIVE MATERIALS

Many alternative materials are being considered and used where possible - but noting that the overall environmental impact may not be reduced if packaging becomes heavier or the product is more liable to damage.

REMOVING PACKAGING

Removing unnecessary packaging used in B2B (e.g. plastic lids on cream previously thought to be needed for stacking purposes, but this is not the case) and sell loose product in store for B2C.

01

Reducing the weight of plastic packaging

Reducing the weight of plastic packaging

In most cases reducing the weight of plastic packaging fits into the firms' existing packaging processes, and hence is relatively easy to adopt across the firm and its supply chain.

The food supply chain's drive to reduce the weight of packaging is characterised by two practices:

- A) The use of thinner plastic.
- B) Reducing the size of packaging.

A: The use of thinner plastic

"Primarily this year we've been focusing on reduce... by using thinner substrates So, we use the thinnest possible film we can that still guarantees the quality of the product when it reaches the consumer. ...We're about to take our [anonymised product] packaging from 50 microns down to 38 microns. My marketing team are really nervous because you know people perceive that thinner packaging is not as attractive and therefore the product isn't premium." (M4i)

B: Reducing the size of packaging

"When I first joined [Company M4], the marketing team used to try and make bags look as big as possible on the shelf because they thought the consumer would think, oh, that's a bigger pack than the one next to it. I believe the consumer is well educated and they're not fooled by the size of packaging, so it needs to be the right amount." (M4i)

"Company M4 have reduced pack sizes and are addressing the marketing issue: "we have an on pack claim that tells you that we've reduced packaging by 23%. And we validate that data in the background and it's kind of driving it that way." (M4ii)

Implications (for both options):

- + Reduced transport cost (financial and environmental).
- + Reduced plastic production volumes i.e. conserving natural resources.
- + Reduced energy consumption in manufacturing new plastics.
- + Demand fluctuations as consumers may associate lighter packaging with reduced product quality (negative implication).

02

Redesigning and reprocessing packaging to promote recyclability

Two key approaches for implementing this strategy are described below:

A. Identifying and circumventing sources of contamination

A major barrier to recycling is contamination. The possibility of contamination in the plastic waste stream increases as soiled plastics, multi-layered packaging and/or a wholly different material are put into the plastic recycling bin. The onus on the consumer to identify and sort various types of plastic waste and ensure their plastic waste is clean enough etc., limits their contribution to recycling. For instance, when consumers find it too difficult to tear apart or separate multi-material packaging or are unable to clean soiled plastic packaging to an acceptable level, they either add it to a recycling bin, hoping it will be recycled (wishcycling), or bin it with their residual waste. Supply chain actors have increased their efforts to offer more convenience to consumers by adopting mono-material for the different parts of packaging (e.g. caps, lids, labels).

"[...] as a further step which is not as drastic as the other two is around colour use and ink. So, we also know from obviously the discussions that are ongoing with the likes of Cflex, recyclers and the UK Plastics Pact² that they're looking for better quality recycling and ... it has to have less contaminant. So, we've been trying to work on ways where we can reduce the number of colours or the ink that we utilise that ... maybe makes our packs a bit cleaner in terms of the sort of the end call." (M4ii)

"[...] we're particularly focused on making our packaging mono material where possible. Where not possible making it very easily separable. So, a lot of what we've been doing, so you can take the plastic liner off really easily. So, you're just putting a liner in the bin and the actual packaging can be recycled, but is also unsoiled." (M1)

B. Recycling back-of-store packaging

A significant source of packaging waste has been attributed to the back-of-store packaging that is discarded by retailers. Finding ways and collaborators to reprocess back-of-store packaging waste, rather than discarding it, has been a significant step towards reducing the amount of packaging waste generated and keeping the materials in the loop for longer.

"A good example of that is the shelf ready packaging that we have in our dairy for example. So where you see the cheese is packed onto the plastic trays. Previously that was being downcycled into I think carpets and bedding We worked with our suppliers and challenged ourselves and said, actually this is food grade material, it's a premium material, how can we keep this within the food supply chain? And we did a collaboration with [packaging solution provider X] whereby all of that back-of-store plastic is sent across to them so that they can put it through a cleaning process to then turn it back into a new primary food contact packaging which we can then use within our stores." (R2i)

Implications (for both options):

- + Reduced burden on consumers to identify, sort and clean plastics.
- + Reduced occurrence of contamination.
- + Prolonged use of premium material.

03

Using more recycled content for food-grade plastic packaging

The use of recycled plastic packaging in the food sector has been hindered by perceived obstacles from food safety regulations. Increased clarity in food safety regulations has increased the use of recycled plastics in food packaging.

"[...] so the PET ones at the moment we have one with 25% recycled content in and one that's got no recycled content in, but from November we will have our first production of 100% r-PET. And the one that's currently got 25% will also increase to 100% by next March; but the rest of our range will be in PP, simply because currently there's no food grade available." (W3)

Implications:

- + Reduced dependence on virgin plastics i.e. conserving natural resources.
- + Recycling plastics reduces environmental pollution.
- + Recycled plastic packaging is more expensive (negative implication).
- + Promoting circularity of food packaging.

04

Adopting reusable plastics

Reusing plastic packaging at least more than once, has increased in both B2B and B2C transactions. Most retailers have explored the options of facilitating the reuse of packaging materials by setting up refill stations for certain food products. Other food supply chain actors have also increased the use of reusable trays which are returned to suppliers to refill for the next distribution.

“From a retail side ... they have started to do like refillable things in the store. So, you know you can now buy refillable biscuits and there’s an appetite to do the same for coffee and tea, and for other lines across retail, so that you come into the store to fill up your container.” (R9)

“Reuse is happening with the fish suppliers and meat suppliers at the moment already. It’s cutting down the cost, it’s cutting down the waste of plastic, The vegetable supply usually comes in the morning and ... we empty the boxes and they take them straight away. The meat supplier, for example if I get like liver, some things for sauces, they send it like that, I tell them wait there for two minutes, empty it and they take them. But then fish comes the night before, they deliver four to six boxes every day. So, they just stay [here and are collected next time there is a delivery]. Compared to the polystyrene boxes I was using when I first started, it’s a lot better.” (R7)

Implications:

- + Reduced dependence on virgin plastics i.e. conserving natural resources.
- + Reduced environmental pollution due to less solid waste released into the environment.
- + Reduced carbon emissions and lower energy consumption as plastic volumes required will reduce.
- + Reusable plastic trays are more rigid and offer more protection for delicate foods in transit.
- + Reusing the plastic trays saves cost on the need to purchase new packaging materials for all orders.
- + Requires extra labour to clean and sanitise packaging for the next delivery (negative implication).
- + Easy build-up of bacteria when not properly sanitised which increases the possibility of cross-contamination in fresh products (negative implication).
- + New cost and effort required to ensure plastic trays don’t pose any biological, chemical and physical hazards to food before packaging (negative implication).

05

Using bio-degradable plastic

Like other sustainability innovation ideas at the point of starting, there is divided opinion on the prospects of biodegradable plastics in food packaging. Beyond being an alternative to fossil-based plastics, the ability to decompose under certain conditions makes it more environmentally sustainable.

“We are also exploring switching over all of our vac packs to being the compostable vac pack. And the cost is huge compared to plastic currently. So, we go through loads of vac packs but to get a sustainable compostable version, it’s like four times more expensive. The business is committed to putting more cost to changing over. But if you’re a smaller company, I don’t think it’s quite realistic at the moment.” (R9)

Implications:

- + Physical properties similar to conventional plastic packaging, meaning there is little/no significant change in work routine.
- + Enhanced circularity potential when the waste generated becomes a useful input for farmers to grow food.
- + Less carbon emissions in the production of biodegradable plastics, as compared to fossil-based plastics.
- + The similarity in physical appearance with other plastics increases the risk of mixing them in the waste streams (negative implication).
- + Biodegradable plastics are relatively new. There is less infrastructure to manage that waste stream (negative implication).
- + Biodegradable plastics are currently more expensive than conventional plastics (negative implication).

06

Removing unnecessary and/or avoidable packaging

Strategies to remove unnecessary packaging are evident both within the pre-consumption supply chain and in-store (sales of loose product where feasible):

A. Pre-consumption supply chain waste reduction

Multiple cases of transitional packaging among suppliers along food supply chains results in huge volumes of *unnecessary and/or avoidable* plastic packaging waste. Supply chain actors are reducing the need to repackage products in transition by embossing the product with the labels of the final supply chain actor (retailer) early in the supply chain.

"[...] we're not going to have plastic packaging reduction targets. What we're going to do, is to approach it in a much more focused way and remove plastic packaging that we deem as pointless. So, couple of examples of that might be the lids that are on top of the cream pots. They're not airtight, it's there for stacking. We've removed those bits of plastic because they didn't actually perform any real function. Well, our customers are not really bothered if that piece of plastic is there or not, so removing that further points to where plastic has been put into applications where it really doesn't need to be, and we can just get by without that piece of plastic being there." (R2i)

B. Loose products in-store

There are also examples of products being sold loose in store, despite the many A-B gaps described earlier that are perceived to make this choice unattractive to some consumers. This strategy removes much of the packaging that would otherwise be added at the pre-consumption stage, although there is inevitably still a need for some packaging for transportation of food. This approach is particularly effective where consumers then bring along their own re-usable cloth bags. It is less effective where stores provide single-use bags (even if those bags are made of an alternative material such as paper - see strategy 7). When used alongside effective marketing and consumer education, the potential of this strategy is significantly increased.

"But equally I know that we have a lot of customer queries about packaging and a lot of our customers are eco-friendly. And we are quite good within our stores. We don't pack all of our products, we have certain vegetables that we don't package - that is just loose." (R2ii)

Implications (for both options):

- + Time and effort spent removing preceding supplier's branded packaging and repackaging is saved and used on other activities.
- + Enhances supply chain relationships and aligns partners towards mutual improvement initiatives.
- + Requires consumer education and effective marketing by retailers for the sale of loose product to have a positive impact.

07

Alternative packaging materials - glass, paper, waxed cardboard

Alternative packaging materials - glass, paper, waxed cardboard

Given that general consumer perceptions of the environmental impact of plastic packaging are significant in their purchasing decisions, supply chain actors have explored other packaging materials as alternatives to reduce their reliance on plastic. For example, there is an increased use of glass, paper and cardboard in food packaging because it attracts an array of consumers. The disposal of paper and cardboard tends to be safer for the environment because it is home compostable, easier to sort for recycling, and cardboard can be reused in homes. Glass packaging is also preferred because of its reusability and ability to protect the product.

"Yeah I think our suppliers and everyone's on the same page. Everyone knows it's time to change and it's better to do it now than be forced to do it in a few years' time. Most suppliers have gone completely away from plastics. Like mushrooms when we get mushrooms from [anonymised] it's completely 100% carbon neutral. He has no plastic, he has none, everything is fully recyclable, he's got electric cars, ..., the whole thing for him is about carbon neutrality ... So, he's amazing and influencing us ..." (R6)

"We much prefer to have our packaging carbon neutral or as close to carbon neutral as we can. I think what [anonymised] does is, like about 80-90% of what we supply them is cardboard, peach paper, and stuff like that." (M2vi)

Implications:

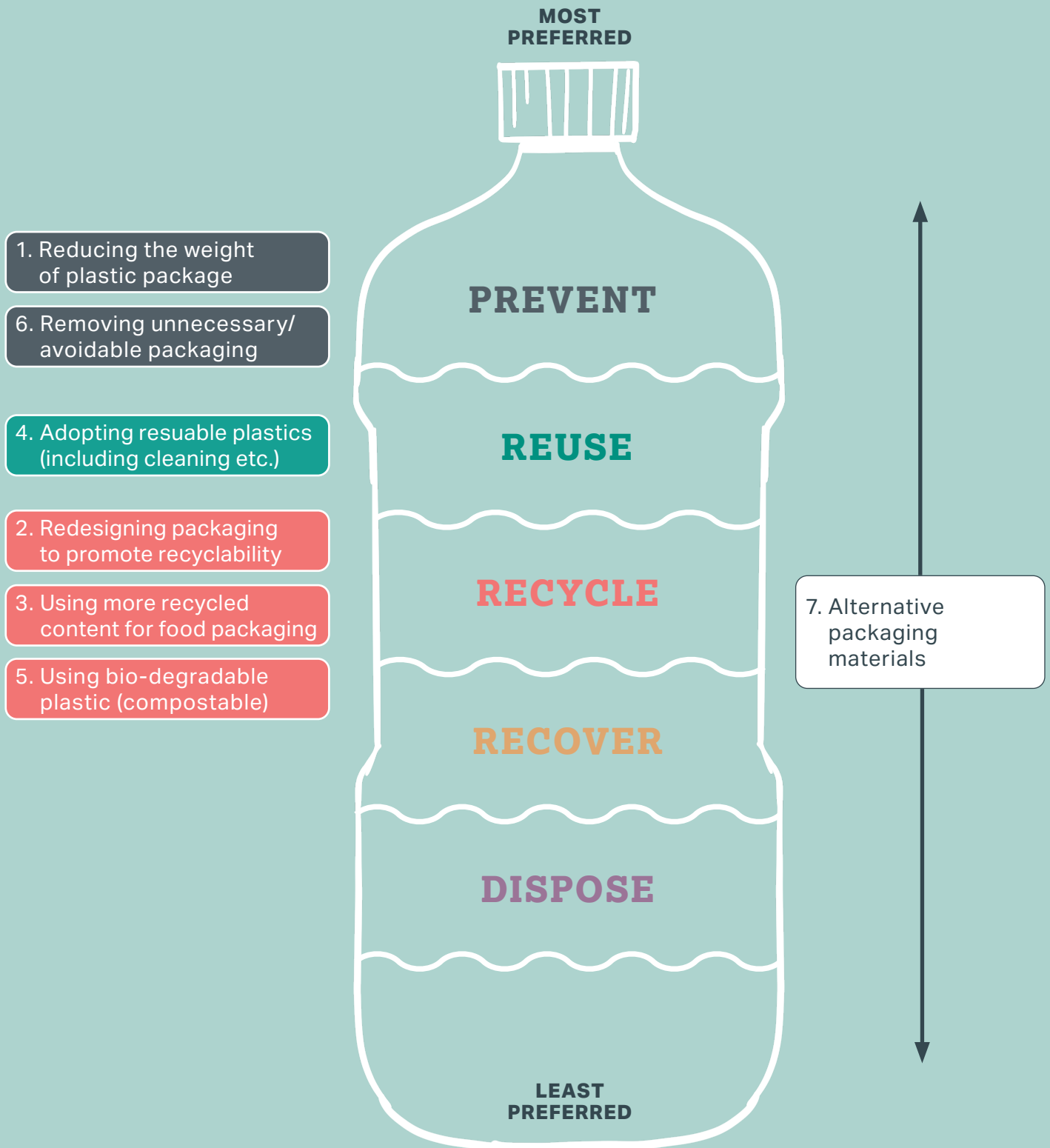
- + Glass, paper and cardboard waste are covered in the government's proposed legislation to ensure they are collected by all local authorities by the end of 2023 (i.e. the 'Consistency in recycling collections in England' legislation³).
- + Switching to alternatives may switch the waste problem to another material.
- + The alternatives to plastic packaging such as glass, paper or bioplastics increases other environmental impacts such as higher carbon emissions and increased water usage.
- + Glass packaging is heavier, hence will lead to a significant increase in transportation costs.
- + Glass can easily break in transit or storage, potentially increasing food waste.

Linking current strategies to the Waste Hierarchy

The Waste Framework Directive⁴ 2008 and Waste (England and Wales) Regulations⁵ 2011 requires every firm to “take all such measures available to it as are reasonable in the circumstances to apply the waste hierarchy as a priority order” (see UK Statutory Instruments: 2011). The Waste Hierarchy defines the preferred waste prevention and management options based on their impact on the environment. The hierarchy is in the shape of an inverted pyramid that shows the most preferred option on the top and descends down to the least preferred option. To tackle plastic waste, supply chain actors are encouraged to deploy strategies with the least impact on the environment (i.e. focus on strategies further up the pyramid).

We classified six of the seven strategies (see figure) currently pursued by supply chain actors into a category of the waste hierarchy pyramid. The classified strategies all continue to make use of plastic, but reduce its environmental impact. The seventh strategy of using ‘alternative materials’ sits outside this categorisation, as the impact of this strategy will vary according to the extent to which the alternative material can be re-used or recycled etc. This strategy is not necessarily better than rethinking how plastic is used or how overall packaging can be reduced.

Categorising Sustainable Packaging Innovations using the Waste Hierarchy



Stakeholder Roles and Interests

Many food supply chain companies spearhead specific sustainability innovation strategies. Their success affects and/or is affected by various individuals and/or groups both within the supply chain (internal stakeholders) and outside the boundary of the supply chain (external stakeholders). Understanding other stakeholder interests and roles is important in planning, decision-making and implementation of sustainable packaging innovation. Key findings from our research are summarised in the table below:

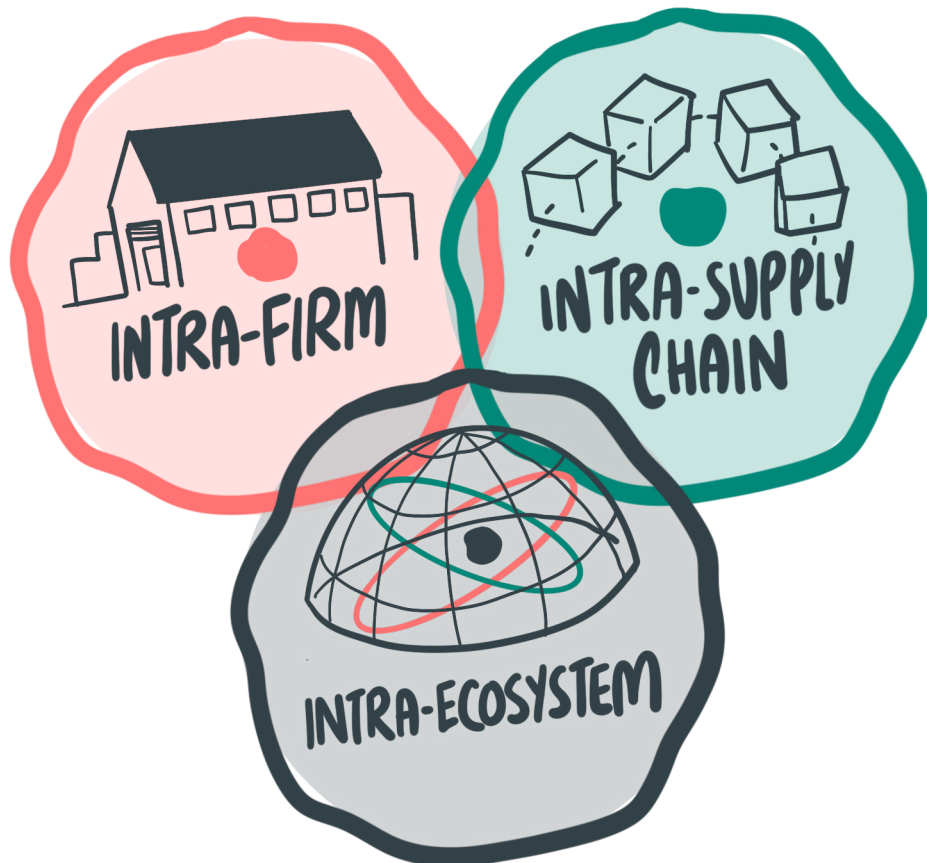
Overview of food supply chain stakeholders and their interests

STAKEHOLDER	INDICATIVE QUOTES	INTERESTS/ROLES
INTERNAL STAKEHOLDERS		
Investors/Shareholders	"I think it's quite easy to say we will reduce plastic packaging or move up to 30% recycled content and everybody be like, yeah. But taking the step on that additional investment on that front still depends on its returns to our owners. Like I said, it's mainly because if the product is unprofitable then it's pointless for them to invest. So there always has to be the business case." (W3)	<ul style="list-style-type: none"> + Earning returns on their investments + Avoiding risky investments
Employees	"So, a lot of pushbacks come from the operational guys. The additional burden of unpackaged products is seen as another task, and they didn't really want to do it. I think the store managers wanted to utilise their staff hours, which get reduced all the time. [...] they didn't want the staff doing extra that delayed stacking shelves." (R3iv)	<ul style="list-style-type: none"> + Less complicated tasks required + Any extra tasks/roles added must be matched with a reward
Farmers	<p>"we would much prefer to do it naked, but the supermarkets themselves are short of what we would say the traditional greengrocer. In terms of packaging there is a supermarket who does what they class as biodegradable packaging. Its double the cost of other packaging. Because obviously we have to buy at their nominated supplier. So we're tied to that cost." (F1)</p> <p>"... we get paid the same whether it's loose or packaged. But for some reasons when it gets to the shop its different. And then you find that the unpackaged stuff is tucked away in the far corner that nobody could find and they go oh nobody bought it. And you kind of go oh really, fancy that! But the packaged stuff is on the front of an aisle end and the other stuff is like five miles down the corner, tucked in with the you know." (F1)</p>	<ul style="list-style-type: none"> + Incur extra costs to deliver plastic packaged products to the supermarkets + Ensuring products are packaged to meet specific supermarket requests + Supermarkets give more priority to packaged items than unpackaged items in their shops

STAKEHOLDER	INDICATIVE QUOTES	INTERESTS/ROLES
Manufacturers & Wholesalers	<p>"[...] I think a lot of the big companies like [anonymised] have their own packaging departments [...] a research centre to enhance sustainability or specifically that delve into removing, reducing the use of plastic packaging or making it more recyclable." (R3i)</p> <p>"Tesco were then the first retailer to really push on the matter so they have a very clear red, amber, green (RAG) list of packaging materials⁴ that you can use and we're like if you have something that's in red, we are going to delist you basically, so black plastic being the key one within that. And that obviously it makes it a very quick and easy business decision that OK, we need to move out of that." (W3)</p>	<ul style="list-style-type: none"> + Developing and trialling new packaging types + Avoiding in-transit damages in the delivery of food products + Avoiding food waste + Minimising costs + Meeting retailer requirements
Retailers	<p>"It's a challenge to get stuff past the retailers and consumers if it's not appropriate. And there's probably more action we can take on the actual product that doesn't actually change anything the customer sees. But the thing with packaging is it has a very direct impact on the customer, in terms of the retailer and the consumer, getting it changed you have to make sure the consumer is happy, and the retailer is happy and approves. So, it's quite a process." (M3i)</p>	<ul style="list-style-type: none"> + Enhancing brand reputation to attract customers + Avoiding sanctions from governmental agencies + Ensuring items are protected from damages while displayed on the shelves
EXTERNAL STAKEHOLDERS		
Consumers	<p>"[...] I mean the consumer is still king [...] still makes the final decision and I think for me there's almost a bit of a green arms race, you know who's responded to your sustainable packaging calls among the individual companies and can make a choice. So, we have to act as consumers prefer." (R2i)</p>	<ul style="list-style-type: none"> + Convenience in purchasing food products + Ease of post-consumption tasks
Government	<p>"And there were parts of that, very very clear how business policies can succeed or fail based on government policy surrounding the environment. I remember we had lots of biofuel companies and there were grants available and then they got pulled and that made companies basically go bust or had to diversify etc. [...] same can happen with the raw material for plastic packaging and we would be forced to find alternatives when we run out." (M2v)</p> <p>"I think COP26 is a big opportunity for our business and generally I think we need to fuel that fire. And so, if you care about food miles, you should care about plastic. And if you care about the planet you should care about plastic and where your food comes from and try and encourage more local production to reduce the need for plastic packaging." (R5)</p>	<ul style="list-style-type: none"> + Setting legislations to drive both: household and commercial waste management practices; and/or to reduce volumes of plastic waste produced + Providing the necessary infrastructure to facilitate plastic waste management
Media	<p>"So, I know that we're always trying to win the annual recyclable challenge organised by a magazine because those stats stayed around and from a PR point of view if you were top, that was used in the advertising, and we know customers who cared about the environment will buy from the most sustainable companies. We as people were competitive to win, hence, obviously we acted more on our packaging innovations." (R4).</p>	<ul style="list-style-type: none"> + Propagating good vs bad practices for the awareness of other stakeholders + Educating consumers on the end-impact of plastic packaging
NGO	<p>"WRAP is pulling together industry, manufacturers, converters and local governments together to look for solutions. So, we joined it because [...] I wanted to make sure that we were associated with it from a brand point of view. So [anonymised] is investing in the right things given the purpose that we've got." (M4i)</p>	<ul style="list-style-type: none"> + Set sustainability targets to drive the use and disposal of plastics + Coordinate industry action towards sustainable practices through networking and knowledge-sharing + Educating consumers on the end-impact of plastic packaging

Sources of stakeholder conflict

Given differing roles, interests and perceptions of the A-B gap among the stakeholders, conflicts may arise and act as significant barriers to achieving a concerted effort in implementing sustainability innovations. Below we highlight conflicting interests which were either:



Intra-firm

Beyond the overall firm objectives, individual workers and departments within a firm have targets to achieve. They forge routines to achieve their respective targets and are likely to push against sustainability innovations that require significant modifications to their routine tasks.

"Any measure to reduce plastic packaging must be linked to sales because although butchers will prefer packaging huge volume customer orders to reduce the volume of packaging material used, the sales team are more interested in high value sales of small things, as this gets them to hit their monthly sales targets." (M2v)

Intra-supply chain

Despite the increased inclination towards fostering competitiveness at the supply chain level, firms are still autonomous and will prefer sustainability innovations that align towards their profitability. Firms are reluctant to share their sustainability ideas with their supply chain to avoid extending to competitors who may also be in business with their partners. Some supermarkets and retailers demand that suppliers use specific packaging materials but are not willing to pay an increased price for the product. Although these initiatives may be environmentally-friendly, they are mostly short-lived.

“In my experience there isn’t much sharing and I do think it’s seen as a marketing tool and competitive advantage at the moment, there’s a lot of marketing campaigns out there around environment and what they’re doing basically. So sharing isn’t top of the agenda.” (R3iv)

Intra-ecosystem

External stakeholders such as the government, the media and NGOs play a significant role in steering and promoting sustainable packaging innovation. The administration of legislation, policies and voluntary schemes foster change in the way plastics are produced, used and then disposed by supply chain actors. Major recent governmental legislation that has been either enforced or proposed includes the Extended Producer Responsibility Scheme (EPR) and the Deposit Return Scheme and the Plastic Packaging Tax. In addition,

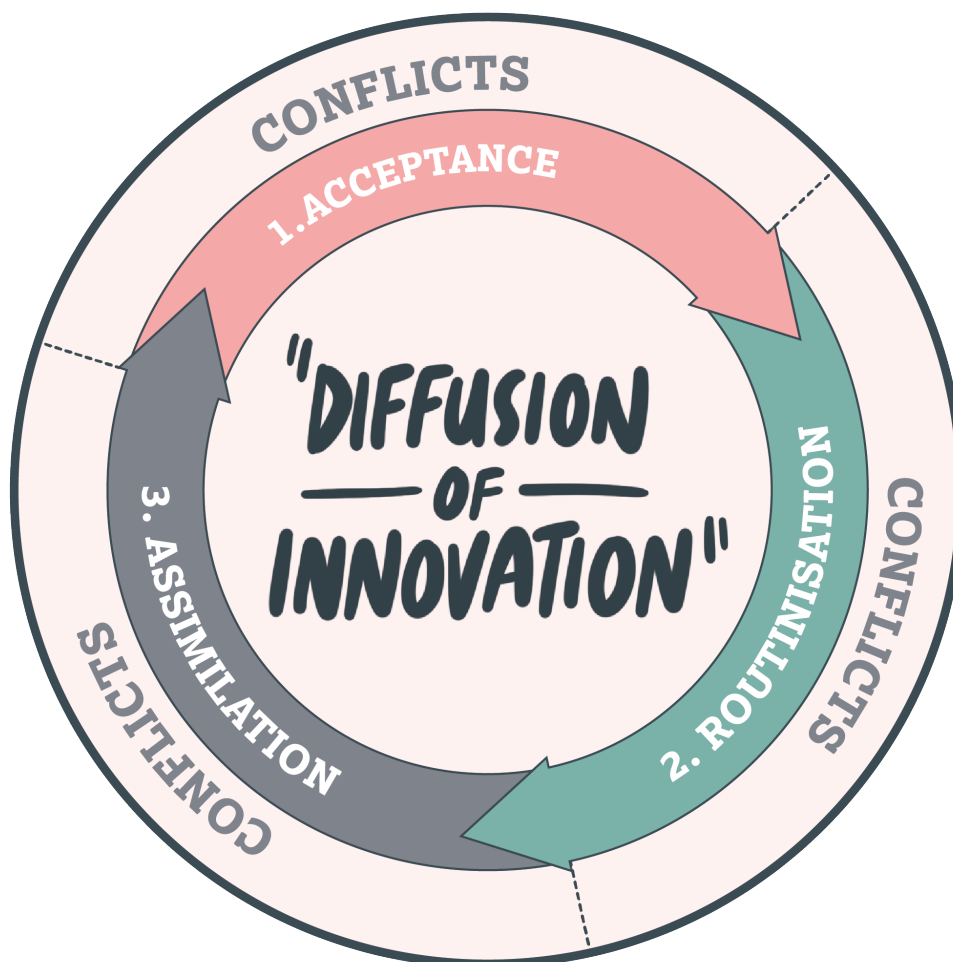
voluntary initiatives and networks such as the UK Plastics Pact²; the Plastics Industry Recycling Action Plan (PIRAP)⁷; UK Circular Plastics Network (UKCPN)⁸; and retailer-driven initiatives have significantly impacted plastic usage among supply chain actors.

However, these initiatives can be counterproductive when the implications are not understood by the supply chain actors. When legislation is not supported with infrastructure, there is little chance of acceptance among supply chain actors. For example, the Plastic Packaging Tax is designed to discourage the use of virgin plastics for packaging but has not yet been complemented with an increase in access to recycled plastics or alternative packaging materials. Given these are more expensive, some firms have chosen to simply budget for the tax as an increase in operational cost. Moreover, the requirement that plastic packaging must contain at least 30% recycled content to avoid the tax does not encourage gradual incremental progression towards the threshold, which may be more realistic in some cases.

“I think just from my perspective, sometimes government regulation can come in and it can have sort of a bit of a knee jerk reaction. For example, I think the taxes are good from a regulatory perspective, but it lends itself to people not necessarily making the right decisions. [...] everyone goes like we’re going to get taxed on the amount of plastic we use; we need to reduce or remove plastic instead of addressing a bigger perspective”. (CO1)

Diffusion of Innovation: From Linear to Circular Supply Chains

To further understand how to roll out sustainable packaging innovation, we make use of the Diffusion of Innovation (DoI) Theory. Focusing on strategies that enable transition from linear to circular supply chains, we apply definitions⁹, which have been adapted to this context from previous academic research¹⁰.



We assume that DoI follows three stages:

01

ACCEPTANCE:

The degree to which an innovation is accepted, and hence that supply chain actors perceive the benefits of sustainable innovation in their organisation and across the circular supply chain.

02

ROUTINISATION:

The permanent adjustment of governance systems, including policies and procedures. This phase also coincides with the provision of infrastructure for the full exploitation of the sustainable innovation.

03

ASSIMILATION:

The extent to which the use of a sustainable innovation diffuses across different tiers of the supply chain. This depicts the breadth and depth of DoI. The higher the compatibility of the innovation with the existing value system the faster the DoI.

Our findings, as summarised in the following tables, explain the barriers and drivers at each stage, and identifies the conflicts arising at each of these stages in the search for sustainable packaging innovation. We explain the variety of resolution strategies currently being employed. These strategies all need to become more widespread in order for more significant progress to be made.



ACCEPTANCE

ROUTINISATION

ASSIMILATION

BARRIERS

- + Cost of sustainable innovations
- + Need for competitive advantage hampering collaboration
- + Economic viability taking precedence over sustainability

- + Lack of recycling infrastructure and high cost of phasing out unsustainable materials
- + Scalability of innovation

- + Demand for recycled content in packaging leading to increased prices and shortage of recycled materials
- + Packaging reduction can't be done at the expense of food waste

"But in all honesty, particularly if you're speaking to a finance director or MD (Managing Director) at the end of the day, it doesn't matter how sustainable our products are if they don't make us any money. So, if I talk to them, this is going to be the impacts of the plastic tax or EPR (Extended Producer Responsibility), then they're like. Yep, here's the budgets crack on with the trials to reduce that as much as we can." (W3)

"Generally, it [recycling] only works at scale, from a numbers perspective it only works at scale. And for it to work at scale all retailers have to be on board. But also, you have to be simplifying the packaging formats. You have to be unifying the way they're washed and cleaned. You have to be back hauling products around the system to make it viable from a carbon perspective, but also from a scalability perspective." (WA1i)

"I mean, obviously part of our strategy is to include recycled content. So 30% recycled has been in our strategy for quite some years. So, the majority of suppliers work towards that, a lot of suppliers are exceeding that. But as more people demand that recycled content the price goes up. The availability becomes squeezed. So, you're really grappling to secure that supply. ... So, they're doing everything they can because ... we've asked for it, it's part of our policy, it's part of being a supplier to us. But they are going to be paying through the teeth for that material. So, the impact will eventually have a knock-on effect." (R1)

Diffusion of Innovation - sources of conflict

DIFFUSION OF INNOVATION STAGE	INDICATIVE FINDINGS
<p>Acceptance:</p> <p>Types of conflict that arise when an innovation is received</p>	<p>Convenience vs sustainability:</p> <p>“What’s been great about Brexit, about COVID and about COP26 is that it’s making people think and it’s making people think should I be buying some of this food? Should I be buying this food in a plastic bag and should I be buying food from abroad with all these food miles. And that’s been our big battle over the last 20 years is that government and big business don’t want consumers to think about these things. They just want to say, here’s the food, you buy it, you just have what you want. And you’re very busy you haven’t got time to cook, so why didn’t you just have a ready meal in the box, which has also got plastic around it, and it’s also got a huge profit for all the people who have been part of the supply chain.” (R5)</p> <p>Cooperation vs competition:</p> <p>“Prior to this I was asking a couple of suppliers what they’re doing and you’d be surprised at how many have already made changes. And they don’t tell us about it, they just see it as business as usual now. And what we’ve seen is your big suppliers, the big, branded suppliers that have got a lot of weight behind them deal in a lot of plastic but also probably have teams working on this, their whole job is just to work on improving plastic, like the amount of plastic they use, or the whole environmental team they will have. So the likes of them have already made changes.” (R3vi)</p> <p>Sustainability vs cost reduction:</p> <p>“But when you actually speak to their [retailer] buying teams, in most cases 90% of them they have no idea or they have no interest personal interest in it, or just say go and speak to this member of the packaging team or this member of their sustainability team. It’s not necessarily fell right the way through and with the exception of [a buyer from anonymised company] ... she wanted everybody within their buying team to have sustainability training ... because in her eyes unless they are bonused and have a financial incentive to improve it they’re not going to like it. Buyers are the most commercially driven people out there, apart from maybe our sales team. And so that’s to me is the best way of doing it. Because if all retail buyers say we’re not going to buy anything that’s not recyclable, there won’t be any unrecyclable packaging. It’s like it could be as simple as that, but obviously making that switch from their side is obviously going to be key and at a time when there’s a lot of cost pressures on every aspect of the supply chain as well.” (W3)</p>

DIFFUSION OF INNOVATION STAGE	INDICATIVE FINDINGS
<p>Routinisation:</p> <p>Types of conflicts faced in governance systems, that need to be resolved to accommodate the innovation</p>	<p>Supply vs demand:</p> <p>“There are businesses struggling to get hold of material, especially a lot of the smaller businesses - obviously they don’t have such a bigger buying power as some of the larger businesses. So, it is something that we’ve heard, and I think that there’s also the challenge that Spain and Italy are also implementing a plastic packaging tax as well in a few year’s time. So the UK isn’t the only buyer in town for recycled content, it is starting to move into Europe. So we are hearing that it is a challenge and we’ve also heard in some instances of people stockpiling materials in preparation for the plastic packaging tax as well. So yeah, it doesn’t surprise me and it goes back to my comment earlier around moving targets and increases in targets may not be the right thing to be doing in the short term, because the industry needs to find out where it is levelling out at overall.” (CO1)</p> <p>Infrastructure vs incentive:</p> <p>“I think the regulations they sometimes can be quite a blunt instrument, and I think the complexities of the supply chain aren’t necessarily considered when they’re put together. Like the Plastic Packaging Tax it’s very unnuanced it’s just 30%. But there was no consideration that before we get consistent recycling collections or before we improve the UK recycling infrastructure for plastics, where is that secondary material going to come from to put into that 30% if you know what I mean. So for instance I think I know that like the PET, recycled PET is like so expensive at the moment that it would just be kind of prohibitive for any soft drink brand owner for instance, to try and put 30% recycled PET into their bottles.” (CO2)</p> <p>Disposability vs recyclability:</p> <p>“I would say that potentially on the input side it’s a challenge to consider the resource element and then on the output side we then have to consider the recyclability of plastic and how it’s a resource impact for us on the back end, where we don’t see with the customer and the consumer more is that making clear what can or can’t be recycled, and we’re particularly focused on making our packaging mono material where possible. Where not possible making it very easily separable.” (M1)</p> <p>Communication vs confusion:</p> <p>“The amount of plastic packaging that’s coming through us as a kind of community group has definitely increased over the 18 months that we’ve been doing it. But one thing that links to the labelling and confusion is that when the kind of announcement that supermarkets would also accept film and other items such as crisp packets, the labelling system doesn’t indicate that. And I think this is linked to the 75% of councils perhaps, but supermarkets are accepting more and more that doesn’t align with the labelling system as far as I’ve witnessed so far. And there’s also ... own brands ... I think the example we got sent was serial packets and the inner lining of serial packets can be recycled with plastic bags. But there’s own brand cereal packets which have a recyclable symbol on it and another brand says you can’t recycle it. But when you look at them, they appear to the consumers to be exactly the same and I’m not sure whether it’s just a timing issue or if they are actually different.” (WA1ii)</p> <p>Legislation vs safety:</p> <p>“The other legislative twist that we hope will be resolved is if somebody does start recycling the film, we need to change the law that allows you to use recycled plastic material in food manufacture. Because at the moment you can’t use all plastic recycled plastic because, for quality reasons, just historical legislation.” (M4i)</p>

<p>DIFFUSION OF INNOVATION STAGE</p>	<p>INDICATIVE FINDINGS</p>
<p>Assimilation:</p> <p>Types of conflicts that make the use of the innovation difficult across supply chain tiers</p>	<p>Product functionality vs sustainability:</p> <p>“We’re working with a number of bodies out there to try and find alternatives. I have to say that few alternatives have been used and there’s a company who claimed to use a biodegradable compostable form, they don’t work from a shelf life point of view. So (a) they’re very difficult to seal, and (b) they don’t give the right barrier. And as I said earlier, the biggest sin to me in food, is waste.” (M4i)</p> <p>Efficiency vs recyclability:</p> <p>“Yeah, so that’s definitely affected our flow wrapper. As I said sometimes we pack it with recyclable film. At the moment we’re doing a bit of both because it’s Christmas. We need to make sure stuff is packed and it’s sealed properly and we get higher numbers of rejects in the recyclable film at the moment. As I said, after Christmas I’m going to work on it and hopefully we’ll get that reject level down again. So the recyclable materials, I guess there’s a reason why the material with nylon has been used for years because it works well. It’s easy to run, its tolerant. And recyclable materials at the moment aren’t always.” (M3i)</p> <p>Material waste vs emissions:</p> <p>“But actually when you stop and look at all the numbers and you stop and look at what’s going on in their marketplace, I still get, you can’t have a two way conversation with customers. They don’t get it. They don’t understand what you’re trying to do, its either all or nothing, and there’s no compromise. They don’t get their nuances that you know we can’t shift from one packaging format to another. So plastic to paper as a good example, paper to compostable. We have to avoid all packaging where possible, because every packaging format, every material has an environmental impact, just depends on where in the supply chain you’re looking and actually what impacts are important to you. And unfortunately at the moment we’re obsessed with waste. We don’t think of it from the carbon perspective or resource perspective which it should be certainly considered in the grand scheme of things.” (R1)</p> <p>Material change vs waste reduction:</p> <p>“We, on the other hand, are not able to do that because of the food contact legislation at the moment. Yes there are materials available at the moment, but in such short quantities and also the technology to be able to get our materials back into the original constituent parts again to make recycled content is very, very limited. So for me yeah, I think you know the materials that we do use at the moment are probably the most efficient. I think there’s a push to move to other materials that end up making us use heavier materials, less functional, potentially will increase the waste through our manufacturing processes or through food waste because the shelf life is not as good as what we currently have.” (M4iv)</p>

Seven conflict resolution strategies

1. Consumer education:

A key strategy supported by many stakeholders. For example: "... if we can educate the consumer and we can responsibly handle plastics it has real benefit to us as a society. And I personally would like to see a greater level of education within schools, for example. That would be perhaps the only thing that I would suggest that we need to start talking about educating the consumer. But that, we need to play our part in that, I understand that. But nowadays I mean, sorry I'm going off on a tangent now, but I mean if we take packaging digital watermarking's for example, QR codes, we can quite easily, convey to the consumer through videos and then infograms etc, this product as recyclable, please place me in this type of receptacle. These things are all aspects that we could utilise to help better educate the consumer I would suggest." (PMii)

2. Incentivisation:

Many stakeholders can be involved in this, for example: "So yeah I'd say, I think the way the regulations are, they don't always incentivise UK reprocessing infrastructure as much as they should, and that's kind of part of our organisation, you know, like we're very keen to try and invest and improve or do projects that show that the UK infrastructure needs to be improved at the same time as all of these new regulations come in." (CO1)

3. Increased operator skills:

This is essential, for example because: "Recyclable film is harder to run. It takes more skill from the operator to know just the right levels and to catch it if something is just slipping out. So you definitely need to keep a closer eye on it. They have to do more checks. We always do checks, but we have to do more frequent checks when we're using these new materials. Yeah, and our engineer is much more involved when we do all these trials and when we actually start using new materials." (M3i)

4. Life cycle assessment:

This strategy applies to all types of materials, including some of the alternatives to plastic: "you can receive full lifecycle analysis of food products and things as well and look at the carbon reporting to go beyond. At the moment we use the conversion factors for different materials so going way beyond that and understanding what the actual lifelong impact of different materials are and they have like their database, is all set up to be linked to the retailers as well so that they do all the forms for you and that, to me, is what needs to be in place by some of the other compliance providers out there." (W3)

5. Downstream-upstream collaboration:

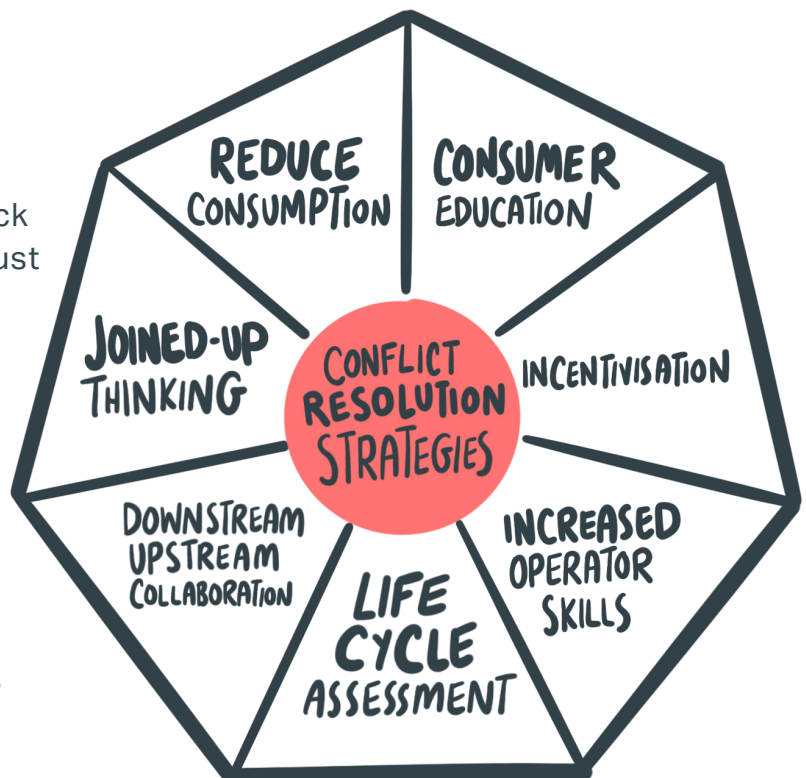
This is more likely to be achieved when sustainable packaging innovation is seen as addressing a collective societal problem rather than a source of competitive advantage. As argued below, for example, developing innovation is easier when: "... everyone comes together, and people try and achieve something because it's easier to do it when you are dealing directly with each other and not trying to take money off each other if you know what I mean. So yeah I think collaboration would be not just, I think a collaboration between for example us as a recycler, a packaging producer and also a seller, so for example retailer. I think if all three can sort of align what each one wants then it will make things a lot easier." (WA3)

6. Joined up thinking:

This collaboration should extend to external supply chain actors, including consumers, government etc: "It's just a lack of thinking about the people. It's literally just when you think of a plastics consultation, you just don't think of the people who use the plastic, you think about people who make the plastic and the people who use the plastic ... And I think it's almost improving our visibility to civil servants, that actually we matter on plastics as well as on food. And getting that connection with BEIS ... being in the head of the guy from BEIS as well as in the forefront of the head of the guy from DEFRA. So maybe the guys from Food and Drink Federation want to be talking to the guys from DEFRA every week. But probably once a month they should also talk to the guys from BEIS who are working on plastics ... or paper or even you know some other materials." (M1)

7. Reduce consumption:

None of the above detracts from the ultimate aim to reduce consumption of packaging entirely, or at least to reduce consumption of virgin plastics. One way to fast-track this is to learn from others who have made progress: "I do think we do need to reduce the amount of plastic that we do use, but I think it does need to be very focused in areas where there is a significant amount of opportunity to reduce the amount of plastic that we use or to maybe make it from recycled materials where possible. So I think the drinks industry has done a lot and they've done a lot over the last 10 or 15 years I think to include a lot of recycled content in their materials." (M4iv)



Recommendations, Provocations and Conclusions

Our research highlights many significant moves to address the plastic waste societal problem in the pre-consumption supply chain. However, many perceived obstacles to change have also been highlighted, which include the perceived A-B gap, but also many other issues.

Supply chain actors have highlighted: a lack of resources in terms of alternative packaging; lack of information regarding the best alternative; and lack of infrastructure to dispose of their plastic packaging waste. These obstacles need to be addressed, and the responsibility for addressing them must be shared between all of the circular supply chain actors, including consumers, as well as external actors such as government and NGOs. Here we focus on the recommendations and provocations for the pre-consumption supply chain actors including how government and NGOs can influence their actions.

Supply chain actor recommendations and provocations

Avoid blame:

Whilst there is some truth behind the 'consumer sovereignty' concept, there are instances where this has not hampered innovation and consumers have been receptive to packaging innovation that reduces plastic waste.

Assess your position within the diffusion of innovation process:

This will involve determining:

- + relevant barriers and drivers - as arise at the acceptance, routinisation and assimilation stages;
- + any related sources of conflict; and,
- + strategies for conflict resolution.

Influence other stakeholders:

Where other stakeholders are hampering innovation, seek ways to influence them and explain the constraints - either individually or collaboratively. Include those responsible for waste management with a view to collaboration.

Trial new packaging alternatives:

Prioritise by measuring the (remaining) sources of plastic waste, including all pre-consumption sources as well as those linked to the final consumption. This will require engaging lower tiers of the supply chain; educating and training employees given that the acceptance and skill-level of the staff implementing a sustainability initiative is linked to its outcome; and, accepting that the 'best' solution is likely to be a moving target for some time to come. There is an ongoing need to aim for 'better' to avoid perfection becoming the enemy of the very good; for trial and error to find the best of the current alternatives.

Recognise plastic waste as a societal problem:

Share successes with competitors, this means consciously moving away from the competition mindset as linked to sustainable packaging innovation, and so finding other ways to be distinctive and gain competitive advantage.

Educate, consult, involve and learn from consumers:

This may be through improved labelling by farmers/manufacturers/wholesalers and through advertising or targeted in-store activities by retailers. The setting up of recyclable-packaging aisle or sustainable aisles in supermarkets can be used to draw consumer attention. In addition, companies must sensitise consumers to any changes in packaging material, clarify the intended impact of the new packaging material, and make such information easily noticeable. Based on the perception that consumers don't read labels, it is important to reach

a good number of consumers at the early stage of sustainable packaging innovation, such as when introducing recyclable material to replace identical non-recyclable packaging.

Government and NGO recommendations and provocations

Legislate to incentivise change, even if incremental:

The UK Government's Plastic Packaging Tax (requiring at least 30% recycled content in plastic packaging) began as a major breakthrough policy because it reduced both the pre-consumption need for virgin plastics and the post-consumption effects by promoting the recycling of plastic waste. However, recycled plastic is scarce and more expensive than virgin plastic, hence, many firms are limited in their capacity to attain the 30% threshold. We recommend the extension of the tax to facilitate incremental changes by setting corresponding reductions in the tax for firms trying but not yet up to the 30% threshold. This would allow a greater reach especially among SMEs who can't compete with the large brands for the limited recycled plastics available.

Acknowledge realistic short-medium term solutions through policy:

Our findings emphasise that most alternative food packaging materials are not without environmental threats. Hence, in the short to medium term, in line with WRAP's Plastics Pact¹¹, the most feasible approach is to develop a well-thought through policy to promote: good post-consumption practices such as reusing and/or recycling of plastic packaging; and pre-consumption practices such as reducing and/or removing several layers of "avoidable" single-use plastic packaging where possible.

Use the plastic tax and EPR income to fund solutions:

In the short term, improve the infrastructure for waste management collection and management, as related to plastic packaging - given that the existing structure makes it easier to influence change. This is currently a better approach to the plastic waste problem than diverting the problem to another waste stream or waiting for ultimate solutions not yet available. Replacing plastic with alternative packaging materials may require huge investment in new systems.

Expand stakeholder engagement:

Extensive stakeholder engagement must be amplified at various stages to increase awareness of the sustainability issues to be addressed. When stakeholders feel more involved and responsible for any sustainability decision taken collaboratively, they are more inclined to invest in sustainable packaging innovation within their firm.

Educate stakeholders:

Some food supply chain stakeholders are currently stuck on packaging materials because they have used it for years and assume that's the most effective material available. However, this is not always appropriate as there have been several advancements in the provision of food contact packaging materials that offer equal/more benefits to the product, and hence provide opportunity to innovate.

Commission regular reviews of alternatives:

Until the plastic waste problem is fully addressed, there is a need to acknowledge the moving target in terms of the best available packaging. A regular review of current packaging across food products is needed to ensure there is justification for each packaging choice. The involvement of policy makers, plastic packaging manufacturers and users, and waste management bodies in this activity will facilitate a more holistic approach that incorporates knowledge-sharing among key stakeholders. This will ensure that there is no better alternative, the chosen material meets all the product's requirements, and there is appropriate infrastructure for post-consumption management.

Involve end-consumers:

End-consumers are major determinants of the success of any modifications to plastic packaging. They are responsible for approving the new material and appropriately sorting and disposing of it after use. However, consumers may be more prepared to accept a sustainability initiative that does not create a significant change to their routines or are easy to implement.

Re-thinking the consumer A-B Gap

Our findings aid understanding of how to re-think the consumer A-B gap by exploring the extent to which this gap hampers sustainable packaging innovation. Whilst supply chain actors have provided many illustrations of conflict between consumer attitudes and behaviours, these perceptions do not always restrict their current strategies to tackle plastic waste. Specifically, whilst our findings suggest that the consumer associates premium quality product with glossy premium quality packaging, we also provide evidence that a reduction in packaging size and weight did not have any noticeable impact on consumer demand for the product concerned. This suggests that either consumer attitudes and behaviours are changing, or that this perceived A-B gap is a misconception. Either way, all perceived A-B gaps are open to challenge - either with a view to illustrating that they are false or with a view to changing the attitudes and behaviours of consumers.

The final part of this research project challenged the perceived A-B gap that consumers want recycled packaging but will not purchase goods in packaging that has tiny specs in it and hence is less shiny than expected. By asking consumers, during our final pilot projects, we found that this gap could also be re-imagined as the consumers claimed that they were not put off by the recycled packaging options offered.

This A-B gap is also no longer a reason to hamper sustainable packaging innovation. Further research is needed to explore the ongoing validity of the remaining perceived A-B gaps identified in this study.

In addition, by analysing the roles and interests of a variety of stakeholders and the diffusion of innovation of sustainable packaging, we illustrate that consumer preferences are just one of the areas of conflict resolution that need to be addressed. The perceived A-B gap sits alongside many other constraints and sources of conflict that need to be resolved, such as between:

- + The supply and demand for recycled plastic;
- + Cooperation and competition; and,
- + Infrastructure versus incentive.

Resolution of these conflicts will require more listening to other parties, to develop joined up thinking, and more collaboration to find solutions that align with the needs of all parties.

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Appendices

Data sources: Mnemonics for research participants

KEY

■ Participatory research	■ Interviewee and workshop delegate	■ Workshop delegate	■ Interviewee	■ Participatory research, interviewee and workshops delegate
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SUPPLY CHAIN TIER	ORGANISATIONS	PARTICIPANTS	BUSINESS ACTIVITY	POSITION	MNEMONIC
Farmers (F)	2	2	Farmers	Director	F1
				Operations Manager	F2
Manufacturers (M)	4	20	Meat Processors	Product Sustainability Senior Manager	M1
				Head of Purpose & Sustainability	M2i
				Packaging Technician	M2ii
				Production Manager	M2iii
				Shareholder	M2iv
				Finance Controller	M2v
				Sales Director	M2vi
				Butcher	M2vii
				Butcher (Manager)	M2viii
				Butcher	M2vix
			Butcher	M2x	
			Cheese Processors	Packaging Technologist	M3i
				Machine Operator	M3ii
				Head of Engineering	M3iii
				Packaging designer	M3iv
			Snack	Managing Director	M4i
Procurement Category Manager-Flexible Packaging	M4ii				
Commercial Controller & Customer Sustainability Lead	M4iii				
Packaging Technology Manager	M4iv				
Head of Sustainability	M4v				
Wholesalers (W)	3	3	Fish suppliers	Managing Director	W1
				Director, Sustainability & Public Affairs	W2
				General wholesaler	Sustainability Manager

SUPPLY CHAIN TIER	ORGANISATIONS	PARTICIPANTS	BUSINESS ACTIVITY	POSITION	MNEMONIC
Retailers (R)	13	20	Supermarkets	CSR- Environmental Manager	R1
				Sustainable Packaging Manager	R2i
				Buying Manager - Packaging	R2ii
				Produce Specialist	R3i
				Health, Safety and Environment Business Manager	R3ii
				Food Safety Manager	R3iii
				Category Manager	R3iv
				Quality and Sustainability Assistant	R3v
				Own Label Marketing Manager	R3vi
				Buyer	R3vii
			Sustainability Manager	R4	
			Online Retailer	Founder	R5
			Hospitality/ Restaurants	Executive Chef	R6
Head Chef	R7				
Chef Director	R8				
Procurement Manager	R9				
Kitchen Coordinator	R10				
Sustainable Procurement Manager	R11				
Development Chef	R12				
Safety Advisor	R12				
Head Chef	R13				
EXTERNAL ACTORS					
Waste Management (WA)	4	7	Recyclers	Head of Communications	WA1i
				Recycling Volunteer	WA1ii
				Co-Director and Founder	WA2
				Commercial Director	WA3
			Council	Public Realm Improvement Leader	WA4i
				Operations Manager Waste & Recycling	WA4ii
Waste Management Officer	WA4iii				
Packaging Manufacturers (PM)	4	5		Technical and Product Development Manager	PM1i
				Technical and Sustainability Manager	PMii
				Director	PM2
				Marketing Director	PM3
				Sales Manager	PM4
Compliance Organisations (CO)	2	2		Director of Procurement	CO1
				Policy Advisor	CO2
Policy/ Government (PG)	1	1		Environmental Advisor	PG1
Consumers/ Consumer Groups (CS)	1	5	N/A	Retired Nurse	CS1
				Retiree	CS2
				University Staff	CS3
				Retiree	CS4
			Church (with Eco-Church Award)	Procurement Staff - for consumables	CS5
Totals	34	65			

PPiPL

PLASTIC PACKAGING IN PEOPLE'S LIVES