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WHITEPAPER

Packaging innovation:
How to take a strategic approach to the evolution of packaging

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Product packaging is a focal point of innovation for many consumer categories. Sustainability goals are key, but brands are also keen to maintain the vital role packaging plays in consumer engagement, education, and retention, which is evolving thanks to the application of digital technologies. Furthermore, the functional properties of packaging can also be enhanced with new technical developments enabling pack designers to delight consumers with new experiences. With so many potential avenues to explore, it's important to take a methodical and comprehensive approach when implementing packaging innovation in your business.

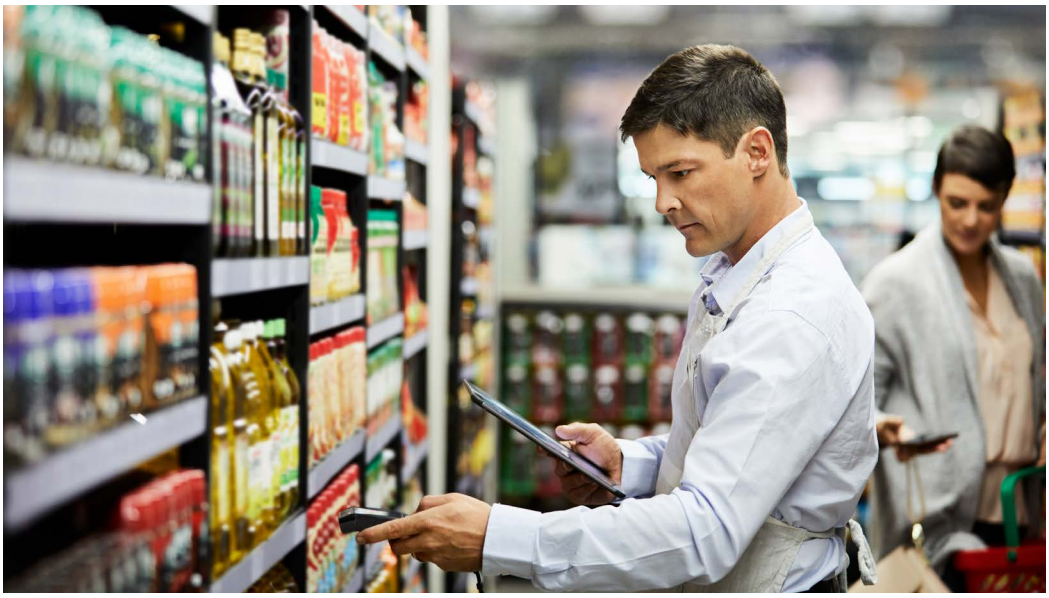
In this whitepaper, we look at how organisations can take a strategic approach to the evolution of product packaging. We'll describe three critical checkpoints which together form a checklist that brings shape and structure to the innovation journey

Cover illustration by Dan Newman. Cog concept by Shababa Selim.

The packaging innovation journey

Consumers' expectations of, and interactions with, product packaging are changing.

Consumers' expectations of, and interactions with, product packaging are changing. Megatrends such as **sustainability** and **digitalisation** are having a significant impact. Meanwhile, packaging **functionality** remains important. There are many complex – sometimes conflicting – requirements at play here and balancing them is not always easy.



What consumers want

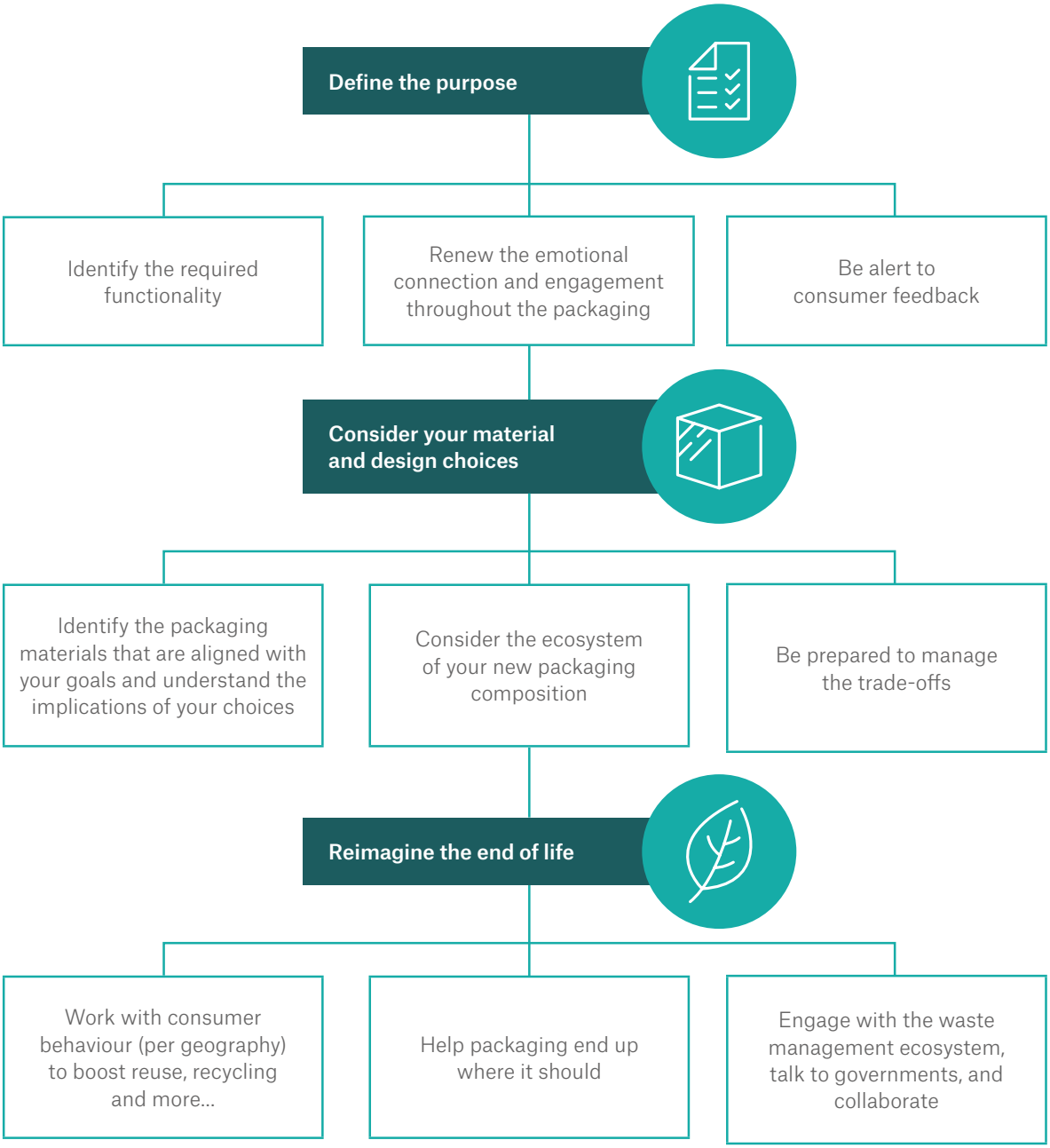
Approximately 80% of UK[1] and US[2] consumers express that they want more sustainable packaging. Over 60% of consumers would reconsider the purchase if the packaging was not environmentally friendly[3], and they also claim they would pay more for sustainable packaging - whilst being willing to explore re-fill and return packaging solutions.[4]

However, the value-action gap needs to be acknowledged here. Consumers don't always behave in the way they say or believe they will. 92% state that they want to achieve a sustainable life and are prepared to act towards achieving it, but only 16% are acting on it.[5]

Different surveys show that consumers prefer plant-based, compostable, and paper/cardboard packaging due to perceived sustainability[6] and recyclable plastic can often be perceived negatively but the reality is often more nuanced.

In this whitepaper, we look at how organisations can take a strategic approach to the evolution of packaging. We describe three core actions which together form an assessment to bring shape and structure to the innovation journey. We aim to help you to:

1. Define the purpose
2. Consider your material and design choices
3. Reimagine the end of life

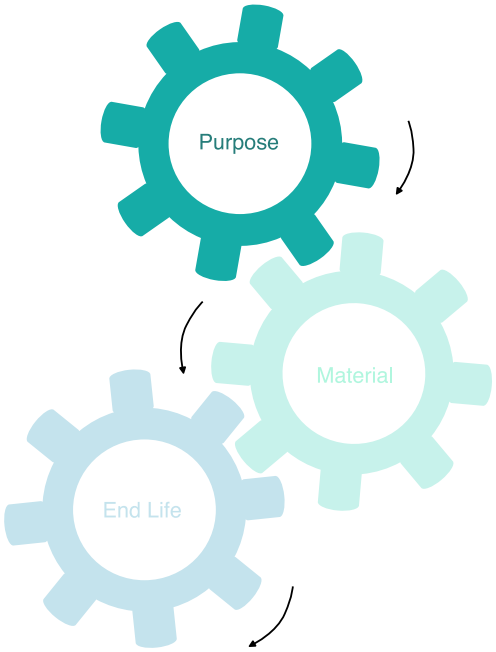


1. Define the purpose

For many products, packaging plays a central role in maintaining quality and safety. This can be the starting point of the packaging innovation self-assessment, although different issues or disruptors can make the gears move. It's also essential to think about the way consumers engage with packaging, both in-store and in home.

These are the key checkpoints to be carried out:

- Identify the required functionality
- Renew the emotional connection and engagement throughout the packaging
- Be alert to consumer feedback and emergent strategies



Identify the required functionality

The baseline requirement is protecting products from external contamination and maintaining quality throughout the supply chain. However, packaging can perform many additional functions; identifying these should be a priority that is frequently revisited.

It's important to conduct periodic evaluations of packaging and product requirements. For example, natural preservatives and cleaner labels are shifting the responsibility from chemicals to processing and packaging, increasing the number of requirements that packaging needs to fulfil.

Detailed consumer research can help define and redefine minimum functionality requirements. It can also reveal evolving consumer priorities which might inform innovation and drive competitive differentiation.

Maximise quality: maximising shelf-life is a primary function of packaging for food, beverage and cosmetic products. It can be enhanced through physical means such as layers, coatings and material combinations. The challenge is finding ways to do this cost-effectively and sustainably.
Cross-sector learning can aid progress here. For instance, **Amcor's** multi-chamber blister system is an excellent example of how packaging innovation can enhance the shelf-life and stability of drugs. It uses a cold-form laminate to hold dry powder in one chamber and liquid in another, eliminating the need for cold storage and glass containers.

Nanotechnology holds much potential too, with bio-nano composites that could be used to replace non-biodegradable, petroleum-based plastic[7] Many nanoparticles used in food packaging applications also have antimicrobial capabilities. They act as carriers for antimicrobial polypeptides (enzymes, antioxidants, anti-browning agents, flavours and other bioactive components) and protect against microbial deterioration. Whilst consumer perception and regulatory challenges remain, this unlocks new opportunities for hygienic and antibacterial packaging, which may even extend the product's shelf-life after it has been opened.

- Identifying the job to be done: Extending the use of packaging beyond providing protection for the product can be a crucial selling point. One example is the development of food packaging that can be used when heating and eating the product. However, this has an impact on the materials that can be used. Polythene and polystyrene allow reheating, whereas polycarbonate packaging may contain BPA, making it unsafe to reheat. Several food brands have launched self-heat/cool containers. With **HotCan's**[8] limestone/water double membrane system, a chemical reaction in the outer can warms food in the inner can. Another example is **HaiDiLao's** self-heating hotpot[9] which contains a 'heating pack' triggered by submersion in cold water.

Renew the emotional connection and engagement throughout the packaging

- Consider the point of purchase: This is where packaging design comes to the fore in terms of engaging the consumer at the point of sale and then enhancing the overall retail experience.

Haptics – the tactile aspects of packaging – play an important role in consumer decision-making. It's about how packaging feels, not just the way it looks. Printed electronics (i.e., radio-frequency identification, ambient intelligence, screens, sensors) can further elevate engagement. Novel dispensing mechanisms can also drive emotional engagement.

- Connected packaging is on the rise. Q1 2019 to Q3 2021 saw a 29% increase in packaging engagement via QR codes, augmented reality (AR) and virtual reality (VR). The pandemic triggered a renaissance for QR codes, leading to new interactive experiences that both engage consumers and increase retention by enhancing consumers' conversation with the brand. For companies exploring artificial intelligence (AI) this has proven very useful.
- Smart packaging can offer great value, increasing return business. This includes enhanced unboxing, where consumers can see what's inside a package without having to open it, thanks to AR and VR. Eye-catching visuals, product preservation, protection, authentication, security and connectivity are all ripe for innovation.

PepsiCo's SmartLabel project enables packaging to offer a greater depth of information, from mandatory details to curated content. Similarly, consumers can learn about the manufacture of drinks, from the barrel to the glass, via AR experiences from **Rémy Martin Cognac** and **Macallan Whisky**.

- Communicate and engage throughout the packaging: Any packaging design must account for labelling regulations in target markets. This generally encompasses nutritional information, allergens, product claims, and advice on packaging disposal for food and beverage products. Naturally, attracting consumer attention at the point of purchase is high on the agenda too.
- Addressing these factors can be challenging when packaging is stripped back to the bare minimum for sustainability reasons. Connected packaging is increasingly leveraged when the printed surface area is limited. This allows deeper engagement with consumers via tools such as QR codes. For instance, showing the product's full traceability path might be beneficial, telling the story of a key ingredient's journey. Recipe ideas and personalisation can also be facilitated through digital platforms.

Be alert to consumer feedback

With every new strategy implemented, the competitive landscape changes, and consumers remain the ultimate decision-makers. Allocate resources to observe, capture and analyse consumer interactions with your packaging in a retail context to identify areas for improvement. Consider whether the packaging delivers the desired outcomes, and whether consumers engage results in the expected way. Gathering this feedback can optimise the design process, leading to ongoing improvements.

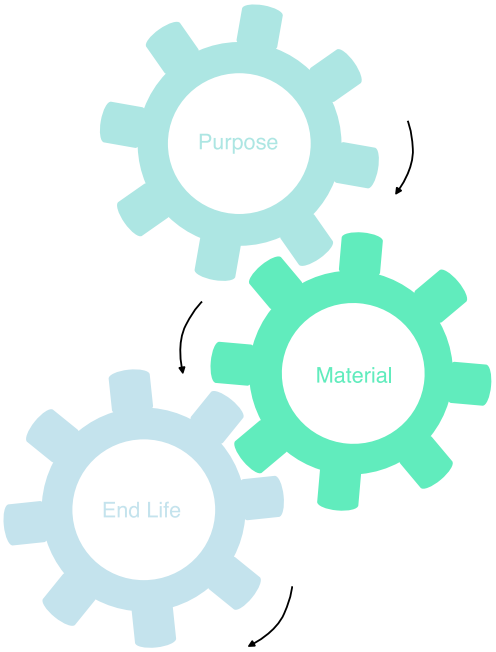
2. Consider your material and design choices

Petroleum-based vs biobased, recyclable vs compostable, plastic vs non-plastic

Having to change the packaging material has usually been a reactive action due to the need to align with a new functionality requirement, minimise costs / adjust to supply issues or comply with sustainability KPIs.

In order to go develop a proactive strategy, you need to go beyond reacting to changes or imminent issues. Your business needs to:

- Identify the packaging materials that are aligned with your goals
- Understand the implications of your choices on design
- Consider the ecosystem of your new packaging composition
- Be prepared to compromise



Identify the packaging materials that are aligned with your goals

Every business has a set of goals it wants to achieve. Some are driven by the company, some are imposed by the government, while others are adopted to match company pledges and to remain competitive. Each geographical market and product type defines boundaries on the innovation journey - lack of composting and or recycling infrastructure, logistics disruptions requiring extra shelf life, and stock theft or counterfeiting for example. Companies must explore alternatives and select those that match their current and future goals.

Understand the implications of your material choices

- While compostable materials are perceived as a silver bullet for sustainability by some, their availability, functional properties and disposal can hinder widespread use. Producing the necessary quantity and quality of compostable material for the FMCG sector remains a challenge. Over the coming years, strategic partnerships and investment may enable progress here. Meanwhile, adding recycled or indeed biobased content or changing the packaging design can result in petrochemical savings without switching to a novel polymer[10] - albeit supply of recycled content can again be a limitation to achieving corporate sustainability objectives

- Upcycle by-products: New packaging materials are emerging for structural, barrier or antimicrobial purposes. These materials can come from various sources such as by-products, biological pathways or alternative markets.

- Policy and regulation must be taken into consideration. The negotiations for a United Nations Treaty on Plastic Pollution will have implications on materials selection.

Exciting examples of upcycled by-products include the creation of biopolymers from avocado seeds by Mexican company **Biofase**. Similarly, an alliance between **Solenis** and **BIO-LUTIONS** led to the creation of fibre-based food packaging from agricultural residues[11].

Kraft Heinz has also adopted biomaterials with an upcycling twist to fulfil sustainable packaging needs. Its Maxwell House compostable coffee pods are made of 85% coffee grounds with a paper lid, a coffee filter made from corn starch, and a plant-based compostable ring made from over 20% coffee bean husks.

Edible and dissolvable packaging materials produced from algae or fruit and vegetable by-products also hold much potential.

- Biotechnology is coming to help: **The University of Science and Technology of China** has created drinking straws that are edible and degradable within days, made of bacterial cellulose and sodium alginate. Their mass production promises to be cheaper than that of paper straws[12]. Another exciting development comes from **São Paulo State University** (UNESP), which has produced an edible bioplastic from type B bovine gelatine[13]. However, it is derived from animal agriculture and rejection from vegan and vegetarian consumers is likely. Materials like these can enhance shelf-life by interacting with food substrates, such as adding active natural compounds that boast antioxidant qualities[14]. Whilst developments like these are still at the research stage, they hold much promise for the future.

- Explore new technologies: From predicting price increases and supply chain disruption to aligning material needs with consumer demand, technology plays a vital role in packaging innovation. It offers ways to keep up with personalisation trends. In the near future, additive manufacturing techniques such as 3D printing could unlock new options for late-stage personalised, on-demand packaging solutions. Also expect to see better integration of manufacturing and warehouse facilities, reducing overseas shipping costs and CO_2 emissions.

Consider the ecosystem of your new packaging composition

Value engineering and design/process optimisation can also deliver sustainability improvements by reducing the number of packaging materials required.

- Make it recyclable: Recyclability goes beyond material and involves design. Recyclable packaging materials range from plastics (PET, PP, PE), glass and metals (aluminium and steel) to paper and cardboard. However, the requirements and capabilities of local recycling infrastructures can be a limiting factor. The thickness of the material, coatings, material combinations and even inks can impair recyclability. Package design should be aligned with consumer usability – indeed consumers play a significant role in the latter stage of the re-use/ recycle journey by cleaning or emptying the packaging to remove residual product. The HolyGrail 2.0[15] initiative driven by **AIM**, the European Brands Association, is looking to overcome some of these issues. It promotes the use of digital watermarks, which carry information about packaging material attributes to enable better sorting within recycling facilities.
- Use recycled materials: When it comes to plastic packaging, there is not enough recycled content available to meet industry demand at present, in particular when it comes to food-grade material. The extent of the shift to recycled plastics needs rapid scaling up of new processing technologies. For instance, while mechanically recycled materials tend to degrade over numerous cycles, recent developments in chemical recycling result in plastic of virgin-like quality. The carbon footprint for these novel processes may bring the sustainability advantage down, so it should be considered and compared.
- Strengthen your supply chain management: When the container ship Ever Given was trapped in the Suez Canal in 2022, worldwide repercussions underlined the vulnerability of the global supply chain. Recently, a shortage of truck drivers resulted in supply disruptions in the UK. But most importantly, the unfortunate conflict in Ukraine has shown the world the need to expand and improve its supply chains.

Several industries are working on tools to leverage AI or supervised learning methods to enhance supply chain management. It's also important to consider how any disruption to the supply of packaging materials might be mitigated if problems should occur.

Be prepared to manage trade-offs

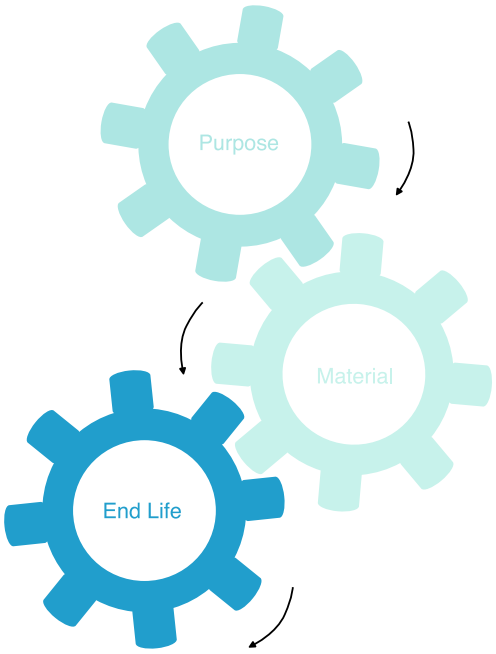
Packaging innovation needs to be mindful of the entire value chain, from production to distribution to consumption. This can introduce complicating factors that should be acknowledged and mitigated at the earliest possible stage.

Value engineering and design/process optimisation can also deliver sustainability improvements by reducing the number of packaging materials required. CO2 emissions associated with logistics also need to be factored in. Light-weighting and downsizing are proven solutions that deserve to be reassessed periodically.

Heinz's baked beans fridge pack is an excellent example of packaging and product optimisation. It reduces the weight of packaging while extending shelf-life and improving functionality (enabling consumers to reclose the container). There is a balance between moving from a more recyclable material to a less recyclable one that can help prevent waste. Evaluating options and risks is critical.

3. Reimagine the end of life

With sustainability being a significant driver of packaging innovation, optimising design and labelling to promote recycling, composting, or reuse is critical. It can only be done by understanding the hurdles and feasibilities of the entire cycle. The ultimate aim is a circular model, maintaining materials at their highest value. This is not always possible: recycling packaging into an equivalent product, composting it towards closing the loop or even re-using it for the same purpose is technically limited:



- Recycling conventional recyclable polymers is more straightforward – several companies have a proven track record of recycling these materials. However, the recycling ecosystem is not mature in most countries. There are also other polymers or complex packaging that can prove more difficult to be recovered.
- Compostable endpoints are interesting, but currently, with a few exceptions, most infrastructures are not yet ready to deal with compostable packaging. However, there is scope for closed events or on-site composters.
- Re-use goes beyond the consumer using the pack again, but involves developing refill schemes, changing the user journey and applying new technologies, whilst driving changes in business models.

Rethinking and reimagining the desired future end of life requires:

- Working with consumer behaviour (per geography) to boost reuse and recycling
- Help packaging end up where it should, but also consider other scenarios
- Engage with the waste management ecosystem, talk to governments, and collaborate with innovators

Work with consumer behaviour (per geography) to boost reuse and recycling.

- Return schemes and inverse vending (reverse vending machines[16]) are great enablers of a circular economy. They deal with used packaging and provide extra stimulus to close the loop. An example is **Loop**[17], a global reuse platform, currently available in 5 countries that works in partnership with major brands and retailers. Loop works with consumer behaviour per region and preferences. In some regions, Loops offers the possibility of home collection of empty containers and delivery of filled ones, whilst in others, consumers would also use the service by disposing of the empty containers in store. They eventually learnt from the initial engagement with consumers and refined their operational model Adapting and providing flexibility for consumers is a must.
- Never stop asking the same question: Does it need packaging? A world without disposable / single-use packaging seems distant, but by understanding and pushing the boundaries of innovation reducing secondary or primary packaging (and perhaps both) can be realised. The cited re-use and re-fill propositions are excellent disposable package-less examples should the consumables be transported in reusable containers. The journey towards package-less begins by minimising or eliminating parts of the packaging: an example from the food and beverage industry includes Mondelez's 'pack light and pack right' initiative. This saw the removal of 6.4 million plastic windows from **Cadbury Easter Egg** packs.

Help packaging end where it should

- Logos, repeated messages or imagery, and suggested recycling points play a key role in promoting the correct disposal or recycling of packaging. **Colgate-Palmolive** is boosting consumer awareness by printing a 'Recycle Me!' message on its packaging.

However, more may be needed to change behaviours, so further work needs to be done to ensure consumers are engaged and can dispose of used packaging into the proper collection route, as well as having appropriate sorting facilities at the end.

- Leverage digital technologies to improve recycling: Technologies such as radio frequency identification (RFID) hold much potential, enabling consumers and local authorities to sort packaging for more effective recycling. **Recycl3r's** Digital Deposit and Refund system is a great example of how serialised and connected packaging can drive better recycling outcomes.
- The detrimental effects of plastic six-pack rings on wildlife have been well documented, but Florida-based **Saltwater Brewery** has turned this around with an edible alternative. Its six-pack rings are made from wheat ribbons left over from the brewing process, making them both biodegradable and edible. If animals encounter this packaging, it can be consumed without causing harm[18]. An example in the CPG space on how packaging can be re-purposed: **Soapbottle** created liquid personal care products contained in a soap-based bottle, that once consumers finish the product, the bottle can be used as a hand soap or ground into washing powder[19].

The future of packaging

Our three checkpoints (Define the purpose; Consider your material and design choices; Reimagine the end of life) ensure packaging innovation strategies are mindful of sustainability, functional requirements and digital capabilities. Specific considerations may vary by application, as well as evolve over time. However, adopting this framework ensures a comprehensive approach.

Right now, the future of packaging is ready to be reimagined. The key is to evaluate the current and future options to address the job to be done for consumers and then understand how to engage and excite them towards reaching the ultimate goal of circular packaging. It is crucial to acknowledge that *reusing, re-purposing, and re-filling* will continue to co-exist with single-use plastics (with the potentiality to be recycled or composted), whilst considering the packaging ecosystem's ability to cope.

Scientific and technological advances are also delivering new raw materials and improving recyclability. In some cases, packaging can be significantly reduced, potentially sparking a separate circuit of innovation involving package-less and/or dispensing approaches. Cross-sector learning has an important part to play, and novel materials and technologies will continue to disrupt the commercial landscape. Deep diving into macro trends enables packaging innovation to be harnessed for the benefit of businesses and customers alike while tackling unintended consequences.

How Sagentia Innovation can help

Sagentia Innovation has years of experience unlocking packaging challenges in terms of strategy development, application of new materials and technologies, a deep understanding of sustainable models and through the application of consumer centric design. Today, building a full understanding of functionality and sustainability requirements is often the starting point. From here, we devise effective solutions which may involve a new operational model, a new technology or the identification of a suitable coating or polymer. With our deep sector knowledge we understand your current position and where you want to be alongside wider packaging trends to ensure the optimum outcome for your business.

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About Sagentia Innovation

Sagentia Innovation provides independent advisory and leading-edge product development services focused on science and technology initiatives. Working across the medical, industrial, chemicals and energy, food and beverage, and consumer sectors, Sagentia Innovation works with a broad range of companies from some of the world's leading and best-known brands, to start-up disruptors, new to the market. Sagentia Innovation is part of Science Group (AIM:SAG), which has more than ten offices globally, two UK-based dedicated R&D innovation centres and more than 400 employees. Other Science Group companies include Leatherhead Food Research, TSG Consulting and Frontier Smart Technologies.

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