Packaging design to reduce household meat waste

An investigation into portioned and divisible packaging design options to enable consumers to reduce household meat waste.
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Research by: Professor Rob Holdway – Director Giraffe Innovation Ltd.
Legacy research commissioned by the previous government

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Executive summary

This project aimed to deliver innovation within the fresh meat category by developing and trialling packaging concepts that would reduce chicken portion waste arising in the UK. A range of concepts were developed and tested with consumer panels to derive a final concept that has undergone technical trials to verify its suitability for commercial production and consumer acceptability.

Working with WRAP, The Co-operative and Vion Foods (UK), Giraffe Innovation Ltd investigated the opportunity to reduce meat waste through a packaging solution. This project is part of WRAP’s programme to prevent household food waste, specifically, identifying ways in which packaging can help reduce food waste.

WRAP’s research\(^1\) has shown that around 2.9 million tonnes of food is thrown away because it is ‘not used in time’ while 2.2 million tonnes is cooked or served, but not eaten. In terms of avoidable poultry waste, around 42,000 tonnes is thrown away because it is ‘not used in time’ while 28,000 tonnes is cooked or served, but not eaten. The majority of this poultry waste was chicken.

The food industry can play a major role in food waste prevention by influencing behaviour and facilitating behaviour change through the way it packages and presents products to the consumer. This project changes the product offer, by developing a packaging solution that helps consumers get more out of the food they buy and waste less. It is thought this work will have the greatest benefit in reducing the meat thrown away because it is ‘not used in time’ by giving consumers longer to eat the product, though a benefit may also be achieved through reducing the likelihood that meat is cooked, but not eaten, by providing the right portion size.

At the outset of the project, a market review was conducted to provide an indication of existing packaging formats within the fresh meat category and emerging trends. Detail from these reviews is given in this report and formed the basis for the functional design element of the project. Throughout the design process the technical, functional and cost constraints of implementing future concepts were acknowledged. A high-level carbon analysis was undertaken of a number of existing packs to identify opportunities for comparative assessment between reducing meat waste vs. increasing packaging. Meat products make a significant contribution to greenhouse gas emissions over their life-cycle, significantly more than the emissions from their associated packaging materials. For this reason the environmental impact of a small incremental increase in pack weight to provide functionality that will prevent food waste should be more than offset.

The functional design stage of the project included generating initial pack design ideas through off-line studio based work and generative workshops with the project team. These ideas were visualised in sketch format and modelled in Solid Works and Cinema 4D computer packages. A shortlist of design ideas was compiled by the project team, which sought to understand the positives and negatives of each of the designs and their success parameters through a process of controlled convergence. It was key to ensure that there were no detrimental effects on production capacity, capital equipment expenditure, pack quality, product quality, shelf-life or sales volume.

The initial designs were evaluated using The Co-operative’s ‘Taste Team’ consumer panel. Their feedback was evaluated and a preferred concept identified. This concept comprised a MAP pack, deep profile PP tray, and is shown in Figure E1. The centre of the pack was increased in height and widened to give a ‘sealing bridge’ so the consumer can use meat from one side of the pack without compromising the freshness of the remaining portion(s).

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\(^{1}\) WRAP (2009) Household Food and Drink Waste in the UK
Given the very positive response from the Taste Team, this concept was revised and a prototype made and filled with product (in this case fresh chicken strips \ goujons). The prototype was then evaluated in home by Taste Team (Figure E2). The new concept was received very positively – achieving a score in line with that required by The Co-operative’s category teams to progress to a production trial. This pack, therefore, is considered a successful design.

There were no significant adverse reactions to the proposed design. The panel was quick to realise the key benefits of the new pack and the potential for it to help them get the most out of what they buy and avoid waste.

Based on a scale where 1 is ‘dislike extremely’ and 9 ‘like extremely’ the ‘overall liking’ for the pack was 7.56/9 (81%) and the 65% would ‘definitely’ or ‘probably’ buy this format.
Once opened, existing meat tray packaging does little to extend the product’s life or facilitate portioning. The new concept, which enables consumers to divide the packaging without exposing a portion of the meat provides significant user convenience and facilitates storage and freezing that extends product life. This divisible pack facilitates greater control throughout the use phase and ensures that consumers without significant freezer space could still benefit from the new pack.

The actual behaviour of the Taste Team members in using the pack is most instructive in determining whether the design will change user behaviour with a relatively high proportion of users taking advantage of the divisible function:

- 38% of respondents chose to cut the pack and use one side and freeze the other, here the divisible function leads to an ‘eat me, freeze me’ behaviour pattern.
- 21% of respondents chose to cut the pack and use one side at a time, effectively extending the ‘use life’ of the product and overcoming perceived loss of freshness.

The extrapolation of these behaviours across avoidable chicken portion waste arising could transfer to a potential food waste reduction of up to 10,000 tonnes per year, if adopted across the whole market, together with the associated reduction in overall packaging waste.

The new design is seen as a derivative of the existing pack format in production and therefore doesn’t require extensive capital equipment and tooling costs. It runs through existing production equipment as the same line speed as the current design. Vion currently utilise ULMA Optima packaging equipment\(^2\) and the only change required is a new sealing head for the new design estimated to be £15,000 per machine.

The modified tray requires a small amount of additional polymer that is likely to increase tray costs by a small margin – estimated to be 0.5% - 1% of current packaging costs depending on raw material prices.

The product offers the same production and retail shelf life as the current MAP format, which is referred to as production plus 7 days.

This concept has the ability to extend across different product formats within the fillet and boned meat and poultry category. The same principles embodied in this prototype pack could also be adopted across other tray sizes (S2-S6). A smaller S2 divisible tray containing two single portions could appeal to single occupancy households, for example.

Further trials are required, however, to evaluate breast size relative to tray portion orientation and size. Variations in breast portion size can result in uneven distribution of chicken pieces within each tray portion. However, for larger portion size trays i.e. S5 and S6 a potential imbalance in meat distribution per tray portion is judged not to be an issue.

The Co-operative is now considering how the new pack can best be introduced, including investigating labelling and merchandising options to help their customers get the most from the new pack, and how it might be developed for other chicken portion products such as breasts and drumsticks.

WRAP are keen to see the pack adopted more widely and to explore, with the food industry, ways in which this new format could be developed for other product types.

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\(^2\) [http://www.ulmapackaging.co.uk](http://www.ulmapackaging.co.uk)
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Glossary

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CO₂e</td>
<td>Carbon dioxide and equivalent greenhouse gas emissions</td>
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<tr>
<td>GWP</td>
<td>Global Warming Potential</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
</tr>
<tr>
<td>PE</td>
<td>Polyethylene</td>
</tr>
<tr>
<td>PET</td>
<td>Polyethylene Terephthalate</td>
</tr>
<tr>
<td>rPET</td>
<td>Recycled PET</td>
</tr>
<tr>
<td>PP</td>
<td>Polypropylene</td>
</tr>
<tr>
<td>CAPEX</td>
<td>Capital expenditure in plant and equipment</td>
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<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
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<tr>
<td>MAP</td>
<td>Modified Atmosphere Packaging</td>
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<tr>
<td>SRP</td>
<td>Shelf Ready Packaging</td>
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</table>

**Draw ratio**

**Avoidable food and drink waste**
Food and drink thrown away because it is no longer wanted or has been allowed to go past its best. In contrast to ‘possibly avoidable’ (see below), the category of ‘avoidable’ includes foods or parts of food that are considered edible by the vast majority of people.

**Possibly avoidable food and drink waste**
Food and drink that some people eat and others do not (e.g. chicken skins). As with ‘avoidable’ waste, ‘possibly avoidable’ waste is composed of material that was, at some point prior to disposal, edible.

**Unavoidable food and drink waste**
Waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances. For chicken – this includes meat bones.

Acknowledgements

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1.0 Background

1.1 Introduction

UK households spend around £174 billion a year on food and drink (including alcohol). The UK food sector is responsible for over 3 million jobs and is worth £84.6 billion to the UK economy\(^1\). However, WRAP estimates that 8.3 million tonnes per year of food and drink waste is generated by households in the UK, approximately 22% of all food and drink purchased, by weight\(^4\). This is the equivalent to 330 kg per year for each household in the UK, or just over 6 kg per household per week.

The greenhouse gas emissions associated with avoidable food and drink waste in the UK account for approximately 20 million tonnes of CO\(_2\)e per year. This is roughly 2.4% of total greenhouse gas emissions associated with all consumption in the UK\(^5\). The level of emissions associated with food and drink waste is equivalent to the CO\(_2\)e emitted by one in every four cars on UK roads. These emissions do not just represent the methane that’s released when the food goes to landfill but more significantly also the contribution from the life-cycle stages in the supply of the wasted food and drink: agriculture, manufacture, packaging, distribution, retail, transport to the home, storage and preparation in the home, and waste collection and disposal.

There is the potential to substantially reduce the amount of avoidable food that is wasted. WRAP’s objective, through the Courtauld Commitment, is to reduce household food waste by 330,000 tonnes by December 2012, with the climate change impact of saving 1.2 million tonnes of CO\(_2\)e. If realised, these reductions would save households money and make an important contribution to reductions in the UK’s greenhouse gas emissions.

Packaging, both its format and the materials used, can play a key role in helping to reduce the amount of food waste arising. This project aims to reduce household meat waste, through innovative packaging design, using chicken (strips / goujons) as an indicative meat product.

1.2 Market context

The UK market for meat and poultry is currently worth £24 billion, the largest and most important food sector with a 22% share of total consumer expenditure\(^6\). Chicken is by far the most popular poultry meat, probably because of its cost, versatility as a food and the fact it is easy to add a wide range of flavours to.

The UK is estimated to be the second biggest poultry producer in the EU after France, producing in the region of 1.5 million tonnes of poultry meat a year. Every year the UK poultry meat industry rears over 850 million chickens, 20 million turkeys, 19 million ducks and around 100,000 geese\(^7\).

EU consumption of poultry products is set to increase by 9% over the next five years from an average of 22.2 kg per capita in 2008\(^8\). This anticipated growth in poultry consumption emphasises the need to decouple market growth from environmental impact, in particular food and packaging waste arising.

WRAP’s Retailer Survey\(^9\) investigated a range of factors believed to influence household food waste (for example, pack size and functionality, date and storage labelling, promotions and availability of tools). Chicken breast packs were studied and it was found that overall there was a fairly wide choice of pack sizes available. Similar proportions (ca. 18%) weighed up to 300g, 301g-400g, 601-700g and over 800g, although there was a lower proportion of packs weighing 501-600g and 701-800g (ca. 8%).

Analysis of the price per kg of the different pack sizes showed that, while the very largest packs were relatively cheaper than the smaller packs, there was an unclear relationship between pack size and price per kg. While some of the anomalies, such as packs weighing 701 to 800g costing more per kg than those weighing 601 to 700g, may be explained by the proportions of premium and/or value range packs in those pack size bands, others cannot. For example, despite a lower proportion of premium packs in the 401 to 500g size band, these packs

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\(^1\) Defra Food Statistics Pocketbook (2010)
\(^2\) WRAP (2009) Household Food and Drink Waste in the UK
\(^3\) WRAP (2009) Household Food and Drink Waste in the UK
\(^5\) www.poultry.uk.com
\(^6\) Packforum seminar Luca Cerani, vice president sales and marketing of Sealed Air’s subsidiary Cryovac Food Solutions
\(^7\) WRAP (2010) A Retailer Survey
were on average more expensive per kg than those weighing up to 300g. This may result in some households buying larger packs than needed, because they are seen as better value for money.

1.3 Household meat waste arisings

Of the 8.3 million tonnes of food and drink waste each year, the majority is ‘avoidable’ – 5.3 million tonnes per year, or approximately 65% of the total\textsuperscript{10}. The remaining 3 million tonnes per year is split equally between ‘unavoidable’ and ‘possibly avoidable’ waste - things like bones, cores and peelings.

Meat and fish represents 6% of the proportion by weight of all food and drink waste (Figure 1) comprising 610,000 tonnes annually in the UK, of which nearly half (290,000 tonnes per year) is avoidable. The unavoidable fraction weighs nearly as much, 240,000 tonnes per year, and comprises bones and giblets, fish heads and shellfish shells.

Figure 1 Proportion of avoidable food and drink waste by weight

Half of the total meat and fish waste is poultry (300,000 tonnes per year) (Table 1). Almost two-thirds of poultry waste is inedible carcasses and bones (190,000 tonnes per year). The avoidable fraction weighs 81,000 tonnes.

This costs £350 million per year and comprises both carcass meat (e.g. chicken thighs and breasts) and processed poultry products, such as chicken nuggets.

Table 1 Poultry waste by avoidability

<table>
<thead>
<tr>
<th>Food type</th>
<th>Weight generated (tonnes pa)</th>
<th>Unavoidable</th>
<th>Possibly avoidable</th>
<th>Avoidable</th>
<th>Avoidable waste (£ million pa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry</td>
<td>300,000</td>
<td>190,000</td>
<td>33,000</td>
<td>81,000</td>
<td>£350</td>
</tr>
</tbody>
</table>

The majority of avoidable meat waste arising is disposed of because it was 'not used in time’ (Figure 2). Diary work conducted by WRAP\textsuperscript{11} indicates that the vast majority of this waste is associated with products being thrown away because they have passed their ‘use by’ date, i.e. as a result of consumers not using or freezing fresh meat before the end of the ‘use by’ date. Only a very small amount of waste was associated with food that looked, smelt or tasted bad.

\textsuperscript{10} WRAP (2009) Household Food and Drink Waste in the UK

\textsuperscript{11} WRAP (2009) Household Food and Drink Waste in the UK
Packaging design to reduce household meat waste

**Figure 2** Weight of avoidable meat and fish waste by type, split by reason for disposal

*NB beef is included in ‘all other meat and fish’ as the confidence interval for beef was greater than ±30% of the estimate.*

### 1.4 Consumer insights into meat waste

#### 1.4.1 Insights into meat waste

To inform this project, in January 2010, WRAP undertook an Omnibus survey. Around 2,000 UK consumers were surveyed to understand meat purchasing and waste behaviour. Full results are given in Appendix 5 but, in summary, the study found:

- Almost one third of households admit “occasionally” throwing away uncooked meat. The remaining two thirds were equally split between a third saying they never throw away uncooked meat because they consume all the meat they buy and a further third say they use the freezer to manage uncooked meat.

- Around 50% of all respondents would “definitely” or “probably” buy a single [chicken breast] portion pack, increasing to 6 in 10 for single households. Unsurprisingly, households with children were less attracted to single portion packs.

- For 4 in 10, one portion is just not enough. The main reason respondents said they were not interested in the single portion pack is sufficiency.

- Almost half freeze all their packed meat so don’t need further encouragement. There is no one single issue that would encourage people to freeze unopened meat packs more often, though better designed or more flexible packs that fit in the freezer could help. Only 1 in 10 do not want to freeze meat.

- More sophisticated packaging could help in freezing ‘opened’ meat packs. With regards to chicken, around 4 in 10 said they already freeze their opened meat packs. 1 in 10 just don’t want to freeze, and another 1 in 10 say they eat it all before it gets to the freezer. For those that don’t currently freeze opened packs, but were open to the idea, packaging design was stated as a key factor that would encourage more freezer use among a significant minority.

Using these combined insights as context, this project sought to develop a packaging format that provided ‘portioning’ functionality. This would have the effect of removing some of the barriers to freezing or using opened, part consumed meat packs and increase the likelihood that the right amount would be cooked in the first place. This would enable consumers to take advantage of larger, value packs, for example, without losing that value by throwing some away. Other WRAP work is looking at reducing the quantity of whole, unopened products thrown away, for example, by changing retail promotional mechanics and improving the application and understanding of date labels and storage guidance.
1.4.2 Increasing use of the freezer, as a means to prevent food waste

Research has been undertaken by WRAP\textsuperscript{12} to understand consumer behaviour with regards to home-freezing of food, and use of the freezer in general, to provide evidence for food industry initiatives to help consumers get more out of their freezers and reduce food waste.

Although it is not possible to quantify the potential food waste saving from optimal freezer usage, there is a strong interaction between other key food waste behaviours such as planning, portioning and storage. The freezer can act as a pause button, giving consumers more time to eat the food they buy, rather than having it spoil or pass its 'use by' date.

The research found that 92\% of respondents regularly froze fresh and refrigerated food at home. Meat and poultry made up the largest proportion of items most often frozen (lamb / beef; 51\%, poultry; 30\% and sausages / mince; 10\%). However, around 60\% thought they could only freeze foods on the day they bought them. Rather it is possible to freeze foods any time before the 'use by' date. This misconception could mean that food is being thrown away unnecessarily. Surprisingly, 50\% of survey respondents said they wouldn't freeze cooked meats e.g. a roast chicken and freezing home-cooked meals, generally, was less common with just 36\% making food with the intention of freezing it or freezing pan-leftovers.

When asked if they would freeze unopened packs of food if they'd been in the fridge 'a few days', two out of three households would (65\%) but one in three would not. When asked about packs of food which had been part consumed and open for a couple of days (and stored in the fridge) only four in ten respondents would freeze the rest of the pack, the majority would discard it on the grounds of food safety.

1.5 Previous work on meat packaging

Previous WRAP work on meat packaging\textsuperscript{13} has focused, primarily, on packaging weight reduction, though there have been consequential benefits for food waste prevention. Faccenda, together with their two project partners (Sharp Interpack and Asda) reduced the weight of the polypropylene (PP) trays commonly used to pack chicken portions e.g. chicken breasts. Reduced pack headroom gives greater stock density on shelf.

The project identified:

\begin{itemize}
  \item 17.5\% weight reduction for polypropylene (PP) trays;
  \item 279 tonnes less PP packaging per annum; and
  \item 588 tonnes less CO\textsubscript{2}e per annum from processing less PP.
\end{itemize}

Following the success of the Faccenda project, another WRAP project focused on packaging optimisation of whole, fresh chicken packs\textsuperscript{14}. Adare worked with Somerfield to develop an innovative solution for chicken packaging, with the aim of reducing packaging waste for both the consumer and the retailer.

The new packaging comprised a flexible shrink-wrap format, which eliminates the requirement to pack the chicken with a tray. The project team also trialled methods by which to print directly onto the film removing the need for self-adhesive labels. According to initial data supplied by the product supplier, these interventions could equate to a 15.5g weight saving per pack, equivalent to 74\% packaging weight reduction. The new pack also has the added benefit of extending the shelf-life of the product by up to two days, by using a high-barrier film in conjunction with gas-flushing.

\textsuperscript{12} WRAP (2010) Understanding Consumer Use of the Freezer
\textsuperscript{13} WRAP (2007) Savings in Household Waste Through the Reduction of Retail PP Tray Weights
\textsuperscript{14} WRAP (2010) Packaging Optimisation for Whole, Fresh Chicken
2.0 Project method and objectives

This challenging project aimed to enable a change in consumer behaviour through innovative packaging design. It sought to deliver reductions in meat waste and benefit consumers and retailers alike. It provides a technical solution to help consumers waste less meat. In particular, it helps consumers:

- buy the right amount;
- keep what they buy at its best – enabling correct storage of the opened, part consumed product (including freezing), by making the packs divisible ('eat me, freeze me') and extending shelf-life after opening; and
- use what they buy – e.g. through enabling correct portioning when cooking.

Whilst previous research has focused on whole bird chicken packaging, the opportunity for The Co-operative and Vion (UK) was to focus on reducing avoidable waste of chicken portions (goujons, breasts and drumsticks etc.). These products represent a significant volume in production and sales for both companies. Moreover, they represent a significant volume in avoidable chicken waste arising (see Figure 2).

The project developed derivative and innovative new packaging format designs and undertook technical and consumer evaluation. It was conducted in the following stages:

1. A detailed review of current meat packaging formats (across chilled and frozen categories and including vacuum packs and 'like' vacuum packs e.g. film/shrink wrapped, and the polybag) and the opportunities for new formats (Section 3.1).

2. From these insights an iterative creative design process was undertaken to generate concepts in sketch and computer aided design (CAD) models. These were discussed by the project team at a creativity workshop and seven concepts taken forward to the next stage (Section 3.2 and 3.3).

3. In order for any pack to be considered by a Co-operative category manager it must be successfully trialled through the Co-operative Taste Team process. The Co-operative Taste Team comprises 2,000 members which are randomly selected to take part in evaluating proposed Co-operative products. The consumer panel is run in conjunction with Leatherhead Food Research. A questionnaire along with full colour images of each of the seven concepts were given to the panel and 36 responses were analysed (Section 3.4).

4. The feedback from this activity identified the consumer panel’s preferred design and led to the development of the final pack in the form of a physical prototype and pre-production sample. This was again submitted to the Taste Team, to trial at home. A further questionnaire was given to respondents and 32 responses were analysed (Section 3.5 and 3.6).

5. A high-level analysis of the relative carbon footprints of the different pack options studied through the market review was carried out, assessing the carbon intensity of meat versus the embodied carbon in packs. This analysis became a proxy for assessing the viability of the new packaging concept (Section 3.7).

2.1 Project team

The project was managed by Giraffe Innovation Limited in collaboration with the main project partners, The Co-operative and Vion Foods (UK). The user validation of the projects research was conducted in collaboration with The Co-operative's own Taste Team user panel.
3.0 Outcomes

3.1 Market review
A high-level review of existing meat packaging available in UK supermarkets was undertaken. The purpose of this exercise was to understand the current pack formats on the market. Although not exhaustive, this analysis fed into the creativity workshop with the project team and in concept generation.

None of the packs analysed explicitly provided a specific function or information to help reduce meat waste arising. However, bulk meat packaging of chicken and turkey breasts facilitated portion control and ‘eat-me/freeze me’ functionality. However, these pack formats are often poorly merchandised, for example, being ‘piled up’ (in some cases raising an issue about air circulation and maintaining cool temperatures) and with limited communication/shelf-presence.

The primary focus for pack development in chicken products has been on whole birds, with the portion packs on the market focussing on higher value beef products. The predominant chicken pack format currently on the market is the MAP thermoformed PP tray format (Figure 3) and is currently utilised by The Co-operative for their chicken range. This pack is robust and well proven to protect and contain meat products. However, once opened, the shelf life extension effect of the MAP is lost.

In order to preserve the chicken within the MAP pack three main gasses are injected into the packaging: carbon dioxide (CO$_2$), to inhibit bacteria and moulds; nitrogen (N$_2$), to avoid oxidation of fats and pack collapse; and oxygen (O$_2$), to prevent anaerobic growth. This format works across different product types – fillets, goujons and boned meat portions.

![Figure 3 Thermoformed MAP chicken tray pack](image)

A number of other meat packaging formats are currently on the market that provide pack weight reduction and extended shelf-life opportunities. The predominant format is the Cryovac Darfresh range (2 web) currently being used by Marks & Spencer for their premium beef range of products as well as fish such as Salmon slices (Figure 4). This vacuum ‘skin’ packaging process uses barrier films that gently surround the product and seal over the entire surface of the pack like a second skin. This format consists of a low profile tray or ‘base web’ that can either be pre-formed or thermoformed on-line from a roll of base web material. The barrier film is draped over the product and, using a combination of vacuum and blowers, the film matches the contours of the product without compaction. This format presents the products well and allows a strong graphic treatment on the side of the pack. The anaerobic nature of this format extends the shelf-life, by up to 4 days, and can deliver a 27% reduction in packaging weight.

Many of the recently introduced ‘skin’ packaging formats for red meats increase pack material costs and require new capital equipment in production which is seen as a barrier to the uptake of these formats for chicken products which have extremely tight margins and a significantly lower retail value than most red meats.

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15 http://www.cryovac.com/EU/EN/PackagingSolutions/thermoforming_vacuum_skin_darfresh.aspx
Several retailers are now also offering 'eat me, freeze me' functionality through individually wrapped portions in a large pack (either vacuum packed, Figure 5, or flow-wrapped, Figure 6). As noted above, these can be difficult to merchandise.

Figure 5  ‘Saddle’ pack produced by Cryovac currently sold in Costco, UK

The Canadian-based company Exceldor\textsuperscript{17} was found to sell single portion packs, with the marketing slogan ‘full meal, no leftovers, ideal for a solo feast’. In WRAP’s Retailer Survey\textsuperscript{18}, 18% of packs were found in the smallest pack size category; weighing under 300g (base 322).

The market review highlighted an increasing number of packaging formats available across the meat and fish sector in the UK. The primary focus appears to be upon extending shelf life through packaging technology such as barrier films. A number of packaging formats also facilitated a reduction in packaging weight, aligned to retailer commitments to reduce packaging used.

Aside from the bulk packs, none of the chicken packaging reviewed was found to provide a divisible element that would enable ‘eat me, freeze me’ functionality.

### 3.2 Functional design process

The generative process for concept development followed a conventional design process. These stages went through a number of iterations:

- Context building throughout the supply chain;
- Factory visits;
- Store visits;
- Packaging analysis – purchase, functional review, weighing and CO\textsubscript{2};
- Sketch generation – offline and in the creativity workshop;
- Concept refinement;
- Computer modelling;
- Consumer testing;
- Prototyping (physical);
- Consumer testing;
- Production trial; and
- Consumer evaluation.

\textsuperscript{17} \url{http://www.exceldor.ca/en/products/classics/individual}

\textsuperscript{18} WRAP (2010) A Retailer Survey
3.2.1 Packaging creativity workshop

Initial concept designs were developed in-house by the Giraffe team and explored further in a creativity workshop (Figure 8) with the project team. Colleagues in marketing, packaging technology and category management were involved.

This participative process assessed and built on the validity of the proposed designs. This included incumbents, derivatives of these formats and more radical design solutions. A number of techniques were used in the packaging workshop to elicit the different packaging design requirements, for example, the Kano model\textsuperscript{19} of customer satisfaction, which examines what elements of a product offering engage different consumer groups.

Concept sketches such as that shown in Figure 9 were refined and modelled in Studio Works and Cinema 4D software. This robust visualisation technique enables the project team and consumers to validate the concept design and pass comment on the benefits or otherwise of the pack.

\textbf{Figure 8} Creativity Workshop – The Co-operative, Manchester

For the purposes of concept selection a two stage ‘controlled convergence’ process was applied to test and shortlist the concepts. This was necessary to ensure equal evaluation of the concepts and overcome the complexity of assessing concept variations. The application of the Kano model generated a consensual view of the constraints (listed below) a new pack design must meet.

**Primary Packaging**
- Weight;
- Recycled content;
- Recyclability;
- Pack size; and
- Pack cost.

**Functionality**
- Divisibility;
- Extended shelf-life;
- Extended use life;
- Temperature abuse;
- Discolouration/odour; and
- Application (fillets/boned etc.).

**Secondary Packaging**
- Materials; and
- Merchandising opportunities.

**Production/Processing**
- CAPEX/Tooling costs; and
- Line running speeds.

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Retail/consumer

- On-pack POS opportunities;
- Merchandising; and
- ‘Premiumisation’.

Other

- Timescale.

The first stage of the controlled convergence process, undertaken on the concepts generated through the workshop, was ‘concept screening’ (a quick approximate evaluation aimed at prioritising the alternatives against a ‘common reference’ product) followed by the second stage ‘concept scoring’ (fuller evaluation of the concepts against weighted criteria aimed at choosing the single concept most likely to lead to product success). Each was supported by a decision matrix which was used by the team to rate, rank and select the concepts. Seven were chosen.

3.3 Concepts developed

The seven concepts were:

1. MAP pack, deep profile PP tray
2. MAP pack, deep profile PP tray perforated
3. Two web PE lined card tray, vacuum pack
4. Individual vacuum packs
5. Individual vacuum packs – tear off
6. Flow wrap – MAP
7. Two web vacuum pack

An iterative creative design process was undertaken to generate concepts in sketch and computer aided design (CAD) models. A description and images for each of the packaging concepts are shown below.

(NB, concept development was completed for chicken breasts though chicken strips were used at prototyping because of variance in chicken breast weights).
Concept 1 MAP pack, deep profile PP tray

This concept is a derivative design of the existing Co-operative MAP pack utilising the same materials. The central fluting rib has been extended to the same height as the side walls. It has also been widened to give a ‘sealing bridge’ so the end user can either cut the pack in two or cut the lidding film on one side leaving the remaining meat sealed. Smooth tray flanges and corners safeguard product freshness avoiding accidental film puncturing.

This format addresses the issue of consumers opening a pack but not using all the product at once; the consumer can use half the meat without affecting the freshness of the remaining product, which can be kept in the fridge or frozen for use at a later date. It also avoids opened trays being put in the freezer with the meat exposed, or the meat being decanted into a freezer bag before freezing, both of which can lead to a perception later on of the meat not being fresh or suffering freezer burn and therefore being discarded.

The deep profile PP tray gives structural rigidity. The tray is optimised to be as lightweight as possible utilising the internal webbing to give strength and minimise volume. The product would be merchandised in the same way as current packs, although label design and on-shelf promotional graphics and messaging would help raise customer appreciation of the pack’s functionality.

This pack format is flexible and could be used for two breast portions (one either side) or four.
Concept 2 MAP pack, deep profile PP tray, perforated

Concept 2 is similar in format to Concept 1, where the centre of the pack has been increased in height and widened to give a ‘sealing bridge’ so the end user can use meat from one side without affecting the freshness of the remaining meat. However, the ability to divide the pack is facilitated by including a perforated centre so the trays can be torn apart without the use of scissors making it safer, easier and more self-explanatory to use.
Concept 3 Two web PE lined card tray, vacuum pack

This concept utilises a PE lined card base and a polymer barrier film to keep the product fresh for longer in-store. The pack is divisible using the space between each piece of meat, keeping the remaining portions fresh. The pack can easily be cut by the consumer using scissors or potentially incorporating a perforation.

The card base allows marketing communication to be printed, for example menu tips, that could help reduce food waste. The pack is lighter than tray versions and uses less plastic.

The pack is designed to be hung in-store using a ‘eurohook’ to help present it clearly to consumers. This pack format is flexible and could be used for single breast portions, two or four.
Concept 4 Individual vacuum packs

This concept uses a multi-layer barrier film to present the chicken breasts in single portions, which enables individuals to buy exactly what they need. It is likely to be most popular with single households. The potential to use Cryovac horizontal flow wrap barrier films would extend the shelf-life of the product – potentially up to 4 days over MAP packaging formats.

This format presents the product on a euro hook in-store and allows a graphic treatment on the pack which can be used to communicate to the consumer.

The pack is lighter than tray versions and uses less plastic.
**Concept 5** Individual vacuum packs – tear off

This concept is similar to concept 4 and utilises horizontal flow wrap technology similar to Cryovac’s Saddle pack (Figure 5). It presents the chicken breasts in single, linked portions, which enables individuals to buy exactly what they need. This divisible format allows the user to tear off the specific number of portions they require. This pack format facilitates an 'eat me, freeze me' function by the use of a tear strip between each item of meat.

The potential to use Cryovac horizontal flow wrap barrier films would extend the shelf-life of the product – potentially up to 4 days over MAP packaging formats.

This format presents the product on a euro hook in-store and allows a graphic treatment on the pack which can be used to communicate to the consumer.

The pack is lighter than tray versions and uses less plastic although it does require secondary in-store, shelf ready packaging (SRP). This format allows a strong graphic treatment on the packaging which can be used to communicate to the consumer.
This is similar to pack formats already on the market (e.g. Figure 6) but the outer bag is designed to give more structure than existing packs and thereby be ‘self-standing’, providing shelf ‘presence’. The pouch, made from a multi-layer barrier film, gives a premium feel. The outer bag allows for strong graphic treatment and communication to the consumer.

In this concept, each portion of meat is individually flow wrapped and placed in an outer bag which has a zip lock function. Portioning comes from items being individually wrapped in the bag which, in itself, offers an ‘eat me, freeze me’ function. This concept could utilise a Cryovac breathable film for the individual flow wrap portions or a MAP pack with breathable flow wrapped portions; the latter could extend shelf-life.
Concept 7 Two web vacuum pack

This concept utilises a thin PP base tray and a multi-layer barrier film to extend the meat’s shelf-life in-store. The pack is divisible, providing space between each piece of meat, which enables the consumer to use part of the product and retain freshness for the other portions or freeze them. The pack can easily be cut by the consumer using scissors or potentially incorporating a perforation so it can easily be torn apart. The pack is lighter than deeper tray versions and uses less plastic. The base tray could potentially incorporate some recycled content. The pack is designed to be hung in-store to help present a clear message to consumers. This pack format is flexible and could be used for single breast portions, two or four.
3.5 Consumer response to the concepts

The top 7 concepts were presented in visual form to the Taste Team panel for consideration. Typically, the Taste Team are used to validating physical products prior to consideration by a category team. However, a prior stage was incorporated into this project in order to validate the concept designs before physical prototyping. This was an important stage in order to converge on the concept most likely to be well received by The Co-operative’s customers. A questionnaire along with full colour images of each concept was submitted to the panel (Appendix 1) and the results collated (Appendix 2). The feedback from this activity identified the consumer panel’s preferred design and led to the development of the final pack in the form of a physical prototype and pre-production sample.

The questionnaire was sent to 50 members of the Taste Team panel with 36 completed questionnaires returned (72%). There was a high-level of chicken products being consumed by the sample with 63% eating chicken 1-2 times a week and 88% usually buying chicken portions.

Five respondents said they ‘often’ throw away opened, part consumed packs of fresh meat, with 20 saying they ‘sometimes’ do this. Fifteen respondents said they usually throw opened packs of fresh meat away because they ‘don’t smell or look right’, 12 because they’d ‘forgotten to freeze it’ and / or ‘didn’t think it was safe to freeze / eat’ and four because they’d ‘forgotten how long it had been opened’.

The respondents answered specific questions against each concept image. Each respondent was also asked to provide anecdotal evidence in support of their responses under the following categories:

- Visibility of the meat inside the pack
- Pack size (number of portions e.g. chicken breast, in the pack, would it fit in your fridge/freezer etc.)
- Packaging (e.g. pack materials, shape, easy to open)
- Merchandising (how it will be displayed in-store)
- Labelling on-pack
- Overall appearance
- What do you like about the concept?
- What do you dislike about the concept?

In response to the two key questions:

Q. Which packaging concept would help you reduce your food waste?
Concepts were ranked as follows:

1. MAP pack, deep profile PP tray perforated (concept 2)
2. Individual vacuum packs (4)
3. MAP pack, deep profile PP tray (1)
4. 2 web vacuum pack (7)
5. Flow wrap – MAP (6)
6. 2 web PE lined card tray, vacuum pack (3)
7. Individual vacuum packs – tear off (5)

Q. Which packaging concept would you most likely buy?
Concepts were ranked as follows:

1. MAP pack, deep profile PP tray perforated (concept 2)
2. MAP pack, deep profile PP tray (1)
3. Flow wrap – MAP (6)
4. Individual vacuum packs (4)
5. 2 web vacuum pack (7)
6. 2 web PE lined card tray, vacuum pack (3)
7. Individual vacuum packs – tear off (5)

With regards to concept 2:

- 89% of respondents said they ‘liked’, ‘liked it a lot’ or ‘loved’ it.
- 53% said it would definitely have a positive effect on reducing food waste; “Similar benefit to concept 1 but easier to use”.
- 80% would ‘definitely’ buy the product and 16% said they would ‘maybe’ buy the product.
With regards concept 1:
- 86% of respondents said they 'liked', 'liked it a lot' or 'loved' it.
- 49% said it would definitely have a positive effect on reducing food waste; "It's a good idea and would stop food waste".
- 74% would 'definitely' buy the product and 16% said they would 'maybe' buy the product.

The individual portion concept (concept 4) was also well received with half the sample (50%) thinking it would help them reduce food waste. It was much less preferred, however, than concepts 1 and 2, with just 40% saying they would 'definitely' buy the product. Comments suggest there is potential, however, to produce more single portion packs perhaps in the conventional tray format.

"You can buy as many or as few as you need and are not left with extra portions you don't need".

"Love the fact that you can buy singles - 'single' people often find that they have to buy for two or for a family".

Negative comments were around it being less value for money than a two or four pack (for those that would want more than one portion) and the eurohook.

The other individual portion concept (concept 5) was not liked at all. The reasons given suggest this was mainly because of the inflexibility of being able to select the pack they wanted (being forced to take the next one on the roll), a dislike for the additional secondary packaging and generally giving an appearance of a poorer quality product.

"Customers would definitely be put off by the fact they can’t chose their bit of meat and would probably find the tearing of the portion a bit of an inconvenience".

Concept 6 also performed well with 49% saying they would buy it but just 40% thinking it would help them reduce food waste. Negative comments were around it being over-packaged, being too large / difficult to store at home and having lower visibility of the meat.

Concepts 3 and 7 performed most poorly. For concept 3, the main comments were around reduced visibility of the meat, the eurohook concept, potentially messy / difficult to open and general appearance being less appealing than the other concepts. For concept 7, the main comments were around the plastic base not being ‘environmentally friendly’, being too large for the fridge / difficult to store at home, the eurohook, and general dislike for vacuum packed foods.

For concepts 1 and 2, a number of Taste Team respondents made positive anecdotal comments with regard to the size of their families and the flexibility a divisible portion pack would provide:

"I throw so much away because there are only two of us in the house, but everything comes in portions for four and I often forget to freeze things either raw or after cooking it”.

"If you are only cooking for a couple or a single person, great way to save food waste”.

"Means you can split into portions suitable for the size of your family without having to repackage them”.

"Good idea to be able to buy a pack of 4 fillets or more even if don't need to use all in one meal, but still able to benefit from the cost saving of buying larger pack vs. just 2 fillets”.

"It is great for small families or single people”.

Overall, users responded well to the user convenience provided by the divisible pack;

"If you want to freeze the other portion, you can do without having to decant it into a freezer bag”.

"That I could freeze half the pack without having to use a bag”.

"Great that I don't have to open the whole pack at once and can keep some sealed up for freezing”.
Further comments supported the objectives of reducing food waste:

"Reducing waste - really don’t like throwing out meat and this would kick start a thinking trigger on freezing/storing other foods as well".

"Gives you the option of using the other product at another time without exposing it to air, therefore can store for longer".

"The ability to leave half the contents sealed to keep it as fresh as possible for as long as possible".

"Raw meat still in a sealed unit if placed back in fridge".

The Taste Team results suggested that behaviour change could be enabled through design changes to the chicken tray-pack format.

Despite concept 2 being seen as the preferred option (just above concept 1) the application of the perforated functionality proved a barrier to likely short term implementation. Due to tooling restrictions and process speed the packaging supplier wanted this feature to be applied in-line once the chicken had been packed. This could be achieved through a circular disk cutter but concerns were raised over line speed reduction and food safety should small shards of plastic come off the cutter. Further concerns were raised over the likely increase in pack flexibility down the central sealing bridge due to the perforations which could harm film and MAP integrity leading to supply chain yield loss. The general consensus amongst all parties was that although it was a desirable feature the divisible feature benefits could be achieved with concept 1. Therefore, the project team agreed to take concept 1 forward to prototype stage and further consumer evaluation with the Co-operative Taste Team panel.

3.6 Prototype pack development and description

Existing Co-operative chicken portion packs use a PP thermoformed tray with a lidding film (tray model: S4). Once opened, the product starts to deteriorate in quality and must be used within a couple of days.

This prototype design was similar to existing Co-operative packs, using the same materials and had the same physical size. However, the ridge in the centre of the pack had been increased in height and width to give a ‘sealing bridge’ so the customer can cut the pack in two and use the meat from one side without affecting the freshness of the remaining meat the other side. This will enable the consumer to keep the rest of the meat in the fridge or freezer; offering greater user convenience.

The packaging prototype is a 400g pack of Chicken goujons, roughly equivalent to four chicken breasts.

The design of the tray has been optimised to account for the two cavity, divisible design. Particular attention has been paid to the draw ratio. This defines the gauge of polymer used in the pack and ultimately impacts upon amount of material used and the weight of the tray. A lower draw ratio tends to result in a lower weight tray. The draw ratio is calculated by dividing the depth of the tray by the width of the smallest opening. A typical single cavity S4 tray has a draw ratio of 0.23 (35mm/152mm). The prototype design has a draw ratio of 0.36 (35mm/96mm – the aperture of one of the cavities). This is well within allowable tolerances where a maximum draw ratio of 0.5 can be achieved or 0.6 for pre-stretched, thermoformed trays.

The prototype two cavity, divisible pack design gives flexibility to increase tray depth to 45mm (draw ratio 0.46) or 55mm maximum for pre-stretched thermoforming processes (draw ratio 0.57).

The label would be added to the pack to one side (as currently). It would therefore be important that the consumer used the meat from the non-label side first so that they could still refer to the date label (‘use by’ date) and any freezing / defrosting instructions for the remaining meat.

3.7 Taste Team assessment results

A series of 50 prototype packs were produced by Vion using current production equipment and supplied to the Co-operative Taste Team consumer panel to use at home (Figures 10-13). A questionnaire (Appendix 3) was

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23 Ways to deliver concept 2 could be further explored, for example, perforating the lidding film only to provide the desired functionality. This could be done at the film printing stage by the converter (rather like toilet roll perforations) and although it would require registration (a relatively simple thing to do) would not affect filling line performance.
supplied to each panel member to complete once they had used the pack. A total of 32 of the possible 50 Taste Team members responded to the trial (64%). Summary results are given in Appendix 4.

**Figure 10** The prototype packs

![Prototype packs](image1)

**Figure 11** Cutting the pack

![Cutting the pack](image2)
The overall score for the packaging prototype was 6.5/9 (72%). The Co-operative only present prototypes which achieve a score over 6/9 (66%) to the category management team for potential market development. This pack, therefore, is considered a successful design.

Based on a scale where 1 is ‘dislike extremely’ and 9 ‘like extremely’ the ‘overall liking’ for the pack was 7.56/9 (81%) and the 65% would ‘definitely’ or ‘probably’ buy this format with 22% responding they ‘may’ buy.

When asked why they usually throw fresh meat out, the responses were primarily split between ‘gone past use by date’ (26%) and ‘meat gone off / doesn't look right’ (25%). ‘Plans changed’, ‘didn't have time to freeze’ and ‘forgotten to freeze’ had equal responses at 15%; all of which are behaviours that a divisible, ‘eat-me, freeze-me’ pack would help overcome.

Although respondents claimed to ‘never’ or ‘rarely’ throw out meat (77%) their actual behaviour when given the prototype pack seems to counter this claim.
Most respondents (38%) cut the pack, using one side and freezing the other half of the pack. Potentially, these people would usually have wasted some of the meat where they were using packs without the added functionality of the prototype pack.

"I like the ease of cutting it in half in order to use later that week or freeze for another time”.

"The size was perfect to cook two individual meals for a couple, or one meal using the whole pack. If freezing was required, the pack could easily be split into two, to fit into smaller spaces in a freezer”.

"The pack size was generally what I would buy to enable me to freeze half of it. It fits easily into my freezer (I only have a small freezer)”.

The pack format’s convenience appealed to a number of the Taste Team. In particular, the divisible function that facilitates freezing without the need to remove the chicken and use additional freezer bags.

"...should reduce waste (I always freeze separately by taking out of packaging and putting into freezer bags) but this was much less hassle”.

"I like that it was sectioned into 2 halves making it easier to freeze just have the packet without having to open, repackage for freezing”.

"I really like being able to split the pack in two. As a single person who only cooks for myself it was handy to be able to freeze a sealed portion without having to separate the chicken myself and wrap in freezer bags”.

"The ability to cut pack in half to freeze. Would normally have to put unused meat in freezer bags to store in freezer”.

"I like the fact that you didn’t have to eat it all at once with living on my own I found that I could still get value for money by buying a larger pack”.

21% cut the pack and used one side at a time supporting the claim that retaining an opened portion in a MAP extends the ‘use life’ by remaining fresher in the fridge. This was supported by anecdotal responses:

"...when we used the second half two days later the meat was still just as fresh”.

"I have more confidence that, when the pack is cut in half, the side I am not using will remain securely closed. I can then put that in the fridge or freezer without having to put it in another container/freezer bag”.

"I liked the concept that you could use part of the product without affecting the other part”.

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Figure 14 Taste Team results, how the pack was used

% Distribution of Scores - Ways of using the product
"(I liked)... the ability to split the pack without air getting to the remaining contents”.

"I like the ability to be able to use half of the pack without unsealing the other half, hence keeping the unused portion fresh for longer”.

"I can just use one portion of the packet without waste”.

Although the primary function of the new format is to reduce the likelihood that opened, part consumed packs of meat are thrown away, anecdotal evidence also suggests that it might reduce the likelihood of too much being cooked in the first place:

"It makes you think about the option to freeze a portion of the product and not make too much food which is likely to be left over”.

Only 8% of respondents froze the whole pack. Unless these respondents intended to defrost and use the whole pack in one go then further benefits could be accrued from the divisibility of the pack. This behaviour type was supported anecdotally:

"(I liked)...that the pack can be split and frozen as two separate parts, which is better when I need to thaw it out to use and don’t need the whole pack”.

There were some negative responses to the pack, these were principally associated with:
- Not needing the divisible functionality, because they used all the contents at once;
- As a result, viewing the sealing bridge as unnecessary additional packaging;
- Thinking that once the pack had been cut in two, there were quite sharp edges exposed (posing a potential safety risk);
- Thinking that the label should be repeated on both sides, they had used the side with the label first meaning the remaining portion had lost its date label.

It was also suggested that it should be highlighted more clearly on the label that the pack can be cut in half to store in the freezer (and linked to the criticism above, to suggest using the side without the date on it first).

Therefore, around 59% of respondents accrued some functional benefit from a divisible / ‘eat me, freeze me’ function with a proportion of another 8% likely also to benefit.

"It’s so simple I’m surprised it hasn’t been thought of before”.

"I had no issues fitting it into the fridge or freezer and then finding a place in the freezer. It was easy to open and the plastic was easy to cut through too”.

Although the Taste Team feedback was generally positive, one respondent expressed concerns about the portion sizes and appropriateness for families.

If you were a family there is probably no need for this product as you would use it all in one go, we are a couple so used each pack separately, maybe you could apply (design) to a larger pack but with the same principle of two sides”.

Most commented that the divisible function of the pack was self-evident; however, there could be the need to promote this feature on future label/pack designs.

Overall, the visibility of the meat was judged to be fine. One comment supported earlier project discussions about the importance of meat visibility:

"I like to be able to see meat before I buy & this packaging allows this”.

3.8 Taste Team results and the impact on reducing avoidable food waste
The Taste Team used the pack in a way that suggests its functionality may help consumers avoid ending up with chicken that might, with a traditional pack, be thrown away. Based on the Taste Team results, therefore, an
estimate of food waste reduction can be calculated. This is inevitably approximate and indicative. It is also based on the total market moving to the new pack format.

Around 59% of respondents accrued some functional benefit from a divisible / ‘eat me, freeze me’ function with a proportion of another 8% also likely to benefit.
- 38% cut the pack, using one side and freezing the other half of the pack.
- 21% cut the pack and used one side at a time.
- 8% of respondents froze the whole pack.

WRAP estimates that around 290,000 tonnes of avoidable meat and fish waste is thrown away by households each year. Around 11% of this comprises chicken portions, such as chicken breasts, thighs or drumsticks. Using these estimates the target for food waste prevention within the scope of this innovation would be around 30,000 tonnes.

Some of the Taste Team respondents indicated that the benefit to them of the new pack functionality, was in terms of taking the hassle out of their usual method of preventing waste e.g. decanting any remaining product to an air-tight container / freezer bag. Given they’re already exhibiting positive food waste prevention behaviours, the pack would enhance their user experience but not further prevent food waste.

For those that don’t usually take any action to prevent food waste, the pack could enable a behaviour change in the following ways:
- Using part of the pack and using the second portion later in the week.
- Using part of the pack and freezing the rest.
- Freezing the whole pack and defrosting the two portions separately.

Basing an assessment of the pack’s potential on the Omnibus study (section 1.4) we could estimate around 30% of consumers fall into the latter category and therefore would benefit from the new pack.

Therefore, were this pack rolled out across the market for chicken portions, up to 10,000 tonnes of chicken waste could be prevented per year (up to 50,000 tonnes CO₂e).

3.9 Carbon assessment

A high-level analysis of the relative carbon footprints of the different pack options studied through the market review was carried out, assessing the carbon intensity of meat versus the embodied carbon in packs. This analysis became a proxy for assessing the viability of the new packaging concept.

This project demonstrates that a divisible, ‘eat me, freeze me’ pack would facilitate greater user convenience, leading to increased portion control and reduction in meat waste arising.

The design of a two cavity thermoformed tray performs well technically and will not compromise the technical performance of the packaging. Due to the increased draw ratio of a two cavity tray, the weight of a typical S4 PP thermoformed tray will increase from around 19.1g for a single cavity tray to 22.5g for a two cavity tray. However, the net GHG impact of chicken significantly outweighs that of the tray materials. This is summarised in Table 2.

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24 Unpublished WRAP data. Estimate excludes chicken products such as chicken nuggets.

25 Almost one third of households admit “occasionally” throwing away uncooked meat. The remaining two thirds were equally split between a third saying they never throw away because they consume all the meat they buy and a further third say they use the freezer to manage uncooked meat.
Table 2 Tray weights of the existing and prototype tray and carbon assessment

<table>
<thead>
<tr>
<th></th>
<th>Old pack (S4 PP thermoformed tray)</th>
<th>New pack</th>
<th>Chicken 350g(^{26})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tray weight</td>
<td>19.1g (38.2g CO(_2)e(^*))</td>
<td>22.5g (45g CO(_2)e)</td>
<td>1.75kg CO(_2)e</td>
</tr>
<tr>
<td>Lidding film</td>
<td>1.5g (2.85g CO(_2)e)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Even a 5% reduction in the current levels of product waste would still deliver a 2 fold environmental benefit, taking into consideration the increase in packaging for every pack sold. A 10% reduction in waste would deliver a 4 fold environmental benefit\(^{27}\). This clearly demonstrates that the environmental impact of the chicken meat is a valid target for reduction using an approach such as this.

\(^{26}\) S4 trays - Vion output Diced – 350g – 3000 cases (10t) per week -30,000 items a week. Vion 30% market share.

\(^{27}\) This calculation is based on Defra’s estimate that 14% of avoidable (edible) poultry meat that is bought, is wasted [Household Food and Drink Waste linked to Food and Drink Purchases, Defra, July 2010].
4.0 Conclusions and next steps

This project demonstrates that a divisible, ‘eat me, freeze me’ pack would facilitate greater user convenience, leading to increased portion control and a reduction in meat waste arising. It also shows that packaging design can play an important role in enabling a behaviour change that facilitates a reduction in food waste. The environmental impact of slightly increasing the pack weight should be more than offset by the reduction in meat waste.

The project shows that packaging design can directly address the main causes of avoidable meat waste, particularly ‘opened/part used’ products and, to an extent, behaviour relating to ‘preparing/cooking too much’.

The Co-operative Taste Team respondents who interacted with the physical prototype showed that the pack performed well and had recognised potential to reduce meat waste arising. The pack achieved an overall liking at 81%, and 65% would ‘definitely’ or ‘probably’ buy this format with 22% responding they ‘might’ buy it.

The actual behaviour of the Taste Team members in using the pack is most instructive in determining whether the design will change user behaviour:
- 38% of respondents chose to cut the pack and use one side and freeze the other; here the divisible function leads to an ‘eat me, freeze me’ behaviour pattern; and
- 21% of respondents chose to cut the pack and use one side at a time, effectively extending the ‘use life’ of the product and overcoming perceived loss of freshness.

The extrapolation of these behaviours across avoidable chicken portion waste arising could transfer to a potential food waste reduction of up to 10,000 tonnes per year, if adopted across the whole market, together with the associated packaging waste prevention.

The new design is seen as a derivative of the existing pack format in production and therefore doesn’t require extensive capital equipment and tooling costs. The new pack design runs through existing production equipment as the same line speed as the current design. Vion currently utilise ULMA Optima packaging equipment. A new sealing head is required for the new design estimated to be £15,000 per machine.

The modified tray requires a small amount of additional polymer that is likely to increase tray costs by a small margin – estimated to be 0.5% - 1% of current packaging costs depending on raw material prices.

The product offers the same production and retail shelf life as the current MAP format. This is referred to as production plus 7 days.

This concept has the ability to extend across different product formats within the fillet and boned meat and poultry category. The same principles embodied in this prototype pack could also be adopted across other tray sizes (S2-S6). A smaller S2 divisible tray containing two single portions could appeal to single occupancy households, for example.

Further trials are required however, to evaluate breast size relative to tray portion orientation and size. Variations in breast portion size can result in uneven distribution of chicken pieces within each tray portion. However, for larger portion size trays i.e. S5 and S6 a potential imbalance in meat distribution per tray portion is judged not to be an issue.

The Co-operative is now considering how the new pack can be best introduced, including investigating labelling and merchandising options to help their customers get the most from the new pack. WRAP are keen to see the pack adopted more widely and to explore, with the food industry, ways in which this new format could be developed for other product types.

28 http://www.ulmapackaging.co.uk
Appendix 1 Taste Team Concept Questionnaire

Part 1 – About you

Before you begin, please can we ask you to complete the fields below:

1. How often do you eat meat? (Please tick)

<table>
<thead>
<tr>
<th></th>
<th>Chicken</th>
<th>Lamb</th>
<th>Beef</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Once per month</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Twice per month</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>1-2 times per week</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3-4 times per week</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Once per day</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Twice per day</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Three times per day</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

2. What type of fresh/raw meat do you usually buy? (tick all that apply)

NB please exclude chilled and frozen pre-prepared foods such as chicken nuggets or burgers; ‘ready meals’ that contain meat products such as cottage pie and processed meats such as mince.

<table>
<thead>
<tr>
<th></th>
<th>Joints (e.g. whole chicken, leg of lamb)</th>
<th>Portions (e.g. chicken breasts, lamb chops)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Lamb</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Beef</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Pork</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3. How often do you throw out fresh/raw meat you’ve bought, either unopened or opened? (tick all that apply)

   a. Unopened (i.e. it’s gone past its use by date before you’ve opened and used any of it)
      - Often (once a week or more)
      - Sometimes (once a month or more)
      - Rarely (less than once a month)
      - Never

   b. Opened (i.e. you’ve used one of the chicken breasts, but not the other in the pack)
      - Often (once a week or more)
      - Sometimes (once a month or more)
      - Rarely (less than once a month)
      - Never
4. Why is this, usually? (tick all that apply)

a. Unopened packs:
- Gone past use by date
- Meat gone off/doesn’t look right
- Not sure how long I’ve had it (e.g. if frozen)
- Plans change, just didn’t have time to eat it
- Forgotten to freeze
- If I feel it’s not safe to freeze/eat
  Other (please specify)

b. Opened packs:
- Gone past use by date/use within date
- Forgotten how long it’s been opened
- Didn’t look right
- Didn’t smell right
- Plans change, just didn’t have time to eat it
- Forgotten to freeze
- If I feel it’s not safe to freeze/eat
  Other (please specify)

Part 2 – What do you think about the concepts?

The following questions were asked for each concept.

1. If you bought this product, how would you use it at home? (tick all that apply)

<table>
<thead>
<tr>
<th></th>
<th>Concept 1</th>
<th>Concept 2</th>
<th>Concept 3</th>
<th>Concept 4</th>
<th>Concept 5</th>
<th>Concept 6</th>
<th>Concept 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy just what you want that week (and not freeze any)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy several, but freeze some of the cooked portions (batch cooking)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy several, some to cook that week and the rest to freeze</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook all of it in one go</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook all of it in one go (from both sides)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook it all but freeze a cooked portion for later (batch cooking)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook some of the pack but freeze the rest (in original packaging)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook some of the pack but freeze the rest in alternative packaging e.g. freezer bag</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cook some of the pack but keep the rest (in the fridge) for another day</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze the whole pack</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze the whole pack and use them as and when you need them</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use scissors to cut the pack in two, use the meat from one side but freeze the other side (in original packaging)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use scissors to cut the pack, cook the meat from one side but freeze the rest (in original packaging)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use scissors to cut the pack, cook the meat from one side but keep the rest (in the fridge) for another day</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use the meat from one side, and freeze the meat from the other side in alternative packaging e.g. freezer bag</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Do you have any comments on the following?
   a. Visibility of the meat inside the pack
   b. Pack size (number of portions e.g. chicken breasts, in the pack, would it fit in your fringe/freezer etc.)
   c. Packaging (e.g. pack materials, shape, easy to open)
   d. Merchandising (how it will be displayed in-store)
   e. Labelling on-pack
   f. Overall appearance

3. Taking everything into consideration, how much do you like this concept?
   [ ] Love it
   [ ] Like it a lot
   [ ] Like
   [ ] Neither like nor dislike
   [ ] Dislike
   [ ] Dislike a lot
   [ ] Hate it

4. What do you like about the concept?

5. What do you dislike about the concept?

6. Do you think that this packaging concept would help you reduce your food waste?
   [ ] Definitely would have positive effect
   [ ] Same as now
   [ ] Definitely would not have positive effect

7. Would you buy this product?
   [ ] Yes
   [ ] No
   [ ] Maybe

8. If you answered no, can we ask why not?

Part 3 - Closing remarks

1. Which is your favourite/least favourite of the concepts?

2. Do you have any other comments about the concepts, meat packaging in general or food waste in the home?
Appendix 2 Taste Team Concept Results

Which is your favourite/least favourite of the concepts?

What is your favourite / least favourite of the concepts?

![Bar chart showing favourite and least favourite concepts](chart1.png)

Favourite concept according to age group

Favourite Concept According to Age Group

![Bar chart showing favourite concepts by age group](chart2.png)
Least favourite concept according to age group

Least Favourite Concept According to Age Group

Which of the following age groups applies to you?

Proportion female/male:
How often do you buy meat?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Chicken</th>
<th>Lamb</th>
<th>Beef</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Once per month</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice per month</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 times per week</td>
<td>5</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3-4 times per week</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once per day</td>
<td>7</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice per day</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three times per day</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What type of fresh/raw meat do you usually buy?

<table>
<thead>
<tr>
<th>Meat</th>
<th>Joints</th>
<th>Portions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Lamb</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Beef</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Pork</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
How often do you throw out fresh/raw meat you've bought, either unopened or opened (tick all that apply)?

A. Unopened (i.e. it's gone past its use by date before you've opened and used any of it)

- Often (once a week or more) - 13
- Sometimes (once a month or more) - 22
- Rarely (less than once a month)
- Never

B. Opened (i.e. you've used one of the chicken breasts, but not the other in the pack)

- Often (once a week or more) - 5
- Sometimes (once a month or more) - 20
- Rarely (less than once a month) - 11
- Never
Why is this, usually? (Tick all that apply)

a. Unopened packs:

- Gone past use by date (6)
- Meat gone off/doesn’t look right (3)
- Not sure how long I’ve had it (e.g. if frozen) (6)
- Plans change, just didn’t have time to eat it (7)
- Forgotten to freeze (3)
- If I feel it’s not safe to freeze/eat (10)
- Other (please specify) (4)

b. Opened packs:

- Gone past use by date/use within date (4)
- Forgotten how long it’s been opened (6)
- Didn’t look right (6)
- Didn’t smell right (5)
- Plans change, just didn’t have time to eat it (4)
- Forgotten to freeze (6)
- If I feel it’s not safe to freeze/eat (10)
Summary – Would you buy this product?

Concept 1

- Yes: 47%
- No: 25%
- Maybe: 25%

Concept 2

- Yes: 10%
- No: 80%
- Maybe: 10%

Concept 3

- Yes: 14%
- No: 53%
- Maybe: 33%

Concept 4

- Yes: 34%
- No: 40%
- Maybe: 26%

Concept 5

- Yes: 36%
- No: 21%
- Maybe: 43%

Concept 6

- Yes: 49%
- No: 17%
- Maybe: 34%

Concept 7

- Yes: 74%
- No: 17%
- Maybe: 9%
SUMMARY - Taking everything into consideration, how much do you like this concept?
SUMMARY - Taking everything into consideration, how much do you like this concept?
SUMMARY – Do you think that this packaging concept would help you reduce your food waste?

Concept 1
- Definitely would have a positive effect: 49%
- Same as now: 40%
- Definitely would not have a positive effect: 11%

Concept 2
- Definitely would have a positive effect: 53%
- Same as now: 38%
- Definitely would not have a positive effect: 9%

Concept 3
- Definitely would have a positive effect: 37%
- Same as now: 49%
- Definitely would not have a positive effect: 14%

Concept 4
- Definitely would have a positive effect: 50%
- Same as now: 39%
- Definitely would not have a positive effect: 11%
SUMMARY – Do you think that this packaging concept would help you reduce your food waste?

**Concept 5**
- **15%** Definitely would have a positive effect
- **35%** Same as now
- **50%** Definitely would not have a positive effect

**Concept 6**
- **5%** Definitely would have a positive effect
- **55%** Same as now
- **40%** Definitely would not have a positive effect

**Concept 7**
- **12%** Definitely would have a positive effect
- **44%** Same as now
- **44%** Definitely would not have a positive effect
Appendix 3 Taste Team Prototype Questionnaire

Part 1 – About you

Before you begin, please can we ask you to complete the fields below:

A. Which of the following age groups applies to you?

- [ ] 18-24
- [ ] 25-34
- [ ] 35-44
- [ ] 45-54
- [ ] 55-64
- [ ] 65+ years

B. Are you:
- [ ] Male
- [ ] Female

C. How many people in your household?
   - Children (18 years and under)
   - Adults (over 18)

   ___________  ______________

How often do you eat meat? (Please tick)

<table>
<thead>
<tr>
<th></th>
<th>Chicken</th>
<th>Lamb</th>
<th>Beef</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once per month</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice per month</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 times per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4 times per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What type of fresh/raw meat do you usually buy? (tick all that apply)

NB please exclude chilled and frozen pre-prepared foods such as burgers; ‘ready meals’ that contain meat products such as cottage pie and processed meats such as mince.

<table>
<thead>
<tr>
<th></th>
<th>Joints (e.g. whole chicken, leg of lamb)</th>
<th>Portions (e.g. chicken breasts, lamb chops)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pork</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How often do you buy chicken goujons, specifically?

- [ ] Often (once a week or more)
- [ ] Sometimes (once a month or more)
- [ ] Rarely (less than once a month)
- [ ] Never

How often do you throw out fresh/raw meat you’ve bought, either unopened or opened? (tick all that apply)

- Unopened (i.e. it’s gone past its use by date before you’ve opened and used any of it)
- [ ] Often (once a week or more)
- [ ] Sometimes (once a month or more)
Part 2 – What do you think about the packaging?

1. When testing the product, how did you use it at home? (tick all that apply)
   - Cooked all of it in one go (from both sides)
   - Froze the whole pack
   - Used scissors to cut the pack, used the meat from one side and kept the rest (in the fridge) for another day
   - Used scissors to cut the pack in two, used the meat from one side but froze the other side (in original packaging)
   - Used the meat from one side, and froze the meat from the other side in alternative packaging e.g. freezer bag
   - Cooked it all but froze a cooked portion for later (batch cooking)
   - Used the meat from one side, kept the rest in the fridge or freezer for another day, but didn’t worry about using scissors to remove the empty half of packaging and just kept the whole pack intact

2. Do you have any comments on the following?
   a. Visibility of the meat inside the pack
   b. Pack size (i.e. pack weight) e.g. Would it fit in your fridge/freezer? Would you generally eat this size of pack in one go, in your household?
   c. Packaging (e.g. pack materials, shape, easy to open)
   d. Merchandising (how it will be displayed in-store)
   e. Labelling on-pack (is the benefit of the new format, detailed in the concept description above, clear to you?)
   f. Overall appearance
3. Taking everything into consideration, and leaving aside branding and welfare standards, how much do you like this pack?

- Love it
- Like it a lot
- Like
- Neither like nor dislike
- Dislike
- Dislike a lot
- Hate it

4. What do you like about the concept?

5. What do you dislike about the concept?

6. Do you think that this packaging concept would help you reduce your food waste?

- Definitely would have positive effect
- Same as now
- Definitely would not have positive effect

7. Would you buy chicken goujons in this packaging?

- Yes
- No
- Maybe

8. If you answered no, can we ask why not?

9. Do you have any other comments? E.g. do you think any other food products would benefit from being in a pack like this?
Appendix 4 Taste Team Prototype Results

Product: Chicken Goujons Packaging Concept

<table>
<thead>
<tr>
<th>Trading Area</th>
<th>Fresh Meat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type</td>
<td>Home Placement</td>
</tr>
<tr>
<td>Panel</td>
<td>Co-operative Employees</td>
</tr>
<tr>
<td>Respondents</td>
<td>32</td>
</tr>
<tr>
<td>Product Issue Date</td>
<td>July 08, 2010</td>
</tr>
<tr>
<td>Report Issued</td>
<td>July 27, 2010</td>
</tr>
<tr>
<td>Pass Criteria</td>
<td>Overall Liking &gt;= 6.50 (based on 9 pt scale where 1 = Dislike extremely and 9 = Like extremely)</td>
</tr>
<tr>
<td>Test Result</td>
<td>[Green Bar]</td>
</tr>
</tbody>
</table>

The co-operative food

Leatherhead Food Research
# Key Results Summary

## Chicken Goujons Packaging Concept

<table>
<thead>
<tr>
<th>Top 3 box score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Liking</td>
</tr>
</tbody>
</table>

# Special Questions Results Summary

## Chicken Goujons Packaging Concept

<table>
<thead>
<tr>
<th>Top 3 box score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
</tr>
<tr>
<td>Frequency of eating fresh meat</td>
</tr>
<tr>
<td>Frequency of throwing out opened meat</td>
</tr>
<tr>
<td>Frequency of throwing out unopened meat</td>
</tr>
<tr>
<td>Frequency to buy chicken goujons</td>
</tr>
<tr>
<td>Help reduce waste</td>
</tr>
<tr>
<td>Likely to eat this Size of Pack</td>
</tr>
<tr>
<td>Number of children</td>
</tr>
<tr>
<td>Reason to throw out meat</td>
</tr>
<tr>
<td>Type of fresh/raw meat</td>
</tr>
<tr>
<td>Ways of using the product</td>
</tr>
<tr>
<td>Willing for future contact</td>
</tr>
</tbody>
</table>
% Distribution of Scores - Overall Liking

<table>
<thead>
<tr>
<th>Rating</th>
<th>% Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislike extremely</td>
<td>0.00</td>
</tr>
<tr>
<td>Dislike very much</td>
<td>0.00</td>
</tr>
<tr>
<td>Dislike moderately</td>
<td>0.00</td>
</tr>
<tr>
<td>Dislike slightly</td>
<td>3.13</td>
</tr>
<tr>
<td>Neither like nor dislike</td>
<td>12.50</td>
</tr>
<tr>
<td>Like slightly</td>
<td>3.13</td>
</tr>
<tr>
<td>Like moderately</td>
<td>12.50</td>
</tr>
<tr>
<td>Like very much</td>
<td>43.75</td>
</tr>
<tr>
<td>Like extremely</td>
<td>25.00</td>
</tr>
</tbody>
</table>
% Distribution of Scores - Age group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>% Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>2.94</td>
</tr>
<tr>
<td>25-34</td>
<td>41.18</td>
</tr>
<tr>
<td>35-44</td>
<td>38.24</td>
</tr>
<tr>
<td>45-54</td>
<td>14.71</td>
</tr>
<tr>
<td>55+</td>
<td>2.94</td>
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</table>
Packaging design to reduce household meat waste

% Distribution of Scores - Frequency of eating fresh meat

<table>
<thead>
<tr>
<th>Frequency</th>
<th>% Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice per day or more</td>
<td>3.03</td>
</tr>
<tr>
<td>Once per day</td>
<td>24.24</td>
</tr>
<tr>
<td>3-4 times per week</td>
<td>33.33</td>
</tr>
<tr>
<td>1-2 times per week</td>
<td>33.33</td>
</tr>
<tr>
<td>Twice per month</td>
<td>6.06</td>
</tr>
<tr>
<td>Once per month</td>
<td>0.00</td>
</tr>
<tr>
<td>Never</td>
<td>0.00</td>
</tr>
</tbody>
</table>
% Distribution of Scores - Frequency of throwing out opened meat

- Often (more than once a week): 0.00%
- Occasionally (once a week): 6.25%
- Sometimes (once a month or more): 15.63%
- Rarely (less than once a month): 37.50%
- Never: 40.63%

Material change for a better environment
% Distribution of Scores - Frequency of throwing out unopened meat

- Often (more than once a week): 2.94
- Occasionally (once a week): 2.94
- Sometimes (once a month or more): 20.59
- Rarely (less than once a month): 35.29
- Never: 38.24
% Distribution of Scores - Frequency to buy chicken goujons

- Often (more than once a week): 0.00%
- Occasionally (once a week): 21.21%
- Sometimes (once a month or more): 42.42%
- Rarely (less than once a month): 27.27%
- Never: 9.09%
% Distribution of Scores - Reason to throw out meat

- Gone past use by date: 26.15%
- Meat gone off doesn't look right: 24.62%
- Not sure how long I've had it (e.g. if frozen): 3.08%
- Plans change just didn't have time to eat it: 15.38%
- Forgotten to freeze: 15.38%
- If I feel its not safe to freeze or eat: 10.77%
- Other: 4.62%
<table>
<thead>
<tr>
<th>Purchasing and using fresh meat</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you ever find you need to throw away whole, uncooked meat portions e.g. chicken breasts, lamb chops?</td>
<td></td>
</tr>
<tr>
<td>Base: All Respondents</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td><strong>Government Office Region</strong></td>
</tr>
<tr>
<td>Total</td>
<td>Male</td>
</tr>
<tr>
<td>1103</td>
<td>614</td>
</tr>
<tr>
<td><strong>Yes</strong> (Includes all comments of rarely, sometimes, often etc...)</td>
<td></td>
</tr>
<tr>
<td>509</td>
<td>194</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>494</td>
</tr>
<tr>
<td><strong>No, I freeze what I can’t use before they go off</strong></td>
<td></td>
</tr>
<tr>
<td>142</td>
<td>50</td>
</tr>
<tr>
<td><strong>No, I freeze the whole pack, defrosting as much as I need, when I need it</strong></td>
<td></td>
</tr>
<tr>
<td>273</td>
<td>33</td>
</tr>
<tr>
<td><strong>No, I cook some/all of the pack and freeze the cooked meat</strong></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>25</td>
</tr>
<tr>
<td><strong>N/A - Vegetarian</strong></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>23</td>
</tr>
<tr>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Would you buy a pack containing just one meat portion if it was available and not more expensive per kg than other packs containing more than one?

Base: Non-vegetarians

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Government Office Region</th>
<th>Marital Status</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Male</td>
<td>Female</td>
<td>Scot</td>
</tr>
<tr>
<td></td>
<td>1544</td>
<td>153</td>
<td>1052</td>
<td>142</td>
</tr>
<tr>
<td>Yes, definitely</td>
<td>457</td>
<td>143</td>
<td>315</td>
<td>108</td>
</tr>
<tr>
<td>28%</td>
<td>27%</td>
<td>20%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Yes, probably</td>
<td>385</td>
<td>130</td>
<td>256</td>
<td>32</td>
</tr>
<tr>
<td>23%</td>
<td>25%</td>
<td>21%</td>
<td>23%</td>
<td>23%</td>
</tr>
<tr>
<td>Unsure</td>
<td>37</td>
<td>15</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>3%</td>
<td>5%</td>
<td>2%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>Probably not</td>
<td>216</td>
<td>102</td>
<td>114</td>
<td>20</td>
</tr>
<tr>
<td>17%</td>
<td>17%</td>
<td>13%</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>Definitely not</td>
<td>440</td>
<td>140</td>
<td>205</td>
<td>34</td>
</tr>
<tr>
<td>27%</td>
<td>25%</td>
<td>20%</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>No, I already buy the bag of individually wrapped portions</td>
<td>33</td>
<td>13</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>5%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>It depends</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Packaging design to reduce household meat waste 64
### Why do you say that?

**Base: Non-vegetarians who are unsure / probably not / definitely not / "it depends" - buy just one meat portion**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Government Office Region</th>
<th>Marital Status</th>
<th>Widow</th>
<th>Divorced</th>
<th>Separated</th>
<th>Single</th>
<th>Married Cohabiting</th>
<th>Divorced</th>
<th>Separated</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>160</td>
<td>270</td>
<td>438</td>
<td>72</td>
<td>33</td>
<td>10</td>
<td>33</td>
<td>70</td>
<td>59</td>
<td>55</td>
<td>565</td>
</tr>
<tr>
<td>Single portion eaten enough for household (2 person/family)</td>
<td>44%</td>
<td>11</td>
<td>257</td>
<td>31</td>
<td>11</td>
<td>9</td>
<td>35</td>
<td>32</td>
<td>25</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>More economical to buy larger pack and split</td>
<td>15%</td>
<td>23</td>
<td>53</td>
<td>57</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>10</td>
<td>9</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Always buy in bulk and store in freezer</td>
<td>18%</td>
<td>28</td>
<td>66</td>
<td>5</td>
<td>1</td>
<td>12</td>
<td>4</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Never don't keep in freezer</td>
<td>12%</td>
<td>23</td>
<td>49</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Infrequent visits to shops not worth it</td>
<td>14%</td>
<td>6</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Buy in bulk (specified)</td>
<td>10%</td>
<td>12</td>
<td>30</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>More unnecessary packaging</td>
<td>4%</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Only buy meat from butcher</td>
<td>3%</td>
<td>5</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Just prefer to buy more unspc</td>
<td>6%</td>
<td>13</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>10</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Only if I need one at the time</td>
<td>5%</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>12</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Packaging design to reduce household meat waste
### Table 5.2

**Would any of the following help encourage you to freeze UNOPENED uncooked meat packs more?**

**Base: Non-vegetarians**

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Government Office Region</th>
<th>Marital Status</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>South East</td>
<td>Married Living Together</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>South West</td>
<td>Widowed Separated Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>West Midlands</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>East Midlands</td>
<td>Single No</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>East London</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>South</td>
<td>Single No</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>North West</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>North East</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Yorkshire</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Wales</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>NI</td>
<td>Single Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>A more visible indication that meat can be frozen on pack or at point of sale</td>
<td>531</td>
<td>186</td>
<td>345</td>
<td>39</td>
</tr>
<tr>
<td>Smaller packs that fit in the freezer</td>
<td>554</td>
<td>232</td>
<td>352</td>
<td>35</td>
</tr>
<tr>
<td>Flexible packs that fit in the freezer</td>
<td>617</td>
<td>224</td>
<td>393</td>
<td>51</td>
</tr>
<tr>
<td>Confirmation that it is safe to freeze meat</td>
<td>505</td>
<td>210</td>
<td>295</td>
<td>50</td>
</tr>
<tr>
<td>Confidence acknowledge about how to defrost meat</td>
<td>455</td>
<td>160</td>
<td>295</td>
<td>50</td>
</tr>
<tr>
<td>If knew that it wouldn't change the taste of the meat</td>
<td>532</td>
<td>130</td>
<td>402</td>
<td>42</td>
</tr>
<tr>
<td>If knew that it wouldn't change the texture of the meat</td>
<td>540</td>
<td>230</td>
<td>310</td>
<td>54</td>
</tr>
<tr>
<td>Missing longer to freeze than after purchase, i.e. if I forget to do it on the day I buy it</td>
<td>494</td>
<td>131</td>
<td>363</td>
<td>49</td>
</tr>
<tr>
<td>I don't want to freeze meat</td>
<td>450</td>
<td>115</td>
<td>335</td>
<td>48</td>
</tr>
</tbody>
</table>

**WRAP**

**Material change for a better environment**

Packaging design to reduce household meat waste
Would any of the following help encourage you to freeze OPENED uncooked meat packs more?

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sco</th>
<th>Ven</th>
<th>Wl</th>
<th>Ne</th>
<th>NW</th>
<th>York</th>
<th>Wst</th>
<th>Nth</th>
<th>Eas</th>
<th>Lanc</th>
<th>Sx</th>
<th>Sw</th>
<th>Single</th>
<th>Marri</th>
<th>Cohab</th>
<th>Divorced</th>
<th>Separated</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1554</td>
<td>591</td>
<td>963</td>
<td>142</td>
<td>72</td>
<td>27</td>
<td>66</td>
<td>164</td>
<td>49</td>
<td>162</td>
<td>156</td>
<td>52</td>
<td>60</td>
<td>93</td>
<td>27</td>
<td>159</td>
<td>315</td>
<td>69</td>
<td>168</td>
<td>356</td>
<td>447</td>
<td>157</td>
</tr>
<tr>
<td>A more noticeable indicator that meat can be frozen, on pack at point of sale</td>
<td>554</td>
<td>195</td>
<td>359</td>
<td>47</td>
<td>26</td>
<td>6</td>
<td>21</td>
<td>64</td>
<td>46</td>
<td>12</td>
<td>52</td>
<td>52</td>
<td>60</td>
<td>93</td>
<td>27</td>
<td>159</td>
<td>315</td>
<td>69</td>
<td>168</td>
<td>356</td>
<td>447</td>
<td>157</td>
</tr>
<tr>
<td>If the original packaging could be denied so I'm not trading unnecessary product</td>
<td>662</td>
<td>246</td>
<td>416</td>
<td>60</td>
<td>36</td>
<td>12</td>
<td>23</td>
<td>82</td>
<td>66</td>
<td>12</td>
<td>60</td>
<td>45</td>
<td>77</td>
<td>195</td>
<td>39</td>
<td>171</td>
<td>396</td>
<td>101</td>
<td>192</td>
<td>449</td>
<td>403</td>
<td>417</td>
</tr>
<tr>
<td>Flexible packs that fit in the freezer</td>
<td>662</td>
<td>226</td>
<td>436</td>
<td>57</td>
<td>31</td>
<td>12</td>
<td>12</td>
<td>73</td>
<td>76</td>
<td>51</td>
<td>55</td>
<td>16</td>
<td>73</td>
<td>104</td>
<td>33</td>
<td>165</td>
<td>356</td>
<td>10</td>
<td>177</td>
<td>446</td>
<td>386</td>
<td>407</td>
</tr>
<tr>
<td>Packaging in a suitable container that can be frozen the product in (won't get the original packaging)</td>
<td>662</td>
<td>226</td>
<td>436</td>
<td>57</td>
<td>31</td>
<td>12</td>
<td>12</td>
<td>73</td>
<td>76</td>
<td>51</td>
<td>55</td>
<td>16</td>
<td>73</td>
<td>104</td>
<td>33</td>
<td>165</td>
<td>356</td>
<td>10</td>
<td>177</td>
<td>446</td>
<td>386</td>
<td>407</td>
</tr>
<tr>
<td>Confirmation that it is safe to freeze meat</td>
<td>662</td>
<td>226</td>
<td>436</td>
<td>57</td>
<td>31</td>
<td>12</td>
<td>12</td>
<td>73</td>
<td>76</td>
<td>51</td>
<td>55</td>
<td>16</td>
<td>73</td>
<td>104</td>
<td>33</td>
<td>165</td>
<td>356</td>
<td>10</td>
<td>177</td>
<td>446</td>
<td>386</td>
<td>407</td>
</tr>
<tr>
<td>Confidence/knowledge about how to defrost meat</td>
<td>662</td>
<td>226</td>
<td>436</td>
<td>57</td>
<td>31</td>
<td>12</td>
<td>12</td>
<td>73</td>
<td>76</td>
<td>51</td>
<td>55</td>
<td>16</td>
<td>73</td>
<td>104</td>
<td>33</td>
<td>165</td>
<td>356</td>
<td>10</td>
<td>177</td>
<td>446</td>
<td>386</td>
<td>407</td>
</tr>
<tr>
<td>Having longer to freeze than after purchase, i.e. if I forget to do it on the day buy it</td>
<td>662</td>
<td>226</td>
<td>436</td>
<td>57</td>
<td>31</td>
<td>12</td>
<td>12</td>
<td>73</td>
<td>76</td>
<td>51</td>
<td>55</td>
<td>16</td>
<td>73</td>
<td>104</td>
<td>33</td>
<td>165</td>
<td>356</td>
<td>10</td>
<td>177</td>
<td>446</td>
<td>386</td>
<td>407</td>
</tr>
</tbody>
</table>