During April to June, 2012, Leatherhead Food Research was commissioned by WRAP to carry out a feasibility study into product life determination practices within the retail supply chain. This note summarises the findings from their work.
WRAP’s vision is a world without waste, where resources are used sustainably.

We work with businesses, individuals and communities to help them reap the benefits of reducing waste, developing sustainable products and using resources in an efficient way.

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**Purpose**

The feasibility study examined how manufacturers and retailers set product life and how much of this time is taken within the supply chain. Cheddar cheese and yoghurt were chosen as worked examples.

The study aimed to determine data availability and the potential for investigating product life on a wider scale as well as lessons that might be drawn on feasible ways to extend shelf life without compromising food safety. It also aimed to identify mechanisms that could be employed to reduce waste through the management of shelf life.

**Method**

Four manufacturers of cheddar cheese and yoghurt were independently visited and interviewed using a structured questionnaire that was designed to explore actual and anecdotal practices. This allowed comparison within their product range. Key control points used in the manufacture of cheddar and yoghurt were identified and, for both products, potential spoilage mechanisms.

Alongside the interviews, 67 responses were received through a wider on-line survey that was conducted to generate a broader understanding of the appetite for shelf life extension and an understanding where these could be made and how these could be facilitated.

**Findings**

(1) **Cheddar cheese**

The durability indication for cheddar cheese is a ‘Best Before’ date and therefore the shelf life is primarily based on organoleptic considerations. Interviewees stated that the product is not tested in the laboratory because good historical data exists relating to the survival of pathogens and the safety of the product. Historical and experiential information is used to determine the shelf life of the product in most cases. This is validated annually through due diligence shelf life testing, which because of the nature of the product, tends to be done on a rolling real-time basis.

The table shows the shelf life for cheddar cheese of different maturity provided by interviewees.
<table>
<thead>
<tr>
<th>Maturation (months)</th>
<th>Actual shelf life (days)</th>
<th>Maximum shelf life (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light/Mild cheddar</td>
<td>4-6</td>
<td>70</td>
</tr>
<tr>
<td>Mature/Extra Mature</td>
<td>8-12</td>
<td>84</td>
</tr>
<tr>
<td>Vintage</td>
<td>18-36</td>
<td>90</td>
</tr>
<tr>
<td>Deli block</td>
<td></td>
<td>196</td>
</tr>
<tr>
<td>Grated cheese</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Shelf life is always set cautiously. There is a buffer of around 15% between actual and maximum life. The maximum life is determined through shelf life testing and the point of failure - the identification of specific quality failure markers. These may be organoleptic changes as the product taste changes with time, which is an issue for products that are aged to develop particular taste characteristics, or visual in the case of surface mould growth. The actual life will be determined by the reduction of the maximum life by a specific factor such as 15% that is based on historical or in-house knowledge.

This buffer between actual and maximum product life is seen as essential for retention of quality, reputation and brand image. The difference between the total life and the maximum life is a factor determined by the manufacturer and/or retailer to ensure that the product is at its maximum quality at the end of its life. It is used to retain consumers’ trust in the product, in that the product is always in perfect condition when bought and consumed. It is also thought to allow the product to withstand some of the storage abuses it may undergo whilst in transit from store to home and within the home itself.

Retailers to whom interviewees were supplying were consistent with their requirement for 75% of the remaining actual shelf life into their own depot systems. The cheddar manufacturers supplied shelf life justification data to the retailers, which in most cases was accepted and a standard life across products was applied (though major exceptions were found).

There is always pressure to extend shelf life in order to achieve the best possible logistical and supply chain advantages, in particular for exported products where 12 months life is required. The biggest factors to consider in this process are quality and brand protection, as there needs to be a cut-off point that would balance these risks. Any shelf life extension would be acceptable to the industry provided that the 15% buffer between actual and maximum life was retained.
(2) Yoghurt

The durability indication for the yoghurts produced by interviewees were 'Use By' or 'Best Before' although in both cases product failure was quality related and the products were micro-biologically stable suggesting that a 'Use By' indication is not required.

The table below shows yoghurt shelf lives provided by interviewees.

<table>
<thead>
<tr>
<th></th>
<th>Actual shelf life (days)</th>
<th>Maximum shelf life (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoghurt</td>
<td>30/32</td>
<td>40</td>
</tr>
<tr>
<td>Yoghurt with fruit</td>
<td>28</td>
<td>37</td>
</tr>
<tr>
<td>'Value' yoghurt</td>
<td>28</td>
<td>37</td>
</tr>
</tbody>
</table>

The maximum shelf life for yoghurt products is typically 20%-25% greater than the actual life. The maximum life is determined through shelf life testing and the point of failure identified by specific quality failure markers which may be organoleptic changes or visual changes in the case of whey separation. The actual life will be determined by the reduction of the maximum life by a specific factor, such as 25%, that is based on historical or in-house knowledge.

Interviewees determine shelf life based on experience, but due diligence testing of all SKUs is carried out throughout the year. Some ‘abuse testing’ is applied and sensory, microbiological and physical testing (total solids & pH). In general, the retailers are led by the expertise of the manufacturer and the same shelf life is applied to similar products across the retail sector (with certain exceptions).

Again, retailers are consistent with their requirement for 75% of actual shelf life remaining into their depots.

Brand integrity was a key reason for not extending shelf life. Some competitor yoghurt products have shorter shelf lives than those in this study, possibly to create an image of greater freshness.

(3) Summary

The shelf life for both products was set by quality parameters regardless of the durability indication given. Complaints or consumer trust were given as the primary factors considered when evaluating the risk of shelf life extension. This was supported by the on-line survey which showed that brand integrity was the most significant factor in setting an actual life that was shorter than the maximum life. However ‘brand integrity’ was typically defined by the companies without recourse to consumer
validation, though taste panels may be used to provide information on sensory changes the product may undergo over life, preference testing is not common.

Shelf life determination is built on experience and validated through continual due diligence testing programmes. This, however, was not used to challenge or change shelf life of products and it is thought that a status quo exists.

**Conclusions**

- Current scientific knowledge is sufficient to determine the total product life, whether it is determined through quality or safety failures. This can be combined with consumer techniques that can clarify and quantify the acceptability of products at end of life, where quality is the overarching factor, and so define the optimum product life. As some of the primary concerns raised related to brand identity and trust, it is important to understand the consumers’ view of when a product is deemed to ‘fail’ when quality is being judged.

- The actual life of the product is determined typically by calculation against the product’s total life, for example 15-25% less than the total life of the product. The total life of the product is determined through experience or validation against guidelines set by trade associations, for example. This buffer was considered essential to maintain brand integrity and trust, as it works to ensure that products are consumed in optimum condition.

- Shelf life was found to be consistent across retailers – though exceptions existed and ‘different’ shelf lives were also given to products for export markets.

- Retailers are consistent in requiring 75% of life into depot, though evidence from interviewees suggests that product is delivered with the remaining life far exceeding 75%. Reduction in supply chain inefficiencies were considered critical though improvements were unlikely to provide a longer shelf life to consumers compared with other opportunities. The evidence shows that manufacturing is carried out to forecast and improvements could reduce ‘over-production’.

There is appetite for extending shelf life but not at the expense of brand integrity or quality. These quality parameters are brand and product-specific and based on historical and perceived expectations of the product. Packaging innovations followed by manufacturing and product advancement were identified as key opportunities for extending shelf life.