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SID 5 Research Project Final Report

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Executive Summary

7. The executive summary must not exceed 2 sides in total of A4 and should be understandable to the intelligent non-scientist. It should cover the main objectives, methods and findings of the research, together with any other significant events and options for new work.

This research was commissioned and funded by Defra. The views expressed reflect the research findings and the author's interpretation. The inclusion of or reference to any particular policy in this report should not be taken to imply that it has, or will be, endorsed by Defra.

This project aimed to develop a refillable packaging system for 'body wash' and to investigate its feasibility with respect to consumer acceptance (female customers, aged 21-40) and sustainability improvements.

This was achieved by completing six objectives:

- Objective 1: To investigate current consumer perceptions of refills and refillable packaging.
- Objective 2: To identify organisational, cultural and other barriers to the adoption of refillable packaging.
- Objective 3: To identify opportunities for refillable packaging within the personal care market.
- Objective 4: To demonstrate the feasibility of refillable packaging by developing a range of product service concepts for one product in the personal care market.
- Objective 5: To gauge feasibility by testing at least one concept with consumers and Boots.
- Objective 6: To identify generic lessons for the use of refillable packaging in industry.

A broad range of qualitative methods were used to collate background understanding, develop design concepts and test the viability of the design solutions. These included a literature review, market analysis, consumer questionnaire, visual templates, analysis workshops, ideas generation workshops, consumer focus groups, and environmental analysis. The data was generally qualitative in nature and as such was analysed using a coding and clustering methodology. (See Appendix 4 for more details).

A number of interesting findings emerged from the project. Selected findings will be presented here, along with references to the documents where more information can be found.

- Prior to the project, refills were often considered under a single heading. Treating all refills in a similar way assumes that they have similar attributes and consumer interactions. During the early stages of this research project it became apparent that there are a wide range of refillable packaging approaches. Through a market analysis and a literature review, sixteen different types of refillable packaging were identified and classified with respect to their delivery mechanism, and the level and nature of their consumer/business interaction (see Appendix 1).
- An understanding of consumer perceptions to refillable packaging and the potential for using refills to reduce packaging waste. Most specifically, a number of attributes which affect consumer satisfaction were identified, as were factors which encourage the purchase of refills (see Appendix 2). These could be useful in guiding the future development of refillable packaging.
- A clearer understanding of the drivers and barriers which affect the success or failure of different refillable packaging systems was obtained, as well as insights into how to overcome these barriers, see Appendix 3.

- Three 'real life' refillable packaging prototypes (named 6a, 6b and 6c) were developed and evaluated with consumers through focus groups (see Appendix 4). The consumer discussions led to a better understanding of the design elements which may lead to the success or failure of a product. Findings related to perceived value; cost vs. size; communication; functional requirements; and marketing issues (see Appendix 5).
- All three refillable packaging systems developed and tested during the project led to large environmental savings over a 6 month period (if used as intended) when compared with the existing tube of shower gel (see Appendix 5). This demonstrated that refillable packing has the potential to reduce household waste in line with DEFRA's research interests, which are outlined in programme area 1.3(ii) of the Waste and Resources R&D Strategy document.
- There was little difference in the environmental impact of the two prototypes favoured by the focus groups.
- Insights were gained into the general use of refills, and more specifically the types of refills in which a concentrate is mixed in the original packaging. Additional findings into the use of refills in the personal care market were also generated (see Appendix 5).
- If refillable packaging is designed carefully and applied to appropriate products, it has the potential to reduce household waste. In order to be successful, refills must benefit the consumer, business and the environment. This means that both consumer and environmental requirements need to be explicitly included in the design brief.

The results of this project have been broadly disseminated through academic journals, conference papers, presentations, reports (see section 9) and recorded on the project website – www.refillable-packaging.org.uk. They have been used to inform the retail and packaging industry about refills, and to drive the development of new markets for refillable packaging systems. The generated data can be used to inform policy makers and funding bodies about the suitability of using refills in this way; to reduce waste and improve customer convenience.

Project Report to Defra

8. As a guide this report should be no longer than 20 sides of A4. This report is to provide Defra with details of the outputs of the research project for internal purposes; to meet the terms of the contract; and to allow Defra to publish details of the outputs to meet Environmental Information Regulation or Freedom of Information obligations. This short report to Defra does not preclude contractors from also seeking to publish a full, formal scientific report/paper in an appropriate scientific or other journal/publication. Indeed, Defra actively encourages such publications as part of the contract terms. The report to Defra should include:
- the scientific objectives as set out in the contract;
 - the extent to which the objectives set out in the contract have been met;
 - details of methods used and the results obtained, including statistical analysis (if appropriate);
 - a discussion of the results and their reliability;
 - the main implications of the findings;
 - possible future work; and
 - any action resulting from the research (e.g. IP, Knowledge Transfer).

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1. Introduction

This report presents the background which led to the project, outlines the methodologies used to better understand refillable packaging systems and summarises the findings which have emerged from a 2 year collaboration between Loughborough University and Boots.

The overall aim of the project – 'Refillable Packaging Systems' - was to develop refillable packaging systems and to investigate their feasibility with respect to consumer acceptance and sustainability improvements. The following report summarises the methods used and findings obtained under each of the six project objectives. All related internal reports and publications are cited throughout the report for further information.

2. Background to the project

In recent years the environmental impact of packaging has become a prominent issue in the UK as it is a very visible product in the waste stream, making up around one-third of household rubbish [E1]. Each year, we generate about 100 million tonnes of waste from households, commerce and industry. Packaging waste arisings now total over 10 million tonnes per annum and are predicted by the industry to continue to rise [E2]. The introduction of the European Packaging and Packaging Waste Directive in 1994, which requires Member States to ensure that all packaging placed on the EU market complies with certain 'essential requirements' has made packaging a more important issue for consideration in many businesses. Over the past 40 years considerable efforts have been made to reduce the environmental impacts of packaging by focusing on issues such as light-weighting and material selection [E3-E4]. However, although these redesign approaches are commendable and should be encouraged, they are not having a radical effect on the impact of packaging. Whilst the weight of packaging per unit of product has decreased, demographic and lifestyle changes such as smaller family size and a demand for greater convenience [E5] have led to increases in the total amount of packaging used. A key report by the Environmental Services Association [E6] identified that in 2003, the total packaging waste going to landfill in the UK rose to over 10 million tonnes per annum. The use of refillable packaging has long been cited as a possible solution to this problem and Defra's recent Waste Strategy for England report also states that most products should be re-used where possible [E2]. However, in the past, attempts to extend the use of refillables beyond a few traditional areas have met with little success and as of mid 2003 no major retailers in the UK operated any schemes in the reuse of primary packaging [E7]. However, prior to this research there had been no explicit recognition of the fact that there are many different types of refillable packaging approaches which can be differentiated in terms of their delivery mechanism and relationship to the consumer/industry – this project identified 16 different types though it is anticipated that it is possible to consider packaging in such a way that there even more [12]. As such reflections relating to refillables have tended to be based on generalisations.

It was felt that recent progress in the field of 'product service systems' might offer an opportunity to readdress the opportunities anticipated by refills. In light of this, the project 'Refillable Packaging Systems' (DEFRA WR0113) set out to develop refillable packaging systems using a product service system approach, and to investigate their feasibility within the personal care market.

3. Methodology

In order to achieve the aim and objectives of the project a broad range of qualitative methods were used to collate background understanding, develop design concepts and test the viability of the design solutions. These methods are summarised in Figure 1 and presented in detail in Appendix 4.

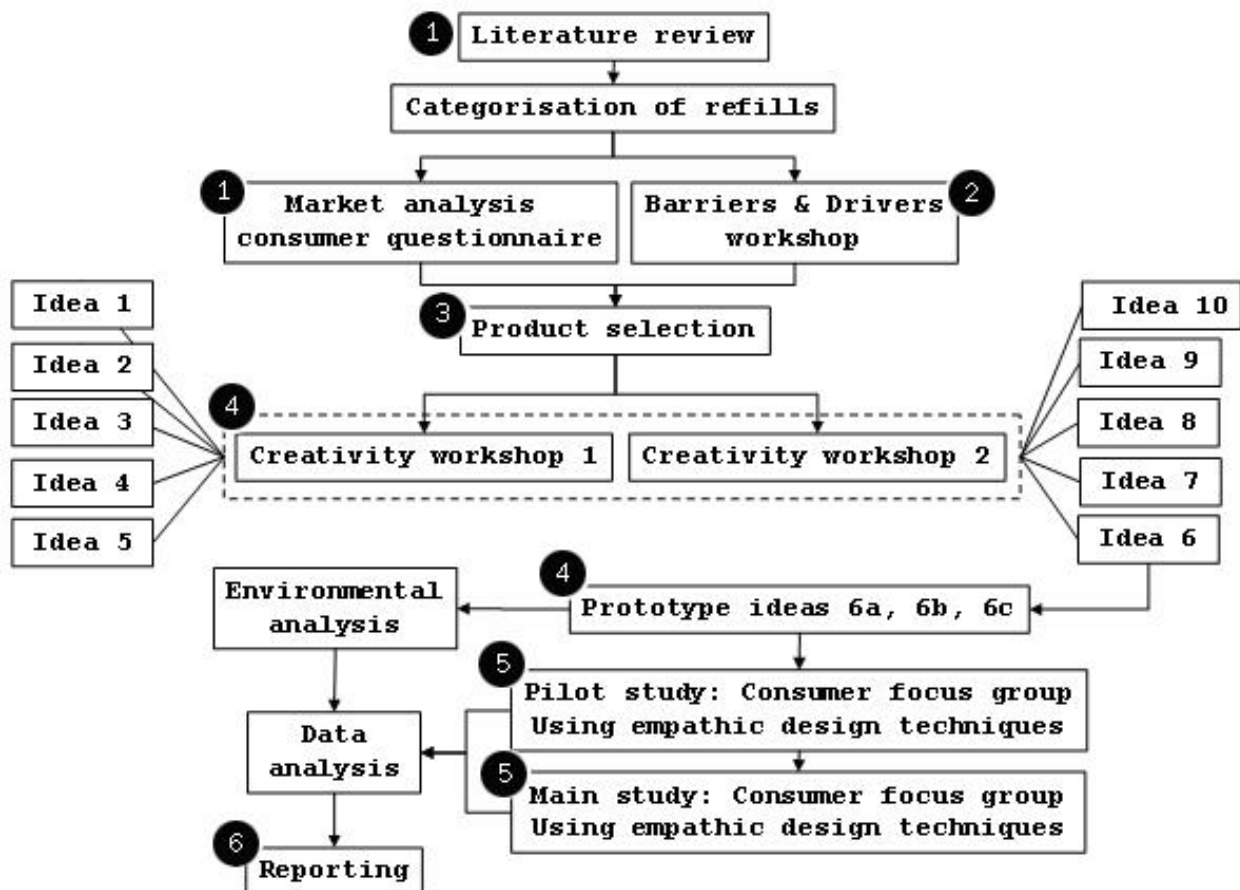


Figure 1 Summary of the main stages of the project and the relating objectives

4. Consumer perceptions of refills and refillable packaging

A standard literature review was carried out to identify the state of the art level of understanding with regards to refillable packaging. In conjunction with this a market analysis aimed at identifying the different types of refills available, was carried out.

On the understanding that a person's 'perception' of refills and refillable packaging is their **interpretation** of how refills and refillable packaging perform and effect their receipt of particular functions, five key questions that would enable a more detailed understanding of consumers experiences to be developed, were identified:

- Are consumers especially aware of refills?
- What types refills do consumers have experience of buying/using?
- Which types of refills lead to consumers having positive experiences and which lead to consumers having negative experiences?
- Do consumers actively seek out refills or actively avoid them – why?
- How broad are people's experiences of refills?

In order to investigate consumer perceptions of refills a questionnaire which investigated these five questions was developed, piloted on 15 participants, refined and delivered to 200 volunteers via the *Boots Evaluation Suite* (<https://www.bootsvolunteers.com>). The people who use the Evaluation Suite are volunteers who are intended to represent a cross section of society. In total 120 questionnaires were picked up and 89 were returned, which equates to a 74.2% return rate which is significantly higher than the average survey response rate of 8% recognised in the methodology literature (Robson, 2002). 60.8% of the respondents were female. The participants ranged in age from 21 to 70+.

Data was collected using a five point Lickert scale from very bad to very good to enable consumers to rate their experiences of different types of refill approaches. In addition respondents were encouraged to detail why they had answered in a particular way. This provided some interesting insights and some rich data.

Analysis was carried out using 'coding and clustering', a common procedure for analysing qualitative data, and was selected as the most appropriate method of analysis as it allows the researcher to derive meaning from words and build theory from data [E8-E9]. Internal validity was adhered to by the process of pattern matching and explanation which took place during the data analysis [E10].

Results

A review of the literature identified that although there is a useful body of work on consumer attitudes of packaging [E11] and consumer perceptions of green or environmental packaging [E12-E13], there is little evidence of investigation into consumer perceptions of refills or refillable packaging.

Through the market analysis the team recognised that there are many different types of refillable packaging, but that this was not immediately obvious to the layperson. It was quickly recognised that this might lead to some confusion when trying to engage with customers about their experiences with refills. It was important that participants did not immediately associate one particularly good or bad experience with *all* refills without being aware of the different types of systems available. The importance of needing to unpick their experiences carefully was identified. Through the market analysis and literature review, sixteen different types of refillable packaging were identified and classified with respect to their delivery mechanism and the level and nature of their consumer/business interaction. For an overview of these 16 types of refills see Appendix 1.

The market analysis also identified a number of attributes which lead to the consumer having either a positive or negative experience of refills (Table 1), as well as the reasons why consumers actively buy refills (Table 2).

Table 1 Attributes leading to a positive and negative experience of refillable packaging

<i>Attributes leading to a positive experience</i>	<i>Attributes leading to a negative experience</i>
Good product quality	Expensive refills in giveaway parent pack
Convenient delivery	Inconvenience / requiring additional planning
Good value	Take up more space
Less packaging and or product waste	Hassle of maintenance
Easy to use	Increased waste
Clean and hygienic	Poor product quality
Takes up less space	Bad delivery
Light to transport	Bad quality packaging
No mess	'Fiddly' to refill
Cheap	Concerns over how long refill will be available for
Quick to use/refill	Incompatibility between systems
Incentives / rewards for use	
Suitability for purpose	

Table 2 Reasons why consumers actively buy refills

<i>Practical</i>	People without cars report specifically buying refills because they are smaller, lighter and easier to carry home. They take up less room. Ease of use/delivery.
<i>Brand related</i>	Product quality. They have had a good past experience. Already engaged with and like the brand being sold as a refill.
<i>Environmental</i>	To reduce waste and/or actively reduce the amount of stuff they buy. Altruism or the desire to be environmentally friendly as long as this is linked with product quality, and/or cost.
<i>Other</i>	They are fun. They are considered the 'norm'. Cost as long as this is linked with product quality. There is a clear reason why the product is sold as a refill.

In terms of costs, customers seemed to have one of two perceptions when it came to refills, either that they *are* cheaper or that they *should* be cheaper than the 'original' product. Of the 69 participants who commented specifically on the convenience of refills. 36% felt they were convenient or very convenient. The main features, identified by respondents, which made refillable packaging more convenient were:

- cost effectiveness
- quick and easy to use
- lighter and more easily transported
- created less waste
- less bulky

- delivered in a convenient way
- specifically suited to the purpose and nature of the product (e.g. single use camera)
- better environmentally

Among the factors which were deemed to make refillable packaging inconvenient, were:

- required organisation
- more expensive
- time consuming
- some poor quality
- inability to change brand / choice
- hard to find / discontinued or not stocked locally

In recognition of the fact that a previous study with Boots customers indicated that they did not understand what was meant by sustainability, within the questionnaire respondents were asked whether they considered refills to be (1) environmentally friendly and (2) socially responsible, effectively breaking sustainability into its core constituents, so that we could establish how they felt about packaging with respect to these issues. The majority of respondents stated that they felt that refillable packaging was better for the environment. The key reasons that were identified by consumers to support this belief were that they:

- use less material,
- generate less waste to go to landfill,
- have less impact through manufacturing,
- reduce the amount of different containers going into shops.

Those respondents that reported they felt refills were more socially responsible cited the environmental reasons listed above as to why this was so. Rather than issues typically associated with social responsibility such as inclusivity, safety and reducing consumption levels.

5. Organisational, cultural and other barriers to the adoption of refillable packaging

The types of drivers and barriers associated with existing refills, from a business perspective were also investigated. In addition to the literature review a 'Drivers and Barriers' workshop held at Boots head office was set up to tap into the expertise of Packaging and Environmental Compliance and Product Bank (the future forecasting arm of Boots). The different refill approaches (see Appendix 1) were analysed to identify potential organisational and sustainability drivers and barriers. A visual template was used to facilitate a conversation about the different drivers and barriers associated with each of the categories (Figure 2). The aim of the template was to use the sections to record different drivers and barriers associated with refills, from a business perspective. The participants' discussion would be recorded with post-it notes which would be secured to the template. For fuller details see Appendix 3. The resulting data was analysed in conjunction with the findings from a literature survey, observations from retail outlets and on-going discussions with different elements of the supply chain, engaged with at conferences such as WASTE 2006.

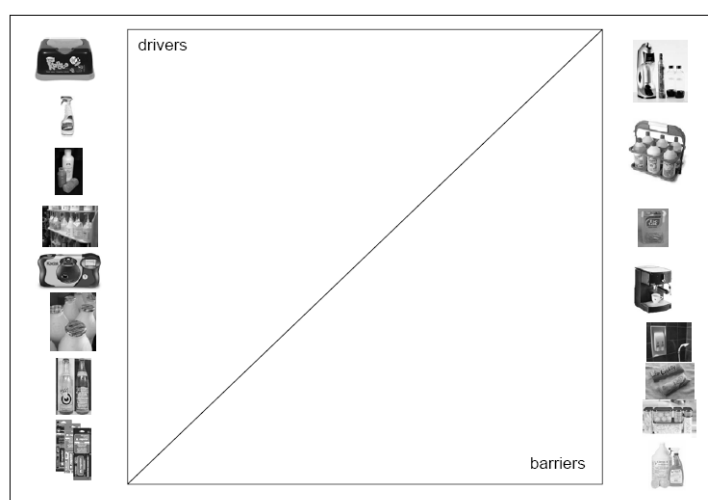


Figure 2 Electronic representation of the template used in the 'Drivers and Barriers' workshop at Boots

Results

It was found that many of the different types of refill had similar drivers and barriers. The drivers associated with the different types of refillable packaging are summarised in Table 3. The barriers associated with the different types of refillable packaging are summarised in Table 4.

Table 3 A summary of the drivers associated with different types of refills

Driver	Type of refill							
	Lightweight self contained refill delivered through dispenser	Self dispense	Original packaging swapped for new product	Deposit system	Top up card	Dispensed concentrate	Dispensed product	Concentrate mixed in original packaging
Reduced resource depletion	◆	◆	◆	◆	◆	◆	◆	◆
Reduced impact of distribution	◆				◆	◆	◆	◆
Reduction in the amount of waste going to landfill	◆	◆	◆	◆	◆	◆	◆	◆
Demonstrates responsible behaviour		◆	◆	◆			◆	
Reduces packaging costs	◆	◆		◆	◆		◆	◆
Encourages customer loyalty	◆			◆	◆	◆	◆	◆
Provides marketing opportunities	◆				◆	◆	◆	◆
Offers the opportunity to use reverse vending machines			◆	◆				
Policy requirements such as landfill tax escalator & the Landfill Allowance Trading Scheme (LATS) ¹	◆	◆	◆	◆	◆	◆	◆	◆

¹ The landfill tax escalator and the introduction of the Landfill Allowance Trading Scheme (LATS) has created sharp incentives to divert waste from landfill (Defra, 2007).

Table 4 A summary of the barriers associated with different types of refills

Barriers	Type of refill							
	Lightweight self contained refill delivered through dispenser	Self dispense	Original packaging swapped for new product	Deposit system	Top up card	Dispensed concentrate	Dispensed product	Concentrate mixed in original packaging
Possible loss of brand lock-in	◆							◆
Increased stock-keeping units	◆	◆		◆		◆		◆
Increased costs of two manufacturing systems	◆					◆	◆	◆
Possible increase in use of resources	◆	◆		◆		◆		
Health and safety risks		◆						◆
High initial cost and difficulty in maintaining enduring appeal						◆	◆	
Possible inconvenience of maintaining system		◆	◆			◆		
Dependency on technology					◆			
Need for financial incentive				◆				
Perceived as old fashioned		◆		◆				
Costs of refilling, returning, cleaning or refurbishing packaging		◆		◆				

6. Opportunities within the personal care market for refillable packaging

The decision to explore refillable packaging opportunities within the personal care market was made as the result of a number of collaborative meetings between the team members at Boots (Environment, Product Bank, Product development, and Marketing functions) and Loughborough.

Boots wanted to focus on a standard product because it was felt that this provided opportunities for learning to be rolled out most easily in the future. In the end ‘body wash’ was chosen for two practical reasons. It was felt that body wash gave opportunities for creative interpretation and also recognised that the formulation of body wash could be tweaked to accommodate a number of potential delivery approaches.



Figure 3 The original 200ml Botanics shower gel tube

Botanics was chosen because the brand manager was strongly supportive of refillable packaging, and the brand was about to undergo a face lift. It was felt that the project offered an opportunity for some new creative input. The existing product is illustrated in Figure 3.

After a programme of market analysis looking at target groups such as the 'young family', the 'cosmopolitan' purchaser etc. it was decided that the audience should be kept as broad as possible. For this reason, women aged 21-40 were focused upon.

7. Development of a range of product service concepts for the Botanics shower gel to demonstrate the feasibility of refillable packaging

7.1 Creative idea generation workshops

Two half day creative workshops were run to help facilitate the creation of potential refillable packaging system concepts for body wash products for the Botanics range at Boots. The key challenge of developing the creative workshop was to determine how to encourage the participants to think about the different types of refills available, outline the attributes of body wash products, feed in other sources of inspiration, and provide the group with the time to generate ideas which met the refillable packaging systems brief. In order to meet these requirements, a series of activities, generated from a range of external stimulus [E14-17] were combined together to create the 'creative workshop'. Full details are provided in Appendix 4.

The first of the two workshops, was run at Boots Head office in Nottingham, UK with a multidisciplinary group from Boots and Loughborough University, the second workshop was run at Loughborough University with a multidisciplinary group of experts in sustainability and packaging design.

7.2 Developing concepts for testing

Sixteen different ideas emerged from the two creative workshops and were disseminated to the participants via email. The findings from the workshops were also compiled, developed and presented to Boots for evaluation. Several ideas emerged as having potential, but specifically 'Dissolvable Test Tube' and 'Snip Test Tube' two variations on a theme were identified to be carried forward into the prototyping and consumer testing stages.

A period of development work followed which involved a number of testing mock ups to progress the concepts towards working prototypes. This period of development mainly took place at Loughborough University, however the Boots packaging technologist was also involved at a number of stages and the team also took advice from *Clarifoil* (www.clarifoil.com), who supplied the soluble materials for idea 6a (see below).

This work resulted in the development of three working prototypes which are referred to as Ideas 6a, 6b and 6c, and shown in Figures 4, 5 and 6.



Figure 4 Idea 6a – Dissolvable sachet containing concentrate, mixed with water in pump bottle and delivered through pump bottle

Blended polymer tube with PP snap fit lid



Pump bottle with PET bottle and PP lid with pump made from a variety of materials

Figure 5 Idea 6b - concentrate delivered in tube refill mixed with water in pump bottle and delivered through pump bottle

Pump bottle with PET bottle and PP lid with pump made from a variety of materials.



3-layer laminate sachet of PET/AL/PP film.

Figure 6 Idea 6c - concentrate delivered in sachet, mixed with water in pump bottle and delivered through pump bottle

8. Prototype testing with consumers and Boots to gauge feasibility.

Once the three prototypes had been developed, it was felt that an essential aspect of the research was to test them on consumers. We wanted to know what consumers felt about each of these prototypes, and we also wanted to determine what consumers instinctively knew, and what they needed to be told about these refillable packaging systems. In order to test the feasibility of the different concepts with typical Botanics customers (females, aged 21-40), a consumer focus group workshop, drawing on empathic design techniques [E18], was developed. A pilot study was run with seven women recruited through *The Boot's Evaluation Suite*, then the process was refined before the main study was carried out.

The focus group programme was designed to encourage as much interactive behaviour as possible. To achieve this it consisted of a number of different activities, each with a specific objective (Figure 7).

Both focus groups were video and audio taped to allow the researchers to interact with the participants without having to physically record data. This also allowed the researchers to leave the room on occasions to allow the participants to talk freely about their experiences and thoughts.

The consumer focus groups were developed in order to get close to the customer and really find out what they thought about the prototypes. Interactive behaviour was encouraged as much as possible; there was a point of display for the participants to look at and to select products from and a sink unit available so that they go through an actual refilling process. Participants were observed handling the prototypes and asked open ended questions about each prototype. Opportunities to listen to the 'murmur' of the participants were

created, so that their opinions about the product could be captured, even when they were not being asked a question directly.

Activity...	Reason...	Guidance...
Introductions Initially meet in Evaluation suite for coffee / badges / introduction to people & activities/ warm up activity	Set the scene and cover the legal bits Aim to get them talking	[Introductory activity]
Activity: Point of sale In annex participants are discretely filmed looking at the point of sale unit.	Video analysis will show 1 st impressions of proposal	
Activity: Filling 6b <ul style="list-style-type: none"> Participants are asked to follow the instructions on the back of the bottle to fill the refill... Participants filmed whilst carrying out the refill activity. 	Do they understand the instructions? What problems (if any) do they have? Do they like the foam? Cleanliness?	[Introduction to filling 6a]
6b: Discussion Group discussion around refill approach 6b	What do they think of the process? Empty bottle? Tap water? Pricing?	[Discussion topics]
Activity: Filling 6a <ul style="list-style-type: none"> Participants are asked to follow the instructions on the back of the bottle to fill the refill. Participants filmed whilst carrying out the refill activity. 	Do they understand the instructions? What problems (if any) do they have? Cleanliness?	[Introduction to filling activity 6a]
6a: Discussion Group discussion around refill approach 6a	What do they think of the process? Plastic dissolving? Pricing? Frequency?	[Discussion topics]
Closing		

Figure 7 Summary of consumer focus group activities

Results

In general consumer feedback was positive but it was clear these types of refills MUST be delivered in the right way. They must promote the positive attributes and mitigate against the negative attributes summarised in Table 1. The key findings from the consumer focus groups are presented below, however a number of additional findings can be found in Appendix 2.

Perceived value

Even though the three refill approaches produced the same amount of shower gel which was delivered in exactly the same manner, the different refill approaches evoked very different responses from the participants involved in the focus groups.

- *Idea 6a:* The dissolvable refill system was perceived as having high added value. The participants thought it would be best marketed as a pampering product, or one that you would give as a gift.
- *Idea 6b:* Participants were unhappy with the residue left in the refill tube and all felt that it was over-packaged for something so disposable. They wanted to drain ALL of the contents out of the refill, otherwise they felt that they were wasting products. As a result of such negative feedback idea 6b was dropped after the pilot study.
- *Idea 6c:* The sachet system provoked mixed responses, ranging from the perception of it being cheap and cheerful, to it being perceived as a high end product. This was due to consumers relating it to different products such as cheap testers and samples, or to more luxurious face masks.

Cost / size relationship

During the study we identified an interesting relationship between the cost and size of refills, which had not previously been recognised in the literature. If a refill is too small and looks 'medium end', consumers are not willing to pay much for it. However if it is really small and packaged well then they will pay more for it – like a diamond. During discussions with Arno Melchior, Global Packaging Director at Reckitt Benckiser, we realised that they have also experienced this and decided NOT to concentrate their products as much as they could as it makes them too small to sell. Discussions between Boots and Unilever also served to confirm this finding.

Effective communication

Effective communication was found to be critical to the success of refillable packaging systems during the consumer focus groups. Labelling and packaging must clearly communicate:

- That the refill is a concentrate.
- Why addition of water is necessary
- What the packaging is made of and what to do with it at end of life.
- Exactly how to carry out the refill process.
- How the formula will mix and how long it will take.
- Full use instructions.
- How long the product will last for.

An example of the final labels used during the consumer testing is shown in Figure 8.

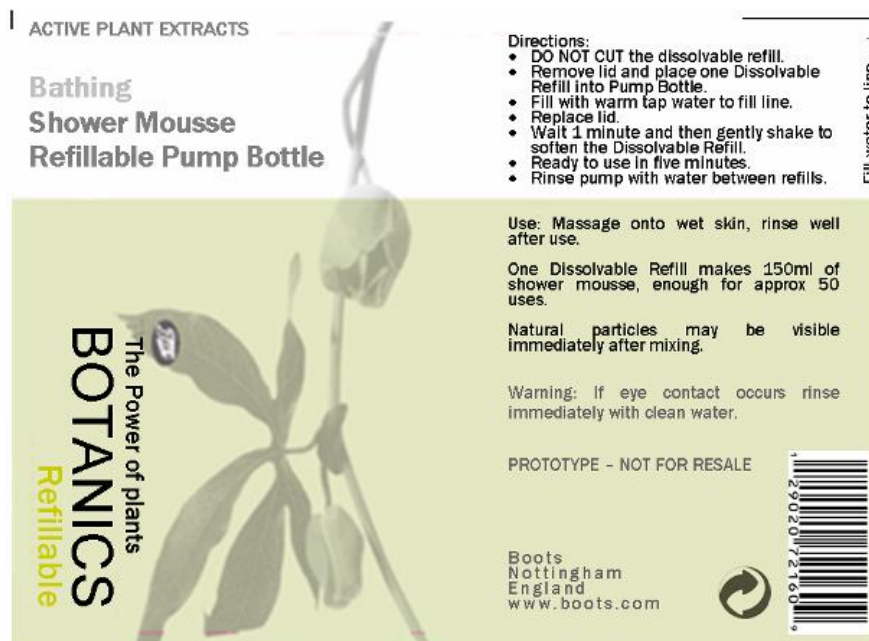


Figure 8 Example of level of detail required on the pump bottles for idea 6a

It must also be immediately obvious that a refillable system is being sold, which means that it must be easy to differentiate between the refill and the original pack.

Functional requirements

It is essential that refillable packaging systems adhere to certain functional requirements, these include the following:

- That the refill process must be easy and as intuitive as possible.
- That the packaging and labelling must be durable enough for repeated use.
- That consumers must be able to drain / use all the contents of the refill (or not be able to see 'dregs' as this is observed as being wasteful by participants).
- That the storage of refills within the home must also be considered.
- That refills must be inclusive (arthritis hands etc).

From a marketing perspective

A number of issues were found during the consumer focus groups which relate to the marketing of refillable packaging systems:

- Consumers need to be told 'what the point of it' is.
- System packaging and marketing must reflect the value of the product (changing the aesthetic design of the tub in 6a (as described in Appendix 4:p20) made a huge difference to the perception of value).
- Consumers relate to what they know (such as liquid tabs for washing machines, travel bottles, bath gems etc.), so building on these approaches is beneficial BUT also be aware that they know what they pay for them.

9. Environmental Analysis

It was felt appropriate to carry out an environmental analysis of ideas 6a and 6c. To assess the success of the concepts that were developed a number of life cycle assumptions were made in order to analyse the products as a product-service-system and to gain an accurate comparison with the original shower gel bottle. To do this it was decided that the concepts and the original would be assessed over a 6 month time span. Two methods were used to carry out an environmental analysis: The Eco-indicator [E19] and The Ecodesign Web [E20].

The Ecodesign web (Figure 9) is a visual life cycle analysis tool developed by Lofthouse & Bhamra [E20] – from the work of Brezet & Van Hemel [E21] which allows users to qualitatively assess the impact of a product or system. The visual template encourages discussion around a number of stages during a product's life cycle. These areas for discussion can be selected for each project, or a standard template can be used.

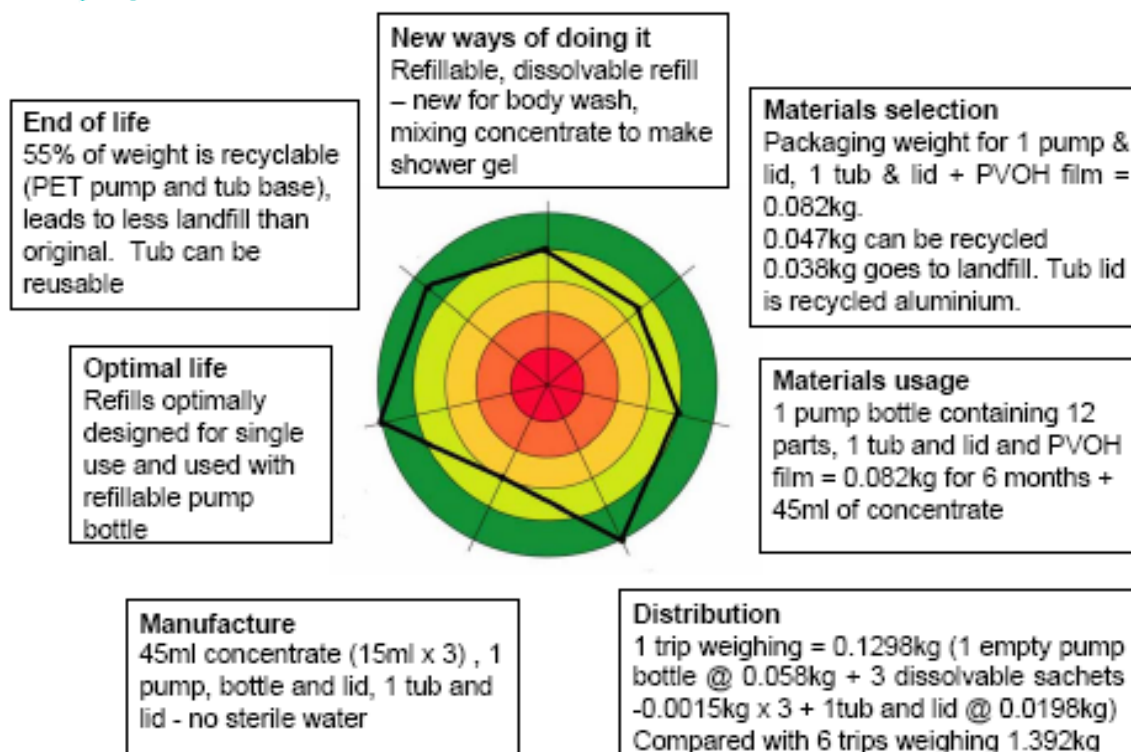


Figure 9 A Completed ecodesign web for idea 6a

The Eco Indicator, developed by Pre Consultants B.V. [E19] is also a life cycle analysis tool, but this tool *quantitatively* assesses the impact of a product or system, using over 200 pre-defined 'eco-indicator values' for common materials and processes. It provides a quick assessment of a product or systems with respect to its impact on:

- Damage to human health
- Damage to ecosystem quality
- Damage to resources.

It allows designers to make a quick but also very detailed quantitative assessment of a product throughout its lifecycle (Figure 10).

Production			
material or process	amount (kg)	indicator	result
PET (bottle)	0.028	390	10.92
PP (lid)	0.010	330	3.30
Pump = PP (80%)	0.016	330	5.28
PVC (10%)	0.002	270	0.54
Steel (10%)	0.002	910	1.82
Inj moulding PP	0.026	21	0.55
Inj moulding PVC	0.002	44	0.09
Inj moulding PET	0.028	21	0.58
Steel processing	0.002	23	0.05
TOTAL FOR 6 MONTH SYSTEM			23.13

Figure 10 An example section of the eco-indicator for idea 6a.

Environmental analysis of idea 6a compared to the original 200ml shower gel bottle

- Over a 6 month period the weight of material used in the packaging for concept 6a is 0.082kg, equating to 59.8% less than for the original packaging (0.204kg).
- Over 6 month period concept 6a requires 0.1298kg of material (comprising the packaging and shower gel product) to be transported, to deliver energising shower gel to the consumer, compared with 1.392kg in the original product. This means that 90.68% less material is transported with idea 6a. This will lead to cost savings related to transport and cost savings related to materials usage.
- Over a 6 month period, idea 6a would generate 0.038kg of material which would have to be sent to landfill, compared with the 0.204kg of material which would be sent to landfill in that period for the original packaging. This equates to 81.37% less landfill waste material.
- 0.047kg of material can be recycled for idea 6a over the 6 month period, compared with 0kg of material from the original packaging.
- For a 6 month period the Eco indicator score for concept 6a is 22.41 compared with 79.86 for the original packaging. This reflects a product's impact based on its effects on human health, ecosystem quality and resources. The lower the result, the better the product.
- The Ecodesign Web for concept 6a is much more positive than for the original packaging over a 6 month period.
- Less surfactants are needed in the product when dispensed via a pump pack.
- Reduction in transport costs as 'water' portion of shower gel is not being transported each time.
- Reduction in amount of resources used in manufacture – product and packaging.
- Reduction in packaging waste generated.
- Increase in the use of recyclable content².
- Idea 6a represents a new way of doing things.
- Consumer trials indicated that female consumers between the ages of 21 – 40 felt concept 6a was 'more special' and something they would buy as a high end product or a gift.
- Consumer trials showed that consumers were not concerned about safety issues – they assumed that if it was on the market it would be safe.
- Concept 6 is likely to lead to prolonged consumer buy in due to initial purchase being for 6 months worth of product.

Environmental analysis of idea 6c compared to the original 200ml shower gel bottle

- Over a 6 month period the weight of material used in the packaging for concept 6c is 0.076kg, equating to 62.75% less than for the original packaging (0.204kg).
- Over 6 month period concept 6c requires 0.124kg of material (comprising the packaging and shower gel product) to be transported, to deliver energising shower gel to the consumer, compared with 1.392kg in the original product. This means that 91.09% less material is transported with idea 6c. This will lead to cost savings related to transport and cost savings related to materials usage.
- Over a 6 month period, idea 6c would generate 0.048kg of material which would have to be sent to landfill, compared with the 0.204kg of material which would be sent to landfill in that period for the original packaging. This equates to 76.47% less material.
- 0.028kg of material can be recycled for idea 6c over the 6 month period, compared with 0g of material from the original packaging.
- For a 6 month period the Eco indicator score for concept 6c is 26.26 compared with 78.86 for the original packaging. This reflects a product's impact based on its effects on human health, ecosystem quality and resources. The lower the result, the better the product.
- The Ecodesign Web for concept 6c is much more positive than for the original packaging over a 6 month period.
- Less surfactants are needed in the product when dispensed via a pump pack.
- Reduction in transport costs as 'water' portion of shower gel is not being transported each time.
- Reduction in amount of resources used in manufacture – product and packaging.
- Reduction in packaging waste generated.
- Increase in the use of recyclable content³.
- Idea 6c represents a new way of doing things.
- Consumer trials showed that consumers were not concerned about safety issues – they assumed that if it was on the market it would be safe.

These environmental improvements are in line with 2008 targets set by the EC Packaging and Packaging Waste Directive (94/62/EC 'The Packaging Directive'), which were increased to:

² It is important to note that whilst the original packaging could easily be made 100% recyclable, concept 6a would still be 90.68% lighter to transport and use 59.8% less material over a 6 month period.

³ It is important to note that whilst the original packaging could easily be made 100% recyclable, concept 6c would still be 91.09% lighter to transport and use 62.75% less material over a 6 month period.

- 60% overall recovery of packaging waste, and
- 55% minimum and 80% maximum recycling of packaging waste [E2 and E22].

The concepts developed during the project also adhere to 'The Packaging (Essential Requirements) Regulations 2003.' The Essential Requirements are, in summary:

- Packaging volume and weight must be the minimum amount to maintain necessary levels of safety, hygiene and acceptance for the packed product and for the consumer.
- Noxious or hazardous substances in packaging must be minimised in emissions, ash or leachate from incineration or landfill.
- Packaging must be manufactured so as to permit reuse or recovery in accordance with specific requirements [E22].

10. Conclusions: lessons for the use of refillable packaging in industry.

Manual qualitative analysis of the audio and video data generated during the workshops was carried out using coding and clustering techniques. The findings which emerged from the project were grouped into 3 categories:

- a. Findings which relate to refillable packaging in general.
- b. Findings which relate to our specific refill 'concentrate mixed in original packaging'.
- c. Findings which relate to refills for the personal care market.

10a Findings which relate to refillable packaging in general

The findings from the research which relate to refills in general, relate particularly to findings regarding the consumers' relationship with refills. Through the consumer questionnaire a number of attributes which lead to positive or negative experiences of refills were identified (Table 1). It is clear that positive attributes often lead to repeat purchases whereas negative ones deter a repeat purchase. Branding and fun (e.g. Pez sweet dispenser) were also identified as reasons why consumers actively buy refills. It was also apparent that people do not mind if a refill system becomes the 'norm' as long as the quality is there and there is a clear reason for it.

In terms of costs, customers seemed to have one of two perceptions when it came to refills, either that they *are* cheaper or that they *should* be cheaper than the 'original' product. As such the price incentive is expected, making it a 'must have' attribute rather than a 'delighter'. If a lower price refill is not delivered, customers are disappointed. In order to encourage consumer acceptance of refills the project found that effective communication is critical. This will ensure that:

- positive attributes of the product are promoted,
- negative attributes are mitigated against, and that
- customers know that they should refill, and how to do it.

The research identified a number of business drivers and barriers to use of refillable packaging systems (see Appendix 3). Businesses believe that there are a number of sustainability drivers for the use of refillable packaging, such as:

- Less waste.
- Minimal packaging.
- Slower resource depletion.
- Being lighter to transport.
- Being a way of demonstrating responsible behaviour through reuse and resource efficiency.

There are also a number of economic drivers for the use of refillable packaging systems, such as:

- Reduction in packaging costs.
- Higher profit margins.
- Reduced use of materials.
- Marketing opportunity to offer customer choice, flexibility and customisation.
- Re-use of packaging,
- Opportunities for increased customer loyalty,

A number of business barriers were also identified, however. With careful design many can be mitigated against, as long as a collaborative approach is taken.

It is also important to note that there are a number of risks associated with refills, these include:

- *From a sustainability perspective:* e.g. if a customer buys a new parent pack each time.
- *From a business perspective:* e.g. that competitors will design a refill for your system and undercut you.
- *From a consumer perspective:* e.g. that the refill system will not be around for a long time, is it worth 'investing'.

Again once these issues have been identified they can, to a considerable degree, be designed out and reassured against.

10b Findings which relate specifically to refills where a 'concentrate is mixed in the original packaging'

Through the development, prototyping and consumer testing of three concepts (see section 8) for the delivery of body wash through a refillable packaging system based on 'concentrate mixed in original packaging' approach, a number of lessons have been identified.

Firstly, there are technical issues related to this type of refillable packaging. A key driver for the development of this approach is to reduce the amount of water that is being transported in order to reduce material usage and transport impacts/costs. This is done by transporting a small concentrated refill which can then be mixed in the original packaging, using tap water. This raises a number of issues surrounding the sterility of the tap water and the loss of control the business has over potential bacterial contamination. This issue of water sterility was raised by one consumer during testing, however the unanimous consensus among the participants was that 'if it wasn't safe it wouldn't be on the market', reflecting the high level of trust Boots gains from its consumers.

In general consumer feedback was positive but it was recognised these types of refills must be delivered in the right way. In order to satisfy consumer needs a refillable packaging system needs to:

- Offer good quality.
- Be very easy to use & appropriately delivered.
- Be clearly communicated.
- Be a brand they like.
- Represent good value.

The environmental analysis carried out on ideas 6a and 6c showed the huge potential that refillable packaging systems based on 'concentrate mixed in original packaging' has for reducing the environmental impact of packaging.

10c Findings which relate to refills for the personal care market

Through the project a number of lessons which can be disseminated more widely to the personal care market, have been identified. The questionnaire identified a number of different types of products which people felt would be appropriate to be delivered as refills. The most popular suggestions were shower gel, bubble bath, soap and moisturiser. This was mainly attributed to them being:

- The easiest to fill
- Cost savings on everyday products
- Would have a positive environmental impact

Participants who took part in the workshop identified a willingness to refill higher end products such as facial cleanser, face wash and hair products. This was attributed to a willingness to take more time over these sorts of products. The most unpopular potential refill was toothpaste as it was felt this would be unhygienic. However it was felt that this was because they could not envisage how something like toothpaste could be successfully delivered as a refill.

Another interesting finding which specifically affects personal care is the importance of being able to 'smell before you buy'. Smell and cost, rather than packaging design, were recognised as the key driver for most sales of personal care products. For our designs an in-store tester would be needed to allow the customers to smell the product and try the pump.

11. Main implications of the findings

The section above presents a brief summary of the conclusions from the research project 'Refillable Packaging Systems'. It is clear that if refillable packaging is designed carefully and applied to appropriate products, it presents a great opportunity to reduce household waste. In order to be truly successful refills must perform for the consumer, business and environment which means that both consumer and environmental requirements need to be written into the brief.

The Refillable packaging produced has demonstrated the huge potential environmental savings which can be achieved by using refillable packaging where a 'concentrate is mixed in the original packaging'. With this in mind Boots are now embarking on investigations into how the technical issues (relating to the water sterility) can be overcome.

12. Possible future work

- Potential to develop a second range of prototypes and test their viability.

- Loughborough University and Boots, alongside other partners, have submitted a proposal to the UEA Carbon Connections Development Fund. This proposal aims to develop a relevant tool for designers regarding environmental analysis (e.g. relating it to carbon footprinting etc). The idea came from the work carried out in this project, where we found that although the environmental analysis methods were invaluable, the Loughborough team had to work very hard to communicate the results to other team members.
- As a follow on to this project, the Loughborough University project team was invited to collaborate with Oakdene Hollins to investigate consumer perceptions and opinions of returnable packaging. WRAP funding has been gained for a project to run from January – March 2008.
- Finally, 16 different types of refills were categorised at the beginning of this project but only 1 type, 'concentrate mixed in original packaging' was investigated in any detail. Following this project there is the opportunity to research the remaining refill types with consumers and develop a broader understanding of refillable packaging systems.

Significant events

A number of events have taken place during the project. These have included product selection (May 2006), two creativity workshops (7th & 21st September 2006), pilot and main consumer studies (April and May 2007), and a dissemination event (3rd December 2007). Additionally:

- Invitation to speak at the CIWM Annual Conference in Paignton held from 10th - 13th June 2008.
- Invitation to speak at 15th European Packaging Law 2008, Sustainable Packaging Seminar, 3 March 2008, Renaissance Hotel, Brussels.
- Invitation to chair a brainstorming workshop at ENG's 4th Senior Executive Summit on Packaging Design 2008 – 1st and 2nd April 2008 in Amsterdam.

References to published material

9. This section should be used to record links (hypertext links where possible) or references to other published material generated by, or relating to this project.

APPENDICES

Note: All the Appendices are published as separate documents alongside this report.

Lofthouse, V A (2009) *APPENDIX 1: Categorisation of refills*. Loughborough University: Loughborough. 18th September 2009. pp 1-3.

Lofthouse V A and Bhamra T (2009) *APPENDIX 2: An investigation into consumer perceptions of refills and refillable packaging*, WR0113: Objective 1, Loughborough University, 18th September 2009. pp1-34.

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Lofthouse V A, Trimmingham R and Bhamra T (2009) *APPENDIX 4: Refillable Packaging Systems - Key Methods and Processes*, WR0113: Objective 6:2, Department of Design and Technology, Loughborough University, 18th September 2009. pp 1-32

Lofthouse V A, Trimmingham R and Bhamra T (2009) *APPENDIX 5: Refillable Packaging Systems - Lessons for Industry*, WRT151: Objective 6:1, Deliverable for DEFRA Waste and Resources Research Programme, Department of Design and Technology, Loughborough University, 14th September 2009. pp 1-24

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