

From rag trade to retail: garment failure and the potential for sustainable fashion

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Abstract: Around 1.8 million tonnes of clothing waste is generated annually in the UK, accounting for around 5% of total UK household waste, with the lifetime of many garments unduly short. As a result of greater attention being placed on waste reduction at European Union and national government level, however, interest in the potential for increased garment lifetimes has grown in recent years and, despite obvious tensions between fashion and longevity, retailers have begun to engage in the debate.

This paper presents findings from a research project undertaken for WRAP (Waste and Resources Action Programme) aimed at an industry-supported approach to measuring, specifying and communicating aspects of clothing longevity. Although a high proportion of garments are thrown away in wearable condition, many of which are reused, others are discarded because they are damaged or worn out. This study was concerned with the latter. Although a literature review identified recent studies addressing the context surrounding the fashion industry and elements of the 'fast fashion' debate, providing some explanation for the disposable nature of much fashion, no primary research relating to garment failure was found. A visual survey of discarded clothing was thus undertaken in order to increase knowledge and understanding of reasons for garment failure. Visits were made to three UK-based textile reuse and recycling organisations. Around 1,500 discarded garments in a failed condition were subject to a systematic analysis, categorised by type of garment and condition and with visual images recorded. Only garments no longer 'fit for purpose', deemed not to be in a good enough condition to be re-sold in the UK, were assessed. The method of first hand observation enabled consideration of why items had been discarded and had the benefit of being less subjective and not dependent upon the memory of people who had disposed of them.

The main reasons why garments appeared to have been discarded were identified as colour fading and problems relating to fabric quality such as pilling of knitted items and fabric breakdown in the form of fraying and thinning. Other key issues were general wear around the crotch of trousers and jeans, discolouration in white shirts and holes in seams. The detailed findings, presented by type of garment and type of fabric, will be useful to fashion retailers and brands wishing to respond to growing concerns about waste arising from short-lived clothing. It should enable them to review their performance criteria and testing procedures in order to adjust garment specifications, and to market garments appropriately.

Introduction

This paper presents findings from a research project commissioned by WRAP (Waste and Resources Action Programme), to develop an industry-supported approach to measuring, specifying and communicating aspects of clothing longevity. The project was designed in the context of WRAP's Sustainable Clothing Action Plan (SCAP), which brings together industry, government and third sector organisations to develop targets, tools and

guidance in order to reduce the environmental impact of clothing.

The volume of waste generated annually from garments, 1.8 million tonnes, accounts for around 5% of total UK household waste (WRAP, 2012.) The potential to reduce the environmental impact of garments through increased longevity has been identified in research by WRAP (2012) which concluded that extending average lifetimes by just three

months would lead to a 5-10% reduction in the carbon, water and waste footprints of clothing. Subsequent research by WRAP (2013) revealed the average lifetime of garments to be 3.3 years although this varies considerably by type: casual clothing has the shortest average lifetime and formal clothes for 'an occasion outside of work' the longest.

There is evidence that a significant proportion of consumers might be interested in longer lasting clothing. In a survey undertaken by Nottingham Trent University and Ipsos MORI for WRAP (2012), 38% of consumers indicated that they 'could do more to buy items that are made to last and would like to do so.'

Product lifetimes have to be defined carefully: around one-fifth of garments have not been worn for at least a year, which prolongs their nominal lifetime but does not imply any reduction in waste. An important distinction is between durability and longevity. Durability is "a measure of how long a product will continue functioning as intended and withstand 'wear and tear' ... before it develops a defect." (Cooper, 2010, p.8). By contrast, a product's longevity describes its life-span (or lifetime) and is "a somewhat different measure, being partly determined by factors other than attributes formed through design and manufacture" (ibid): these include user behaviour towards the item and wider, socio-cultural influences. This distinction is especially important in the clothing sector as nearly one half of all discarded garments are reused (WRAP, 2012), being in wearable condition. By contrast, the focus of this paper is on garment failure and thus on durability.

Key threats to garment lifetimes are fabric failure, component failure, construction failure, accidental damage and colour change. For garments, as with many types of product, the threat of failure can be reduced by setting and testing key quality levels and by design engineering that anticipates risks. Yet within the clothing sector there is currently no common approach to assessing or guaranteeing the durability of garments; nor are there legislative standards that apply directly to durability, other than the general requirement that goods sold are 'fit for purpose'.

Established testing procedures exist for textiles, components and the constructed garment, but they are not used consistently by all retailers.

Moreover, the pass/fail criteria are set by each retailer, in some cases varying by product category, and are often linked to the brand or retailers' market position. Even if garments fail the testing criteria and are considered sub-standard, it is common practice for a commercial decision to be made by the retailer to accept the product with a disclaimer attached to a swing ticket; clothing is a sales-driven industry, with fashion often taking priority over quality. Furthermore, many such tests are not directly related to longevity.

Aims

The research was undertaken within the context of a project aimed at developing a 'Clothing Longevity Protocol' for industry stakeholders as a mean of enabling them to reduce their carbon emissions. This paper reports on the project's first phase, in which the specific aim was to understand and explain consumer perceptions of garment failure using secondary research and primary data from a survey on the condition of discarded garments.

Secondary research

There has been wealth of writing on sustainable and ethical fashion in recent years (e.g. Black, 2008, Giesen, 2008, Fletcher, 2008, 2012, Siegle, 2011). In order to explain the disposable nature of much fashion, it is important to consider the context surrounding the fashion industry and, specifically, elements of the 'fast fashion' debate. Understanding consumers' behaviour is also necessary in order to explain the differing points at which people deem their clothes ready for disposal. Finally, the review addresses expectations of garment longevity and evidence surrounding improved durability of textiles. There is very little published research directly relating to garment failure. Some data on clothing longevity and consumer expectations is available from a study for Defra by Fisher et al. (2008); however, this focused on consumer understanding of sustainable clothing and associated behaviour rather than on garment failure.

Over the last 15 years fashion has become faster and cheaper (Black, 2008). The concern is that 'fast fashion leads to fast landfill' (Allwood, 2006: p 65). Yet consumers under the age of 24 have never really known a high street without 'fast fashion': the tradition of two to three fashion seasons per year, with retail collections updated every few weeks, has long

departed. Pressures on quick turnaround and price have inevitably led to lower quality. In a survey for Defra, 63% of consumers thought that clothing had become lighter in weight over the previous three years and a similar proportion said that the lifetime of clothing had become shorter (Morley, 2006).

Although there are a few stories of high profile brands and designers refusing to feed this fashion machine, the most notable example being Vivienne Westwood (Bilby, 2012), most retailers are in the business of spotting fashion trends, reacting quickly and providing cheaply. Evidently the many consumers who buy into fast fashion regard such garments as readily disposable.

Nonetheless certain retailers are tackling concern about waste, mindful of growing environmental awareness. H&M and Marks and Spencer, for example, are offering a service whereby they 'take back' used clothing and in return provide a discount on future purchases. The overall effect of such an approach is uncertain, however: it may even encourage consumer spending rather than stop it or make it more considered.

Market analyst Francesca Muton (2012) has argued that some fashion trends are starting to extend beyond a few seasons, a reaction to some consumers not wanting to re-invent their wardrobe every season. A groundswell of discussion, along with raw material price hikes (notably cotton), seems to suggest that the time may be right for a re-think of consumption and disposal. On the other hand, recent literature suggests that consumers may take an interest in product lifetimes but that longevity is not a 'top of mind' priority and is bound up with other purchase factors (Cooper, 2010; Brook Lyndhurst, 2011). In the case of clothing, the aforementioned survey by WRAP (2012) found that good quality and durability were among key criteria used by consumers when buying clothing. Yet some consumers do not know how to assess quality in garments and judge how long they will last. Thus barely a third checked the type of fabric a garment was made out of by 'looking at and feeling' it before making a purchase.

Selling longevity as a proposition has not been well researched (Cooper 2010). Sender (2011) found that the importance of clothing longevity to women increased with their age, reflecting

the popularity of fast, disposable fashion among youths and a greater emphasis on durability and quality among older women. Wilber (2013) and Muton (2012) concluded that 16–24 year olds need a story to guide them through quality, unaware of how a good quality button, for example, makes a difference to price, and that such information needs better communicating through marketing and at point of purchase.

A framework to classify which products are more likely to be bought with longevity in mind has been proposed by Brook Lyndhurst (2011). Within this framework is the 'classic' product that is less subject to the changing whims of fashion, for which functionality is the key: such products tend to be disposed of when they fail physically in some way rather than due to a change in the fashion trend. Brook Lyndhurst's research suggested that people do not expect a shirt, jumper, jeans and a coat to last more than 2 years, and proposed "working with retailers and manufacturers to develop 'anchor' or 'classic' products of home furnishing and clothing that could be marketed as durable lynchpins" (Brook Lyndhurst, 2011, p.52).

Design for durability involves ensuring the physical and technical robustness of the garment (Annis, 2012), as well as addressing the emotional qualities that garments can provide. It requires consideration of the role of the design and production teams, the materials they initially select, the amount and type of testing, and the communication to the consumer.

With pressure constantly to produce new collections, the designer can feel estranged from the user and not feel sufficient incentive to build increased longevity or emotional qualities into the garment. Cooper et al. (2013) have produced a series of guidance notes for increasing longevity in each of eight categories of clothing, aimed at design teams.

In the case of material selection the environmental implications may be complex as the choice has consequences for how products are to be washed and, therefore, the potential for saving energy (Fletcher and Goggin, 2001).

Retailers are already addressing longevity in some product areas, notably school-wear, in which smart technologies such as stain defence finishes are used, and outdoor and technical products, into which durability is being

purposefully designed. A related area in which durability has been considered is sportswear. For example, Nike state that to make sure the fabrics do not pill, lose their shape, tear, bleed or fall apart after washing, a testing company puts them through various tests involving abrasion machines and laundrometers (Shellenbarger, 2011). Best practice for clothing in general includes wearer trials as part of the product development process, supplementing wash cycle tests. However, it is problematic to simulate product wear to the degree required within the time constraints of the seasonal critical path.

This review has found that fashion appears to have become faster and cheaper over the past twenty years but that it is an appropriate time for retailers and brands to start reconsidering the durability of certain garments and communicating this aspect of quality to consumers more effectively.

The sustainability benefit from reducing waste by increasing product longevity is potentially substantial. Although consumers expect a relationship between price and durability, the latter appears difficult for them to identify during purchase, and certain types of product, notably 'basics' and 'classics', appear especially suited to the proposed Longevity Protocol.

As no significant research on physical faults with garments at the point of disposal was uncovered during the review of secondary literature, the need for primary research was confirmed. This was consequently carried out and the findings are reported below.

Method

A systematic analysis of 1,476 discarded garments, classified by type (Figure 1), was undertaken in order to identify the incidence of physical faults. The garments were limited to those judged to be no longer 'fit for purpose', having been donated to charity but considered not in a good enough condition to be re-sold in the UK. The items selected were primarily bound for Africa or Pakistan, where they would be re-sold as clothing items if possible and recycled if not. Three textile recovery centres were visited: Traid in London, Oxfam in Huddersfield and IG Cohen in Manchester. The sorting belt at the Traid warehouse from which clothes were selected and analysed is shown in Figure 2.

First hand observation enabled objective analysis of the complete garment, together with consideration of the primary reason why it might have been discarded. As observational research, it had the benefit of being less subjective and not dependent upon memory (Venjatarmani et al., 2006; Zaltman, 1997; Graves, 2010) or subject to inconsistency in language around degradation. It was important to visualise the garments as the spectrum of problems such as colour fade is broad. Visits to textile recovery centres, as distinct from homes, allowed for a large number of items to be analysed over a relatively short period of time.

A simple random sample of items was selected from conveyor belts, bags and bins. The sample included the full range of discarded items: 30% tops, 18% trousers, 15% jumpers, cardigans and hooded tops, 15% nightwear and underwear, 12% outerwear, 6% dresses, skirts and shorts, and 3% school-wear. The items analysed mirrored the type and proportion generally found in textile recovery centres, and the main brands identified broadly reflected the market share of the leading high street retailers.

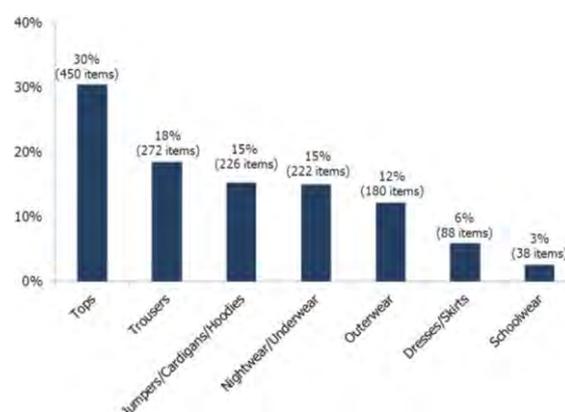


Figure 1. Garments in sample, by type.



Figure 2. Sorting belt at the Traid Warehouse.

Research findings

A visual analysis identified the two main faults in garments as colour fading (particularly for jersey and woven fabrics) and issues relating to fabric quality (most notably pilling in the case of knitwear and jersey). Another common problem was fabric breakdown, particularly for woven garments, in the form of fraying and thinning (especially around hems) and general wear around the crotch of trousers and jeans. Other notable issues included dimensional stability issues with knitted garments, discolouration in white shirts (particularly the collar) and holes in seams (including jacket linings).

Almost 70% of garments analysed had a colour-related problem; this was most commonly fading, but included discolouration and logo issues. Many garments had some kind of fabric-related problem, including a majority with pilling and more than a quarter with fabric breakdown (i.e. frayed, thinned or worn). A fifth had a dimensional stability issue (i.e. stretched or out of shape), and nearly one in ten had problems related to trims such as zips and buttons. In addition, 29% of garments appeared to have been subject to accidental damage (mainly stains or tears). Many garments had multiple faults (hence the total exceeds 100%). In the rest of this section, the findings are analysed first by type of problem and then by type of garment.

Analysis by type of problem

Many garments demonstrated some kind of colour fault. The most common was colour fading (53%), but issues with a logo (16%) and discolouration (15%) were also noted (some garments had multiple problems). Among the discoloured items, nearly two thirds (65%) involved white garments and 13% exhibited discolouration around the collar.

Fabric quality was another common problem. Pilling affected a majority of garments (55%). Over a quarter (29%) showed some kind of fabric breakdown: among these garments 39% were frayed, 23% had thinning and 15% worn fabric. Key problem areas included hems (22% of garments with fabric breakdown), collars (13%) and the crotch (10%).

One in five garments (20%) had a problem relating to dimensional stability, primarily knitwear. Garments were most often categorised as stretched (33% of affected

items) or out of shape generally (26%) or at the knees (14%).

Around one in seven garments (14%) had holes in seams, either through seam stitching coming undone or breaking, or the fabric wearing around the seam. Areas most commonly affected were the crotch (21%) and armpit (16%).

There were few failures with trims such as zips, buttons and embellishments such as sequins or gems: just 8% of garments were affected. Of these, missing buttons (46%) and broken zips (22%) were the main issues.

Analysis by type of garment

More detailed analysis by garment type was undertaken on specific items of interest, where sample size allowed. Particular attention was given to less trend-led (or 'classic') garments, as these were under consideration for the Longevity Protocol trials; the items analysed were cardigans, shirts, t-shirts, jeans, work trousers and jackets.

Unsurprisingly, the key issue with cardigans was pilling, which affected 83% of items. Pilling tends to make an item of knitwear look aged (Figure 3). Other key problems liable to be reasons for disposal included colour fading (51%) and dimensional stability (34%).



Figure 3. Cardigan with signs of pilling and colour fading.

One of the key problems with shirts, especially if white, was discolouration (54%), either all over or around the collar. Some non-white items (35%) had issues with colour fading. 32% had some kind of fabric breakdown, the collar again being a main concern (Figure 4).



Figure 4. Shirt collar issues.

Pilling and colour fading were key issues for t-shirts. Nearly two-thirds (65%) showed signs of pilling, making the item look worn and old. 51% were faded and 42% had issues with the logo, typically a cracked appearance (Figure 5). 24% showed signs of problems with dimensional stability, mainly looking out of shape.



Figure 5. Logo problem.

In the case of jeans, accidental damage was a key problem, with 51% having some kind of stain or rip unrelated to fabric degradation. 86% were colour faded (N.B. if colour fading was part of the original design, the item was not included). 27% had holes in seams, mainly the crotch, side seam or hem (Figure 6).



Figure 6. Jeans worn at crotch.

Work trousers were analysed as a classic item less subject to fashion trends; the main faults were found to be fabric breakdown (50%) and holes in seams (42%) (Figure 7).



Figure 7. Work trouser with seam damage.

Finally, in the case of jackets (including coats and mackintoshes), colour fading was again the main problem, affecting 50% of garments. The other key issue was holes in seams, mainly in the jacket lining (Figure 8).



Figure 8. Jacket linings ripped at pocket seam.

Conclusion

Growing interest from the EU and the UK Government in waste reduction has renewed the debate on product life-spans in recent years. In the specific case of clothing, the high volume of discarded items annually has led to increased garment longevity being identified as a means by which companies should reduce their environmental footprint.

The survey results described in this paper suggest that the main explanations for garment failure are colour fading and issues relating to fabric quality. Other common problems are fabric breakdown in the form of fraying and thinning, general wear around the crotch of trousers and jeans, discolouration in white shirts and holes in seams. The industry needs to focus on associated elements of design and manufacture in order to address garment durability.

Companies will benefit by reducing the number of garments failing after a short period because

this will result in fewer returns. Such quality management is important but the primary motive behind the research was a need to reduce substantially the large number of garments designed and manufactured in such a way that inevitably results in unduly short life spans.

Implementation of the Clothing Longevity Protocol, an industry-based code of conduct aimed at increasing garment longevity, will require companies to have greater knowledge of the physical faults that lead to garments being discarded. Creating a database with information on the primary causes of garment failure was a first step. Further research will follow in order to identify the measures necessary for change, such as establishing appropriate performance criteria and testing through repeated wash cycle testing and extended wearer trials. Companies will then be in a position to review their performance criteria and testing procedures in order to adjust garment specifications, and to market garments appropriately.

The study was concerned with the durability of garments, their ability to withstand 'wear and tear', rather than the broader concept of longevity. Further research is required to explore garment longevity, which will need to consider the role of the fashion industry, user behaviour and socio-cultural influences upon clothing practices. Major, indeed systemic, change in the sector appears necessary if average garment lifetimes are to increase substantially. The time seems right for stories of quality to be told, user expectations to be raised, and brands and retailers to collaborate and share best practice in order to achieve the necessary change.

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References

Allwood, J. Laursen, S.E. Malvido de Rodriguez, C. and Bocken, N.M.P. (2006) *Well Dressed?*, Cambridge, University of Cambridge.

Annis, P. (ed) (2012) *Understanding and Improving the Durability of Textiles*, Cambridge, Woodhead

Bilby, E. (2012) Westwood announcement at London Fashion Week, [online] Available from:

<http://reuters.com/article/2012/02/19/fashion-britain-westwood-idUSL5E8DJ0H920120219> [Accessed 8th October 2013].

Black, S. (2008) *Eco-chic: the fashion paradox*, London, Black Dog.

Brook Lyndhurst. (2011) *Public understanding of product lifetimes and durability*, London, Department for Environment Food and Rural Affairs.

Cooper, T. ed., (2010) *Longer Lasting Products: alternatives to the throwaway society*, Farnham, Gower.

Cooper, T. Hill, H., Kininmonth, J., Townsend, K. and Hughes, M. (2013) *Design for Longevity: guidance on increasing the active life of clothing*. Report for WRAP. Banbury, WRAP.

Fisher, T., Cooper, T., Woodward, S., Hiller, A. and Goworek, H. (2008) *Public Understanding of Sustainable Clothing*, Report for Defra. London, Defra.

Fletcher, K. (2012) *Fashion & Sustainability: design for change*, London, Laurence King.

Fletcher, K., Goggin, P. (2001) The Dominant Stances on Ecodesign: a critique. *Design Issues*, 17(3), pp.15 -25.

Giesen, B. (2008) *Ethical Clothing – New Awareness or Fading Fashion Trend?*, Saarbrücken, VDM.

Graves, P. (2010) *Consumer.ology: the market research myth, the truth about consumers and the psychology of shopping*, London, Nicholas Brealey.

Morley, N., Slater, S., Russell, S., Tipper, M. and Ward, G. (2006) *Recycling of Low Grade Clothing Waste*, London, Department for Environment Food and Rural Affairs.

Muton, F. (2012) Overview of Global Fashion Market Trends, [web video] January 15. Available from: <http://source.ethicalfashionforum.com/article/mase-rclass-video-overview-of-global-fashion-market-trends> [Accessed 6th October 2013].

Sender, T. (2011) *Women's Fashion Lifestyles*, [online] Available via: Mintel [Accessed 6th September 2013].

Shellenbarger, S. (2011) Work Wear Hits Pay Dirt, [online] January 2011. Available from: <http://online.wsj.com/article/SB10001424052748704013604576103990720064626.html> [Accessed 13th October 2013].

Siegle, L. (2011) *To Die For: is fashion wearing out the world?*, London, Harper Collins.

Venkataramani, J., Maheswaren, D. and Peracchio, L.A. (2006) Mapping the Frontiers: theoretical advances in consumer research on memory, affect and persuasion, *Journal of Consumer Research*,

33 (1), pp. 139-149. Available via: JSTOR, [Accessed 6 October 2013].

Wilber, J. (2013) Social values as a new framework for targeting the market, [online] January 9. Available from: <http://source.ethicalfashionforum.com/article/social-values-as-a-new-framework-for-targeting-the-market-> [Accessed 13th October 2013].

WRAP. (2012) *Valuing our Clothes: the true cost of how we design, use and dispose of clothing in the UK*, Banbury, WRAP.

WRAP. (2013) *Clothing Longevity and Measuring Active Use*, Banbury, WRAP. <http://www.wrap.org.uk/content/clothing-longevity-measuring-active-use> [Accessed 13th May 2015].

Zaltman, G. (1997) Rethinking Market Research: putting people back in, *Journal of Marketing Research*, 34 (4), pp. 424-437. Available via JSTOR, [Accessed 6th October 2013].