Product development and supply: help or hindrance to clothing longevity?

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Abstract: Designing longer lasting clothing helps to reduce unsustainable levels of product disposal and subsequent waste. This has led to a call for retailers to enhance clothing longevity, supported by new business models to reduce any impact on competitiveness. While some research suggests that a significant proportion of consumers would buy longer lasting clothes, this view is not necessarily accepted by industry strategists. This paper, which reports on research undertaken for WRAP (Waste and Resources Action Programme), explores conflicting priorities between commercial and sustainable practice, and problematic trade-offs in the supply chain between commercial, technical and design aspects of reducing the environmental impact of clothing. The study adopted a mixed methodology, incorporating qualitative interviews and a survey, and encompasses views of retailers, manufacturers and suppliers from different segments of the UK fashion market.

The findings confirm that retailers and brands drive the new product development process and set standards for their supply chains, but globalization, product churn and testing regimes challenge the critical path schedule. Although current tests confirm product quality (WRAP, 2013), there is a perception within industry that designing for longevity increases testing, inflating the risk of failure and extending lead-times, resulting in a mismatch between cost, time and longevity priorities that limits adoption of design for longevity. Meanwhile, clothing longevity is not perceived to add value for many consumers and therefore is not prioritised. While it is technically possible to enhance clothing longevity, the findings demonstrate empirically that this deviates from current commercial drivers of global clothing supply chains. By combining different perspectives on supply chains, new product development and sustainability, inherent conflicts are revealed.

Introduction

Designing clothing that lasts for longer than current norms helps to reduce excessive, unsustainable product disposal and waste. This has led to a call for retailers to enhance clothing longevity, recognising that this may need to be supported by new business models to reduce any impact on competitiveness (WRAP, 2012). Although over a third of the population claim that they could buy more clothes that are 'made to last' and would like to do so (WRAP, 2013), there is limited evidence that this view is shared by industry strategists.

The paper uses evidence from interviews and a survey with clothing industry stakeholders to explore the conflicting priorities, perceptions and tensions between commercial and sustainable practice in this emerging field, and discusses the drivers exerted on the supply chain and the commercial, technical and design aspects of reducing the environmental impact of clothing.

The research on which it is based was undertaken for WRAP (Waste and Resources Action Programme) and aims to identify ways to address problematic trade-offs and make recommendations for industry and future research.

Literature review

Longevity of clothing takes into account durability as well as user behaviour and wider socio-cultural influences (Cooper, 2010). Drawing upon this understanding of longevity, a

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review of recent studies explored issues associated with clothing longevity from technical and consumer perspectives, as well as the commercial aspects of designing new clothing products and the clothing supply chain.

Clothing longevity: technical and consumer considerations

Garment waste accounts for around 5% of total UK household waste, even though carbon, water and waste footprint studies indicate that extending the useful life of clothing, assuming this reduces product sales, could effectively reduce negative life-cycle impacts (WRAP, 2012). Most of these impacts are embedded in clothing production, rather than its use and care, and research suggests that increasing the useful lifetime of clothing by one third could reduce its environmental footprint by over 20% (*ibid*). However, at present a range of fabric, component, construction and colour failures shorten clothing lifetimes, even though such failures are often avoidable.

As a result, policy attention has turned to reducing the environmental impacts of clothing by designing garments to last for longer. Designing products for longer lifetimes is a UK Government policy objective (HM Government, 2013) and a priority in the Sustainable Clothing Action Plan produced by WRAP. An assumption that longevity need not have a negative commercial impact if appropriate business models and pricing strategies are adopted is consistent with government policy (HM Government, 2013), but appears to be at odds with the view of some industry strategists.

The latter point to alternative research into consumer behaviour and expectations which suggests that consumers make increasingly regular purchases (Fisher *et al.*, 2008) of low price, lower quality (Leonard, 2008), fast turnaround clothing (Black, 2008). Concern surrounding issues associated with fast fashion is, however, increasingly evident from some retailers, consumers and media commentators (Muton, 2012). Concerned consumers, dominated by mature women who favour durable clothing and are influenced by the relationship between price, quality and value (Mintel Oxygen, 2011; WRAP, 2012; Fisher *et al.*, 2008), create an opportunity to increase the longevity of (in particular) classic items and schemes for clothing buy-back and re-use (WRAP, 2012).

Increased garment longevity would clearly require changes in industry practices. For example, tests of product longevity and extended wearer trials can help product developers to make decisions that avoid or delay garment failure (Cooper *et al.*, 2014), with extreme tests of durability for some performance items and other recent advances in testing now available that could fit better with the supply chain's speed and cost imperatives and changing consumer care practices (Shellenbarger, 2001; Annis, 2012; Cooper *et al.*, 2014).

New product development and the clothing supply chain

New product development (NPD) of clothing incorporates idea generation, market screening, concept and technical development and commercialisation, leading to the design and specification for each clothing item (Swink, *et al.*, 2010). In practice, the process may cause delays in the supply chain through indecision associated with multiple interests, conflicting priorities and functional constraints of the design and technical staff, marketing, purchasing, production, sourcing and finance roles of retailers and brands, compounded by the trend for rapid proliferation of products and globalisation of supply.

The fast fashion approach addresses these conflicts (Cachon and Swinney, 2011) with two system components: cost effective manufacture and rapid new product introduction, in which the design selection process is shortened and emphasis on materials testing reduced (Marion, 2013). Consequently, much fast fashion is based on minor product adaptations during season, supported by postponement, modularisation and fabric platforms, rather than new designs (Cachon and Swinney, 2011; Caro and Gallion, 2007; Barrie, 2013).

Influenced by the spread of fast fashion, it might be expected that commercial imperatives would include fast decision making, shorter lead-times, reduced sampling, and greater use of virtual technologies to minimise additional sampling (Khan *et al.*, 2012). In practice, design and brand integrity results in slow decision making and added product testing (Brun and Castelli, 2008; Pisano and Adams, 2009), which fosters a resistance to innovative design practices that could shorten the design or

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manufacturing process (Oxborrow, 2014). Indeed, Abecassis-Moedas (2006) found that close-to-market design decisions and waiting for information from market or component tests inhibits creativity and delays the critical path, leading to unsustainable practices in sourcing and logistics (Khan *et al.*, 2012). Early supplier involvement in the design process, co-design and modularity can improve on time and cost performance (*ibid*), but in reality may merely enable a retailer to compensate for increased global sourcing lead-time. Meanwhile Aage and Belussi (2008) found that clusters of firms better acquire fashion and technical knowledge, but supply chain clusters have fragmented while retailers have assumed control of the design role and direct responsibility for outsourcing production (Abecassis-Moedas, 2006).

Melnyk *et al.* (2009) concluded that supply chain metrics favour short-term cost elimination, rather than strategic priorities. Low cost global sourcing has increasingly become the industry norm (Hameri and Hintsa, 2009; Lowson, 2002; Scheffer, 2012) and often results in short-term supplier selection decisions and frequent supplier switching (Harland *et al.*, 2005; Tachizawa and Thomsen, 2007). The cost focus also increases the potential for supply chain risk, including external environmental and sustainability risks which can affect economic, social and environmental performance (Christopher *et al.*, 2011). Barriers to the adoption of sustainable supply chain practices include lack of transparency, data reliability and influence over upstream suppliers (Rauer and Kaufmann, 2015). Correspondingly, risk mitigation factors are limited because of high demands on data, collaboration and time (Christopher *et al.*, 2011) while commercial resilience depends on building social capital, such as brand reputation (Rauer and Kaufmann, 2015).

Methodology
A mixed methodology was used. This included 21 semi-structured interviews with strategic managers and operational professionals of key clothing retailers and suppliers. An online survey administered to a database of 120 retailers, brands, suppliers and clothing/textiles manufacturers secured a further 21 responses. The dual approach was used to capture comparable data from a wider sample to explore a range of commercial, technical and behavioural aspects of producing clothing to last for longer than current norms. Respondents covered discount to luxury market levels, fast fashion and classic items, within the UK clothing production-distribution chain: all were based in the UK, though most have global supply chains.

Findings and analysis
The findings from interviews and surveys are presented below, covering themes identified during the research, and structured in this paper around aspects of sustainable and commercial strategy; industry perceptions of consumer expectations; aspects of new product development and testing, and implications for supply chain management.

Environmental and commercial sustainability
Most respondents have strategies in place for sustainability of their clothing design and/or production. Sustainability measures included selection of appropriate materials and reducing energy and water consumption, however, rather than addressing product lifetimes. For some retailers and brands, clothing longevity is considered instead as a value-statement for consumers, embodied in print, trim and manufacturing quality; finishes to prolong clothing life; guarantees to customers of product lifetime (durable items) or number of washes (intimate garments), and comparable wash/wear tests to demonstrate value. However, there was uncertainty over how clothing longevity can be measured and communicated to consumers, and whether this strategy could win market share.

Customer perceptions
Manufacturers appear to expect their products to last longer than do their retail customers, with fast fashion predictably having the shortest lifetime expectancy. Overall, respondents expected most garments to last 1-2 years, with coats and suits lasting over 5 years. This gap is explicit for jeans, for which fast fashion lines have a predicted life of 1 year, compared to 5 years for high street classics. Respondents perceived that consumers in value-conscious high street and low value markets might buy clothing designed, tested and guaranteed to last for longer, and may pay more for this, whereas. fast fashion consumers would not.

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Longevity initiatives and testing

Testing of materials and components is done by specialist testing facilities at key points in the global supply chain, primarily during NPD, rather than for replenishment cycles. Most tests are designed to ensure products are 'fit for purpose' at the point of sale; longevity of components or finished products is not routinely tested for, or may be retrospective, (i.e. after products arrive on sale) to underpin durability claims or inform subsequent practice.

Retailers and suppliers indicated that current performance criteria achieve appropriate product quality for their consumers and markets, and that testing is reduced for small volume, fast fashion orders. Tests for longer lasting clothes, they suggest, could potentially include additional or revised tests to increase confidence in product performance, improved labelling and information for consumers. To increase product durability *per se*, respondents suggested improvements to yarn and fabric specification, enhanced technical knowledge, and improvements to dyeing, fabric treatment, and garment construction.

NPD implications

Retailers suggested that most designers prioritise fashion, with an emphasis on style and colour, but that they are expected to have an awareness of performance standards. To explain the apparent general decline in product quality, retailers said that to meet price points their top priorities would be to downgrade garment style features and materials used, and that commercial decisions would often over-ride quality if garments failed to meet testing standards. That said, in higher end markets such products are more likely to be rejected and improved.

Garment longevity was said to depend on sourcing criteria for the yarns and fabrics for each product and on the construction methods on individual specifications. Interviewees and survey respondents indicated that, for many products, longevity is not generally considered a high priority, and consequently such practices are not being adopted consistently within the industry. One suggested designing in new finishes and technologies such as improved abrasion, anti-pilling, stain resistance, soil or stain release and anti-microbial treatments to improve product longevity. However, the survey also revealed that industry practitioners believe that clothing longevity tests could increase garment costs by up to 5% for some products and add up to 2 weeks to garment lead-times, confirming suggestions that improving garment construction to last for longer could increase costs (WRAP, 2013).

Supply chain implications

Retailers expect to receive test reports and performance information on yarn, fabric and finished garments at the product development stage, including a written assurance that the yarn/fabric is suitable for the intended end use. In reality, it was said that this level of confidence in testing and quality information is often built up over years of experience, in established buyer-supplier relationships. This sense of trust and shared ownership of the final product was most evident in suppliers to the middle and higher levels of the market. New or remote suppliers may be less familiar with working procedures and fail to supply the required confirmation. Garment suppliers normally pay for tests on their products, although costs are sometimes passed on to retailers.

While retailers (or brands) drive clothing performance standards, in practice the global nature and fast pace of the industry means that they are not always in full control of yarn and fabric selection, while product proliferation, shorter selling seasons and lead time pressures make it more difficult to test new fashion products within the constraints of the critical path.

Discussion

While clothing companies need to adopt a strategy that embraces design, production, sourcing, testing and communication to support sustainability (Fletcher, 2008) and satisfy consumer demands (Khan *et al.*, 2012), our findings suggest an industry perception that designing for longevity involves more costly and lengthy sampling and testing, increases the risk of garment rejection prior to sale and increases lead-times. On closer inspection, design for longevity adds to the pre-existing (and so far unresolved) conflict between the drivers of cost pressure, on the one hand, and design integrity on the other.

While superficially the extra cost and time required to design more durable products challenges the cost driver, it is clear that the effects of cost-centred decisions are more

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profound. The lack of technical skills and knowledge required to design for longevity is exacerbated by globalisation, supplier switching and fragmentation of industry clusters (Aage and Belussi, 2008).

Even in markets where cost is less dominant, design integrity is a barrier to adopting design for longevity, which is perceived to limit fabric, component or garment construction options, require finishes that affect style features and involve additional tests that slow an already problematic product development cycle (Oxborrow, 2014). Furthermore, there is a lack of confidence in data, collaboration, and initiatives that could shorten design decisions (Marion, 2013) but facilitate design for longevity (Fisher, *et al.*, 2008).

Furthermore, while retailers and brands argue that consumers are satisfied with garment durability, this stance does not fully account for the other aspects of longevity that could be better aligned to design integrity, giving consumers reason to develop emotional attachment to their clothes and thus reducing premature disposal.

There is a persistent and systemic mismatch between cost, time and longevity priorities that compromises the transition to longer lasting clothing. This is exacerbated by the strategic and operational behaviours of retailers and suppliers and their interpretation of consumer behaviours and preferences. Expecting retailers and brands to adapt their NPD processes to design and test for product longevity remains problematic, especially without better understanding of clothing longevity - beyond durability - from both a consumer and commercial perspective.

Conclusions

While it is technically possible to enhance clothing durability, the primary obstacles were revealed through this study to be systemic and rooted in the commercial drivers of global clothing supply chains. The research has added empirical data to theoretical ideas, bringing together different schools of thought on clothing supply chains, design and product development, and sustainability. The findings highlight a conflict between commercial imperatives such as cost, time, design integrity and sustainability imperatives, including increased product longevity. Ultimately, there is no clear driver for mainstreaming design for

clothing longevity, particularly from a commercial perspective; hence acceptability currently appears low, while limited time and resources, conflicting priorities and perceived risk limit more widespread uptake. The cost-benefit trade-offs are not fully appreciated, nor are the broader aspects of clothing longevity.

The findings are based on a relatively small sample, with implications for generalisation.. This confirms a pressing need to understand better the commercial implications of incorporating clothing longevity into NPD and supply chain practices. Understanding consumer perceptions and opportunities for new business models is critical to stimulating change in the clothing supply chain. It is recommended that businesses consider the preferences of their own target consumers and evaluate the cost-benefit and reputational implications of selling potentially fewer garments that last for longer than at present. In the long term there is a critical need for the industry to re-evaluate its strategic priorities and implement aligned supply chain and NPD practices.

Acknowledgments

References

Aage, T. and Belussi, F., 2008, From Fashion networks to design: creative networks in industrial districts, *Industry and Innovation*, 15 (5), 475-491.

Abecassis-Moedas, C., 2006, Integrating design and retail in the clothing value chain: An empirical study of the organization of design, *International Journal of Operations & Production Management*, 26 (4) 412-428.

Annis, P. (ed.), 2012, *Understanding and improving the durability of textiles*, Woodhead Publishing, Oxford.

Barrie, L., 2013, *Supply chain key to Gap's global growth plans*, Just-Style.com 18 April 2013. Available at; http://www.just-style.com/analysis/supply-chain-key-to-gaps-global-growth-plans_id117581.aspx

Black, S., 2008, *Eco-chic: The Fashion Paradox*, Black Dog, London.

Bosshart, D., 2006, *Cheap: the real cost of the global trend for bargains, discount and consumer choice*, Kogan Page, London.

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Brun, A. and Castelli, C., 2008, Supply Chain Strategy in the Fashion Industry: Developing a Portfolio Model Depending on Product, Retail and Brand, *International Journal of Production Economics*, 116, 169-181.

Cachon, P. and Swinney, R., 2011, The Value of Fast Fashion: Quick Response, Enhanced Design, and Strategic Consumer Behaviour, *Management Science*, 97 (4) 778-795.

Caro, F. and Gallien, J., 2007, Inventory Management of a Fast-Fashion Retail Network, *Operational Research*, 58 (2) 257-273.

Christopher, C., Mena, C., Khan, O. and Yurt, O., 2011, Approaches to Managing Global Sourcing Risk, *Supply Chain Management*, 16 (2) 67-81.

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

Cooper, T., Claxton, S., Hill, H., Holbrook, K., Hughes, M., Knox, A. and Oxborrow, L. (2014). *Clothing Longevity Protocol*. A report for WRAP, London. Available at: http://www.wrap.org.uk/content/clothing-longevity-protocol-1

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

Hameri, A. and Hintsa, J., 2009, Assessing the Drivers of Change in Cross-border Supply Chains, *International Journal of Physical Distribution and Logistics Management*, 39 (9) 741-761.

Harland, C., Knight, L., Lamming, R. and Walker, H., 2005, Outsourcing: Assessing the Risks and Benefits for Organisations, Sectors, and Nations, *International Journal of Operations and Production Management*, 25 (9) 831-850.

H M Government, 2013, *Prevention is Better than Cure: The role of waste prevention in moving to a more resource efficient economy,* London, Defra.

Khan, O., Christopher, M. and Creazza, A., 2012, Aligning Product Design with the Supply Chain: a Case Study, *Supply Chain Management, an International Journal*, 17 (3), 323-336.

Leonard, A., 2008, *The Story of Stuff*. Available at www.youtube.com/watch?v=gLBE5QAYXp8

Lowson, R., 2002, Apparel Sourcing Offshore: An Optimal Operational Strategy? *Journal of the Textile Institute*, 93, 15-24.

Marian, P., 2013, Viewpoint: Is Lululemon growing too fast?, Just-Style.com, 22 March 2013. Available at: http://www.just-style.com/analysis/is-lululemon-growing-too-fast_id117334.aspx.

Melnyk, S., Lummus R., Vokurka R., Burns, L. and Sandor, J., 2009, Mapping the Future of Supply Chain Management: A Delphi Study, *International Journal of Production Research*, 47 (16) 4629-4653.

Mintel Oxygen, 2011, *Women's Fashion Lifestyles*, May. Available at http://academic.mintel.com/display/578314/

Muton, F., 2012, *Masterclass video: Overview of global fashion market trends*, Ethical Fashion Forum. Available at http://source.ethicalfashionforum.com/article/masterclass-video-overview-of-global-fashion-market-trends

Oxborrow, L., 2014, *Future scenarios in UK apparel supply chains: A Disaggregative Delphi Study*, DBA thesis, Nottingham Trent University.

Pisano, G. and Adams, P., 2009, *VF Brands: Global Supply Chain Strategy*, Harvard Business School case 9-610-022, November. Available at www.ecch.com

Rauer, J. and Kaufmann, L., 2015, Mitigating external barriers to implementing green supply chain management, *Journal of Supply Chain Management*, 51 (2) 65-88.

Scheffer, M., 2012, Growth Regimes and Innovation in the Current Decade, in Shishoo, R., (Ed.) 2012, *The Global Textile and Clothing Industry,* Technological Advances and Future Challenges, Cambridge, Woodhead, pp 8-28.

Shellenbarger, S., 2001, Work Wear Hits Pay Dirt, *Wall Street Journal.* Available at http://online.wsj.com/article/SB100014240527487040136045761039907200064626.html

Swink, M., Melnyk, S., Cooper, M.B. and Hartley, J., 2010, *Managing Operations across the Supply Chain*, New York: McGraw Hill.

Tachizawa, E. and Thomsen, C., 2007, Drivers and sources of supply flexibility: an exploratory study, *International Journal of Operations & Production Management*, 27 (10) 1115-1136.

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

WRAP, 2013, *Clothing Longevity – Measuring Active Use.* Available at http://www.wrap.org.uk/content/clothing-longevity-measuring-active-use