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Product Lifetimes And The Environment

Consumer expectations of product lifetimes around the world: a review of global research findings and methods

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Abstract
This paper presents the findings of research to identify and evaluate current studies into consumer expectations of product lifetimes across durable goods. Following a literature review, studies were classified using a product categorisation scheme formulated at Nottingham Trent University and a product lifetime expectations typology adapted from Oguchi et al. (2016a) was developed. The results would appear to suggest that consumer expectations of product lifetimes are in decline, and that those in the United Kingdom appear to be lower than those in other parts of the world. However, identifying differences in consumer expectations of product lifetimes is hindered by the different methods employed in studies, as face-to-face interviews, and online, telephone and postal studies all have the potential to produce different results. Three key challenges to furthering research into consumer expectations of product lifetimes were identified: Product coverage, definitions of consumer expectations and sampling strategies. Only if these challenges can be addressed will researchers be able to draw meaningful conclusions on both personal and cultural trends in expected product lifetimes and make a positive contribution to addressing both material and social aspects of the circular economy.

Introduction

The extension of product lifetimes has been identified as a fundamental strategy to work towards a circular economy (Bakker, Wang, Huisman, & den Hollander, 2014; Moreno, Braithwaite, & Cooper, 2014). However, research has suggested that current product lifetimes for electrical and electronic equipment (EEE) may not always meet consumers' expectations (Oguchi et al., 2016a), potentially indicating a demand for longer lasting products. Furthermore, the methods used to assess consumer expectations are often inconsistent (Oguchi et al., 2016b). This makes comparison of studies across space and time difficult, preventing researchers from coming to robust conclusions on whether product lifetime expectations are declining. This understanding is critical because if consumer demand for longer-lasting products is decreasing, then this makes it harder to make the business case without recourse to statutory instruments (Ervine, 2010), public policy (Cooper, 2010a) and environmental arguments (Cooper, 2010b). In addition, divergent methodological approaches (Oguchi et al., 2016a) and inconsistent product coverage (ERM, 2011) hinder researchers' ability to conduct cross-cultural studies (Oguchi & Fuse, 2015). This makes it difficult to understand differences in product lifetime expectations which may be embedded in the cultural context in which the acquisition, use and disposal of consumer goods are situated.

This paper collates and compares previous research into consumer expectations of product lifetimes. It then outlines and evaluates their findings and methods to elucidate trends in consumer expectations and identify how this field of research, which is crucial to the attainment of a circular economy (Montalvo, Peck, & Rietveld, 2016), can be taken forward at a global level.

Methods

A critical review of the literature (Grant & Booth, 2009) was undertaken by identifying key recent publications (2000 onwards) in the field of expected product lifetimes and examining their reference lists. This was corroborated with keyword searches (e.g. expected product lifetimes) in Google Scholar (Google, 2017) and Scopus (Elsevier, 2017). The review undertaken at Nottingham Trent University (NTU) was compared to parallel work carried out at the National Institute for Environmental Studies in Japan to ascertain if there were any gaps in the NTU study. Ten publications from across the globe which explicitly surveyed consumer expectations of product lifetimes were identified. The methods employed by these studies and the products they cover are detailed above (Table 1).

Product coverage was determined using a product categorisation scheme developed at NTU (see Table 6 in the appendix). The classification scheme groups products into eighteen product categories and is informed

Study	Methods	Products studied	Number of products studied	Number of product categories covered
Oguchi et al. (2016a)	Online survey	Electrical and electronic equipment	4	2
Echegaray (2016)	Telephone interviews	Electrical and electronic equipment	10	3
Wieser et al. (2015)	Online survey	General	21	7
Consumer Technology Association (2014)	Telephone interviews	Electrical and electronic equipment	10	1
Langley et al. (2013a)	Online survey	Clothing	24	1
Knight et al. (2013)	Telephone survey	Electrical and electronic equipment	3	2
Cox et al. (2013)	Focus groups	General	30	10
Wilhelm et al. (2011)	Online survey	Electrical and electronic equipment	1	1
Tasaki et al. (2004)	Postal survey	Electrical and electronic equipment	6	3
Cooper (2004)	Household interviews	Electrical and electronic equipment	15	5

Table 1. Study methods and product coverage.

Expected product lifetime	Description	Examples
Intended	How long does the participant plan to use the product	Langley et al. (2013a); Tasaki et al. (2004)
Ideal	How long does the participant want the product to last	Oguchi et al. (2016a)
Predicted	How long does the participant anticipate that the product will last	Cooper (2004); Cox et al. (2013)

Table 2. Typology of expected product lifetimes (adapted from Oguchi et al., 2016a).

by previous research in both actual (e.g. Gutierrez, Adenso-Diaz, Lozano, & Gonzalez-Torre, 2011) and expected product lifetimes (Table 1), Mintel Academic market research reports (e.g. Carroll, 2017) and the classes of durable goods outlined in United Nations Statistics Division's (1999) Classification of Individual Consumption According to Purpose (COICOP). Durable goods are defined as products "that may be used repeatedly or continuously over a period of more than a year" (UN, EC, OECD, IMF & World Bank, 2009).

A typology for expected product lifetimes was adapted from a recent study of consumer expectations of product lifetimes for electronic goods (Oguchi et al., 2016a). Oguchi et al. (2016a) examined three different types of consumer expectations: Intended, ideal and predicted lifetimes. The adapted expected product lifetimes are defined above (Table 2). These definitions serve to distinguish between a participant's intentions for a product's use-time and their understanding of how long it should last (lifetime).

Study	Intended lifetime	Ideal lifetime	Predicted lifetime
Oguchi et al. (2016a)	X	X	X
Echegaray (2016)			X
Wieser et al. (2015)			X
Consumer Technology Association (2014)			X
Langley et al. (2013a)	X		
Knight et al. (2013)			X
Cox et al. (2013)			X
Wilhelm et al. (2011)		X	X
Tasaki et al. (2004)	X		
Cooper (2004)			X

Table 3. Expected product lifetimes surveyed by each study

Questions concerning intended lifetime seeks to ascertain how long a participant plans to use a product for. However, questions concerning ideal or predicted lifetimes strive to ascertain how long a participant wants or anticipates a product to last respectively. This typology was applied to eleven studies to facilitate comparison of consumer expectations between studies (Table 3). The findings of this exercise are described in the following section.

Results

An initial evaluation of expected lifetimes across 73 products would appear to indicate lower consumer expectations in the United Kingdom (UK) than Europe, as well as a decline in the lifetime expectations of UK consumers over time. Geographic comparisons were possible for 23 of the products, representing six product categories. Twenty-two of the products had shorter predicted lifetimes in the UK in comparison to Europe. Temporal comparisons were possible for 13 of the products, representing four product categories. The results indicate that 12 products had shorter predicted lifetimes in more recent studies. Table 4 provides an example of predicted lifetimes for washing machines.

However, drawing firm comparisons between these studies is hindered by the following factors: Limited product coverage, inconsistencies in the questions posed by the studies of consumer expectations and the employment of differing sampling strategies. These are described below.

Product coverage

Seven of the ten studies addressed expected product lifetimes for EEE (Cooper, 2004; CTA, 2014; Echegaray, 2016; Knight, King, Herren, & Cox, 2013; Oguchi et al., 2016a; Tasaki, Terazono, & Moriguchi, 2004; Wilhelm, Yankov, & Magee, 2011), two studies addressed a range of durable goods across the product categories (Cox, Griffith,

Study	Echegaray (2016)	Wieser et al. (2015)	Knight et al. (2013)	Cox et al. (2013)	Cooper (2004)
Location	Brazil	Austria	England and Wales	United Kingdom	United Kingdom
Method	Telephone interviews	Online survey	Telephone interviews	Focus groups	Household interviews
Predicted lifetime in years	10.00	12.58	7.14	5-6	12.00

Table 4. Geographic and temporal differences in predicted product lifetimes for washing machine.

Study	Question
Echegaray (2016)	"Thinking about the way you use these devices, what do you consider as the minimum reasonable time they should last? How much time should (DEVICE) last?" (Echegaray, 2016, 201)
Wieser et al. (2015)	"How long do you expect the following products to last or flawlessly function under normal intensity of use (in years and months)?" (Wieser et al., 2015, 390).
Consumer Technology Association (2014)	"About how many YEARS would you expect the following electronics products to last before the technology is outdated or stops working?" (CTA, 2014, p.8)
Cooper (2004)	"What would be a reasonable life-span for these products?" (Mayers and Cooper, 2001, p.108)

Table 5. Examples of questions posed by selected studies on predicted lifetimes.

Giorgi, & King, 2013; Wieser, Tröger, & Hübner, 2015) and one study examined clothing (Langley, Durkacz, & Tanase, 2013a, 2013b) (Table 2). Seventy-three products were surveyed in the ten studies, representing twelve of the eighteen product categories defined by NTU. Six product categories were not evaluated by current research, these were: Bicycles, jewellery, clocks and watches, kitchenware, musical instruments, small tools and fittings and sports equipment.

Whilst recent research has examined the product lifetimes of a number of products it is not exhaustive, there are still areas which need to be further investigated to understand consumer expectations of product lifetimes across all categories of durable goods.

Consumer expectations

The results show that the ten studies evaluated were amenable to classification using the typology for expected product lifetimes (Table 4). Nine of the studies explicitly address predicted lifetimes, while only three address ideal lifetimes and two address intended lifetimes. The limited information on the questions posed to consumers by some of these studies and inconsistences in the questions (Table 5), make direct comparison difficult as the extent to which they conform to the typology of expectations outlined in this paper (Table 2) is unclear.

Sampling strategy

Nine studies employed survey methods with varying sample sizes and strategies (Table 1). Cox et al. (2013) was the only study in which focus groups were used for data collection, during which participants deliberated to reach a consensus on expected product lifetimes. The other nine studies employed face-to-face, postal, telephone or online survey methods, and participants individually responded as either individuals or heads of household. Additionally, all the studies were conducted at varying scales, from a focus on urban areas to nations as a whole, in six countries across the world. When coupled with the inconsistences in the questions posed by the studies discussed above, the diverse sampling strategies make it difficult to compare expected lifetimes across studies.

Discussion

The inconsistent product coverage, differences between the consumer expectations under investigation and divergent methods and sampling strategies employed pose barriers to understanding consumer expectations of product lifetimes. These challenges are discussed below and suggestions are offered to address them.

Product coverage

Current research into consumer expectations of product lifetimes has primarily focused on EEE, whilst limited research has been conducted on clothing and consumer durables in general. This has resulted in patchy coverage with everyday products such as kitchenware, small tools and fittings, and space heating and cooling products being poorly understood in terms of product lifetime expectations (ERM, 2011). Academic enquiry to address the challenge of product coverage in the future could focus on studying under-researched products and evaluating the uniformity of consumer expectations across products within particular product categories (e.g. mobile phones and laptops within electronic goods).

Consumer expectations

The variability in the focus of questions posed by previous research in consumer expectations hinders the comparability of past research findings. Whilst a number of studies could be considered to have evaluated predicted lifetimes (as defined by Oguchi et al., 2016a), relatively few have examined ideal lifetimes and intended use times. Without knowledge of the consumers' ideal lifetimes and intended use, it is difficult to ascertain whether current product lifetimes wholly meet the expectations of the consumer.

Further investigation should seek to estimate and evaluate differences between different types of product lifetime expectations, and identify how these expectations might change over time. This is crucial if the potential for lifetime extension and "slowing resource loops" (Bakker et al., 2014, 309) is to be fully realised.

Furthermore, future research should clearly stipulate what

type of consumer expectations are being investigated and increased focus should be placed on understanding ideal and intended lifetimes. Research into intended lifetimes could follow the active use approach developed by NTU and WRAP (Waste & Resources Action Programme) in their study of clothing longevity (Langley et al., 2013a, 2013b; McLaren, Oxborrow, Cooper, Hill, & Goworek, 2015) whereby participants were asked how much time has elapsed since they acquired the product and how long they intend to continue to use it for.

Sampling strategy

The variety of methods and sampling strategies employed in the research make direct comparisons between studies difficult. The majority of studies in consumer expectations of product lifetime employ opt-in sampling strategies whereby participants elect to take part in market research. In the fields of opinion polling and market research, questions remain around the representativeness of using non-probability (opt-in) sampling techniques such as consumer panels (Baker et al., 2010). However, cost remains a crucial factor limiting the application of random samples in this context.

Further enquiry should first seek to establish consensus among researchers in the field in order to develop robust and replicable survey methods and sampling strategies that can collect comparable data. The process of back-translation (e.g. Brislin, 1970) would ensure that meaningful data can be collected to facilitate cross-cultural studies. Comparative studies would enable the identification of both general and cultural/geographic-specific best-practice and barriers to extending product lifetimes (Oguchi & Fuse, 2015), supporting their role in attaining a circular economy (Montalvo et al., 2016).

Conclusions

This paper has identified and evaluated ten studies from across the globe which explicitly survey consumer expectations of product lifetimes. The findings would appear to indicate that consumer expectations are declining for many products. However, the variety of methods and sampling strategies employed by the studies makes direct comparisons problematic. This paper identified that if issues of product coverage, varying definitions of consumer expectations and sampling strategy can be addressed, then research in expected product lifetimes area will be able to make an invaluable, timely contribution to this emerging field of enquiry.

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Appendix

Product categories	Description
Bicycles	Bicycles include all types of bicycles and tricycles except toy bicycles and toy tricycles.
Cars	Cars include all motor cars, passenger carriers and utility vans.
Clothing	Clothing includes coats, jeans, trousers and shirts.
Electronic goods	Electronic goods include mobile phones, computers, games consoles, cameras, printers, laptops, tablets, sound systems, radios and other electronic equipment.
Floor coverings	Floor coverings include carpets, rugs, vinyl flooring and floor tiles.
Footwear	Footwear includes shoes and boots.
Furniture	Furniture includes sofas, chairs, tables, dining chairs, bookshelves, beds, freestanding wardrobes and cabinets.
Household textiles and soft furnishings	Household textiles and soft furnishings include curtains, fabric blinds, bedding, cushions, tablecloths and towels.
Jewellery, clocks and watches	Jewellery, clocks and watches include jewellery, cuff links, tiepins, clocks, watches, alarm clocks and stopwatches.
Kitchenware	Kitchenware includes cookware, tableware, glassware, cooking utensils and storage containers.
Large kitchen appliances	Kitchen appliances include washing machines, fridges, freezers, dishwashers and ovens.
Musical instruments	Musical instruments include keyboards, wind instruments, string instruments and percussion.
Power tools for the home and garden	Power tools for the home and garden include electric drills and saws, hedge trimmers and lawnmowers.
Small household appliances	Small household appliances include irons, vacuum cleaners, kettles, toasters, other small kitchen appliances, and personal care appliances such as razors and hairdryers.
Small tools and fittings	Small tools and fittings include hand tools, garden tools, ladders, door handles and locks, power sockets, bulbs, batteries and wires.
Space heating and cooling products	Space heating and cooling products include boilers, radiators, water heaters, water storage tanks, storage heaters and air conditioning units.
Sports equipment	Sports equipment includes sport-specific footwear such as running shoes and football boots, and equipment such as bats, balls, weights and nets.
Toys and games	Toys and games include board games, puzzles, soft toys and electronic toys excluding games consoles.

Table 6. Nottingham Trent University in-house product categories.