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Developing scenarios for product longevity and sufficiency

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Abstract
This paper explores the narrative of peoples' relationships with products as a window on understanding the types of innovation that may inform a culture of sufficiency. The work forms part of the 'Business as Unusual: Designing Products with Consumers in the Loop' [BaU] project, funded as part of the UK EPSRC-ESRC RECODE network (RECODE, 2016) that aims to explore the potential of re-distributed manufacturing (RdM) in a context of sustainability. This element of the project employed interviews, mapping and workshops as methods to investigate the relationship between people and products across the product lifecycle. A focus on product longevity and specifically the people-product interactions is captured in conversations around product maintenance and repair. In exploring ideas of 'broken' we found different characteristics of, and motivations for, repair. Mapping these and other product-people interactions across the product lifecycle indicated where current activity is, who owns such activity (i.e. organisation or individual) and where gaps in interactions occur. These issues were explored further in a workshop which grouped participants to look at products from the perspective of one of four scenarios; each scenario represented either short or long product lifespans and different types of people engagement in the design process. The findings help give shape to new scenarios for designing sufficiency-based social models of material flows.

Introduction

This paper reports on work undertaken as part of a UK EPSRC funded project that explored how redistributed manufacturing (RdM) has the potential to disrupt the way we produce and consume products across the lifecycle through engaging users in local modes of sustainable production. In response to such disruption the research explored new business scenarios to promote resource sufficiency through exploring the engagement of people with their products across different product lives.

It is proposed that new, localised structures of design and manufacturing can enable large reductions in resource consumption by limiting waste in a supply chain (e.g. reducing transport distances) and through addressing the flows of resources at critical times in the lifecycle of products. Design and manufacturing strategies that extend product life offer one of many approaches that can reduce post-production resource flow. Such strategies may also promote more localised manufacturing, greater levels of bespoke mass customisation and the structural facilitation of closing different resource loops. The closing of resource loops across product lifecycles theoretically promotes increased resource efficiency and an increased utility of resources, thereby increasing the sustainability of production and consumption activities (Ellen MacArthur Foundation, 2013). An opportunity for such strategies is to not only create new systems of production and consumption, but also to challenge the paradigm of persistent growth implicit in current patterns of industrial production and consumption. The idea of questioning growth confronts 'business as usual' practices head on and as such remains on the margins of the debate. It is however, an important part of the debate.

At one level strategies for greater resource utility sit happily in a context of efficiency: making what we do today ever more efficient and resourceful (Ehrenfeld, 2008). This focuses on reducing current environmental impacts of manufacturing and pursuing current goals of productiveness. An efficiency response to this moderates business as usual modes of operation without a change to overall production goals, to attune and respond to resource scarcity through technological responses that can include for example, circular economy frameworks, environmental technologies and waste reduction initiatives. However, many argue that efficiency alone will not deliver sustainable outcomes (Ehrenfeld 2008, Princen 2005, Cooper 2005, Jackson 2009). Predominately this is because efficiency-based decision making does not take the long view.

Connecting sufficiency and product durability

A radical transformation in patterns of production and

consumption is required to respond to eco-services decline as a result of increasing resource depletion, climate change, increases in global population and growing requirements for excessive resource consumption. In contrast to efficiency, strategies driven by a sufficiency rationale challenge the fundamental goals of maximum productivity and growth. (Princen 2005) argues that sufficiency presents a different rationality to the one that dominates advanced industrial and post-industrial societies that emphasise the efficient and the judicial (and in production terms, the linear and the lean). A sufficiency rationale recognises the complexities and dynamics of natural systems and the imperative of promoting an ecological integrity that can protect the eco-services on which all economic transactions rely (Princen 2005, pp25-26). Sufficiency equals resource security that equals sustainability. This is long-term thinking.

This analysis suggests that shifts in thinking are required to counter high levels of material consumption while maintaining levels of productivity conducive to supporting a society's economic, social and ecological wellbeing. The premise of this research is that a shift to a more durable product culture will provide environmental benefits (Braithwaite et al 2015, Bakker et al 2014). However such a shift will not only require technological and system changes such as those proposed by the theory and practice of circular economies (efficiency-oriented), but also a much greater understanding of, and engagement with the people to address issues of demand. The paper links concepts of product durability, repair and adaptation to redistributed manufacturing to create greater potential for dispersed 'making'. It proposes that through extending material utility using local making knowledge and services, there is a potential to deliver a sufficiency-led product culture.

Methodology

The paper reports on three objectives of the BaU project: to map consumer interventions across the lifecycle of products; to explore people-product relationships in product repair; and to envision more sustainable scenarios of product development in RdM contexts. Meeting these objectives required the application of different methodologies.

A literature review was undertaken to explore consumer interventions across the product lifecycle. Within Customer Relationship Management (CRM), consumer touchpoints (Dahan et al, 2010) are a well-established tool for mapping and understanding the interactions between a brand and its customers (Hogan et al 2005, Martin et al 2011, Baxendale et al 2015). Building on the theory of customer journey maps, the project employed the mapping of consumer intervention points to visualise the opportunities for the consumer to intervene in, and modify, the intended or expected product lifecycle. The project used current literature to map points of intervention in a customer journey throughout the entire product lifecycle, from product specification, design and manufacture, through promotion, sale and use, to repair, re-sale and disposal. A key aim of this mapping exercise was to explore new opportunities for people-product interactions to support sustainable production and consumption in RdM contexts.

The second phase of the project explored product repair as a means to investigate peoples' interactions with their products in use. This study included semi-structured interviews that were carried out between May and July 2016. A survey of relevant literature was also completed prior to interviews to establish key interview themes and to help populate the customer journey map (Saca, 2016). A key purpose of the interviews was to understand what constitutes brokenness and repair and to find out how people engage in the repair process and to further understand the role of more localised product interventions (e.g. maintenance and making) in slowing resource loops. In total 41 interviews were completed: 10 were visitors to the Farnham Repair Cafe and the Guildford Repair Cafe; 16 were volunteers at those Repair Cafes or members of other Makerspaces (The Restart Project, Men in Sheds); and 15 were members of the general public.

In the final stage of research new scenarios for business ('Business as Unusual' BaU) were developed. Here scenario planning is used to visualise the key assertions of the BaU project – that manufacturing is localised, people are involved in the design of their products, and overall resource use is low. Based on these three founding concepts, two critical uncertainties were identified: product longevity (the length of product life) and consumer design drivers (the nature of consumer interactions and the types of consumer data). Four different scenarios formed the basis of a workshop activity exploring different product lifecycles and customer interventions. Note the BaU project also researched fast moving consumable goods and the use of large consumer data sets; while the work is not core to the scope of this paper, it does inform the development of the scenarios.

Engaging people in the product lifecycle

The customer intervention map

A literature review identified the relevant phases of a customer journey across the lifecycle in order to create a Consumer Intervention Map (CIM). In common with existing CJM models, the CIM depicts the customer journey space at increasing levels of detail. Based on the literature the map was populated with 'active' touchpoints where consumers directly and intentionally intervene to alter the brand's intended, or expected, customer journey model. Passive touchpoints (for example magazine advertising or sales staff interactions) that do not involve consumer intervention were excluded. The identified touchpoints were mapped to their appropriate phases in the product lifecycle (Figure 1) using a system of colour coding to identify different stages of the lifecycle and diferent colour tones and positioning to indicate the different drivers of intervention. The inner circle

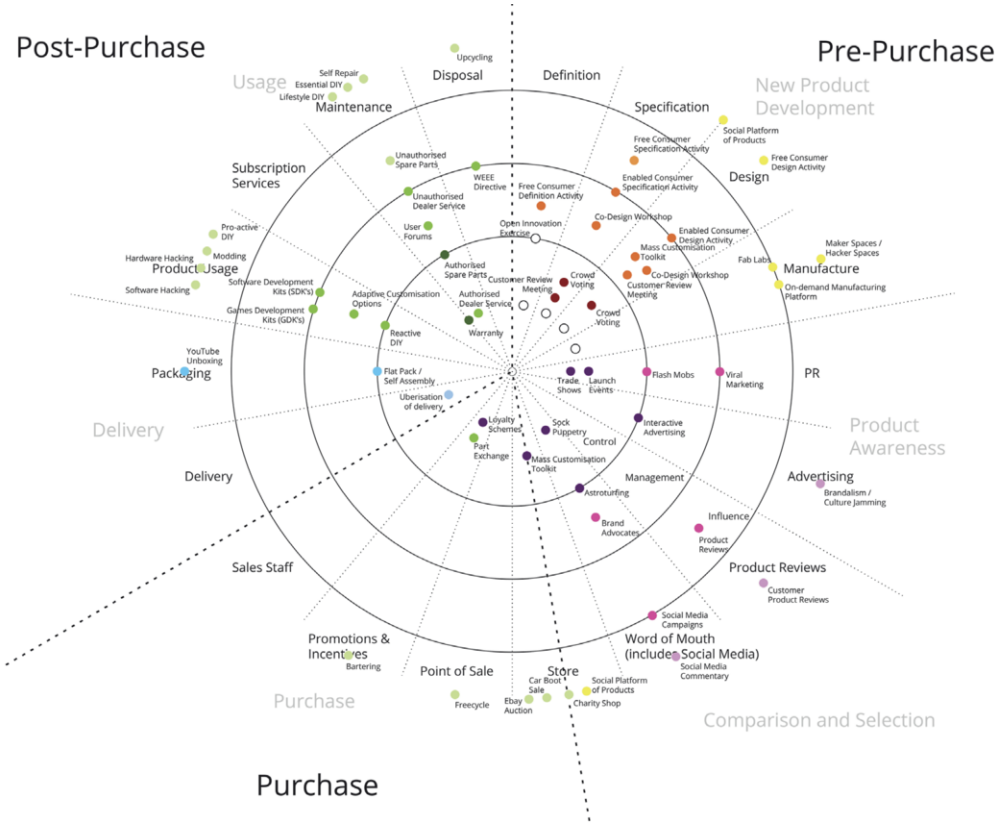


Figure 1. Consumer intervention map populated across the lifecycle (source: CIM, 2016).

represents touchpoints driven and 'owned' by the product/brand organisation; moving to the outside of the circle or beyond its boundaries, represents less control from the organisation and a move to independent initiatives by individuals or communities (e.g. hacking a product to create new functionality is a people-product intervention outside the circle). The CIM was used to plot the different product journeys that resulted from exploring the BaU scenarios in the later workshop activities.

Product repair

The primary focus for this part of the project was the activities found in repair cafes. A total of 26 interviews with volunteer repairers and people bringing products for repair were undertaken. A brief overview of repair cafe respondents' motivations and barriers to repair is presented in Table 1. Perceptions of brokenness varied but most respondents referred to a loss of function or a decline in the performance of the product that no longer meets the expectations of the user. Poor product performance was similarly highlighted in a study undertaken by Nottingham University (Salvia et al, 2015). Which found that vacuum cleaners were replaced due to a decline in the performance of the product, and specifically the reduced power of the vacuum suction: a problem that can be easily remedied by cleaning or replacing the filters. Instead, many owners chose to dispose of the product and purchase a new one. Comments made by repair cafe interviewees highlighted issues of product care and maintenance, such as a lack of maintenance know-how, an inability to take newer products apart (e.g. glued components) and expectations that products today don't last that long. Heiskanen (1996) states that people replace products because of technical failure, dissatisfaction or a change in their needs. Similarly, Granberg (1997) and Cooper (2004) present different types of obsolescence that reflect a complex set of relationships between people, their products, technological trends, and the economic and cultural contexts of product use. The very different relationships people have with their products are also evident in repair café conversations. People report a decline in product performance as a primary factor to dispose of a product. A lack of maintenance and general care across product-life are also key reasons why product functionality decreases below acceptable levels and people seek alternative solutions. A lack of product knowledge and lack of technical information about the product and its spare parts can also play an important role in this decision-making process. Similar points have been reported in earlier literature (e.g. Gwilt et al, 2015 and Salvia et al 2015) The relationships people have with their product also matter. Sometimes it's an emotional connection (Chapman, 2005) - a gift from someone special; a product passed down through the family; a

Motivations and barriers to product repair			
When is a product considered to be broken?	**What makes something worth repairing?**	**Why don't you repair it yourself?**	**What are the main barriers for repair?**
- When it doesn't work as it used to - When it no longer can do what it was bought for - When the main function doesn't work anymore - When it is no longer convenient to use - When it stops working or doesn't work well - When the quality and performance decreases	- A product with emotional attachment that you want to keep - A familiarity with the product and technology - Better to repair than replace with a product you don't understand. - Cheaper to repair than replace - Cheap products are not worth paying repair for	- Lack of knowledge - Lack of time - The inconvenience of repair - The ease of buying a new product - Not owning the right tools - Concerns about voiding the warranty - Concerns that product won't work anymore - Lack of creativity to do repair - Lack of skill	- Lack of access to spare parts - Obsolete components - Lack of knowledge about the spare parts required - Products are not designed for longevity or repair -Products designed for manufacture, not disassembly - Difficult to open products to repair them - Products not looked after, are seen as disposable

Table 1. Repair cafe participants' views on product repair (Saca, 2016).

comfortable chair; a favourite dress. Other times the attachment is more pragmatic. One elderly lady explained how she much preferred trying to fix her products (she'd brought a number to the cafe already) because she was familiar with how the product worked and what all the buttons do (or the ones she needed to know about), and she didn't want to consider having to think about all that again with a new product using new technology.

Community based repair initiatives alongside on-line IFixit instructions and Makerspaces have provided a new type of platform for people to make different decisions about extending their product's life using local making contexts. Not only do such repair initiatives contribute to waste reduction and product longevity, they also provide places for people to socialize, share and learn new skills (Kohtala 2015; Prendeville et al 2016).

Interventions during product use provide opportunities to transform the worn into the useful, the old into an adapted new. It is this potential for extending the utility of material resources that offers the potential to disrupt business as usual practices. This is not new – thrift, for example, is a historical norm. What is emerging as a challenge is how resource resilience can be promoted through strategies of redistributed making.

Business scenarios for product longevity and sufficiency

Customers' product needs may be met in entirely new ways through creating hybrid models of co-design and production between customers, local makerspaces and manufacturers, where new product experiences and communities can be connected and informed (Sanders 2008). Longer lasting products coupled with a culture of repair provide an interesting backdrop for proposing new business scenarios. New configurations between circular business models and design strategies will not only extend product life but also reframe the role of the product in different modes of consumption (Moreno et al, 2016). Bocken et al (2016) identify new business models that shift a "dominant business model logic" to a circular economy mode.

Similarly, this exploratory study identified two critical elements in considering a shift in the production paradigm. One focused on the nature of engagement with people across the lifecycle, from very engaged (people-led activity) to people inspired (data driven input). The other addressed the timeline of a product's lifecycle from short-life to long-life. . Four conceptual business scenarios reflecting structural change in relationships between production and consumption emerged and were explored with expert participants at a workshop (BaU, 2016). Two of these scenarios focused on product longevity and the engagement of people at different scales. Figure 2 shows the core factors of both durability scenarios. These explore who designs (consumers or experts); the need for technological developments; the scale of data required for consumer engagement; and the scale of the organisation.

For example, in the scenario, Engaging Endurables (Long Life Cycle + Customer Led Design), durable products with long life cycles are crafted and exchanged in localised systems. They are designed by individual customers who work with the makers to customise their purchases. Technology development facilitates consumer engagement and co-design, and builds local networks of makers and maintainers. Local businesses work with end users through apps, service provision, and physical exchange and repair points. In the scenario, Democratic Durables (Long Life Cycle + Customer Inspired Design),

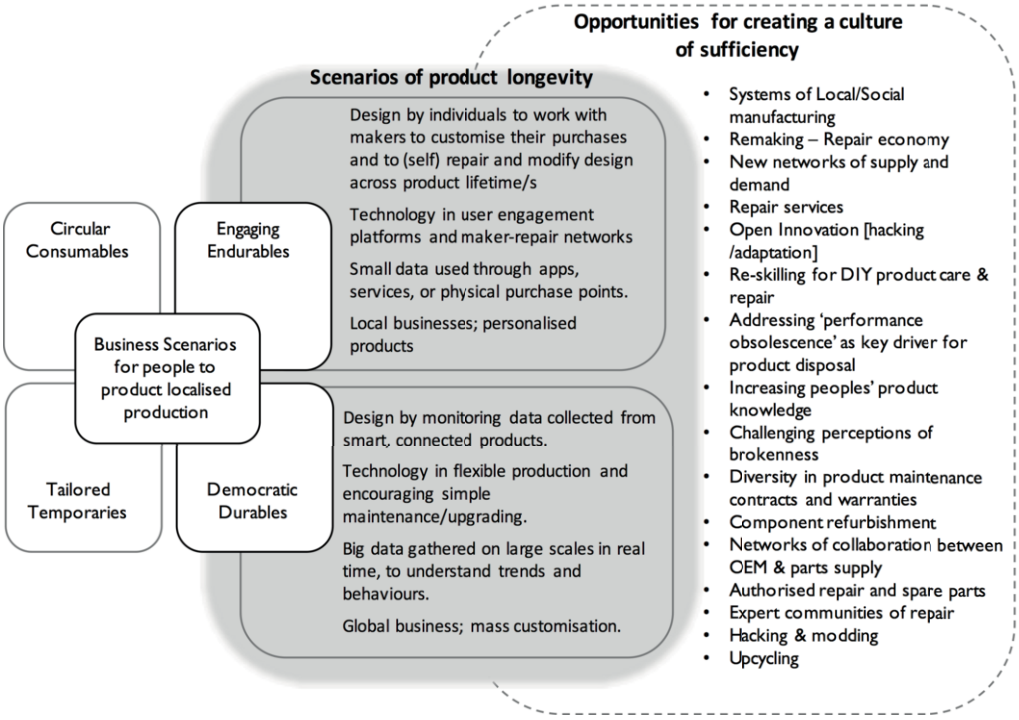


Figure 2. Business as Unusual scenarios with a focus on product longevity.

connected products with extended life cycles are produced, maintained and exchanged in a localised system. They are designed by monitoring lifecycle data collected from products in use. Technology development is focused on delivering flexible systems of supply, assembly, maintenance and upgrade. Large companies gather big-data in real time to understand trends and behaviours, and translate these into targeted offerings working with localised branches and assembly centres. New product-people interactions across the product lifecycle help shape new modes of consumption. Longer-lasting products for example, explore ways in which different people-product interventions can recalibrate peoples' views of resource use, product adaptability and their value. Figure 2 also links durability scenarios to opportunities for structural change to enable a slowing of resource flows in product life, in part achieved through the adoption of modes of redistributed making and consuming.

Conclusions

Reframing ideas of disposability and linear product flow is critical in current contexts where efficiency-oriented drivers have proved ineffective at creating sustainable business outcomes. Product obsolescence, in its many forms, can only be successfully addressed if a greater emphasis is placed on business strategies of sufficiency alongside those already addressing efficiency. This exploratory research suggests that developing a better understanding of the opportunities and challenges posed by long-life products, alongside the potential of different people-product interactions in product life, will support evolving cultures of sufficiency and the creation of new systems of sustainable production and consumption that enhance the lifespan of material utility. Individual motivations for this may be driven by economic necessity but also may be influenced by the areas highlighted in this study, such as a familiarity with the technology or functionality of a product, an emotional attachment to a product or a desire to learn new skills. The viability for distributed making and product life extension is also determined by the presence of new infrastructures, services and skills to support repair and adaptation. There are opportunities for RdM strategies to establish a capacity for different collaborations between OEMs, the suppliers of parts, local fixers and makers and end users in creating sufficiency-based social models of material flows.

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