Systems and service design and the circular economy

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Systems and Service Design and the Circular Economy

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Introduction

People in the western world are now living in a service economy due to a general economic shift from making products to providing services (Bhamra and Lofthouse, 2007). In addition services are being increasingly embodied in the products we buy (*ibid*). Thus far this has been driven by business motives (Goedkoop et al, 1999; Mont 2002) rather than environmental concerns as by adding services to their products companies can obtain higher producer-customer interaction and increase competitive advantage (Bhamra and Lofthouse, 2007). But, there are a growing number of practitioners who are looking to systems and service approaches as a means of achieving consumer value alongside greater sustainability improvements. In these approaches consumer need and value is addressed in place of product functions. Impacts that affect the sustainability of a product occur across its life-cycle, including material selection, use, and end-of-life. Systems and services provide an opportunity to reduce life cycle impacts (Trimingham, 2015). There is a continuum of products and services which includes the following:

- Pure tangible products such as a bottle, dress or artwork;
- Tangible product with accompanying services such as a car with a guarantee;
- Hybrid of products and services such as a restaurant;
- Major service with minor products and services such as an airline;
- Pure service such as babysitting (Bhamra and Lofthouse, 2007).

In recent years design for sustainability has looked towards systems innovation and a service view to achieve greater sustainability improvements (Trimingham, 2015). The services that are of interest to sustainable design are known as eco-services, or sustainable Product Service Systems (PSS). Moving from manufacturing products to providing services is also known as the 'functional economy', and has been linked to the creation of a more environmentally sustainable economy (Bhamra and Lofthouse, 2007), dematerialisation and the creation of value whilst consuming less resources.

In 2003, McDonagh and Braungart argued that sustainable design needed to take a 'whole system' view, where increased consumption does not lead to increased negative environmental impact. They modelled man-made systems on natural processes where resources are cyclical, and fed back into the system rather than becoming waste. They coined this as the 'cradle to cradle' approach. The Brezet model of innovation (1997) highlights the

benefits of taking a systems thinking approach and is expanded on by Cheschin and Gaziulusoy in chapter 29. Recently cradle to cradle thinking has evolved into Circular Economy thinking but is still grounded by the ethos that man-made systems should reflect cyclical natural systems as much as possible. The Circular Economy refers to an industrial economy that is "restorative by intention; aims to rely on renewable energy; minimises, tracks, and hopefully eliminates the use of toxic chemicals; and eradicates waste through careful design (Ellen Macarthur Foundation, 2010). The concept of the circular economy is grounded in the study of non-linear, particularly living systems and is based on the following principles:

- Design out waste
- Build resilience through diversity
- Work towards using energy from renewable sources
- Think in systems
- Think in cascades (*ibid*).

Sustainable Product Service Systems

The overarching aim of Sustainable PSS is that they focus on consumer need through addressing functions that lead to consumer satisfaction with reduced environmental impacts (Clark et al, 2006). There is less need for a physical product and a reduced focus on product ownership. This way of defining sustainable PSS based on their focus of satisfying consumer needs through the utility they provide, has been adopted by numerous authors (Clark et al, 2006, Fiksel, 2006; Morelli, 2003; UNEP, 2002; Kang and Wimmer, 2009, Ness, 2007, Rapitsenyane, 2014). PSS is also referred to as servitization (Baines et al 2007; Martinez et al, 2010, Mont, 2002; Kang and Wimmer, 2009; Hernandez-Pardo, Bhamra and Bhamra, 2013; Tukker, 2004). The function-oriented innovation nature of PSS as opposed to a product-oriented innovation, presents opportunities for a shift from ownership to fee-based access to shared resources (Tukker and Tischner, 2006). Although there is a distinction between Product Service Systems and servitization (Rapitsenyane, 2014), these terms are not isolated from one another (Morelli, 2003; Baha et al, 2014, Smith and Maull, 2014). In the context of conventional manufacturers, PSS can be viewed as a strategy through which manufacturers can servitize their business (Rapitsenyane, 2014; Baines et al., 2009). PSS can be viewed as an integration of new product development and new service development (De Lille et al, 2012). The aim of simultaneously addressing product and service components of value creation is to shift the business focus "from designing (and selling) physical products only, to designing (and selling) a system of products and services which are jointly capable of fulfilling specific client demands, while re-orienting current unsustainable trends in production and consumption practices" (Manzini and Vezzoli, 2003). The re-orientation of unsustainable trends in production and consumption provides the rationale for this kind of strategy to be called sustainable Product Service Systems. A utility focus allows a company to concentrate on adding value rather than tangible features. These values can represent convenience, comfort, information or emotional and cultural values (Rapitsenyane, 2014). PSS must therefore be socially constructed alongside stakeholder participation (Morelli,

2006, Tukker and Tishner, 2006). PSS's deliver value through three orientations (or focus of value); Product orientated; use orientated; and result orientated (Tukker, 2004). These are also referred to as; services providing added value to product life cycles; services providing enabling platforms for customers; and services providing final results to customers (UNEP, 2002). An overview of these orientations can be found in Table 1.1.

Table 1.1 Types of eco-services (adapted from Bhamra and Lofthouse, 2007)

	Product Orientated Services	Use Orientated services	Results Orientated services
Features	• Customer ownership of the physical good • Services enhance utility	• Ownership of the product resides with the service provider. • Consumer gains the functions of the product without ownership	• Product owned and run by supplier. • A result is offered rather than a specified product or service. • How customer need is satisfied is irrelevant, as long as it is satisfied.
Environmental benefits	• Increase product lifespans and therefore save energy and materials over time	• Reduction of products needed • High use intensity • End of life disposal becomes the responsibility of the service provider • Resource reduction	• Incentives to optimise service life and efficiency. • Significant reductions in material and energy consumption. • Profits are tied to efficiency.
Business benefits	• Income from the service • Customer tie-in • Reduced costs	• Economic gains from less resource • Shared costs throughout the lifecycle	• Reduced costs • Improved customer-supplier relationship
Examples	• Warranties • Maintenance agreements	• Photocopiers • Leasing arrangements • Car share	• Pest management service • Gardening service

The advantage with PSS is that value can be created with consumption of less resources (Kang and Wimmer, 2009). Values inherent in PSS are either tangible, where customers see a financial benefit of choosing PSS over product ownership, or intangible, where value comes from the experience of using PSS (Tukker, 2004). Table 1.2 highlights PSS categories and win-win potential, demonstrating positive sustainability and business impacts.

PSS Categories and win-win potential			
Services providing added value to product life cycle	**Services providing enabling platforms for customers**	**Services providing final results to customers**	UNEP Table 1.2 Sustainability
Product Oriented	**Use Oriented**	**Result Oriented**	Tukker (2004)
Minimising costs for a long lasting serviceable product (economic)	Maximum use of a given product	Optimisation of use reduces energy and material consumption (environmental	
Design for end of life (environmental)	Fewer products needed for a community of people in a given period of time	Product life extension services (economic & social)	
	Low service provider costs	Application of end of life strategies to components and materials to save on material and component costs (environmental and economic)	
	Product life extension services		

Table 1.2 Sustainability and business added value from PSS (Rapitsenyane, 2014)

Service Design

The promotion of services as a means to add value to product offerings has also seen the development of service design as a discipline in its own right. Service Design has essentially removed the product offering altogether, however is still viewed as a process of value creation (Vargo and Lusch, 2004). The proposition, rather than being product focussed, is in the form of resources that may include services, information, knowledge or skills of staff (ibid). Service design is human centred and uses design tools and techniques to work with others, to explore and redefine models of public services from the user perspective and to emphasise human involvement through the process of co-creation (Parker and Heapy, 2006). The role of the user is to co-create value by directly interacting with these resources and contributing their own skills and resources if necessary (Kuzmina et al, 2012).

Service design may be defined as an approach that is used to innovate or improve services making them more effective (Stickdorn and Scneider, 2010; Moritz 2005). It can facilitate change in services including within the public sector where design processes and skills form

an approach to tackle pressing economic, social and environmental issues (Mulgan and Albury, 2003; Cottam and Leadbeater, 2004; Thomas 2008). For example during the Dott07 project (a year of community design projects in the North East of England), a service design approach was used to address the sustainability agenda within educational institutions. It brought together stakeholders in a process of problem solving to co-develop and co-design resources that solved specific environmental problems (Thackara, 2007).

The impact of service design thus far has been broad, found within government, communities, healthcare, and education (Sangiorgi, 2011; Thackera, 2007). It has been used to change behaviours and build capacities of users and service providers to engage with the service process of co-creation, reconfiguring relationships and resources of the service (Szebeko, 2011; Pacenti, 2011). Some examples of service design have seen alternative service scenarios that bring communities together and encourage new sustainable behaviours such as sharing spaces or health support to address social and environmental issues (Cottam and Leadbeater, 2004; Cipolla and Moura, 2011).

Case Study's

Three very different case studies are presented below highlighting the breadth of possibilities for sustainable innovation through taking a systems and services approach. The common denominator is that they are designer-led and the strategies embedded within each project stem from design thinking. The first case study focusses on building capabilities within small to medium enterprises (SMEs) to encourage them to explore the use of sustainable product service systems approaches to increase competitiveness. The second case study presents more user-focussed outcomes of an action research project that had a specific focus on refillable packaging within the personal care market. The final case study looks at how design approaches can be used to explore change in education toward sustainable development by reframing it as a service.

Supporting the adoption of sustainable Product Service Systems in Botswana (Rapitsenyane, 2014)

This case study presents the results of a workshop based study with designers and SMEs in the leather manufacturing industry in Botswana carried out to support a doctoral thesis supervised at a British University. Its purpose was to explore the use of design knowledge to build service orientated capabilities in traditionally product orientated companies to enable these companies to operate, grow and be competitive in a predominantly knowledge and service economy.

Methodolody

A multiple case study approach was adopted with a purposefully selected sample of 3 SMEs in the leather industry in Botswana. All SMEs were micro (employing 1 to 6 people), operated in different market segments, and mostly served business to business customers. Two sustainable designers were also involved in the study. Data was collected through site visits, workshops and interviews. Data was also collected from the designers through

interviews following the workshops. The purpose of the workshops was to expose SMEs design capabilities in a conscious process of developing PSS offerings alongside the brought in designers. Data gathered for each case study was transcribed and analysed in N-vivo. The purpose of the analysis was to explore interactions between designers and SMEs. Activities were targeted at overcoming barriers to PSS differentiation. Thematic analysis was adopted (Braun and Clarke, 2006) to identify themes and patterns.

Findings

Six themes were identified during the study which build a framework for exploring PSS offerings within SMEs (see figure 1.1):

Identify value to initiate engagement – different situations prompted SMEs to engage with new knowledge related to PSS. Both internal and external factors stimulated this engagement. These included the need to launch new product offerings and the desire to explore new market opportunities. Financial benefit was a key driver to engaging SMEs.

Building understanding – of how design can be used to drive companies towards adopting PSS. Central to engaging companies with this was co-design approaches to infuse growth possibilities, and offer a balance to the dominant business perspective.
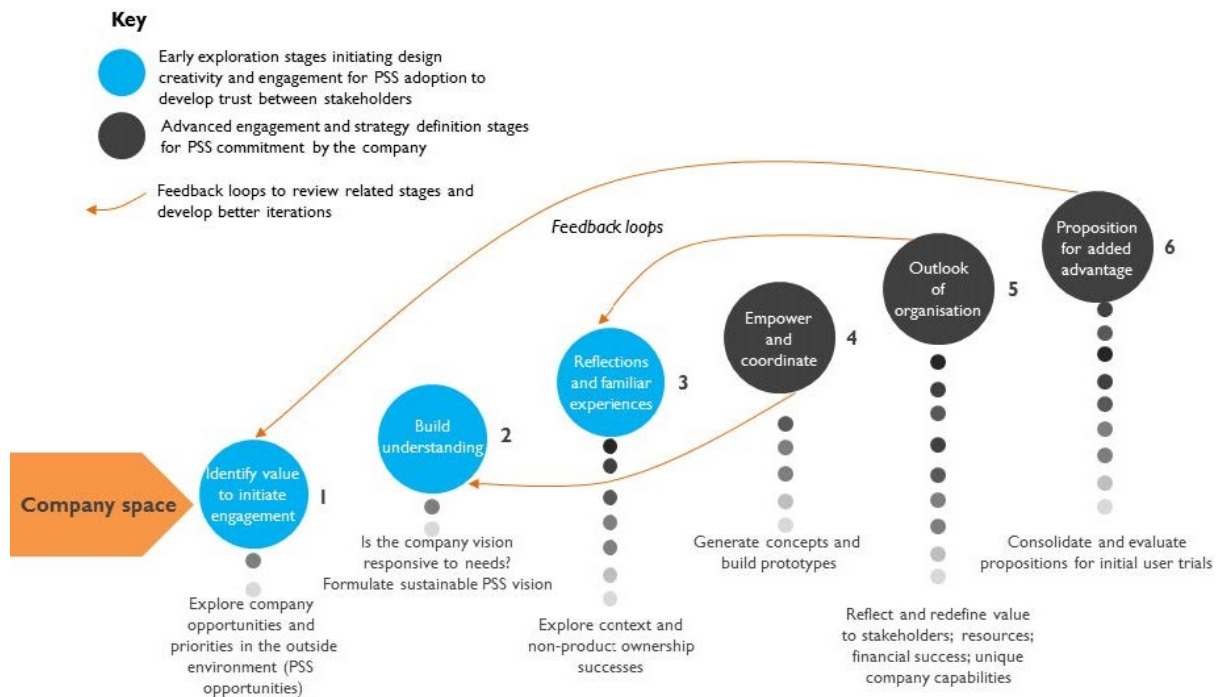
Reflections and familiar experiences – designers built enhanced capabilities through improving the confidence of SMEs to engage with PSS. This was a result of an educative mentorship approach and through visualization of possibilities.

Empower and co-ordinate – the definition of a development process for the company to empower them to generate solutions. Identification and deployment of relevant tools to guide logical and systematic solution development.

Organisational outlook – This included designers linking the need to be creative to company visions, shifting SMEs focus from defining value strictly in tangible terms. An exploration of aspects bearing on a company's activities, such as stakeholders, user needs, value of brand, and relationships aided these conversations.

Proposition for adding value – including strategies adopted by each company to differentiate themselves. A key feature was that designers were regarded as key stakeholders in facilitating the process of developing propositions. Strategy explorations included customer retention strategies; external partners; opening new markets; services providing added value to product life cycle and services providing enabling platforms to customers.

Figure 1.1: A design capabilities shift process towards service-oriented differentiation
(Rapitsenyane, 2014)

Within the leather manufacturing companies that took part in the case studies benefits of a sustainable PSS approach were seen. These included highlighting new business models (for example rental of leather goods), opening up new markets, enhanced understanding of consumers and increasing business opportunities. Across all six themes the role of design in influencing a shift towards service orientation was identified. SMEs still lack the innovation language often found in design. A co-design approach is required in order to unify the business needs of profits with the human centred approaches required to support servitization through the interpretation of needs in a product or service (Baha et al, 2014).

Refillable packaging (Lofthouse et al, 2009)

In recent years the environmental impact of packaging has become a prominent issue in the UK as it is a very visible product in the waste stream, making up between 15% and 25% by weight of household dustbin waste (INCPEN, 2003). The use of refillable packaging has long been cited as a possible solution to this problem, and their potential is clearly recognised by bodies such as The Waste and Resources Programme (WRAP) and The Department of Environment Food and Rural Affairs (DEFRA). This case study presents the results of a study to investigate their feasibility (using a PSS approach) within the personal care market.

From a sustainability perspective the main drivers for using refillable packaging systems stem from the potential to minimise packaging for refills, which reduces material use and ultimately slows resource depletion. The lighter weight of refills also reduces the

environmental impact of distribution as less energy is required to transport the product, which in turn leads to cost savings. In addition less material will end up in landfill when the refill is disposed of.

Methodology

The overall aim of the project was to develop a refillable packaging system for 'body wash' products (i.e. shower gels and or bubble baths) and to investigate its feasibility with respect to consumer acceptance (female customers, aged 21-40) and sustainability improvements. In order to achieve the project aim a broad range of qualitative methods were used to collate background understanding, develop design concepts, and test the viability of the design solutions.

Following the completion of the background research, which aimed to better understand refills and how they are perceived by consumers and industry, a series of educational activities, creativity techniques and design activities were combined together to form the 'creative workshop' programme. The 'creative workshop' aimed to; encourage invited participants to think about the different types of refills available, outline the attributes of body wash products, feed in other sources of inspiration, and provide the group with the time to generate ideas which met the refillable packaging systems brief (Lofthouse, 2007).   As a result of these workshops, a wide range of ideas for delivering body wash products through a refillable packaging system were generated. These were worked up into concepts for evaluation. Prototypes were trialled with consumers via a 2 hour focus group programme, which combined together a series of different activities. The activities aimed to understand how the users felt about the prototypes – whether they liked them, engaged with them and/or accepted them, and more specifically, what elements they instinctively understood and needed to be explicitly explained. Data was collected by video and audio recorders, and after being transcribed qualitative analysis was carried out by hand using a 'coding and clustering' method (Strauss and Corbin, 1990, Robson, 1993).

Findings

With respect to consumer perceptions of refills, a number of attributes which lead to the consumer having either a positive or negative experience of refills were identified (see Table 1.3).

Table 1.3. Attributes leading to a positive and negative experience of refillable packaging (Lofthouse et al, 2009)

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

From an economic perspective refillable packaging can lead to an overall reduction of packaging costs, and often leads to higher profit margins either because they are designed to use minimal materials, or be re-used by the same or another customer. Many types of refills can also encourage increased levels of customer loyalty, which can lead to increased revenue. Refills also offer the opportunity to present consumers with greater choice, flexibility and customisation. Companies can also highlight reuse and resource efficiency through the use of refills, as a way of demonstrating responsible behaviour.

However, a number of organisational barriers stand in the way of refillable packaging, these include: the commitment required by the retailer to provide space for both the parent pack and refill used in many types of refill system (leading to an increase in stock keeping units); possible requirement of extra space for storage, cleaning; additional logistics requirements. Issues which lead on to potential additional costs which might arise from additional staffing, cleaning / refurbishment, return logistics and the need for additional manufacturing lines. From a marketing perspective another barrier associated with refills is the potential difficulty in establishing and retaining brand loyalty and customer buy-in. It may be difficult to convince customers to make the initial investment required to take part in some refillable systems. However initial findings from this study do suggest that if the consumer is already engaged with a brand, they will be a lot more likely to adopt and 'refill' alternatives offered to them, especially if they lead to additional cost savings.

The findings from this study have dramatically increased levels of understanding about the potential implications of PSS, in the form of refillable packaging, and how it might be successfully utilised by business. It has been seen that to be truly successful refills must perform for the consumer, the environment and business. This means they must offer good quality; be very easy to use and appropriately delivered; be clearly communicated; be offered through a brand consumers like; and represent good value whilst radically reducing the amount of 'stuff' produced and moved around. To do this the design brief must incorporate both consumer and environmental needs as well as business requirements. Failure to consider both these elements is likely to lead to failure.

Service design and its role in changing education (Kuzmina et al, 2012)

The current sustainability crisis provides an urgent need for an intentional change that entails a transformative process of deep alteration to the nature of education, individuals and institutions within the educational system (Neilson et al, 2007; UNESCO, 2009). Traditionally, education is viewed as the preparation of individuals for economic life (Sterling, 2003), however there is an emerging view of the need for education to reflect alternative views of society and incorporate social and environmental responsibility, cooperation, and contextual knowing (*ibid*. Capra, 1994). This doctoral research investigated if a service design approach could be used to analyse and transform education towards education for sustainable development.

Methodology

A study of 6 British state schools of primary education was carried out. The schools were selected with differing levels of engagement with the sustainability agenda, varying size and from differing economic areas. The focus was on understanding educational change towards sustainable development from the service providers perspective. Ethnographic methods were used to gather data including interviews and observations. Additional questionnaires were carried out with school staff. The data was analysed using grounded theory methods (Strauss and Corbin, 1998). Meaning making occurred when the data was brought together and analysed through the concept of the service.

Findings

The use of service design as a concept to explore change in education towards sustainable development reframed the problem as a change needed in the provision of the service by the provider to its user, (as opposed to its general perception as a learning process). In this case the provider is the school, and the user is the student and the wider community. Analysis highlights that schools approach change in an integrative way through developing resources around environmental and social issues alongside users whilst engaging them in meaningful learning process. This frames the change towards sustainable development in schools to be partly dependant on the development of capabilities within the service provider and providing them with opportunities to engage with change in a holistic and enduring manner.

From the research a number of service design strategies were developed. These were informed by the data from the schools that already followed an integrative approach to sustainable development and by the service design thinking that places user's needs at the centre of the change process.

Making complex issues accessible: an emerging role of service design to promote sustainable education within schools is to make such issues accessible to the main user of the service – students. Schools should approach this through real life learning. Placing needs and capabilities of students at the centre of its service and relating it to relevant social and environmental issues.

Acquiring resources: a 'sustainable resource' is one that is acquired during the process of solving a problem related to a social or environmental issue. This supports real life learning for users and becomes a tangible representation of the school's values. It can be based on real ownership (playground made of recycled materials), or symbolic (projects based within the community).

Support from stakeholders: support from all stakeholders in the provision of sustainable education increases participation and provides motivation. Support is created by opening up opportunities for participation and leading activities.

Building desired identity: school's perception of self as a contributor to sustainable development allows it to build ethos and identity. Leadership plays a crucial role and this leads to the prioritisation of sustainable development projects.

Self assessment: schools that undergo continuous assessment with regards to attaining sustainable development goals helps to support building identity, leadership and the need to acquire further resources.

The research outlined the relationship between learning processes as a service offering, institutions as service providers and students as users of the service. The research used the integrated framework as an analytical lens to present it from a service perspective. This highlighted that change was needed in both the service offering (expanding it to include sustainable development) and in the service provision process through involvement with users as co-creators of the service. It identified that the capacity and capabilities of the service provider were also an important factor in the success of the service.

Implications for Design

PSS's are a business strategy that take into account product and service life cycles (Tan and McAloone, 2006). In this way, the concept is representative of a holistic approach to sustainability innovation (Rapitsenyane, 2014). A view of the whole landscape of the problem, environment and relationships between factors is necessary in this holistic view especially if looked at from the design perspective (Rapitsenyane, 2014). A whole system design approach is necessary to aid such decisions (Fiksel, 2006) and move away from its traditional focus on material products (Morelli, 2003). Characteristics of a system include the

problem being investigated, the context in which the system is to be operated, relationships between factors and stakeholders and their interactions (Charnley et al, 2011).

The characteristics of PSS imply the need for cross disciplinary knowledge co-creation and problem investigation across the entire components of a system (Rapitsenyane, 2014). It assumes a life cycle focus that concentrates on functionality and value to consumers and reducing environemtnal impacts (Goedkoop et al, 1999; Tukker and Tishner, 2006). The focus on consumer values and satisfaction inherent in PSS and service design presents a need to reorientate consumer behaviour towards them and demands customer involvement as co-producers (Manzini and Vezzoli, 2003; Kang and Wimmer, 2009; Morelli, 2003)

The importance of design in the performance of companies has been reported by various authors with varying levels of application. Kotler and Rath (1984) argue the use of design by companies' marketing departments as strategic in matching customers' requirements to product related attributes. This provides a link between user needs and the solution to be proposed. A leadership position for design in new product development as argued by Perks, Cooper and Jones (2005) expands beyond traditional design tasks to include direct interface with customers. This role addresses the gap often found between design teams and the marketing departments (Von Stamm, 2003). The versatility of designers being able to cover such stretching roles stems from superior design capabilities like interpreting, coordinating and facilitating (Turner, 2000) and can be related to Mozota's (2006) four powers of design: design as differentiator, design as integrator, design as transformer and design as good business. The use of design in this way can allow use of user-oriented innovation models to create new business opportunities, ultimately increasing market share. The resistance from manufacturers to create new business opportunities by adopting PSS, often needing mind-set change (Rapitsenyane and Bhamra, 2013) can be managed through a capabilities view to service oriented differentiation.

Conclusions

There are a wide range of business and sustainability advantages to engaging with services and systems, if consumer needs can be met and the systems be designed to work effectively.

The two approaches highlighted in this chapter are a move from product only offerings to sustainable Product Service Systems, and reconceptualising processes as services in order to reframe the issue of change towards sustainable development and clarify connections between stakeholder and social and environmental issues.

Within both approaches designers can work alongside stakeholders to transform their approaches towards sustainable development and introduce the notion of value co-creation and develop user-centred capacities within project teams. This opens opportunities for new design activities requiring that design capabilities be cultivated to be deployed differently; to enable service oriented differentiation in traditionally product oriented companies or to highlight service characteristics within previously process orientated situations. This type of innovation can be driven by users, suppliers and other actors in the value chain.

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