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Fluid transitions to more sustainable product service systems

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ABSTRACT

While Product Service Systems (PSS) are not inherently sustainable, they may form part of the mix of innovations that contribute to the development of more sustainable futures. However, whether the current trajectory of PSS research, with its emphasis on universal frameworks and standardisation adequately reflects and builds upon PSS diversity revealed by case study research may be questioned. Opportunities for transition to more sustainable PSS may be lost. In response, this paper draws on sustainable architecture to propose fluid transitions to more sustainable PSS: to PSS design practices that embrace diversity and enable specific PSS to be developed which address contextual interpretations of sustainability challenges. The core ideas of the PSS design are critically engaged in light of the principles and priorities of fluid transitions. Research directions to support fluid transitions to more sustainable PSS design practices are then explicated.

1. Introduction

While for many years design was viewed as one of the root causes of unsustainable patterns of production and consumption, today design for sustainability is thought to offer considerable utility in transitions to more sustainable futures (Thorpe, 2010). With origins in industrial design, initial

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work in this field focused on helping manufacturing firms meet new environmental regulations by improving the environmental performance of products (Roy, 2000). Subsequently, the need to attain greater improvements in environmental performance, led to the development of life cycle or eco-design theory and practice. These approaches aim to reduce and balance the environmental impacts of products, often with reference to material and energy reduction in particular, across a product's lifecycle: extraction, manufacturing, use and disposal phases (Roy, 2000). Limits to this somewhat techno-centric approach such as rebound effects, increases in demand induced by resource efficient products that cancel out environmental gains (Berhout, 2002), stimulated research to explore the meaning and role of products in society (*cf.* Walker, 2006; Ehrenfeld, 2008; Chapman, 2009; Thorpe, 2010). New insights have been sought on how products contribute to material culture and sustainable design responses developed in light of these, *e.g.* the design of emotionally durable products (Chapman, 2009).

So today much of sustainable design still focuses on products, closely associated actors and processes. However, broader observations of changes in patterns of consumption and production has led to the emergence of service innovations as an equally valid focus for sustainable design (*cf.* Dewberry et al., 2013). Research shows a number of firms now use their products as a foundation for service offerings. In some instances, firms add services to their products, such as extended warrantees to household appliances and repair and maintenance services to vehicles (Stahel, 2006; Gaiardelli et al., 2014). Perhaps more radically, other manufacturers have developed performance orientated service innovations which are based on their products but also potential substitutes for these, *e.g.* document handling services provided by manufacturers of photocopiers (Stahel, 2006). Similarly, many pesticide and herbicide producers no longer only provide chemicals but integrated crop management services too (Bartolomeo et al., 2003). In utility sectors, energy service companies (ESCOs) supply a range of services to housing developments to meet requirements for thermal comfort and hot water (Steinberger et al., 2009; Ceschin, 2013).

Such design strategies often involve examining the functionality of products in various contexts and proposing alternate service orientated means which use fewer resources to satisfy demand for such functionality (Roy, 2000; Maxwell et al., 2006; Geum and Park, 2011). For example, considering the functionality of answerphones and proposing alternative services such as voicemail. There are various definitions of such services including: eco-efficient producer services (Zaring et al., 2001), eco-efficient services (Hockerts, 1999; Meijkamp, 2000; Brezet et al., 2001), eco-services (Behrendt et al., 2003) and product service systems (PSS) (Goedkoop et al., 1999; Tischner et al., 2002; Mont, 2004). The latter term is used extensively in literature. PSS are understood to comprise both products and services, which are combined to provide units of service which satisfy customer requirements for functionality. A number of PSS definitions can be found in literature, for example:

> "A system of products, services, networks or actors and supporting infrastructure that is developed to be competitive, satisfy customers and be more environmentally sound than traditional business models" (Mont, 2004).

The origins of PSS lie within the resource efficiency or so called factor four discourse (Mont and Emtairah, 2008). This discourse proposes that gains in resource productivity, perhaps most notably factor four, can be achieved through market mechanisms and are necessary to help move society towards more sustainable futures. A number of PSS types have been elaborated to demonstrate in theory at least the potential of PSS to improve resource efficiency in both intermediate and final markets. A common categorisation of PSS types is used in literature (*cf.* Hockerts and Weaver, 2002; Tukker, 2004; Mont, 2004; Baines et al., 2007; Cook et al., 2012; Ceschin, 2013; Armstrong et al., 2014):

Product Orientated PSS: ownership of the product (material artefact) is transferred to customers and services are provided to help ensure product performance over a given period of time. Examples include maintenance contracts and warranties.

Use orientated PSS: ownership rights related to the product are retained by the service provider (who may or may not have manufactured it) and the customer purchases use of the product over a specified period of time. Examples include, sharing/pooling, renting and leasing.