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Sustainable Innovation for a Circular Economy.

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As the concept of circular economy is gathering momentum in the design industry, we are currently witnessing compelling innovation for new materials, technologies, products, services and business models, which aims to drive forward the circular approach in industry. With a particular view to the textile & clothing industry, examples include pre and post-consumer waste materials such as plastic bottles, tyres, fishing nets and discarded textiles, which are recycled to produce new materials for products such as sportswear, swimwear, jeans, footwear and accessories. Moreover, this industry has been striving to develop and implement closed-loop systems, such as Teijin's Eco Circle and Adidas' 'Sport Infinity' recycling, so that products can be recycled infinitely at end-of-use. However, although this much-needed circular approach to innovation is high on the agenda of the global textile & clothing industry, the concept is noticeably absent in the specialist category of wearable technology, where there is little evidence of stakeholders considering end-of-life issues or circular design opportunities. Although wearable technology is still deemed a niche segment, this area is predicted to grow at unprecedented levels, thus making the need for sustainable innovation in this field extremely urgent. While products such as smart watches and activity trackers have a relatively short life span; a third of users discard their trackers within six months (Ledger, D and McCaffrey, D., 2014), textile-based wearable technology is a particular concern, as electronic elements are often embedded into the textile or clothing in a seamless and invisible manner, thus creating hybrid products, which are extremely difficult to recycle at end-of-life. There are significant opportunities for the integration of circular lifecycle thinking into the innovation process for future products, in particular during the early stages of the design process (Walker, 2006; Bhamra and Lofthouse, 2007; Sherwin, 2012 and Köhler 2013). The concept and inception stage is pivotal, as '*...critical thinking and the challenges of precedents and standards must begin to prefigure the design process...*' (Walker, 2006). Therefore, it is essential to develop design briefs, which offer the designer inspiration and guidance in regard to the desired design outcome (i.e. sale or rental of a product), while embedding objectives to optimise resource use and reuse as part of a circular economy. Furthermore, companies need to provide designers with appropriate support by developing designers' '*core competencies in circular design*' (Ellen MacArthur Foundation, 2015). These skills need to extend to all other areas of the product lifecycle (i.e. raw materials, manufacture, in-use and end-of-life stages), and rely on efficient communication and collaboration channels between all of the stakeholders involved in the lifecycle of a product. In order to contribute to the discussion and development of guidance on the implementation of Design for Circular Economy (DfCE) in industry, this paper shares the recent findings from practice-based PhD research, which investigated the creation of a sustainable design brief by embedding end-of-life solutions into the design of wearable technology, utilising extensive periods of material exploration and user-centred research. In addition, this paper proposes a starting point for developing the concepts presented into ideas that could be suitable in an industrial context.