

Do e-Textiles for Fashion Require Specific Legislation and Developmental Guidelines in Order to Avoid Harmful Waste? [†]

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[†] Presented at the International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles (E-Textiles 2020), Virtual Venue, UK, 4 November 2020.

Keywords: e-textiles; waste; legislation; design for disassembly; circular design

1. Summary

This research aims to identify the legislative gap that lies within textiles, electronics and nanomaterials for the safe disposal and recovery of e-textiles. This research examines the current knowledge and understanding of the environmental impact of new e-textiles and the legislation in place to make them safe as they are developed, manufactured and discarded within design for disassembly principles and circular economy theory.

E-textiles are a rapidly expanding body of materials, with extensive prototyping and market testing being carried out globally for fashion, military and medical applications [1]. This is leading to novel combinations of nanomaterials, electrical components and fibers. A small number of researchers such as Kohler 2011, 2013 [2,3] and Veske, P. et al. (2019) have identified the need for regulations specifically in this area and have highlighted the potential environmental impact of e-textiles, stating, “Lack of standardisation of smart textiles and their waste management seems to be a significant barrier for industry entering the mass-market” Veske, P. et al. (2019) [4]. These new materials are partially covered by a myriad of directives and legislature within the EU and UK, which is leading to a call for action to clarify where e-textiles reside within current legislation and where e-textiles require specific consideration in this regard. Heinzl, T. and Hinestroza, J. P. (2020) [5] discuss the philosophical questions needed to categorize materials that are both organic and inorganic and how we can address this dilemma.

Electronic waste is a global problem as illustrated by Fedele (2016) [6], highlighting unregulated e-waste recycling in Ghana. In January 2018 the Chinese government enacted a ban on receiving waste from other countries, pressing countries to find solutions at home. The EU Waste Electrical and Electronic Equipment (WEEE) directive instigated in 2006 [7] to address electronic waste management provides clear and actionable outlines for electronic devices with emphasis on producer and user responsibilities. In 2019, the WEEE directive stated the need to assess whether nano-embedded materials require specific treatment to avoid harmful waste. WEEE is based on circular economic theory, de Jesus and Mendonça (2017) [8] highlight the barriers to a circular economy advocating intervention and environmental innovation to create a global multi-layered consensus.

The same cannot be said for the complex directives and legislation relating to fashion and textile waste, where there are many recommendations and self-regulatory options with little incentive to take part when it comes to disposal and recovery. The Pulse report (UK Gov 2019) [9] identified the need for producer responsibility in fashion and asked for “increased pressure from international political level(s)” and the UK government found that “clothing companies are not yet required by legislation to take responsibility for end of life recovery ... unlike electrical and electronic goods.” The World Economic Forum

Citation: Saunders, J. Do e-Textiles for Fashion Require Specific Legislation and Developmental Guidelines in Order to Avoid Harmful Waste? *Proceedings* **2021**, *68*, 3. <https://doi.org/10.3390/proceedings2021068003>

Published: 4 January 2021

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(2019) [10] makes the point that, “in contrast to paper, aluminium or steel, there is no credible recycling concept for the billions of tonnes of fast fashion items sold every year, mainly from non-biodegradable fibres”. Thus, considering the potential of e-textiles in fashion, the projected waste profiles are chilling.

The EU and UK have sought to explore the effects of nanomaterials; however, there is currently no specific direction on the disposal of nanocomposite materials other than to assess nano substances as part of existing REACH legislation [11]. The NanoRisk Governance Council are bringing together three nano research areas, RiskGone, Gov4Nano and NanoRigo, with one aspect of their remit being to consider the safe and sustainable growth of nanomaterials with a “safety by design” approach. A number of researchers have highlighted the potential impact of nanomaterials often used in e-textiles. Souza (2020) [12] showed that silver nanoparticles “can be genotoxic, cytotoxic and induce morphoanatomical and biochemical changes” and Begum et al. (2011) [13] recommend the ecologically safe disposal of graphene. The Royal Commission on Environmental Pollution (2009) [14] led to the UK Government Facility for Environmental Nanoparticle Analysis and Characterisation, to detect and monitor manufactured nanoparticles in the environment, and a further body in the Nanotechnology Research Coordination Group (NRCG). Currently, nanotechnologies are being monitored and a number of research projects are underway however “specific regulatory measures for nanomaterials are still rare”, Fautz, C. (2013) [15].

2. Motivation and Results

The motivation for this research is to demonstrate that guidance and legislation specifically in relation to fashion e-textile disposal and recovery are required to avoid toxic e-textile waste ending up in landfill. This research aims to develop a new e-textile sustainable framework and subsequent white paper to inform future legislation to pre-empt the negative effects of the expanding number of e-textiles in fashion and wider markets, providing an intervention so waste problems are pre-empted and mitigated rather than retrospectively considered in a crisis situation. This will mean both building on existing legislation and developing new legislation that specifies e-textiles. At this early stage, building in design for disassembly principles and circular thinking will mean this exciting new breed of materials will not slip through legislative nets, causing catastrophic environmental impacts in the future.

There are a number of reports that advise a circular framework to bring about changes in textiles production and consumption. The Ellen Macarthur Foundation 2017 [16] report is an influential voice in the circularity debate, however e-textiles are currently not given specific attention. This is similar to the European Environment Agency (EEA, 2019) [17] who recommend actioning circular principles in fashion through incentives and regulation.

Initial consultations at events and conferences have brought about discussion and feedback on the complexities of developing a regulatory framework.

The UAL Social Design Institute and Policy Lab knowledge exchange event agreed that an environmental policy framework for e-textile waste was important before the output rises exponentially (February 2020).

The Nano Risk Governance council stakeholder consultations acknowledged that management of nano waste should be incorporated into their remit (September 2020).

The Digital Fashion Innovation symposium showed that producer responsibility and extended producer responsibility should be strongly considered as a basis for an e-textiles framework for sustainability (September 2020).

Findings have highlighted the lack of legislation in the area of textile waste with only recommendations and a range of self-regulatory initiatives, which do not tackle the growing waste crisis across the UK, EU and the world.

There is a mixed response to nanomaterial waste and recycling planning as there are gaps in knowledge relating to the environmental impact of nanoparticles, particularly when incorporated into complex products and disposed of in landfill.

Electronic waste leads the field, according to the Global E-waste monitor (2020), in the adoption of a circular system and producer responsibility legislation (now in 78 countries) and provides a good starting point for a sustainable framework for e-textiles design and disassembly.

To conclude the research, a proposal framework will be created followed by consultations, interviews and workshops with key industry leaders, producers and researchers to establish viewpoints and individual needs. The framework will be re-worked following feedback and re-presented to finalise a proposed framework and legislation for the UK.

Funding: This research received no external funding.

Institutional Review Board: Not applicable.

Informed Consent: Not Applicable.

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