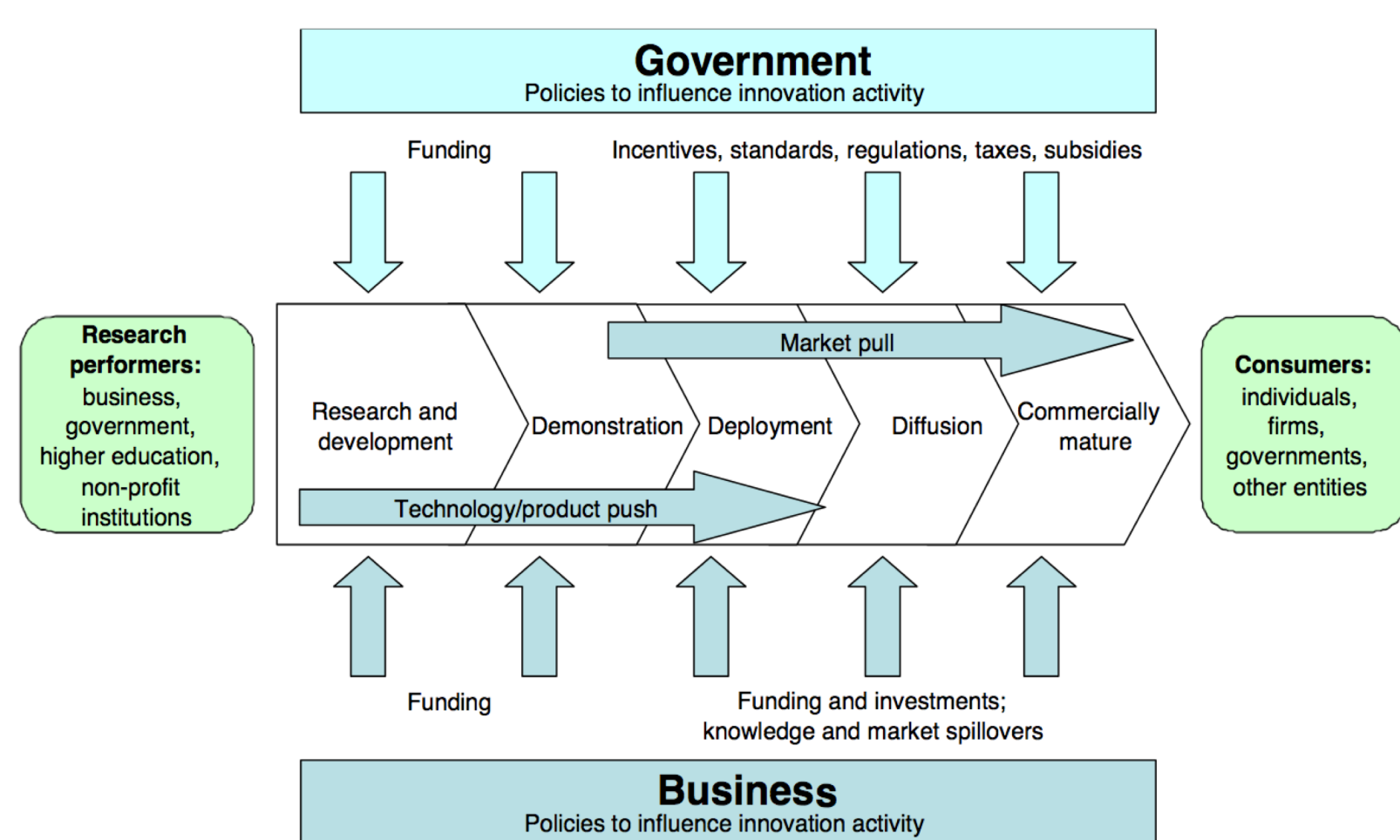
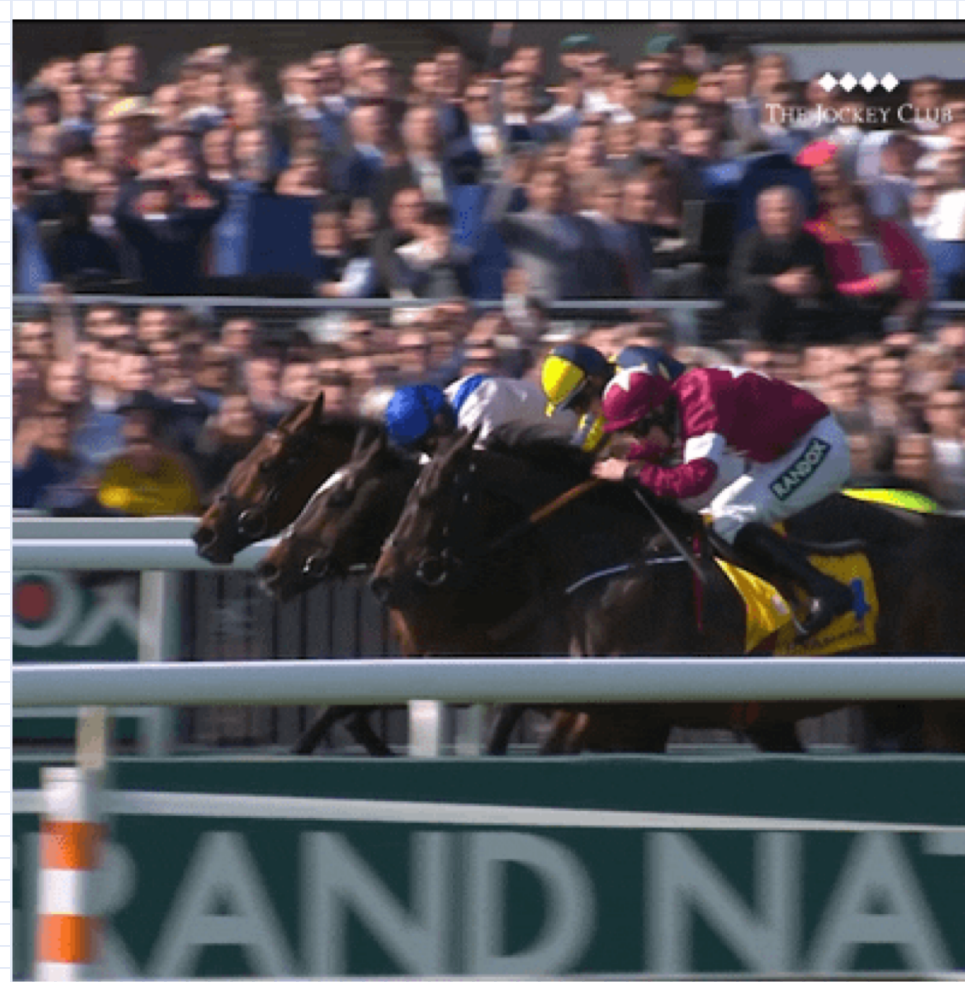


# DO E-TEXTILES FOR FASHION REQUIRE SPECIFIC LEGISLATION AND DEVELOPMENTAL GUIDELINES IN ORDER TO AVOID HARMFUL WASTE?

Figure 2. The innovation cycle



Source: Based on Metz B, Davidson O, Bosch P, Dave R and Meyer L (eds). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press. p.157, figure 2.3.



## NANO MATERIALS IN E-TEXTILES

Graphene • Graphene Oxide • Reduced Graphene Oxide • Graphene Ink and Nylon with polytetrafluoroethene wrapped fibres • Lead zirconate titanate (PZT) • Barium Titanate • Zinc Oxide • Sodium hydrosulphite • poly(styrenesulfonate) (PSS) • Polyvinylidene fluoride (piezoelectric polymer) • Nanofiber polyvinylidene fluoride (PVDF) • poly(vinylidene fluoride-co-trifluoroethylene (PVDF-TrFE)) • bismuth telluride • antimony telluride • Polyvinylidene fluoride (PDVF) • poly(3,4-ethylenedioxythiophene) (PEDOT) with various dopants (typically polystyrene sulphonate (PSS) • terephthalate (PET)/indium tin oxide substrate • polyaniline (PANI) • polypyrrole (Ppy) • Polythiophene (Pth) • wood-derived cellulose nanofibrils (CNFs) • Polyurethane • conductive gold-coated nylon • silver nano particles • poly(3-hexylthiophene) (P3HT); indene-C60 bisadduct (ICBA) formulation • polyimide coated silica fibers • Polythiophene (Pth) • poly(3-hexylthiophene) (P3HT); indene-C60 bisadduct (ICBA) formulation • polyimide coated silica fibers • Polythiophene (Pth) •

## TEXTILE WASTE : “MAKE, USE, DISPOSE”

Consumption of new clothing is estimated to be higher in the UK than any other European country – **26.7kg per capita**. This compares to 16.7kg in Germany, 16kg in Denmark, 14.5kg in Italy, 14kg in the Netherlands and 12.6kg in Sweden. Fixing fashion: clothing consumption and sustainability Environmental Audit 2019

2012  
930,000  
tonnes  
of clothes  
purchased

2016  
1,130,000  
tonnes  
of clothes  
purchased

2017  
Less than 1% of  
garments are  
recycled or reused  
= 350,000 Tonnes  
per annum

Design to improve life.dk

(Traid 2017)

## ELECTRONIC WASTE “MAKE, USE, DISPOSE”

- In 2017 we produced 50 million tonnes of electronic waste
- Only 20% is formally recycled.
- 3.9 million tonnes of that are small devices
- Annual growth rate 4-5%

(The Global E-Waste Monitor 2017)

Globalwaste.org offers e-waste data from Global and Regional Waste Monitor for most countries, including the amount of e-waste generated in total and per capita and discarded prior to any collection, reuse, treatment, or export;



The early stage of this research has identified a gap in UK/ EU legislation regarding e-textiles.

The research indicates that there is no substantial legislation in the UK or EU in relation to the lifecycle and disposal of e-textiles and will provide original insight into developing effective legislation.

## GUIDELINES, STANDARDS, DIRECTIVES

United Nations Sustainable Development Goals • Paris Climate Agreement • EU Directive on waste 2008 amended in 2015 • Initiative 2030 Agenda for sustainable development • EU Cost Action 628 Life Cycle Assessment (LCA) • European Platform of Life Cycle Assessment or the UNEP/SETAC Life Cycle • EU-JRC End of Waste Criteria • Organisation for Economic Cooperation and Development (OECD) • World Business Council for sustainable Development • World Economic Forum (WEF) • WWF • Fairtrade Foundation • The ESRC STEPS (Social, Technological and Environmental Pathways to Sustainability) Centre • Waste and Resources Action Programme (WRAP) Globalwaste.org • MISTRA Future and Emerging Technologies (FET) • The Global Organic Textile Standard (GOTS) • Technology Assessment Framework (TA) • Recycling Potential Index (RPI) • Sustainable Society Index (SSI) • Ecological Sustainability Index • Higg 2.0 • Land Use Sustainability Index • CRB • SCAP Sustainable Clothing Action Plan • TCFD • Microfibre initiative • Environmental Impact index (EI) • Make Fashion Circular • Ellen McArthur Foundation Recommendations • London Textile Forum • ZDHC • Green Economy Coalition • Nano Technology Risk Assessment • FTSE 100 Sustainability report • DOW Jones Sustainability Index • Environmental P&L • A AI1000 Standards /Framework • Content Claim Standard • Cradle to cradle Standard • BS 8001: 2017 Circular Economy • IPPC Integrated Pollution Prevention and Control (EU) Business for Social Responsibility (BSR) - Water Quality Guidelines • Biodegradability standards • Eco-Labels • Green Economy Coalition • (Gov4Nano • NANORIGO • RiskGONE) • The Step Initiative (StEP) e-waste • UNU ViE-SCYCLE, e-waste • UNEP IETC The International Environmental Technology Centre (IETC) • Design for recycling (DfR)

## CALL FOR GUIDELINES

Nano Technology Risk Assessment  
Wickston, F. and Miller, G. (2016).

Koheler 2013:  
“Anticipatory eco-design strategies”

Rijavec, T. (2010)  
‘Standardisation of smart textiles’

Green Economy Coalition  
“innovation governance”

“Government needs to provide clear economic incentives for retailers to do the right thing.”  
Environmental Audit Committee House of Commons 2017

E-textiles network,  
Southampton University  
Jan 2019. Discussions highlighted a need for guidelines.

REACH

Nano materials

“no “credible” recycling for fast fashion”  
(WEF, 2019)

Textiles

Electronics

WEEE

## FINDINGS: RESPONSIBILITY

•Design for disassembly / Anticipatory Design

•Circularity Shaw 2017, Ellen McArthur Foundation

•Extended Producer Responsibility Stones and Murry 2018

•Sustainable Economics - Natural resource accounting /GDP /Natural Capital Expenditure

•User Responsibility (Fixing Fashion 2017)

## METHODOLOGY:

1. Desk research, document analysis
2. Evaluate current frameworks and their credibility
3. Investigate current legislation - what factors constitute legislation - methods to influence legislation
4. Industry consultation from a range of aspects: medical /military/textile manufacturers / e-textile scientists /designers/end users to investigate and discuss disposal of e-textiles, user responsibility/ design for disassembly
6. Propose a framework
7. Run a series of workshops to discuss and test the framework
8. Evaluate and finalise a framework and prepare documents for a white paper

The research will contribute to the reduction or neutralisation of the environmental impact of the emerging e-textiles sector particularly in fashion apparel. Initially this will be UK wide but may inform legislation on an EU and global level. Bringing legislation together that specifies e-textiles will mean this exciting new breed of materials will not slip through legislative net and cause catastrophic environmental impact in the future.