

This item was submitted to [Loughborough's Research Repository](#) by the author.  
Items in Figshare are protected by copyright, with all rights reserved, unless otherwise indicated.

## **WEAR Sustain (Wearable technologists Engage with Artists for Responsible innovation): Sustainability Strategy Toolkit**

PLEASE CITE THE PUBLISHED VERSION

LICENCE

CC BY-NC 4.0

REPOSITORY RECORD

Sametinger, Florian, Camille Baker, Heritiana Ranaivoson, and Nick Bryan-Kinns. 2019. "WEAR Sustain (wearable Technologists Engage with Artists for Responsible Innovation): Sustainability Strategy Toolkit". figshare. <https://doi.org/10.17028/rd.lboro.9724631.v1>.

# WEAR Sustain (Wearable Technologists Engage with Artists for Responsible Innovation): Sustainability Strategy Toolkit

FLORIAN SAMETINGER, University of the Arts Berlin, Germany

CAMILLE BAKER, School of Communication Design, University for the Creative Arts, Epsom, UK

NICK BRYAN-KINNS, Media and Arts Tech Centre School of EECS Queen Mary University of London, UK

HERITIANA RANAIVOSON, imec-SMIT-VUB imec Brussels, Belgium

This paper presents the results of the EU-funded innovation action project Wear Sustain (Wearable technologists Engage with Artists for Responsible innovation) which involved a total of 46 teams in 2 rounds of seed funding with the goal of setting the stage for the sustainable and ethical transformation of the field of textile wearable technology. Looking at three of the funded teams, we especially focus on both the process of how they were motivated to challenge their own practice, but also how the project supported them in transforming it into a more critical, sustainable practice, taking into account expert consultations, network events, and stakeholder workshops.

Here, we introduce the Sustainability Strategy Toolkit (SST) and Wear Sustain platform, which was built to cater to the aforementioned challenges and provide textile wearable technologists with sustainability and ethics resources, a self-assessment tool, a viable network of peers as well as thematic hubs which provided hands-on support for the teams. We argue that this platform in conjunction with the SST may provide a starting point for novices as well as experts in the field of sustainable and ethical wearable technology, and will help push the field towards a common language regarding a more responsible practice. It supports in informing and subsequently empowering artists, designers, and technologists to implement a more sustainable and ethical approach in their practice.

Furthermore, we critically assess the barriers we encountered with the inclusion of diverse stakeholders, providing arguments for stronger involvement of industry and their collaboration with individual artists and small teams. Finally, we elaborate on the discrepancy of a global innovation paradigm and the everyday reality of wearable technologists (drawing from the experience of the teams involved in the project), and how this impacts further development of the Wear Sustain platform as an arena for debate regarding the transformation of textile wearable technology practice towards more responsible, sustainable and ethical innovation.

Additional Key Words and Phrases: Sustainability Strategy, Wearable Technology, Ethical Practice

## 1 INTRODUCTION

This paper presents the results of the EU-funded innovation action project WEAR Sustain (Wearable technologists Engage with Artists for Responsible innovation), which involved a total of 46 teams in 2 rounds of seed funding with the goal of setting the stage for sustainable and ethical transformation of the field of textile wearable technology. Looking at three of the funded teams, we especially focus on both the process of how they were motivated to challenge their own practice, but also how the project supported them in transforming it into a more critical, sustainable practice, taking into account expert consultations, network events and stakeholder workshops. Here, we introduce the Sustainability Strategy Toolkit (SST) and WEARSustain platform two of the key aims and outputs from the project, built to cater to the aforementioned challenges and provide e-textile and wearable technologists with sustainability and ethics resources, a self-assessment tool, a viable network of peers and mentors, as well as home hubs which provided hands-on support for the teams during their funded support. It aims at providing the nurturing ground for future collaborations. We argue that this platform, in conjunction with the SST, provides a starting point for novices, as well as experts in the field of sustainable and ethical wearable technology, and will enable the field towards a common language and practices regarding a more responsible practice. It informs and subsequently empowers artists, designers and technologists to implement a more sustainable and ethical approach in their practice. Furthermore, we critically assess the barriers we encountered with the inclusion of diverse stakeholders, providing arguments for stronger involvement of industry and their collaboration with individual artists and small teams. Finally, we elaborate on the discrepancy of a global innovation paradigm, versus the everyday reality of wearable technologists and smart/e-textiles innovators (drawing from the experience of the teams funded by the project), and how this impacts further development of the WEAR Sustain platform as an arena for debate regarding the transformation of textile wearable technology and e-textiles design practice, towards more responsible, sustainable and ethical innovation.

---

**Publisher:** Loughborough University (© The Author(s)). The authors of this paper acknowledge the right of Loughborough University to publish the paper under the Creative Commons Attribution 4.0 International (CC BY-NC 4.0) licence.

**Rights:** This work is made available according to the conditions of the Creative Commons Attribution 4.0 International (CC BY-NC 4.0) licence. Full details of this licence are available at: <https://creativecommons.org/licenses/by-nc/4.0/>.

**DOI:** <https://doi.org/10.17028/rd.lboro.9724631>

©2019

## 2 WEAR SUSTAIN

### 2.1 Background

The EU Horizon 2020 WEAR Sustain project yielded a growing community of experts who interacted with the project through the main project platform ([network.wearsustain.eu](http://network.wearsustain.eu)), which gives registrants access to specific resources on sustainable and ethical technologies, resources, processes, and people, etc. allowing for networking. The project investigated what would be required by designers, artists, technologists and business actors in order to critically assess issues of sustainability, in terms of the environment, society, and economics, as well as ethics, regarding their endeavours in making new innovative wearable technology. WEAR built on the European dialogue on ethical environmental and labour issues, as well as on the collection of personal data by wearable technology. The insights gathered throughout the project, provided the foundation for the iterative, participatory development of a Sustainability Strategy Toolkit (SST), whose aims were to be a best practices guide to support different types of actors or diverse users who are already within the WEAR network, as well as potential future users of the network. It also aims to assess their understanding, readiness and their innovation's impact regarding environmental and social sustainability and ethics. The result is based on the premise that teams in the WEAR network, as well as future wearable technologists and designers require both a strong network of stakeholders with a shared interest, and a comprehensive knowledge base, which is easily accessible.

### 2.2 Towards a sustainable and ethical practice?

This paper critically investigates the question whether or not the aforementioned framework of WEAR project, online platform and SST may support stakeholders in pushing their practice towards a more sustainable and ethical one. This inquiry is based on the analysis of six specific teams within the project that show a range of different foci in terms of sustainability and ethics.

The research questions we explore in this paper are:

RQ1: What are current sustainable and ethical practices of wearable technology development uncovered by bringing designers, artists, technologists and business actors together?

RQ2: What challenges are faced by contemporary wearable design teams in designing and producing ethical and sustainable wearable technologies?

RQ3: How could the challenges of RQ2 be addressed in the short and long term?

This paper opens by introducing a representative selection of teams who took part in the WEAR project who form case studies for examining current understandings and challenges of sustainability and ethics in wearable development. We then introduce key challenges of the sector and describe the development of our Sustainability Strategy Toolkit which acts as a first step to addressing these challenges. We conclude with reflecting on pragmatic challenges to ethical and sustainable wearable technology development and the outlook for innovation in this sector.



Fig. 1: The SST diagram

### 2.3 WEAR Sustain Open Call Teams

Forty six teams were selected from an open call to take part in the WEAR Sustain project. In this paper we focus on 6 of the 46 teams, who provide representative highlights of how the project impacted their take on sustainability and ethics.

Table 1. Teams that were analysed regarding sustainability and ethics in their practice.

Team	Topic	Technologies	Sustainability focus
a	Air-purifying Wearable	Nano filter-technology	Materials, Re-use, Environmental Sustainability
b	E-textile kit for people with disabilities	DIY sensors and accessories	Co-Design, Empowerment, Environmental Sustainability
c	Remote touch therapy	Wearable robotics	Waste prevention, Recycling, Emotional durability, Co-Design
d	Mycelium based materials	Biotechnology, Mycelia	Biomaterials, Circular Design, Animal rights, Waste prevention
e	Sensual Jewellery	Sensor-equipped jewellery	Production Ethics, Data Privacy, Female empowerment
f	Wearable shelter	Sensor- equipped, solar-powered wearable	Durability, Repairability, Open Source

Through interviews and team reports we found that the level of knowledge regarding sustainability and ethics differed greatly from team to team. There was a broad spectrum from teams who came to the project already with a firm understanding of the topic, sometimes laying it out quite narrowly, only having a passing knowledge of sustainability and ethics, and even seemed to have a rather opportunistic approach (adhering to WEAR Sustain's guidelines only to get an access to funding and support). The underlying topic thus needed to be put into perspective as some teams framed sustainability more in terms of their business enduring over time, rather than environmental sustainability or ethical labor or ethical and environmentally sustainable materials sourcing, thus leaving out the ethical collection and use (if at all) of personal data. By providing thorough information and various activities (webinars, mentoring, workshops) about the current state of research on sustainability, the WEAR Sustain consortium aimed to explore these numerous perspectives on sustainability. While these activities supported the teams in some way, overall the terms sustainability and ethics themselves were received quite ambiguously and teams were struggling at times to open up to a broader understanding which would benefit their practice, until they each had their mid-tem and final monitoring panels. Each team was assessed on their progress and success in implementing ethical and sustainable practices in various aspects of their product design and development cycle, and had to justify what they had achieved. It was also apparent to the consortium partners after Call 1, that many teams as well as our selection team and the jury members were not really clear on the aims of the project and some teams were clearly applying just to find additional funds to assist in their innovations and entrepreneurial efforts, rather than necessarily interested in being truly being ethical and sustainable in their product design and development, or whether it was a good match to the call. This was remedied in the 2nd Call criteria and selection process.

In hindsight, it was quite challenging for teams to consider all the issues that they were confronted with, sometimes due to lack of time, information and guidance, e.g. if I am thinking about sustainability of manufacturing processes, I am often not thinking about the sustainability of my business model - these two topics overlap: e.g. what are the ethical implications of recycling etextile when it involves exploitation and environmental damage? Who do I turn to in order to get the right information, how do I measure the impact and implications of my product? Each team was challenged on these issues and more during their monitoring panels for each of the major reporting periods in their 6 month support period. Reviewing the continuous reports a sense being overwhelmed by the broadness of the topic was evident. Some teams were able to focus in on specific parts of ethics or sustainability, e.g. data ethics or compliance to the GDPR standard, open source software or durability of used materials. There was no expectation for that to be perfect on all possible aspect of product development and the life-cycle of their product, but asked that they

do as much as they could. Some of the teams had a distinct position on sustainability, especially regarding design for durability and longevity. Consequently they took into account material effects, as well as production techniques to that end. These were a small number and rated by the consortium as the top teams in terms of meeting the expectations of WEAR Sustain.

Team e, producing their prototype in China were asked whether that brought about any ethical concerns, they referred back to international standards (such as ISO 9001) and a number of international certifications, which are all widely acknowledged, but do not necessarily reflect ethical standards of production, data storage and data use. This example makes clear that for someone producing large quantities of a product, it is very unlikely that they will have full insight into ethical implications of their product. They are limited to controlling the data they themselves gather, the working conditions they employ and the social impact their product has. On the production side, the teams were reassured by certifications and standards that are not built on sustainable and ethical considerations, but on quality considerations. These would have to be developed anew, in order to provide wearable technologists and e-textiles innovators with some unified standard that they can adapt. It was necessary, and through the platform and throughout the project, that we achieve this, to provide resources and guidance for wearable technologists and e-textiles innovators, to navigate the terrain of sustainability and ethics. Teams b and e Some have used an ethical self-assessment questionnaire provided by the WEAR Sustain team that helps assess ethics and sustainability of potential partners. This being only a start, it was clear that the WEAR Sustain platform would need to include existing resources, toolkits and guidance platforms, in addition to a newly constructed assessment toolkit, built from the insights gathered throughout the project, leading to new standards and ethical and sustainable certifications.

Teams a, c, and d focused on very specific technological parts that they were trying to obtain through either sustainable manufacturers or produce themselves in a DIY way. With most projects, data ethics and the use of personal data in general became an issue towards the end of their support by WEAR Sustain, partly due to the requirements of the GDPR, and because they were either specifically asked to explore that direction (in particular after the mid-term evaluation), or the state of their development required them to do so. Regarding the source of their information, all teams used resource links that are made available through the WEAR Sustain Platform, and made use of mentoring and interaction with other teams, which provided them with extra insights or a different perspective on their project. However, there were teams that did take into account the guidance, resources and support only scarcely, because they were scored low by the monitoring panel in their mid-term of final reporting period and would not receive their final financial installment until they did. These were necessarily teams that had not put ethics and sustainability at the core of their project. Since these were at the core of their selection (in particular for Open Call 2 teams) and subsequently of their evaluation, such teams usually had a hard time to go through mid-term and end-term evaluations. Actually, while it is to some extent possible to only rhetorically deal with ethical and sustainable issues in a short, written report; it is much more difficult in front of the Monitoring Committee's experts. Therefore, a number of teams had to adapt their activities towards more sustainable or ethical approaches in order to have a positive mid-term or end-term evaluation.

## 2.4 Critical Assessment of transformation processes

When reviewing the progress and potential transformation that the teams went through during the course of the project, it became evident that it was far more difficult to engage the industry in making much needed changes towards ethical and sustainable innovation and production processes. Within some teams, there were issues regarding communication with their technology/industry partners, which made it more difficult for them to follow the WEAR rules for development and progress, hindering their innovative and disruptive approaches to solve the problems.

What was learned was, in terms of challenging designers and industry:

1. Some teams thought sustainability = sustainable production (rather than sustainable business models) and that ethics = ethical production lines (labour), not the ethics of personal data they capture;
2. Education is still needed = teams / designers think terms "sustainability and ethics" sound like two quite narrow and distinct topics;
3. Digging deeper - team/designers are not always considering most of the issues we asked them to consider in their process: e.g. if I am thinking about sustainability of manufacturing processes, I am often not thinking about the sustainability of my business model - these two topics overlap: e.g.

what are the ethical implications of recycling e-textile when it involves exploitation and environmental damage?".

### 3 THE SUSTAINABILITY STRATEGY TOOLKIT AND PLATFORM

#### 3.1 Introduction to the SST

The experiences of the teams outlined above highlight the need for resources for improving the sustainability and ethical practices of wearable technology design and production. While frameworks for sustainability, as well as numerous handbooks, online guides, and resources regarding a more sustainable lifestyle and production development exist, such as e.g the "Lazy Person's Guide to Saving the World"<sup>1</sup> issued by the United Nations, the "Circular Design Guide"<sup>2</sup> promoted by IDEO and the Ellen MacArthur Foundation, the "Fair Fashion Guide"<sup>3</sup>, none of them is specifically targeting the development of wearable technology, apart from Greenpeace's "Guide to Greener Electronics"<sup>4</sup>, which provides distinctly new challenges with the overlap of technology innovation and textile craftsmanship. How technologists, artists, designers and industry professionals in this field could be supported to innovate more sustainably is a continuous challenge which this work aims to address.

Wearable technology and smart/e-textiles are inherently interdisciplinary, bringing together technology innovators, fashion designers and artists, the textile industry and craftspeople. The interweaving of digital technology and smart materials with traditional textiles not only creates new challenges regarding the product's lifecycle, such as waste management, recycling, disassembly and such, but also regarding transparency of the design and development in terms of the origin of materials, sourcing methods and the technology used. How one is to assess more or less sustainable choices, where trade-offs lie and which path is the suitable one to take, depends on ones' process and has to be supported not only by data available on for examples sustainable materials, processes or data choices, but also by an expert community and in open discourse with others in the field.



---

<sup>1</sup> <https://www.un.org/sustainabledevelopment/takeaction/>

<sup>2</sup> <https://www.circulardesignguide.com/>

<sup>3</sup> <https://www.fairfashionguide.de/>

<sup>4</sup> <https://www.greenpeace.org/usa/research/guide-to-greener-electronics-2017/>

Fig. 2: Stakeholder Workshop at the final project event in Brussels.

In order to begin to address these challenges we undertook to develop a Sustainability Strategy Toolkit (SST). In the process of developing the SST, several aspects were evident from discussions, interviews, and surveys that were conducted with different stakeholders involved in the project.

The SST makes the aggregated knowledge tangible and accessible, while providing the opportunity for others to assess their product or service or innovation's impact regarding sustainability and ethics, and to get access to recommendations for improvement for future research, innovation and development. This includes a network of 46 teams, experts, mentors and hubs that were involved in the project over the 24 months, and by a collection of resources from best practice examples, sustainability knowledge base, and the current discussion on ethics in technology, textiles and fashion development. While for actors well-versed in the field of sustainability, it provides touch-points with other experts and actors undertaking similar endeavors, deep information tailored for specific phases of their project, for novices, the SST introduces ways and means to address the theme of sustainability and ethics in their work from the start. It breaks the aforementioned dimensions down into subcategories which were informed by the WEAR projects and amended by a literature review and research into existing toolkits and strategy frameworks.

Thematically, the SST revolves around ethical considerations such as data collection and privacy, social cohesion, workplace conditions and sustainability aspects, such as the product's material and energy impact, life-cycle, sourcing and use, re-use or waste. It is structured in three distinct categories, which were developed during the project: 1) innovation and collaboration, 2) data use, and 3) creating positive environmental, social and economic impacts.

By providing a connection between individual tacit knowledge inherent within the teams of practitioners and the current discussion on sustainability and ethics in technology development, citizens, entrepreneurs and other stakeholders are able to:

- better assess the impact of wearable technology projects in terms of sustainability and ethics,
- connect with other actors who might have gone through the same process already and may be able to offer guidance, and
- provide a measurable outcome and basis for argumentation regarding follow-on funding and inclusion of small and medium enterprises (SME's) into future development

Based on the notion of Sustainable development<sup>5</sup>, the toolkit includes the meta-dimensions of social sustainability, economic sustainability and environmental sustainability [5], but adds the dimension of individual or personal sustainability, which can be referred to as the maintenance of private good of individual human capital or more specifically, maintenance of health, education, skills, knowledge, leadership and access to services [6].

### 3.2 Navigating the SST

The SST is entered via the expert network website ([wearsustain.eu](http://wearsustain.eu)), and allows users to assess their sustainability and ethics impact step by step, upon finalisation, leading to initial recommendations for their project, which are subsequently amended by other actors in the community, and allows for creative professionals and wearable technologists to take a stance regarding sustainability and ethics in their projects. It provides the resources to assess sustainability concerns in collaboration, production, business development, working environment, data privacy and ethics. The SST is available for everyone, but users are encouraged to become part of the network in order to be able to contribute to it, get access to all content and to promote it further. The recommendation system has to be made tangible and communicable, otherwise its value within the development process drops. It will not only rely on digital data, but prompt the communication between different actors within the network, such as individual artists or designers, industry experts, technologists, hub leaders or other actors with similar issues. Development, process of implementation, use of the toolkit's iterative development and inclusion of expert teams and users into the process.

---

<sup>5</sup> <https://sustainabledevelopment.un.org/>

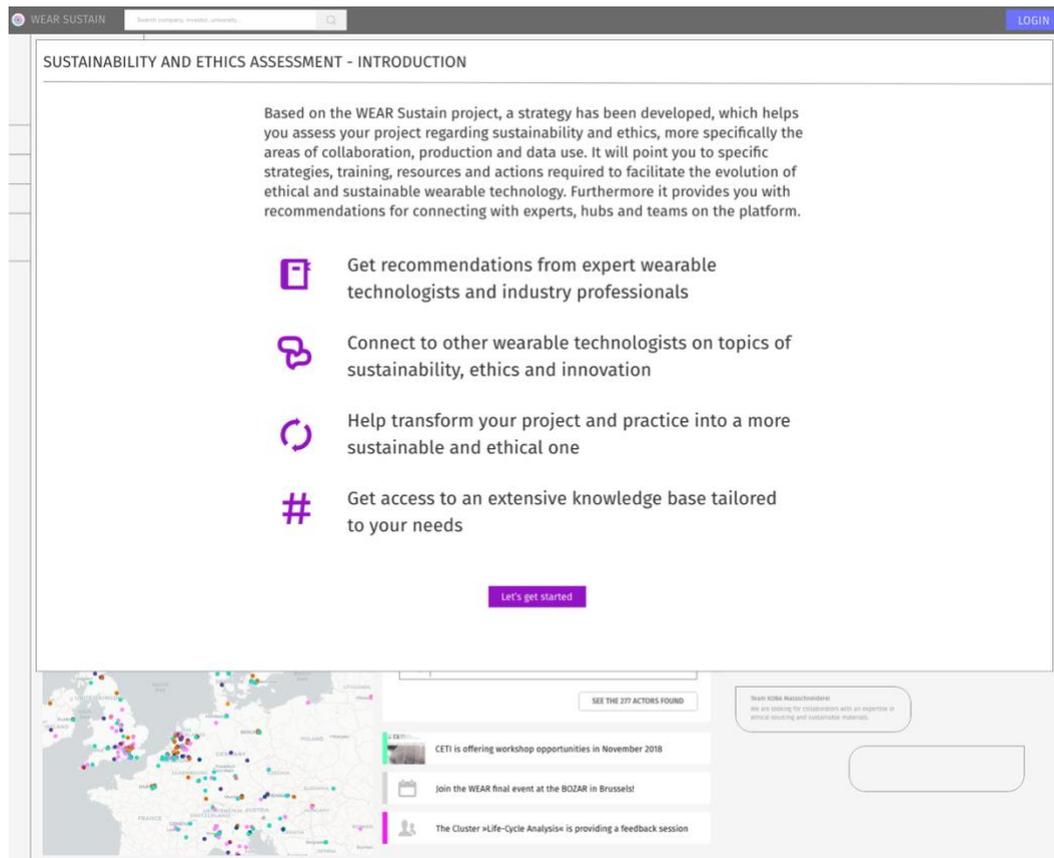


Fig. 3. Screenshots of the SST prototype.

With an early click-dummy of the SST and connected network we tested, the way users interact with it. Furthermore in one of the final events, the authors conducted a workshop with the participants including mentors, hub leaders, industry professionals, researchers and practitioners. The workshop followed the world cafe methodology and provided some insights to if and why the platform and SST would be used, including easy access to content, involvement of stakeholders, ability to contribute, sharing knowledge through a vibrant community and connecting to industry players.

### 3.3 A Global innovation paradigm and the everyday reality of practitioners

There is a discrepancy between 'going to market as fast as possible' and incorporating a sustainable perspective into the work which is significant. Especially in technology development, the take on sustainability is largely focused on material, environmental impact of technology [1], and only recently have the socio-ethical considerations been on the rise, especially regarding data security and personal privacy, commercialisation of data on the one hand, ethical business models and working conditions on the other - and only because the public and concerned groups have brought them to the foreground. This new direction makes it clear that incorporating sustainability perspectives into technological innovation means innovating the technological process itself [2]. Ethical responsibility implies not only taking into account the potential impact on our current society, but also on future societies, and especially those involved in the physical making of the projects made for society. A sustainable and ethical mindset thus provides a long-term perspective with regards to technology implementation [3], [4]. This background gives rise to two main aspects of the SST: It requires a community of experts in a digital network and it builds on a repository of data which is compiled from various source on sustainability, ethics and responsible innovation.

During the project, within the teams some artists or designers struggled with their industry partner, as well as with conveying the focus of sustainability and ethics to others. We strongly argue that the transformation towards sustainability and ethics cannot only be managed from the bottom up, but a stronger involvement of the industry in setting the stage for sustainable and ethical smart/e-textiles and wearable technology is desperately needed. This also means the development of a common language regarding sustainable and

ethical wearables by the combined teams, which we aimed to provide as a starting point, with the development of the WEAR Sustain platform and toolkit that were developed to facilitate this process.

#### 4 CONCLUSIONS

With the project now completed, we are taking away several key aspects that emerged from the process, the outcomes and paths of transformation of the teams. While WEAR was an Innovation Action rather than a research project, it was found that:

1. Through mentoring, expert consultations, reviews, interaction amongst members of the WEAR Sustain Ecosystem, views on sustainability and ethics in wearable technology development are broadened / advanced.
2. Pushing teams – through team reporting and our periodic Monitoring Committees' feedback and financial incentives (or penalties depending on the teams' performance) – to find more rigorous approaches to their design processes, sourcing materials, manufacturing and end of life options, made them become more aware and diligent.
3. Opinions / level of knowledge regarding sustainability and ethics differed greatly from team to team.

This work contributes to understanding the implementation of sustainability and ethics principles into the practice of wearable technology, and raises questions of responsible innovation in the field. Overall it

- provides recommendations on how to incorporate ethical principles for handling body data collected from wearable devices, as well as the production processes, from design to fabrication to prototyping;
- identifies new production models which rely on partnership between creative professionals (e.g. artists, craft practitioners and designers), and technologists (e.g. engineers, programmers and technology companies);
- assesses the opportunity to have recourse to ethical, small-scale manufacturing models (manual production or on-demand production);
- provides essential resources for future design teams, hubs and mentors to go through the step by step process of developing ethical and sustainable smart/e-textiles and wearable technologies;
- trains actors to become experts in order to get a commitment from them to continue the work of WEAR Sustain for future generations of ethical and sustainable smart/e-textiles and wearable technologies;
- provides a significant contribution and sets an example for further funding initiatives and supports the implementation of the European Commission's Sustainability Policies.

In terms of continuing the work and bringing it to maturity, the current consortium made an effort to build a business case. which aims at bringing the expert community platform and the SST to market. In the long run, the intention is that consortium members will further develop the SST, platform engagement and stakeholder network and develop it into a user-driven, AI-supported platform, that gathers additional resources on sustainability and ethics as applied to wearable technology and smart/e-textiles as well as pulling them from the internet (ethically of course). It will also lean on a human-centered approach, allowing for current actors in the network to be central to the development and iterative testing of a first beta version and become mentors and training consultants to grow the network into a movement toward more responsible technology development, especially now that governments are now declaring a global climate emergency and young children are demanding much more from those making these decisions.

Another development at the time of this writing is, that a sister EU project under the umbrella STARTS initiative<sup>6</sup> began in April 2019, with a mission to support, integrate and maintain the other sibling projects and their funded sub-projects, such WEAR Sustain and VERTIGO (see STARTS website) as they end, as well as other new Lighthouse projects such, as RE-FREAM<sup>7</sup> and MindSpaces<sup>8</sup> and to create more resources and services for artists and designers collaborating with technologists to aid them in responsible and sustainable project development. So the future will tell how truly successful the WEAR Sustain endeavours were, bay we have a plethora of resources and case studies to develop forward from for future growth in

---

<sup>6</sup> starts.eu

<sup>7</sup> re-fream.eu

<sup>8</sup> mindspaces.eu

these areas toward making better products, services and innovations in the smart/e-textiles and wearable technology.

### **ACKNOWLEDGMENTS**

The work has been funded European Union's Horizon 2020 research and innovation programme under grant agreement No. 732098. This paper was supported by all consortium partners.

### **REFERENCES**

- [1] M. Redclift, "Sustainable development (1987-2005): an oxymoron comes of age," *Sustain. Dev.*, vol. 13, no. 4, pp. 212–227, Oct. 2005.
- [2] P. Weaver, Ed., *Sustainable technology development*. Sheffield: Greenleaf Publ, 2000.
- [3] C. J. Kibert, L. Thiele, A. Peterson, and M. Monroe, *The ethics of sustainability*. Citeseer, 2011.
- [4] E. Felton, O. Zelenko, and S. Vaughan, *Design and ethics: Reflections on practice*. Routledge, 2013.
- [5] T. Robertson, "Ethical issues in interaction design," *Ethics Inf. Technol.*, vol. 8, no. 2, pp. 49–59, 2006.
- [6] C. Becker et al., "Sustainability design and software: the karlskrona manifesto," in *Software Engineering (ICSE)*, 2015 IEEE/ACM 37th IEEE International Conference on, 2015, vol. 2, pp. 467–476.