**WEAR: Wearable technologists engage with artists for responsible innovation: Processes and progress**

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**Abstract**

*Wearable technologies are a nascent market, growing exponentially and moving into our everyday lives more and more. They are exciting in their capacity to break down barriers between artists and designers and digital technology companies. Technology is becoming more efficient, accurate, and personalized. Hardware is becoming smaller, less visible, more connected and the collected data more seamless and ubiquitous. At the core of the wearable technology concerns is the amount of data that electronics companies are allowed to collect, in particular of their users’ personal data. Numerous technology companies and start-ups are working to make the next wearable device or application for body data tracking. This article provides a first critical analysis of the selection and monitoring processes used in these Open Calls and reports on initial work of the WEAR Sustain network, which for eighteen months has operated as a Pan-European catalyst for 46 projects in wearable technology design and development to the point of market and investment readiness, and discussing next steps for its Sustainability Toolkit for lasting impact.*

**Keywords**

wearables, e-textiles, ethics & sustainability, network, improved industry practices

**Context**

The dark side of wearable technology development reveals a unique set of insidious problems largely to do with their controversial data collection practices. Aside privacy issues, there are significant ethical issues around social, environmental, labour, mineral sourcing and supply chain activities life cycle of products in both the fashion and electronic technologies industries, including wearable devices. There is an urgent need to raise awareness and make significant changes in the industry, while continuing development of the wearable technology and smart textiles industries. A sustainable strategy for wearable technologies and e-textiles must now include ethical employment of labour and waste management processes.

By building their knowledge, users can better understand and articulate their rights to access, own, explore, and use their body data, and play a more active role in interpreting or reinterpreting this data, however they choose. However, without their knowledge and awareness of where their personal data are being collected or who owns their data, consumers are left unprotected against corporate and government surveillance. This raises a variety of important issues, such as: ethical (concerning the lack of privacy, and corporate ownership of personal data for consumerist agendas), as well as aesthetic, environmental and more. These issues need to be addressed in a highly critical way.

**Meeting the challenge**

WEAR (Wearable technologists Engage with Artists for Responsible innovation) Sustain is a two-year project that started in January 2017, funded by the European Commission Horizon 2020 Research and Innovation initiative to engage art, design and creative industries to work more closely with technology and engineering industries, to shift the development of the wearables and e-textile landscape towards a more sustainable and ethical approach. Through WEAR Sustain, 46 project teams and start-ups are currently funded to further develop sustainable and ethical wearable or e-textile prototypes towards market readiness.

WEAR aims to bring wearable technology industry players, engineers, tech companies, etc. to work more closely with designers and artists across Europe, to shift the development of the EU wearable industry, drawing on the rich European landscape of technology and smart textile stakeholders, to addressing the core critical, ethical, aesthetic and environmental issues head on, during the initial design research and development stages. WEAR Sustain has built and extended the European dialogue on these ethical and sustainability issues. It aims to reach out and engage a wide range of stakeholders, with an emphasis on technologists with artists and designers collaborating with engineers and technologists. As such WEAR set out to:

* Develop a sustainable European network of stakeholders and hubs, to connect and push the boundaries in the design and development of ethical and aesthetic wearable technologies, and develop local hubs to become advocacy centres for wearable technologies with a mandate for aesthetic and ethical design and development processes;
* Encourage cross-border and cross-sector collaboration between creative people and technology developers to design and develop wearable technologies and smart/e-textiles;
* Develop a toolkit or framework within which future prototypes can be made that will become the next generation of what ethical and aesthetic wearable technologies and smart textiles could/should be;
* Lead the emergence of innovative approaches to design, production, manufacturing and business models for wearable technologies. Such novel approaches will rely on the involvement of artists and designers in the R&D process, so we will develop a sustainability strategy and toolkit to help guide future R&D processes;
* Make citizens, entrepreneurs and other stakeholders more aware of the ethical and aesthetic issues in making and use of wearable technologies, to demand better from technology companies, manufacturers and governments.

In particular, WEAR Sustain aims to promote collaborations between technologists and designers/artists to develop sustainable and ethic wearables. A core activity in that respect is the organization of Open Calls to select and support teams developing prototypes of such wearables.

The WEAR Sustain network prioritizes:

1. engagement with alternative discourses in the conceptualization and design of wearables and e-textiles by prioritizing artist-technologist synergies;
2. addressing issues of sustainability in both production and end-of-life wearables and e-textiles;
3. foregrounding ethical issues of privacy and ownership of personal and embodied data. In building a network of 700+ like-minded actors in the sustainable and ethical wearable space from hubs to individual artists and technologists, WEAR Sustain presents a unique and compelling cross-section of the contemporary landscape which aim to shape a more sustainable and responsible future for wearables.

The story behind WEAR Sustain comes from a much deeper motivation from the consortium partners, each being motivated by a passion about changing the way industry, especially the electronics and technology industry and supply-chain, but also the fashion and textiles industries, and how they make their products. We all want to help to stop harming the environment, the surveillance of customers and users, and want generally contribute to better ways of doing things for the benefit of society. What drives those of us who initiated WEAR Sustain is: to contribute to innovation with a purpose, with a soul and aim to build a network of like-minded pioneers.

#### **Network of experts, mentors and hubs**

WEAR Sustain started off setting up a Pan-European- network of local hubs, experts and mentors in the wearables and e-textiles domain, to attract, support and facilitate the development activities of selected teams, as well as to identify other members of the network, by mapping the creative industries, textiles and tech sectors and stakeholders to become valued members and ambassadors of the network. As part of the mapping, WEAR Sustain partners demonstrated through various knowledge exchange events, how wearable technologies and e-textiles are spreading into different fields, such as art, ICT, fashion, interaction design, performance, video gaming, film and other creative industries. This mapping included non-creative stakeholders, such the military, emergency services, aerospace, fitness, medical and materials science sectors. It facilitated dialogue and collaboration, while developing shared theoretical references, viable business models, as well as a common language, terminology and practices.

The project consortium wanted to ensure that selected teams were facilitated in their development of their prototype(s), and to encourage their unique solutions to sustainable, open innovation, as well as business development towards market access. For each project, a support framework was used to define the concrete methods that would support that project. Each awarded team was able to individualize the support they received, depending on the type, stage, complexity and innovation of their project, maturity of the prototype from the outset, and the experience of the team, etc. This was enabled by a network of expert mentors that we developed through the WEAR Sustain networking tool DataScouts created by our We Connect Data partner, and assembled to assist in this process. WEAR Sustain identified supporting organizations connected to the Creative Ring, a wide European network of creative hubs with a strong focus on creative industries engagement, digital transformation, the fablab and Maker organizations in Europe, as well as accelerators and VCs actively supporting/investing in wearables, hardware, fashion, IoT, etc., as well as a broad network of creative professionals to draw up, including fine and performing artists, fashion designers, textile designers, interaction designers essential for the WEAR project.

**Part1 – Open Call and team selection**

Teams are selected based on their project to develop relevant products that are ethical and sustainable based on the Call Themes of: environment, use and reuse vs. waste and planned obsolesce, energy and batteries, body/ physiology/somatics, emotional and mental health, social/ cultural/ economic (addressing data collection, surveillance, privacy, algorithmic focussed marketing, human rights and labour practices.

The idea that artists and technologists can collaborate to develop and deliver innovations is becoming more and more mainstream. As European Commissioner G. H. Oettinger states, In the digital age, art and engineering are no longer contradictory modes of thinking’ (STARTS, 2016). Besides, these collaborations can prove fruitful, leading to radical innovations, solving crucial social or environmental challenges. WEAR Sustain has challenged artists and designers to work with technologists and engineers to focus their creativity and technical prowess on the problem of designing and developing ethical and aesthetic wearable technologies. More precisely, WEAR Sustain has attracted proposals from teams of artists and technologists, has selected the best projects, and is supporting their design, development and venturing activities. From a sustainability point of view, it is collating the selected teams’ experiences to provide recommendations for similar future collaborations, and will disseminate the selected teams’ results to ensure their sustainability beyond the end of the project.

Below we will analyse the Open Call selection process. We will then focus on how the selected teams are monitored during their six-month collaboration within WEAR Sustain, then briefly describe the results of these processes, followed by a critical self-assessment of these processes and of their results. Since Open Call 2 teams are still being supported at the moment this article is written, the analysis mainly focused on Open Call 1’s results, and the influence they have had on how we have designed selection and monitoring in Open Call 2.

1. ***Objectives of team selection***

In WEAR Sustain, one Work Package, led by imec, is devoted to the selection and the follow-up of WEAR Sustain teams. The objective over the two years of the project is to organize two competitions to select and follow up over the course of the project maximum 48 teams of creative people and technologists to develop fully functional prototypes of wearables. Specific objectives are:

* Attract a wide variety of compelling, innovative solutions for wearable technology, across all possible application domains – min. 100 application per call;
* Ensure a high number of quality proposals from across Europe – applications from at least ten European countries;
* Keep administrative burdens on participating teams of artists and entrepreneurs to a minimum and allow for a low barrier of entry to the yearly competitions;
* Implement adequate management tools to monitor and ensure participant performance.
1. ***Objectives put into practice: The selection* *criteria***

The selection process has relied on Open Calls with four phases. In the first phase (the first four months of WEAR Sustain), the consortium has developed selection criteria and defined the selection process. While led by imec with UCA’s support, this crucial phase has benefitted from every consortium member’s input and validation. Five criteria have been defined, in decreasing order of importance:

* 1. *Addressing call themes*, i.e. whether this project is in line with the WEAR application goals (social sustainability and/or economic sustainability and/or environmental sustainability and/or data ethics & privacy);
	2. *Creativity*, i.e. whether the project is truly creative, from a technological *and* a design/artistic point of view;
	3. *Team*, i.e. whether the collaboration relies on a balanced collaboration between artistic and technological disciplines, beyond the diversity within the collaboration, and the expertise of the involved team members;
	4. *Business potential*, including end-user validation and the market vision;
	5. *Feasibility*.

In order to ensure a high number of quality proposals from across Europe, all consortium partners assisted in dissemination exercises, including setting up local events, and attending local events to create awareness of the WEAR Sustain programme. This has taken place before and during the actual Open Call 1 (1 April–31 May 2017).

1. ***The evaluation and selection process***

The third phase is the evaluation and selection of the proposals exclusively received on the F6S portal:

* The submitted project proposals were assessed against the eligibility rules for beneficiaries, i.e. completeness of the submission file, and eligibility of the SME or individual entrepreneur;
* Three external experts reviewed all eligible proposals, with a profile specialized in design/arts, technology, sustainability/ethics or business (the latter was not initially foreseen). These experts had not any collaborative relationship with the project consortium nor the candidates;
* The highest rated projects were invited to pitch their project proposal to the Selection Committee, a panel of five external experts. The live, online pitch was used for clarification and further examination of the proposed idea;
* Finally, the selected teams were awarded EUR 50k (35k as financial support and 15k in-kind service provision via so- called innovation vouchers) to support and promote the prototyping of their idea, when adhering to their prototype plan and passing the midterm and term evaluations.
1. ***The Monitoring Committee***

All selected teams become part of the WEAR Sustain programme for around six months, with varying starting dates, notably depending on their speed to gather relevant administrative information required. At the start, they have received EUR 10k, and access to their innovation vouchers. The reception of the rest of their award is dependent on the positive evaluations by the Monitoring Committee.

Mid-term or after three months for each team all are evaluated by the Monitoring Committee, comparing the progress of all funded projects with the pre-defined milestones and deliverables. The Mid-term Evaluation Milestone is a crucial moment for assessing the progress of a project and the feasibility of meeting the project goals by the End Term Evaluation Milestone. The Monitoring Committee is composed of four external experts with diverse profiles and no known collaborative relationship with neither the project consortium nor the selected teams, and one representative of WEAR Sustain. End-term, or after six months, these teams are evaluated by the same Monitoring Committee.

1. ***The monitoring criteria***

In their evaluation, the Committee is asked to take into account notably whether the team has reached the set objectives, and if not, how they plan to remedy this situation; if the team is innovative, sustainable and ethical. To do so, they have received for each team a self-evaluation report, including information on:

* Latest activities and problems
* Whether objectives have been reached and what have been the encountered problems
* The plans for the next three months (only for the mid-term report)
* Perspectives on their activities after the end of their
* Six-months collaboration with WEAR Sustain
* Collaborative innovation and sustainable business models
* Data use
* Creating positive environmental, economic and social impacts.

Besides, each team has had a fifteen–twenty minutes online presentation and discussion with the Monitoring Committee for the mid-term and the end-term evaluations. It has been the opportunity for the Committee to get more details on some points of the report.

1. ***The post-evaluation process***

Following the evaluation, each team receives a green, orange or red evaluation. A green evaluation means that the project is on-track and can proceed as planned. An orange evaluation corresponds to Milestones delayed, with a planning that should be adjusted to reach the intended goals. Requirements are sent to the team, which must be addressed rapidly in order for the team to be allowed to continue and get the corresponding payment. A red evaluation means that the project is off-track, innovation is irrelevant or the team does not show commitment to the project. The project is stopped and remaining budget reallocated to other projects or teams.

1. ***Selection results***

For Open Calls 1 and 2, respectively 68 and 103 teams submitted; 63 and 95 were deemed eligible; 39 and 38 were invited to pitch; 22 and 24 were selected.

For Open Call 1, seventeen expert reviewers were selected and assigned to review the submitted proposals. The 39 companies that passed the online evaluations were invited to choose a presentation slot over the two days, and asked to dial into a call to pitch their proposal to the jury. Five jury members were selected from the pool of available reviewers, based on their availability and their profile (business, tech, design/artist and sustainability/ethics expertise).

1. ***Monitoring results***

Regarding monitoring in Open Call 1, fourteen teams were immediately cleared to proceed. Eight were required to provide additional information. No project was stopped after the mid-term review. At the Open Call 1 end-term review, thirteen teams were immediately cleared to proceed, nine teams were required to provide additional information. Eight were able to do so but 1 team was stopped after the response to the requirements was deemed insufficient, and a hearing with representatives of the Executive Project Management Board hearing proved to be unsatisfactory. That team was no longer eligible for further funding. The mid-term review of Open Call 2 is ongoing at the moment when this article is written. Eleven out of 24 teams have been required to provide additional information. No project was stopped after the mid-term review.

*I.* ***Progress reports***

Teams were required to report monthly on their progress and challenges they encountered. An initial analysis of these monthly reports identified a number of common themes across the teams. Most frequent challenges were schedule delays, slow production, and problems with technical integrations. Teams also reported challenges within their teams such as low availability of key staff, which again led to schedule delays. Sustainability was mostly mentioned by teams in terms of concerns about the sustainability of manufacturing processes and materials rather than concerns about sustainable business models or healthy and sustainable society. In terms of ethics the primary concern of teams during their development process was the ethics of data privacy and anonymity of data. Teams also reported concerns about, and special attention paid to ethical and fair treatment of works in the production and manufacturing processes.

**Part 2. Selection: A critical self-assessment**

In this section, we would like to highlight and discuss some limitations and problems encountered in these processes. As explained previously, Open Call 2 is still ongoing. This does not give us enough perspective to assess it. However Open Call 1 selection and monitoring processes have been assessed internally, and this has had some consequences on how Open Call 2 has been designed.

1. ***Comparison with the key performance indicators (KPI)***

First, Open Call 1, and partly Open Call 2, have been assessed in comparison with the KPIs set by WEAR Sustain regarding the selection process. These were in terms of the number of proposals to be received during the Open Calls, the origin of these proposals, and the number of reviewers.

According to the first KPI, it was expected to receive in average 100 proposals. There have been a lower number of proposals received than expected, with 68 and 103 proposals for Open Call 1 and Open Call 2 respectively. This can be explained by the time taken for the project to promote itself and become known to potential applicants; the time necessary for applicants to find a partner to team to develop a proposal and to work with. In that respect, several people reported to us, notably during Open Call 1 events, that they were going to submit a proposal for Open Call 2. Besides, for Open Call 2, we made most selection criteria more constraining (see after). Possibly more proposals would have been received if the criteria had been less strict for Open Call 2.

In the WEAR Sustain project proposal to the European Commission, it is stated that applications were to be received from at least ten European countries. We actually received for Open Call 1 applications from 16 countries, out of which teams from nine countries were selected. While we performed much better than our KPIs, it is important to note that applications were concentrated in a few countries. Three countries (United Kingdom, Netherlands, Spain) accounted for more than half of selected teams. After Open Call 1, we made the assumption that this may be due to the organization of main events in these countries, or because they already benefit from a stronger ecosystem around wearables. This led us to organize most Open Call 2 dissemination events in underrepresented countries: Portugal, Greece, Denmark but also France.

The impact on Open Call 2 has led us to conclude on the importance of existing ecosystems. Actually, the distribution was about the same for Open Call 2, with France and Germany much more represented. Portugal, Greece and Denmark, and in general Eastern and Nordic European countries were not much represented among received proposals. Therefore, the influence of the existing ecosystems is probably the best explanation. A project alone, such as WEAR Sustain, cannot remedy existing imbalances.

The third KPI related to the organization of the Open Call in terms of the number of reviewers for each written proposal, i.e. two external reviewers. It was decided to have three reviewers for each eligible proposal in the end, in order to have more different points of view on each application. With a higher budget we would have opted for four reviewers, allowing us to have the four profiles represented (business, art & design, technology and sustainability).

1. ***Our selection criteria at the test of Open Call 1***

Beyond KPIs, the organization of Open Call 1 (and feedback received from reviewers and applicants) allowed us to realize that some of the five selection criteria were not as clear as we thought they were, or that there were some redundancies between sub-criteria. This led to a few significant changes between Open Calls 1 and 2.

The main changes relate to the first criterion: ‘Addressing call themes’. For Open Call 1, the criterion was designed in a way that did not put enough emphasis on sustainability and ethics, thus going to some extent against the broad objectives of WEAR Sustain. Thus, some applications tackled the first criterion by providing ways to improve health and well-being, but without really taking into account environmental sustainability or data-related ethics. To remedy that, we stated for Open Call 2:

Irrespective of the chosen theme(s), both major concerns (ethics and sustainability) must be addressed in the proposal. That means they should at least choose one of the themes in 1.1 (environmental sustainability) and one in 1.2 (data ethics and privacy).

Therefore, any project that in no way addressed Ethics and Sustainability was not deemed eligible. Besides they can also (but it is not mandatory) choose one theme in 1.3 (including notably health-related themes, which proved [overly] popular in Open Call 1).

Besides, Creativity and Business Potential were modified. For Open Call 2, creativity became articulated around two sub-criteria: technical and artistic. The previous three sub-criteria were not as clearly delineated. Business potential became articulated around two sub-criteria: the business model and the targeted market. A previous sub-criterion appeared to deal more with feasibility (the last criterion).

Conversely, the WEAR Sustain consortium realized that some eligibility or selection criteria were too strict, which led to a loosening of such criteria for Open Call 2. One example is the citizenship or residency of team members. For Open Call 1, *all* team members had to be citizens of, or reside in, the European Union, or an associated country. This consortium decision stemmed from our reading of the conditions set by the European Commission but it appeared that it was possible to allow for people and legal entities from further abroad to become team members. To justify the value of these teams to the European Union, we continued to ask that the team leader was part of an EU country.

1. ***Unexpected questionings of WEAR Sustain’s scope***

The scope of what qualifies as wearable and smart textiles was enlarged compared to what was first envisaged. This is notably due to difficulties in precisely defining what we include as wearables or smart textiles. Initially, we implicitly envisaged that we would fund the development of *prototypes* and that they would generate *data*. It appeared however that some unexpected projects fitted with our definition, for example, those that dealt only with fabric or textile without involving any electronics. Another example, more common in Open Call 2, relates to the development of services, processes, or industry enablers, rather than only products. However, apps or platforms without any underlying material component remained out of the scope.

Finally, a more general set of constraints or limitations for our selection process and the selected teams deals with the limited means and support that these teams receive (and the limited means that our consortium itself has to operate, more generally).

The selected teams have to pursue objectives that may require them to make trade-offs, or that can be to some extent contradictory with each other. We ask them, ideally, to be *skilled* teams, relying on an *international* collaboration that is *balanced* between the technical innovation and the artistic/design creativity components, related to wearables and smart textiles. At the same time, we want them to have follow-up activities after the six-months support, from other potential grants to a market launch in the year after. And, last but not least, the activities need to be sustainable and ethical. A few examples have arisen where it appeared that it would be easier, at least in the short term, to set up a business model around collecting and using data, which would have been very questionable from a data privacy point of view.

**Part 3 – Sustainability Strategy Toolkit (SST)**

WEAR Sustain’s core agenda was initiated to address ethical and sustainability issues in the fashion, smart fashion, textiles and smart/e-textiles, and wearables devices and technology sectors, and to develop a sustainable strategy that would also address the ethical employment of labour and waste management processes. The goal of the SST is to develop best practice methods and networks for enabling, facilitating and sustaining future collaborations, design, development, manufacturing/production and end-of-life solutions for wearable technology and smart/e-textiles founded on ethical and sustainable foundations.

The SSTis being developed around the insights gathered throughout the project and synthesized in the form of design and industry-specific strategies to create and develop future advocacy centres and successful partnerships with the network of hubs. Such a strategy aims to further educate designers and development teams using wearable embedded electronics to understand and focus on how to source ethical minerals and materials, locally made components, recycling and/or upcycling of both non-electronic and electronic parts, how to avoid waste by fabricating made-to-measure wearables, economical application of new materials, replaceable components, as well as careful separation of new and traditional materials, lifespan considerations, and encouraging companies to employ strategies for recycling or disposal, using a modular system of wearable hardware that not only ensures that the garment/device can be worn longer and be washed, but also that electronic technology and carrier material can be separated once one of them outlives the other, and so on. The SST is aimed at teams and start-ups that either already have sustainability integrated into their development but want to improve other aspects of their process, or as an incentive and how-to-guide for teams and start-ups who do not yet implement sustainable practice.

WEAR Sustain will compile the SST that will identify new production models that rely on partnership between creative professionals (e.g. artists, craft practitioners and designers), and technologists (e.g. engineers and technology companies). It will assess the opportunity to have recourse to ethical, small-scale manufacturing models (manual production or on-demand production). The long-term aim is that the toolkit should be a significant contribution for further funding initiatives and support the implementation of the EU Commission’s Sustainability Policies.

The toolkit will provide guidelines and best practices for future research, innovation and development in ethical wearable technology addressing the following three categories:

1. Innovation and collaboration: in terms of a business model canvas for wearable technologies and smart/e-textiles; providing business models for wearable technologies and smart/e-textiles to exchange and share data ethically; creating a digital ecosystem around a wearable and smart/e-textile innovations in the ethics and sustainability development and design; supporting artist/designer and technologist and industry collaboration in general; developing communities and local ecosystems in this niche field.
2. Data use: data collection/data storage and production: fabrication/design/prototyping. The amount of data that wearable technologies capture, in particular their users’ personal data, raising ethical issues regarding ownership and processing of this data by the wearable technology manufacturers and service providers.
3. Creating positive environmental, economic and social impacts from the electronic, textiles and fashion industries on society. Tackling ethical issues that include poor labour practices and working conditions within manufacturing, mineral sourcing and the supply chain.

The toolkit is intended to offer essential ethical improvements to design, development and business practices within Information Communication Technologies (ICT) and creative industries, and can therefore stimulate ethical and sustainable efforts for the future of the EU Economy. It will primarily be aimed at the established and future research hubs making or using on wearable technology, creative professionals working with wearables, the wearable technology industries, higher education institutions, wearable tech project developers, and future EC funded projects working around wearables.

Finally, WEAR Sustain partners will assess how to promote ethical, sustainable small-scale manufacturing models (manual production or on-demand production). Therefore, during the project we will reflect on methodologies and processes explored and used by teams; identify and understand the successful elements of their integration, and the strategies that enable sustainability across the different industries and provide a new path for them to follow for future.

In summary, the toolkit will provide guidelines for industry-specific methodologies and hands-on techniques to:

* Support the development and maintenance of collaborations within teams and among the network, beyond the end of the project;
* Integrate project learning into the core practice of research development, manufacturing and product distribution, the product life cycle, and waste management;
* Develop a step-by-step plan for hubs to follow for ongoing advocacy and innovation support of future projects in their region;
* Develop best practices for training and a contracting for individuals, experts, service providers, SMEs and companies to work with across Europe.

Knowledge and insights collected through analysing teams’ reports, knowledge sharing events and expert roundtables with WEAR network members and the public, consultations with WEAR experts (mentors and hub leaders) and WEAR team members (through one-to-one consultations and surveys) have been gathered over the course of the project. Case studies of teams are presented, showing how project teams negotiate and advance their goals of practical execution of sustainable aspects. They illustrate how design quality and technology readiness level (a metric set by the European Commission to measure readiness to go to market from idea to full production), are affected when utilizing the interdisciplinary skill sets under the light of sustainable practice goals. These insights have been used to develop the first version of an online toolkit to assist current and future teams to find ethical and sustainable resources for every stage of product development, a huge task in a largely difficult and unethical and polluting set of industries connected to wearables.

The first click-prototype of the SST demonstrates basic functionality, content and interaction. A survey of individuals working the wearable design space including 16 respondents from the WEAR network were undertaken to inform the requirements of the click-prototype. The three categories with regard to content ‘Sustainable collaboration & business’, ‘Sustainable & ethical production’ and ‘Ethical issues – data & workplace’ were identified for the prototype, and this was tested through scenario walk-throughs of how it might be used by potential users. Much work has gone into the development of a sustainability strategy through analysing procedures and tools that have evolved through the work of the WEAR Sustain selected teams, as a means to embed sustainability into their practice. The final results of the SST comprise WEAR Sustain’s goal to develop a sustainability strategy to have ongoing support for ethical and environmentally sustainable electronic textiles and wearables development, providing an open access toolkit that will enable future projects to also embed circular design, sustainability and ethics into their own practices.

**Summary**

In this article, we have outlined how the WEAR Sustain network has demonstrated that artists working with technologists can innovate in terms of product or manufacturing, and develop economically viable and attractive business models. An initial analysis of all monthly project reports combined with a short survey of individuals working in the wearable technology design field suggests that, as with any project, project management is complex but that the distributed combination of artists, technologists and production brings additional communication and collaboration issues. Not least are the challenges of rectifying manufacturing errors and negotiating Non-Disclosure Agreements in multiple languages and across various disciplines.

In terms of sustainability, the predominant concern of projects was the sustainability of their production process and materials, which in itself brings challenges when working with international partners who may not have comparable approaches to sustainability. The reports point to the importance of hubs as resources of skills, expertise, and production equipment, especially in terms of sourcing materials and technologies with suitable properties. However, concerns were raised about the environmental impact of rapid prototyping without suitable recycling or reuse, and the utility of 3D printing was also questioned which challenges the dominant narrative of maker spaces as the solution to low-cost, low-carbon local manufacturing. Ethical implications were considered within the projects and their development process rather than broader ethical impact of the products developed. This may in part be due to the difficulty of finding information about ethical and sustainable aspects of wearable technologies. One way to address this may be for hubs to become centres of excellence for particular aspects of sustainable and ethical wearable design along with a content-rich and easy to navigate online resource on sustainable and ethical wearable design.

This article has also described and analysed the selection and monitoring processes within WEAR Sustain. To do so, it has first described the EU project’s broad objectives. It has then analysed the selection and the monitoring processes. It has briefly described the results of these processes, and provided a critical self –assessment. Finally, it has given insight into the SST and the next steps for the WEAR Sustain project and its network as a whole.

This article should be seen as a first step in the understanding of what WEAR Sustain has delivered in terms of supporting collaborative innovation in the field of ethical and sustainable wearables, and in general regarding the analysis of how to best select and monitor projects. While the scope is quite specific, we believe it is important for current activities around the collaboration between artists and technologists, or for the reflection on how to promote ethical and sustainable innovation, or in relation to wearables.

The reflections presented will need to be further prolonged when the Open Call 2 is finished. It would also be worth comparing with other similar projects or processes relying on Open Calls and/or aiming at fostering collaborations between artists and technologists.

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**Contributor details**

Camille Baker’s practice is focused on Performance and Emerging Technologies, with emphasis on wearable technologies and mobile phones used as a performance tool and collaborator. She is a reader in interface and interaction, in the School of Communication Design at the University for the Arts, Epsom, Surrey, UK. Dr Baker was the initiator and one of the consortium partners' principle investigators (PI) on the WEAR Sustain project [www.wearsustain.eu](http://www.wearsustain.eu/), which is focused on moving the smart/e-textiles industry to become more ethical and sustainable through the collaborative projects of artists and technologists. She will be part of a three-year follow-on EU project called  STARTS Ecosystem starting in January 2019, and has just released her monograph called, *New Directions in Mobile Media and Performance* – featuring theory and practice on mobile devices, AR/VR and wearable technology in various forms of artistic performance, especially since the release of the first iPhone.

Nick Bryan-Kinns is Reader in interaction design and director of the EPSRC+AHRC Media and Arts Technology Centre for Doctoral Training at Queen Mary University of London. He is director of EECS International Joint Ventures and was a visiting professor of interaction design at Hunan University, China. Bryan-Kinns is a Fellow of the Royal Society of Arts, Fellow of the British Computer Society, and leads the Sonic Interaction Design Lab in the Centre for Digital Music. He has published international journal papers on cross-cultural design, participatory design, collaboration, mutual engagement, interactive art, cross-modal interaction, and tangible interfaces. His research has been exhibited internationally and reported widely from the New Scientist to the BBC. Bryan-Kinns was Deputy Dean at QMUL, held a Royal Academy of Engineering Industrial Secondment for commercializing academic research, and has provided expert consultation for the European Commission and National Science Foundation on Creativity and IT. He chaired the Steering Committee for the ACM Creativity and Cognition Conference series, and is a recipient of ACM and BCS Recognition of Service Awards. In 1998 he was awarded a Ph.D. in Human Computer Interaction from the University of London.

Berit Greinke has recently been appointed as junior professor in Wearable Computing at Berlin University of the Arts and Einstein Center Digital Future (ECDF). She has previously worked as a post-doctoral researcher at Design Research Lab, Berlin University of the Arts. Her work focuses on engineering design methods and fabrication techniques for electronic textiles, combining crafts with novel manufacturing technologies. Her aim is to initiate innovation in textile design by repurposing scientific methods and procedures, and transform them into functional and poetic artefacts. She completed a diploma degree in Textile and Surface Design at Berlin Weissensee School of Art, and an MA in design for Textile Futures at Central Saint Martins College of Art and Design. She has gained a Ph.D. at the Doctoral Training Centre (DTC) for Media and Arts Technology at Queen Mary University of London.

Heritiana Ranaivoson is Senior Researcher and Project Leader at imec-SMIT-Vrije Universiteit Brussel (Belgium) since 2010. He currently acts as Project Coordinator for the EU H2020 WEAR Sustain project. Before joining imec, he was associate researcher at Cerna, the Centre for Industrial Economics at Mines ParisTech (2008-2010). He holds a MSc in Economics and Management from the Ecole Normale Supérieure de Cachan (ENS Cachan) and a PhD in Industrial Economics from Université Paris 1, Panthéon-Sorbonne. He was a member of the Unesco Expert Group on the Statistical measurement of the diversity of cultural expressions (2007-2011) and since 2008 he is part of the U40-Capacity Building Programme „Cultural Diversity 2030“. He has led several projects at international, national and local levels, funded by public (e.g. European Commission, Unesco) or private (e.g. Google) organizations. His main research interests are cultural diversity, media innovation, wearables and the economic impact of digital technology on cultural industries.

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