Towards a Sustainable Framework in Digital-Social Innovation: Integrating Circular Economy, Capability Approach and Action Research.

Summary

The relentless pace of digital innovation is by large driven by economic models of growth and their demand for novelty, generalizability and scalability. As innovation-researchers, we question the societal and environmental sustainability of this model and look for alternatives in partnership with communities, businesses, and the 'hard-to-reach'. In doing so we focus on three aspects of sustainability: 1) *material sustainability*, the materials and energy resources used to make a device 2) *technology longevity*, the skills, knowledge and infrastructure required to access and maintain a technology 3) *human capabilities*, the individual and societal 'freedoms' afforded or hindered by the technology. We address these aspects by applying a participatory, agile and reflective approach that integrates a) the principles of circular economy b) the practices of open-source licensing c) the principles of capability approach. We conclude by outlining the development of Clasp, an anxiety management system prototyped in partnership with adults with autism.

Keywords

Digital Innovation; Participatory Design; Action Research; Cradle to Cradle (C2C); Circular Economy; Capability Approach (CA)

Theme: 7. Special Sessions

Subtheme: 7.34. Transformative Science for Transformative Social Change: What kind of Science for Sustainability Transformations

Introduction and Motivation

This paper emerges from several years of community-based innovation research during which we experienced the tension between the institutional drive for novelty, commercialisation, generalizability, and the specific needs of our community partners. Our aim is to address this tension by first reflecting on *if* and *why* digital innovation should play a role in tackling complex societal issues and then suggesting pointers on *how* this could be done by outlining our approach in the digital-health domain.

Digital innovation for 'social good' is a growing area of research which seeks to promote positive social change by building innovative software solutions with a social conscience [7]. Initiatives such as Games for Change[1], green hackathons, and Ushahidi[2] are examples of how digital technology is used to tackle complex societal challenges. However, one must question whether technology innovation, digital or otherwise, can sustainably tackle the very societal issues that it has contributed to [2]. Silberman et al. [14], for example, points out that *"there is a tension between the historical focus on technological novelty and sustainability goals"*. In a recent report on risk and innovation [1] the UK Government scientific adviser, Mark Walport, states that *"debates about risk are also debates about values, ethics and choices […] and fairness, or who benefits and who carries the risk"*.

Work by scientists such as Walport [1] as well as by thinkers such as Schön [12], Galimberti [8], and Feenberg [5] help to understand, not only the challenges, but also the fundamental role that innovation plays and should play in tackling societal issues. From Galimberti, for example, comes the realization of the 'inevitability' of technology innovation and the civic responsibility to become, at least, attentive observers of its process *"to avoid history to happen without us knowing it"* [8]. Feenberg argues that, in order to bring a transformative change in society, practice must complement the 'incompleteness' of technical knowledge by translating community values *"into technological language"* [5].

[1] http://gamesforchange.org/
[2] http://www.ushahidi.com/

However, this "*technological language"* faces a number of sustainability issues here summarised as follows: 1) *Material sustainability* – are the materials, energy resources and processes used to make the technology harmful to humans or the environment? Are they resourced fairly? Can they be reused? 2) T*echnology longevity* – can the technology be easily repaired and maintained? Are the skills required to operate the system available and transferable? 3) *Human capability* – what and whose capabilities does a technology afford or hinder? To address these aspects we need approaches that both facilitate theoretical reflection and practical application. We argue that the circular economy approach [10] as well as the human development and capability approach [3] are meaningful ways for exploring potentially sustainable technology development processes.

Underpinning Concepts

The circular economy approach is a thinking framework that considers economy as a network of systems that transform resources (e.g. actual material, energy) and feeds them back into a closed virtuous loop. It draws from a number of regenerative 'no-waste' practices such as Cradle to Cradle design (C2C) which develops products as *services* that are economically strong, socially beneficial, and ecologically intelligent [10]. C2C does so by following three key tenets: (a) consider waste as a resource, (b) leverage on natural energy sources, and (c) promote diversity. Over the years, the C2C approach has been successfully applied to a broad range of products from leading industries[3] (e.g. Ecover, Puma) addressing tensions between economic growth and environmental health and human wellbeing.

However, we argue that even a sustainably and ethically designed technology may still lead to unexpected and undesirable consequences to society by, for example, expanding the capabilities of some individuals or groups and limiting the ones of others. Gonzalez et al. [9], for instance, report on gender-inequality implications of a small-scale renewable energy intervention in Bolivia, while Biggeri and Ferrannini [4] argue that the emergence of such 'opportunity gaps' is a wide-spread phenomenon. The study, reflection and policy intervention on this tension is at the core of Amartya Sen's Capability Approach (CA) [13]. CA is a way to approach human well-being that posits *human freedoms* at its core. These freedoms are described as the *capabilities* of an individual to be or to do what she values and has a reason to value [11].

Our approach to technology innovation draws from principles of action-research and has emerged from research-partnership with hard-to-reach communities [7]. It is participatory, reflective, and agile, and sees digital technology as a means for problem exploration rather than an end-solution. It has been applied over the years in research-community partnerships that included remote island communities, homeless people and adults with autism [6, 15, 16]. In the next section, we outline how principles of C2C and CA can be applied to our technology-innovation framework by introducing one of our technology prototypes, 'Clasp', as a case study.

Towards a Sustainable Development of Digital-Heath Devices

Clasp is an anxiety management and peer support network system for adults with autism (ASD) [12]. Clasp was developed during a nine-month research partnership with ASD adults and their families; it has received wide media attention[4], end-users, and care-providers' support. Clasp has now entered a second phase of development (from prototype to pilot). One of the main lessons learned from Clasp's first phase of development is that *"everybody is unique"* and *"has different needs"* [15]. For example, one of Clasp's components, a stress-ball like tactile device, keeps a log of the anxiety triggers every time is squeezed. However, the design of such device does not suit all our partners: some prefer a wearable tool, others worry about 'technology dependence'. This raises fundamental research questions: how can we 'open-up' and 'tear-down' a technology to suit both individual and collective needs? How can we do it in transparent, sustainable and affordable way? How can we move beyond 'gadgets' and investigate the long-term societal and ethical implications of personalised health-technology?

Our ultimate goal is to make digital-health technologies accessible and affordable to all parts of society including the hard-to-reach groups who, like remote communities, the elderly and people with disabilities, are in need of personalised health-care, but may have limited access to digital technology due to limited know-how,

[3] http://www.c2ccertified.org/
[4] http://www.bbc.co.uk/news/technology-29031641

finances, infrastructure and poor designs. Our approach is to include CA and C2C principles in our agile and action-research based innovation framework [7]. We do so by applying both the three tenets of C2C and the CA principles as reflective lenses along the full technology development cycle: from requirement-capture to deployment 'in the wild'. For example, by using Clasp as a case study, we are investigating the role of low-cost distributed and independent manufacturing (e.g. 3D printing) in personalised digital-health whilst jointly reflecting on its impact on potential service users and on health-policy making with our research partners.

In other words, Clasp is to serve as a case study to both co-design exemplars for future digital-health tools and to investigate their potential impact on the increasingly diverse 'vulnerable edges'. We argue that technology innovation that only focuses on generalizability and scalability for the relatively more affluent 'averages' weakens our economy by concentrating wealth and power in the corporate network of the few [17] instead of harnessing the strengths of more diverse, distributed and potentially more resilient parts of society.

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