



Making Sustainability: How FabLabs Address Environmental Issues

Impact Case Study

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Abstract

Digital manufacturing technologies are proliferating and can enable socially significant, innovative new forms of production and consumption. This thesis examines the environmental sustainability issues in peer production and how they are addressed in Fab Labs (fabrication laboratories): shared spaces where users can design and make their own artefacts outside of conventional mass production channels, using, for example, laser cutters, 3D printers and electronics stations. Fab Labs are open to members of the general public, who learn to use the equipment



themselves and are encouraged (or required) to document and openly share their projects. 'Making' in Fab Labs and the 'maker movement' are often endorsed by proponents as a better alternative to mass consumption and consumerism, whether through enhancing skills

to build and repair, answering one's own needs as opposed to 'satisficing' through passive consumption, or distributing production within local networks as opposed to long, transport-intensive and large-volume supply chains. However, Fab Labs and makerspaces are contexts rife with paradox and complexity concerning appropriate use of materials and energy. Little empirical research on material peer production

currently exists, and the environmental impacts, and benefits, of digital fabrication are largely unknown.



Primarily through ethnographic research methods and Symbolic Interactionist analysis, the thesis examines daily practices and discourses in selected Fab Labs and how sustainability is represented in these communities. The findings articulate how the actors' interactions, expressed intents and contextual conditions serve to shape the Fab Lab. The key finding is the conflict actors encounter between – on the one hand – setting ambitions, promoting particular ideologies and espousing sustainability-oriented values, and – on the other hand – realizing and enacting these values in the mundane and constraining routines of everyday practice. Even actors with a clear ecological mandate struggle to engage with emerging sustainability issues in a rapidly changing sociotechnical environment. Present

topics of concern and everyday tasks overshadow future strategy and vision work as well as engagement with environmental issues and rapid technology developments. However, actors who consciously and visibly strive to enact the espoused Fab Lab ideology, i.e. offering access to empowering, distributed technologies that enable people to meet their own local needs by design, appear better able to identify and tackle the environmental sustainability issues as they arise. Environmental issues are also intertwined with and embedded in other ideological concerns, but they are rarely promoted in their own right.

The thesis also details the current landscape of research literature on distributed production, who is studying these environmental issues and how, and the potential opportunities and threats in this new mode of production. The thesis thereby contributes to research on peer production communities, social shaping of technology and sustainable design. Knowledge of current maker practices and their sustainability implications have value for the peer communities studied, but also potentially technology developers and policy makers. As Fab Labs are experimental spaces for new digital manufacturing capabilities and activities, the wider implications of the findings may indicate how increasing digitalization and citizen involvement in production will transform design and production – and the sustainability implications therein.



Summary of impact beyond academia

The dissertation examined technology subcultures, groups who set up experimental technology infrastructures before they become mainstream, i.e. on-demand production/manufacturing with increasing user engagement and agency. The dissertation delivered new insights into these emerging practices on the margins of design, where digitalization is shifting the places of design and production and the types and roles of intermediaries. The technology subculture actors (fab labs, makers, hackers) are well placed to influence discourse, narratives and the meanings of new modes of production and consumption: the 'new industrial revolution'. They establish new behaviours and practices in the making as they interact with citizens and institutions (their users and partners) in their daily activities. Engaging with these groups in non-academic and semi-academic settings in public events and specialized subculture events, through talks and workshops that communicate research findings, has had impact in terms of the visibility of sustainability issues and how groups orient to sustainability. The talks and networking activities have also served to network groups with each other to further share knowledge on sustainability issues.

Based on the dissertation, invitations to write publications aimed at a non-academic audience and give talks at public events have raised awareness of the value of participation in design and technology. Some publications and talks were targeted at a professional design practitioner audience, drawing attention to new design practices and user engagement enabled by digitalization.

Underpinning research, context and summary of methodology

The constructivist research bridged Design Research and Science & Technology Studies (STS). The main study was a longitudinal ethnographic study. In the study the observations (participant and non-participant observations) involved the 'middle range' of lab organizers' and active practitioners' interactions: how they organized, what they espoused, and the relationship between what they espoused and what they actually did. The analysis framework was the STS/symbolic interactionist "social worlds" framework wherein fab lab communities were examined as part of social worlds interacting with others. For one paper in the article-based dissertation the dataset (also gathered using ethnographic methods) was analysed using grounded theory axial coding congruent with symbolic interactionist analysis and the social worlds framework. Another paper in the article-based dissertation is positioned in design research and used participatory design methods. To ensure robustness the analysis was based on property space analysis, i.e. qualitative comparative analysis (QCA), which – as in the ethnographic studies – also analyses discourse and practice as well as key thematic clusters. The other article in the dissertation is an integrative



literature review analysing and mapping the emerging phenomenon of distributed production and how it is studied in various fields.

References produced by researcher from/during doctoral research

invited book chapter: Kohtala, C. (2019). Makerspaces as free experimental zones. In M. Charter (Ed.), *Designing for the Circular Economy* (pp. 260–269). Abingdon, UK: Routledge. <https://www.routledge.com/Designing-for-the-Circular-Economy/Charter/p/book/9781138081017>

invited essay: Kohtala, C. (2017). Systems of Resilience: A Dialogue on Makers, Making and their Principles of Conduct. In A. Briceño & T. Vivanco (Eds.), *Fabricating Society* (pp. 55–65). <http://www.fundaciondid.cl/wp-content/uploads/2017/07/FabricatingSocietyResearchBook.pdf>

Berglund, E., & Kohtala, C. (Eds.). (2015). *Uusi Helsinki? 11 näkökulmaa kaupungin mahdollisuuksiin | Det nya Helsingfors? 11 olika perspektiv på en stads möjligheter | Changing Helsinki? 11 Views on a City Unfolding*. Helsinki: Nemo.

Details of impact

Invited talk and panellist in Design Culture Salon event, based on dissertation findings (FI) (2019)

Contribution to Design-for-Sustainability event at Dutch Design Week (NL) (2018), including co-organizing a panel and giving a talk based on dissertation findings

Invited talks for the general public on active citizens in production/consumption and urban development, such as Helsinki Design Week Talks at the city hall and Design Museum (FI) (2017, 2018) <https://www.designmuseum.fi/en/events/aalto-design-research-book-talks-dialogues-on-design-and-society-2/>

Invited talk and panellist at urban sustainability event for the public, based on dissertation findings (SE) (2016) <https://vimeo.com/200165244>

Talk at grassroots maker event conveying dissertation findings (NL) (2016)

Contribution to Open Source Circular Economy Days Helsinki events for the general public (FI) (2015-2017), including organizing displays and giving talks



Mainstream technology media covering dissertation defence (FI) (2016)
<https://www.uusiteknologia.fi/2016/03/10/tee-itse-valmistus-ei-aina-vihreaa/>

Mainstream technology media interviewing researcher in fab lab research site (FI) (2013)

A participatory design workshop involving city library planners and local makers/hackers, as part of the dissertation research, extended the relationships between the library and the maker communities for years after the workshop to mutual benefit (FI) (2013)

'Sustainable Maker Culture' seminar for general public, World Design Capital Pavilion, Helsinki (FI) (invited to organize by World Design Capital Helsinki Foundation) (2012)



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