

Beyond Sharing Surplus Food: On Design to support Grassroots Initiatives in their Pursuit of Sustainability

DISSERTATION

zur Erlangung des Grades eines Doktors

rer. pol.

der Fakultät III – Wirtschaftswissenschaften,
Wirtschaftsinformatik und Wirtschaftsrecht der
Universität Siegen

vorgelegt von

Philip Engelbutzeder

Siegen, den 04.06.2024

Erstkorrektor: Prof. Dr. Volker Wulf

Zweitkorrektor: Prof. Dr. Gunnar Stevens

Dekan: Prof. Dr. Marc Hassenzahl

Date of Disputation: 17.12.2024

DOI: <https://doi.org/10.25819/ubsi/10617>

Abstract

This dissertation examines the intersection of socio-technical design and grassroots initiatives within the domain of food saving and food sharing, rooted in the context of the Foodsharing community in Siegen, Germany. It explores how socio-technical design can support grassroots efforts in the initiation, daily operations, growth, and broader transition towards sustainable food practices. Through a practice-based and action-oriented research approach, this study delves into the nuances of community values, needs, challenges, and socio-technical practices, revealing the complexities of negotiating surplus food redistribution, community building, and the integration of prosumption practices.

Key findings highlight the critical role of socio-technical design in facilitating the sharing of not just food surplus but also resources crucial for food production, thereby fostering a culture of abundance. This shift from food sharing to food resource sharing underscores a transformative ambition towards more sustainable food systems, challenging traditional economic paradigms of consumption, and promoting a holistic approach to community engagement and sustainability.

By engaging with the Foodsharing community in Siegen, this dissertation uncovers the intricacies of designing socio-technical systems that accommodate the dynamics of grassroots initiatives. It presents a nuanced understanding of how digital artefacts and platforms, like Foodsharing.de and Telegram, can serve as catalysts for community building and the amplification of sustainable food practices. The study advocates for an approach that accommodates the evolving digital literacy and needs of grassroots communities to support their scaling and growth.

This research contributes to the fields of Sustainable Human-Computer Interaction (SHCI), Human-Food Interaction (HFI), and action-oriented research in Human-Computer Interaction (HCI) by providing insights into the interconnectedness of socio-technical design, community building, and sustainable food practices. It emphasizes the need for HCI designs that are sensitive to the complexities of grassroots initiatives, advocating for designs that sup-

port the transition from surplus management to the realization of food abundance.

In conclusion, this dissertation underlines the potential of socio-technical design in supporting societal change through grassroots initiatives, proposing a shift towards sustainability that is deeply rooted in community engagement, resource sharing practices, and the collective pursuit of abundance. It calls for further research on integrating these insights into the design of socio-technical artefacts, thereby supporting the ongoing evolution of grassroots initiatives towards sustainable food systems.

Acknowledgements

This dissertation, encompassing research activities conducted from 2019 to 2023 at the Institute of Information Systems and New Media, University of Siegen, represents not only an academic journey but also a personal one, filled with valuable contributions from numerous individuals. I am deeply grateful to each one of them.

Firstly, I extend my heartfelt thanks to my supervisor, Prof. Dr. Volker Wulf. His unwavering belief in both me and my work, taking both seriously, really meant a lot to me. Prof. Wulf's passion for making a change in the world and his dedicated approach have profoundly influenced me. His ability to instill excitement and drive is truly rare and immensely appreciated.

I am also indebted to Prof. Dr. Timo Jacobi and my co-supervisor, Prof. Dr. Gunnar Stevens, for opening the doors to the Socio-Informatics team. Many thanks to Prof. Dr. Gunnar Stevens for supporting me in the beginning, allowing me to explore and grow within this vibrant field.

I am immensely grateful to Prof. Dr. Dave Randall for his mentorship and guidance. His wisdom and support have been pivotal in navigating the complexities of academic research, providing me with clarity and direction at every turn. Working with him has profoundly influenced the development and articulation of the arguments in this thesis.

I would like to extend my gratitude to my co-authors and colleagues, especially Leonie Jahn, Marvin Landwehr, Lea Katharina Michel and Dennis Lawo. Engaging in discussions and collaborations with them has been instrumental in enhancing my understanding. Their unique perspectives and insightful contributions have added meaningful depth to the research.

I extend my sincere appreciation to everyone who has been a part of the grassroots community in Siegen and the wider Foodsharing movement. This includes the dedicated volunteers, professionals, and all other participants. Their eagerness to engage and collaborate has been essential to this dissertation. Although I cannot mention their names to maintain their anonymity, their contributions are deeply acknowledged and cherished.

This journey would not have been possible without the support and encouragement of these remarkable individuals. Their impact on my activist and academic life extends beyond the pages of this dissertation, and for that, I am very grateful.

Related Publications

Sections of this thesis have previously been published as conference or journal papers.

Lawo, D., Esau, M., Engelbutzeder, P., & Stevens, G. (2020). Going vegan: The role (s) of ICT in vegan practice transformation. *Sustainability*, 12(12), 5184. <https://doi.org/10.3390/su12125184>

Engelbutzeder, P., Randell, D., Landwehr, M., Aal, K., Stevens, G., & Wulf, V. (2023). From surplus and scarcity toward abundance: Understanding the use of ICT in food resource sharing practices. *ACM Transactions on Computer-Human Interaction*, 30(5), 1-31. <https://doi.org/10.1145/3589957>

Engelbutzeder, P., Bollmann, Y., Berns, K., Landwehr, M., Schäfer, F., Randall, D., & Wulf, V. (2023, April). (Re-) Distributional Food Justice: Negotiating conflicting views of fairness within a local grassroots community. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1-16). <https://doi.org/10.1145/3544548.3581>

Jahn, L., Engelbutzeder, P., Randall, D., Bollmann, Y., Ntouros, V., Michel, L. K., & Wulf, V. (2024, May). In Between Users and Developers: Serendipitous Connections and Intermediaries in Volunteer-Driven Open-Source Software Development. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (pp. 1-15). <https://doi.org/10.1145/3613904.3642541>

Furthermore, the following publication contribute to the subject matter presented. Nonetheless, they have not been incorporated as sections within this thesis.

Lawo, D., Engelbutzeder, P., Esau, M., & Stevens, G. (2019, November). Towards a Network of Practices: Identifying Central Elements to Inform Design. In Proceedings of the Halfway to the Future Symposium 2019 (pp. 1-4). <https://doi.org/10.1145/3363384.3363470>

Lawo, D., Engelbutzeder, P., Esau, M., & Stevens, G. (2020). Networks of practices: Exploring design opportunities for interconnected practices. Proceedings of 18th European Conference on Computer-Supported Cooperative Work. Exploratory Papers (pp. 13-17). https://doi.org/10.18420/ecscw2020_ep03

Weber, P., Engelbutzeder, P., & Ludwig, T. (2020, October). “Always on the Table”: Revealing Smartphone Usages in everyday Eating Out Situations. In Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (pp. 1-13). <https://doi.org/10.1145/3419249.342015>

Engelbutzeder, P., Cerna, K., Randall, D., Lawo, D., Müller, C., Stevens, G., & Wulf, V. (2020, October). Investigating the use of digital artifacts in a community project of sustainable food practices: ‘My chili blossoms’. In Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (pp. 1-4). <https://doi.org/10.1145/3419249.3420089>

Landwehr, M., Engelbutzeder, P., & Wulf, V. (2021, May). Community supported agriculture: the concept of solidarity in mitigating between harvests and needs. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-13). <https://doi.org/10.1145/3411764.3445268>

Lawo, D., Neifer, T., Esau, M., Engelbutzeder, P., & Stevens, G. (2021, July). Scan&Go: Understanding Adoption and Design of Smartphone-based Self-checkout. In Proceedings of the 18th International Conference on e-Business (pp. 183-194). <https://doi.org/10.5220/0010625701830194>

List of Figures

1	View of the foodsharing.de map for the city center of Siegen . . .	32
2	View of a store on the foodsharing.de platform	33
3	View of the pick-up slots	34
4	Summary of Going Vegan Findings.	46
5	Co-Evolving Practices and Artefacts (inspired by [230]). . . .	64
6	One of the Telegram stickers.	93
7	Food sharing and food resource sharing in the context of surplus and abundance	111
8	Key Takeaways	119
9	SharingEvent and SharingHut24/7 as a hub for other sustainable food practices	139
10	Header of the Foodsharing.de platform	168
11	Actors in Foodsharing.de platform design	169

List of Tables

1	Participants Going Vegan.	52
2	Juxtaposing Food Sharing and Food Resource Sharing	78
3	Interview participants	91
4	Interviews and participants	132
5	Use of ICT, their primary role, and their target audience	145
6	Overview of interviewee pseudonyms and their roles	172

List of Abbreviations

CO ₂	Carbon Dioxide
Chili Project	Chili-Sharing Project
FAO	Food and Agriculture Organization
FOSS	Free and Open-Source Software
HCI	Human-Computer Interaction
HFI	Human-Food Interaction
ICT	Information and Communication Technology
IOT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IX	Intermediary Experience
PD	Participatory Design
RQ	Research Question
RRFM	Really Really Free Markets
SDG	Sustainable Development Goal
SHCI	Sustainable Human-Computer Interaction
SPT	Social Practice Theory

Contents

Abstract	ii
Acknowledgements	iii
Related Publications	iv
List of Figures	vii
List of Tables	viii
List of Abbreviations	viii
I Fundamentals	1
1 Introduction	2
1.1 Motivation	3
1.2 Objective and Research Question	10
1.3 Areas of Contribution	11
2 Related Work	16
2.1 Social Practice Theory and Change	16
2.2 Human-Food Interaction	18
2.3 SHCI and food	19
2.4 Sharing Food	23
2.5 Scaling local efforts	27
2.6 Research gaps	29
3 Research Approach	31
3.1 Research context	31
3.2 Methodology	38
II Collected Findings	42
4 Going Vegan: The role(s) of ICT in vegan practice transformation	43
4.1 Introduction	43
4.2 Materials and Methods	51
4.3 Results	52
4.4 Discussion	63
4.5 Conclusions	74
5 From Surplus and Scarcity toward Abundance: Understanding the Use of ICT in Food Resource Sharing Practices	77
5.1 Introduction	77
5.2 Background and Related Work	80
5.3 Context: The Grassroots Community and Its Project	86
5.4 Method	88
5.5 Results	92
5.6 Discussion	106
5.7 Conclusion	118
6 (Re-) Distributional Food Justice: Negotiating conflicting views of fairness within a local grassroots community	122
6.1 Introduction	122
6.2 Related Work	125

6.3	Method	130
6.4	Context	133
6.5	Results: Challenges and Opportunities	134
6.6	Discussion	149
6.7	Conclusion	157
7	In Between Users and Developers: Serendipitous Connections and Intermediaries in Volunteer-Driven Open-Source Software Development	159
7.1	Introduction	159
7.2	Related Work	160
7.3	Context	167
7.4	Method	170
7.5	Results	173
7.6	Discussion	186
7.7	Conclusion	194
III	Lessons Learned	195
8	Discussion	196
8.1	Supporting Grassroots in Surplus Saving and Sharing	197
8.2	From Sharing Surplus Food towards Food Resource Sharing	217
9	Conclusion and Outlook	232
	References	240

Part I

Fundamentals

The initial segment of my dissertation encompasses the foundational structural and conceptual elements. In Chapter 1 (Introduction), the research field is introduced, and the overarching research question is presented. Chapter 2 (Related Work) details the current state of the art, theoretical positioning, and identifies a research gap. Chapter 3 (Research Approach) delineates the research context, as well as the methodology and research approach employed in this thesis.

1 Introduction

Eating food sustains individual life. Yet food extends beyond a personal necessity. It serves as a connector, echoing sociologist Georg Simmel's insight that food holds significance for both individuals and society:

“Of everything that people have in common, the most common is that they must eat and drink. It is precisely this which is, oddly enough, the most egoistic, and the most unconditionally and most immediately limited to each individual: what I think, I can let others know; what I see, I can let them see; what I say, hundreds can hear - but what the individual eats, no one else can eat under any circumstances. In none of the higher areas is this the case, that that which one person has, the other must renounce. However, insofar as this primitive physiological fact is absolutely general to humanity, it immediately becomes the contents of shared actions, [and thus] the sociological structure [Gebilde] of the meal comes about, which directly unites the exclusive egoism of eating with a frequency of meeting, a habituation to association as is seldom attainable through higher or more spiritual motives. Persons who share no particular interests can find themselves sharing a meal (...).” [355]

It is evident that eating food is a great deal more than a merely functional activity and clearly entails much more than the satisfaction of individual needs. Food transcends mere consumption. It brings people together through their social need for solidarity [343], whereby sharing plays an essential role [191]. In line with that, sharing food serves as the “bedrock of human civilization” [82] and is linked to emotional affect, expressions of care and empathy, all of which foster social relationships [197].

Moreover, food entails an economic facet, specifically the massive global industry of food production and its distribution, and an ecological aspect, emphasizing the environmental impact as well as the importance of respecting and preserving the natural environment that feeds us. The interplay between

economic, ecological, and social dimensions is recognized by sustainability scholars [297] and enshrined in the "three pillars" of sustainability, as outlined in the 2002 United Nations Declaration on Sustainable Development [378]. Therefore food, and especially investigating food sharing practices in grassroots initiatives is a worthwhile endeavor when addressing issues of sustainability. In this context, this thesis is about the role of technology and how socio-technical design can support such efforts.

1.1 Motivation

This research is propelled by the urgent need to address the paradox of food waste amid hunger, and the potential of community-led initiatives to offer innovative pathways towards sustainability. It is estimated that about one-third of global food production is lost or wasted [113, 254]. In 2019, it was reported that 650 million people worldwide were still facing undernourishment [124]. Among them, 135 million individuals across 55 countries and territories were experiencing acute food insecurity [125]. Data from the World Food Programme in 2020 revealed a troubling escalation, with food insecurity affecting 309 million individuals in 72 countries [393]. According to the UNEP Food Waste Index Report 2024 [376], approximately 1.05 billion tons of food are wasted globally. This includes 19% of food available to consumers at the retail, food service, and household levels, along with 13% of food being lost throughout the supply chain. These figures highlight pressing moral and ethical concerns regarding the global distribution of food and resources.

Food waste contributes significantly to greenhouse gas emissions and resource depletion. A study conducted by a network of institutions addressing food waste [50] reveals the intricate and multifaceted nature of food waste drivers. Influences stem from technological, institutional, and social factors. The Sustainable Development Goals (SDGs) [377], specifically SDG 12, address the reduction of food waste under the theme of "Responsible Consumption and Production". This goal emphasizes the need to ensure sustainable consumption and production patterns, which includes reducing food waste at the retail and consumer levels, as well as reducing food losses along production and supply chains. The United Nations is calling for current food waste to be

halved by 2030. SDG 12 aims not only at reducing food waste but also at transforming our consumption patterns to be more sustainable, which includes a comprehensive approach to managing resources and waste throughout the food system. As a result, in February 2019, the German federal government formulated a 'National Strategy to Reduce Food Waste' [116], which in turn holds the federal states and local authorities to account, but also addresses companies in the food industry and civil society initiatives such as 'Tafeln' (food banks) or 'Foodsharing.de'.

The pursuit of reducing food waste and fostering sustainable food systems is a critical challenge and opportunity in our contemporary world, where the balance between feeding a growing population and preserving our planet's resources is precarious. In the context of grassroots initiatives this research endeavors to investigate and enhance the sustainability of food systems, acknowledging the multifaceted nature of food production, distribution, consumption, and waste management. At the heart of this research is the recognition that changing current food systems towards sustainability significantly impacts environmental health, social equity, and economic vitality [386].

Regarding food waste, the environmental impact is significant and multi-dimensional, with key implications for greenhouse gas emissions, water use, and energy consumption. When food is discarded, the resources used in practices like producing, processing, transporting, storing, and preparing it are also wasted. This includes significant carbon dioxide (CO₂) emissions. In 2017, the emission of 9.3 gigatons of CO₂ equivalent can be attributed to worldwide food loss and waste, representing about half of the total global greenhouse gas emissions from the whole food system [401]. Food systems are currently responsible for 21-37% of total greenhouse gas emissions [245]. The agricultural practices employed globally contribute to a range of environmental concerns, including deforestation, water scarcity, soil degradation, and biodiversity loss. Moreover, the use of pesticides and fertilizers has far-reaching implications for ecosystem health and food safety.

The social and economic dimensions of food waste are equally crucial. On a global scale, the Food and Agriculture Organization (FAO) estimates the annual economic cost of food waste to be around \$1 trillion [112]. This rep-

resents a substantial loss of economic resources and potential. Therefore, the research detailed below investigates how grassroots initiatives address issues of social justice and equity especially regarding the distribution of food and food resources.

Furthermore, the inquiry into grassroots initiatives and their contribution to the sustainability of food systems is a vital and timely endeavor in the context of global environmental and socio-economic challenges. This thesis is driven by the recognition that local, community-led initiatives can play a pivotal role in transforming food systems towards greater sustainability. A recent literature review [386] on the components of a change towards sustainability in food systems concludes that future research should also stress the socio-cultural dimension, because examining environmental issues depends on such an emphasis. The literature in question has increased substantially in volume in the last couple of years, and expresses a demand for a 'deep change' in terms of "values, consumption and production practices, as well as politics allowing for deliberation and grassroots mobilization" [386]. Therein, "grass-root organizations promote and engage consumers and small-scale producers in adopting non-conventional practices of producing and consuming food" [386]. Those grassroots actions are seldom managed but emerge [348].

In this thesis, the term 'grassroots initiatives' is strategically chosen to encompass both grassroots movements and grassroots communities, recognizing that while they share similarities, they also possess distinct characteristics. Grassroots movements are characterized by their focus on advocacy and striving for systemic change through collective action. They aim to address broader societal issues, leveraging the power of the collective to instigate significant shifts in policy, perception, or societal norms. On the other hand, grassroots communities are more intimately focused on creating local spaces of mutual support and engagement around shared interests or identities. The emphasis here is less on broad systemic change and more on the cultivation of a supportive network that enables individuals to thrive within a shared context.

Grassroots initiatives are uniquely positioned to address sustainability issues in food systems for several reasons. These initiatives are often deeply rooted in local contexts, understanding the specific environmental, cultural, and socio-

economic conditions that shape food production and consumption [28, 31]. This local knowledge is valuable for designing and implementing sustainable practices that are both effective and culturally relevant. Grassroots initiatives typically adopt a bottom-up approach, which can be more adaptive and responsive to local needs compared to top-down strategies [63]. The social dimension of grassroots initiatives is crucial. This thesis will investigate how these movements address issues of social justice and equity.

Moreover, grassroots initiatives are often at the forefront of innovation [335, 176] in sustainable agriculture, championing practices such as permaculture [99, 270], community supported agriculture [223], and urban gardening [375, 232]. These practices not only contribute to environmental health by promoting biodiversity, soil regeneration, and water conservation but also enhance food security and local economies. Another critical aspect of this research is understanding how grassroots initiatives can influence policy and mainstream food systems. By examining case studies and success stories, the research will identify the mechanisms through which small-scale initiatives can scale up their impact and drive broader systemic change.

One key motivation for this research is therefore to understand and document the diverse strategies employed by grassroots organizations to collect, redistribute, and utilize surplus food in pursuit of sustainability. Grassroots innovations are crucial in addressing the challenge of food waste [357], especially as a significant portion of the food discarded at the retail level is categorized as 'surplus' rather than 'waste' [334]. This is because it remains edible or recoverable [66]. While grassroots initiatives have the potential to foster sustainable practices [335, 386], for these to be effective at a scalable level, it is essential to understand the challenges that such initiatives face. The thesis examines two in particular. Firstly, we need to understand better how different and heterogeneous practices, beliefs and values may impact on success and secondly, we need to address the problem of scale, especially the various roles that Information and Communication Technology (ICT) can play [274, 359, 354]. Although grassroots initiatives are considered to have the potential to support change towards sustainable practices [335, 386] and especially sustainable food practices [318, 139, 386], arguably not enough

contributions in HCI deal with an understanding of these communities and the different roles digital artefacts play [274]. Yet, digital artefacts and especially ICT can play an important role in supporting a sustainable food system in general [101, 333] and especially within grassroots initiatives engaging in their local food production and consumption context [354]. Svenfelt and Zapico [354] emphasize a need for more comprehensive and integrative research that addresses various aspects of the food system holistically. This includes the potential role of ICT in promoting sustainable practices, addressing food waste, and understanding the complex interplay between food production, distribution, and consumption practices. They highlight the use of ICT to build networks and communities, providing access to resources for small-scale farmers and urban gardeners [354]. The thesis aims to explore the socio-technical practices of grassroots initiatives with the objective of identifying best practices and models that are scalable or transferable to various contexts.

In sum, the research into grassroots initiatives and their role in saving and sharing surplus food is not just about reducing waste. It is about understanding and amplifying the impact of local, community-led initiatives that have the potential to make significant contributions to environmental sustainability, social justice, and economic efficiency. By highlighting and learning from these grassroots efforts, we can develop more effective strategies to tackle the global challenges of food waste and hunger. In the search for the right ingredients for food-system change, this thesis investigates the factor of saving surplus food and sharing it. Herein, the thesis focuses on how grassroots initiatives deal with these issues and what design implications can be drawn for a transformation towards more sustainability.

My personal motivation for writing this dissertation describes a journey of over 10 years. After completing my studies in German and European Business Law at the University of Siegen in 2013, I was fascinated by two thoughts, which can be outlined briefly as follows: Firstly, I asked myself why there were so many injustices in the world and what this had to do with me. My naive attempt at a solution was to realize an all-encompassing network of sharing, especially via digital platforms. That was one idea. The other was

that after years of studying, I no longer wanted to learn anything that someone else wanted me to learn. I wanted to be free to choose what I learn every day. In these early days I read a quote from Noam Chomsky, which he said when asked what he would advise the current student body: "This world is full of suffering, hardship, violence and disasters. Everyone has to decide: Is it your business or not? I say: look around, analyze the problems, ask yourself what you can do, and get to work!". That sums up the two thoughts well.

In 2014, when I began my PhD journey, I decided to cancel my apartment and venture into the world to actualize the idea of a multi-sharing-network, and therefore especially join self-organized activist groups. My goal was to gain insights into their day-to-day lives and explore ways I could contribute. Before long, I crossed paths with Adrian, one of the founders of the German-speaking Foodsharing.de movement at an activist gathering. The platform Foodsharing.de enables people to save and share food in German-speaking countries. The gathering was initiated to expand Foodsharing.de internationally. The night I met Adrian, and we sat on a balcony in Italy, I realized, that he was also dreaming of an all-encompassing network of sharing, especially via digital platforms. He called it a multi-sharing platform. Intriguingly, his concept did not only focus on the act of sharing itself. Instead, Adrian placed great emphasis on saving and redistributing surplus. He envisioned this multi-sharing platform as a means to save the surplus in order to then share it. In the next 30 days 30 people were living together in one house. Among them developers, designers, lawyers, cooks, and many other skilled people that were eager to actualize a multi-saving-and-sharing platform. Over a period of two years, this group convened 15 times across central Europe.

During that time, I connected with HCI researchers at the University of Siegen. They expressed interest in bringing the Foodsharing.de movement to the city of Siegen. Consequently, I reached out to a Foodsharing.de activist with experience in assisting interested individuals in other cities to establish the necessary structures for a local Foodsharing community. Our efforts bore fruit in spring 2016 when Foodsharing officially launched in Siegen. Although I was not directly involved in the local Siegen community, I continued to contribute at the national and international levels to support the development of Foodsharing.de and especially the multi-saving-and-sharing platform. Yet,

the group which formed around the wider idea of a multi-saving-and-sharing platform, realized in early 2017 that they would not achieve their set goal all at once and divided into several other projects. Three of those still exist:

- **Karrot.world** is an online platform designed for grassroots initiatives and community groups. It facilitates the coordination of face-to-face activities at a local level, emphasizing autonomy and voluntary participation.
- **Kanthaus** is both a project house and a housing initiative dedicated to fostering sharing and waste reduction. Its mission also includes the development of Free and Open-Source Software and the pursuit of a social-ecological transformation.
- **FLAKE** is an analog multi-sharing platform that I co-designed with members of the permaculture movement. The concept involved bringing white bedsheets, cardboard, and pens to over 15 festivals to support sharing. We arranged these materials into a snowflake-like sculpture, inviting people to write down their needs and potential contributions. This setup encouraged festival-goers to see what others were offering or searching for.

In spring 2018, I made the decision to step away from the national and international realms of food activism. My goal was to gain firsthand experience in a local context, understanding how activism could succeed with everyday people in an ordinary city. Choosing Siegen, Germany, as my new home, I aimed to explore ways to enhance and support the potential of a local food movement. During the initial 12 months of my stay in Siegen, I refrained from participating in any organizational and coordinating activities related to food sharing practices. This decision stemmed from my experiences of living without a permanent residence for four years and spending the last year living without financial resources, making it necessary for me to gradually reintegrate into society.

In October 2019, when I became involved with Foodsharing Siegen again, I observed that the community I helped establish in 2016 had not held any coordinative meetings for over two years. The community's practices mainly

focused on rescuing food that would otherwise be discarded. Coordinated through the Foodsharing.de platform, these efforts required minimal organizational involvement from a few members with special administrative rights. The practices created a 'microcosm' for each collaborating supermarket, where pick-ups were coordinated within a team through the platform. While this fulfilled the purpose of coordinated food saving, it lacked an impact on community building or broader goals related to sustainable food practices, such as prosumption practices [310]. The community also did not seem to have a clear socio-political vision; members appeared content with obtaining free food and preventing waste.

To nurture the organizational culture and promote community development, I made the decision to invite all Foodsharing members from Siegen through the Foodsharing.de platform to my shared apartment. The idea was to cook and share a meal together, followed by a coordinating round. Subsequently, I organized multiple cooking and organizational events at my shared apartment for the Foodsharing Siegen community, thus deepening my involvement. My experience sparked a curiosity to understand better the inner workings of the grassroots community in Siegen and how projects emerge, particularly in the context of food surplus. I aimed to explore what role I and technology could play in enhancing their collaboration to address local needs, while simultaneously contributing towards global sustainability efforts. Since my initial involvement, a dynamic community has developed around Foodsharing Siegen. This growth has given rise to several projects, some of which are significant in the context of the thesis that follows.

1.2 Objective and Research Question

Since beginning the research in early 2019, guided by socio-informatics principles [394], the research has focused on understanding how socio-technical design can support grassroots initiatives in their initiation, daily operations, and growth. My mission involved diving into the established grassroots community in Siegen (especially Foodsharing), collaborating with individuals driven to launch new projects, and supporting their development. My objective throughout was to obtain a nuanced comprehension of the community's

values, needs, challenges, negotiation processes, and the socio-technical practices inherent in their endeavors.

My second objective was to explore how socio-technical design can enhance the links between food saving, food sharing and prosumption practices [310]. As the Foodsharing.de platform particularly promotes food saving and sharing of surplus food I wanted to understand how the Foodsharing Siegen community could integrate prosumption practices like growing, harvesting, and cooking food. Therefore, I investigated the design spaces of surplus with transformative ambitions.

This thesis follows, and accordingly provides insight into the answers to, two interconnected research questions (RQs):

RQ1: How can socio-technical design support the efforts of grassroots initiatives dedicated to food saving and food sharing, and especially their initiation, daily operations, and growth?

RQ2: How can socio-technical design support the nexus of grassroots' food saving and food sharing practices with more sustainable food practices, especially in the realm of food resource sharing?

1.3 Areas of Contribution

The evolution of academic research, particularly within the realm of qualitative studies, reflects a significant paradigm shift from objectivist perspectives towards an acknowledgment of the intrinsic link between methodological approaches and political and ethical stances [127]. This transition is readily observable across a broad spectrum of research domains, including feminist research [208], postcolonial studies [288], value-centered design [183], and participatory design (PD) [313, 157], among others. These areas have increasingly emphasized the importance of integrating ethical and political considerations into the research process, recognizing that the choice of methodology can profoundly influence the research outcome and its societal implications. This shift towards a more reflexive and ethically engaged research practice has been particularly prominent in the field of SHCI and HFI. SHCI, with its

focus on promoting sustainability through the design and use of technology, inherently involves ethical considerations regarding the impact of technology on the environment, economy, and society (see, e.g. [337]). Similarly, HFI, which examines the relationship between humans and food in the context of digital technology, navigates complex ethical and political territories concerning sustainability, health, and social equity (see, e.g. [29]). By highlighting the intertwined nature of methodology and broader ethical and political issues, these fields showcase how modern research embraces a comprehensive perspective. Researchers are not only contributing to their specific areas of study but also engaging with wider societal debates, underscoring the role of academic research as a catalyst for social change and ethical reflection. This evolution marks a move towards a more holistic and socially responsible approach to research, where the implications of methodological decisions extend beyond the academic sphere and into the fabric of society.

In general, this thesis makes contributions to three interconnected fields of research that align closely with the background of digital artefacts supporting sustainable food practices: SHCI, HFI, and action-oriented research in HCI. It emphasizes the need for a comprehensive approach to research that combines methodological rigor with ethical and political awareness to create impactful knowledge that transcends academic boundaries and promotes sustainable and equitable societal progress.

1. Practice-based research in Sustainable HCI

SHCI is an evolving field that focuses on integrating sustainability principles into the design, development, and usage of interactive systems. Practice-based research in this domain involves a hands-on, iterative process where practical applications, user experiences, and environmental considerations converge to create sustainable socio-technological systems.

Practice-based research in SHCI is characterized by its focus on real-world application. Researchers engage directly with the design and use of technologies. This often involves community participation to ensure that technological interventions are accessible, culturally relevant, and effectively address local sustainability challenges. Thereby this thesis follows a grow-

ing body of literature which argues for the importance of understanding practices, routines and habits to support change, e.g. [339].

I aspire to expand upon the perspective established by Knowles et al. [211], who asserted: “The kinds of SHCI activities that seem to meaningfully contribute toward sustainability are not those that solve well-defined problems, but rather those that contribute more subtly to a shift in culture or power.” Echoing Håkansson and Sengers [187], Knowles et al. acknowledge that this places us in the challenging position of not being certain about what specifically to design. Yet, as they [211] point out, “it does at least mean that we are looking in the right place for inspiration to strike.”.

2. Social aspects within Human-Food Interaction

Within HCI, the field of HFI has developed considerably in recent years. The role of digital artefacts within the interplay of humans and food is at the core of HFI. In their review of HFI, Altarriba Bertran et al. [14] give an overview of the field. While the publications are almost equally divided between attributing “agency to technology” and using “technology to support people in their agency”, there is an imbalance in the focus: 66% of the contributions are oriented towards functionality and 34% towards experience, while within the latter individual experience (22%) was examined more often than social aspects (12%) [14]. This thesis contributes to this field with a human-centered view of how to support sharing practices as part of the cooperative and collaborative aspects of food practices. It further adds to the understanding of food sharing as an issue that extends beyond mere distribution. Thus, we especially contribute to an understanding of the ‘social’ elements within HFI.

Furthermore, the thesis contributes to the expanding body of HFI research addressing sustainability and food. It especially highlights the intersection of food and sustainability in community settings, indicating a joint field of Sustainable HFI.

3. Action-oriented research in HCI

Action-oriented research in HCI represents a dynamic and purposeful approach to the study of and support for “local solutions to local problems”

[164]. This methodology is rooted in the principles of emphasizing collaboration, democratic principles, and practical problem-solving in real-world contexts. It involves active participation in the environments where HCI systems are deployed, understanding user needs and practices, and iteratively designing and testing solutions in situ.

Action-oriented research is closely related to the socio-informatics approach of the Siegen school [164, 166]. The socio-informatics approach is firmly rooted in praxeology, emphasizing the study of social practices influenced by the use and application of ICT artefacts. It recognizes that employing ICT artefacts can provoke social systems to question and modify existing practices through a process that is not predetermined. Consequently, socio-informatics demands a methodological blend that incorporates insights from social sciences with knowledge derived from design principles. Based on the tradition of socio-informatics (e.g. 'consumer informatics', 'IT for the ageing society', 'IT to support skilled work', 'IT to decarbonize production and consumption'), its application aims to provide comprehensive support for the respective practices. By working directly with communities, researchers can tailor responses to specific challenges and foster a more profound organizational or social impact.

This research approach emphasizes the importance of designing for diverse user groups and has been instrumental in driving socio-technical change within communities and beyond.

In the context of the three areas of contribution, distinguishing between 'Food Sharing' and 'Food Resource Sharing' is crucial for understanding sustainable food practices (see also chapter 8.2). Food sharing focuses on redistributing surplus food items, addressing immediate needs in communities where food is not equitably accessible. It is consumption-oriented and often reactive, dealing with scarcity and emphasizing the end use of food products by recipients. In contrast, Food resource sharing involves sharing resources essential for food production, such as seeds, plants, and soil, as well as knowledge and spaces for communal activities. It is prosumption-oriented [310], aiming for self-sufficiency and promoting abundance. Participants engage in both

producing and consuming food, fostering a sustainable cycle within communities.

This distinction underscores the central contribution of the dissertation: the role of socio-technical design in supporting grassroots initiatives, particularly in sustainability through community building and the abundance of its resources through food resource sharing practices. Understanding the differences between food sharing and food resource sharing practices is crucial for designing interventions that enhance the sustainability and resilience of community-led food initiatives.

2 Related Work

This section presents the relevant research related to the thesis. The initial section (2.1) introduces the theoretical framework. Besides providing a general overview of social practice theory (SPT), the emphasis is placed on understanding how practices undergo change. Next, HFI is explored in section 2.2, followed by an examination of the role of food in consumption and production within the field of SHCI in section 2.3. Section 2.4 discusses the tensions between sharing and gifting, and reviews the current state of the art of food sharing in HCI. Related work on scaling local community efforts is addressed in section 2.5. Finally, section 2.6 presents the research gaps.

2.1 Social Practice Theory and Change

SPT offers a nuanced perspective aimed at reconciling the dichotomy between individual-centric and structural-centric views of behavior [306]. Traditionally, the individual-centric view, exemplified by the concept of homo oeconomicus, posits that human behavior is primarily driven by rational, self-interested decision-making. On the other hand, the structural-centric view, represented by homo sociologicus, argues that societal norms and structures predominantly shape human behavior. SPT suggests a different approach by focusing on practices as the emergent level of the social [306]. Within this framework, the spotlight shifts from viewing individuals as the originators of actions to seeing them as carriers or as the intersection of different practices [306]. This perspective underscores the idea that individuals act within the confluence of various practices, making everyday practices themselves the fundamental units of analysis.

Schatzki [322] and Reckwitz [306] have made highly influential contributions to SPT. Reckwitz conceptualizes practices as the "routinized way in which bodies are moved, objects are handled, subjects are treated, things are described, and the world is understood" [306]. In Schatzki's [322, 323] early work, he introduces two key notions of practice: one is the concept of a linked or organized nexus of different elements ('practice-as-entity'), and the other

is the idea of practice-as-performances. These two notions are in a recursive relationship, where the act of doings and sayings "actualizes and sustains practices in the sense of nexuses" [322].

Expanding on Schatzki's framework, Reckwitz [306] describes practices as a routinized type of behavior that consists of several interconnected elements that cannot be reduced to individual elements, but exist due to their connectedness: Forms of physical activities, forms of mental activities, things and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. At the same time, Schmidt [326] has pointed out that 'routine' on its own cannot fully explain practice because there is inevitably a normative element. Exactly how different norms influence the practices we find in the context of food sharing is central to the research described in this thesis.

Within the development of the discourse, for example with regard to energy consumption, Gram-Hanssen et al. [152] show that a previously trivial understanding of consumption is moving into the complexity of everyday life, especially moving beyond linear considerations of production, distribution and consumption [152]. Consumption is a moment within practices, and not a practice itself [384]. Gram-Hanssen et al. thus show that energy is not consumed for its own sake - but in the performance of specific practices [152]. Research is increasingly delving into how practices are connected, in particular the elements through which connections arise [151, 185, 202] and the relationship between these connections, so-called interconnections [224].

Within the discourse of SPT, the transformation of practices, especially towards sustainability, is a focal point of interest. This theoretical perspective interrogates how daily routines, characterized by stable interconnections of elements that maintain equilibrium [347], can be shifted towards more sustainable practices. The disruption of one element within these routines can lead to "crises of routines" [306], a concept that underpins the strategy for inducing change in practices.

According to Shove et al., practices are divided into established routines, proto-practices which are nascent and not fully integrated, and ex-practices

which are abandoned routines [341]. The objective of interventions, therefore, is to disrupt and realign practices towards sustainability. However, the complexity of practices and their interconnected nature [130], poses significant challenges to designing effective interventions. Current research, which primarily focuses on identifying opportunities for intervention without a long-term strategy for practice transformation [67], underscores this difficulty.

Further illustrating the complexity of practice transformation, Twine's research [374] on dietary changes to veganism highlights the multifaceted process of adopting new food practices. This involves not just substituting ingredients but also exploring new foods and acquiring new skills, such as vegan cooking. The transition impacts related practices, including shopping and meal preparation, demonstrating the interplay between new competences, materials, and the meanings attached to veganism. As noted by Cettina et al. [55], changing one practice may require reconfiguring a range of related practices, necessitating interventions across various dimensions. This comprehensive approach highlights the need for a multifaceted strategy to achieve sustainable practice transformation, addressing both the technological and socio-cultural aspects of change.

2.2 Human-Food Interaction

Within HCI, the field of HFI has developed considerably in recent years. The role of digital artefacts within the interplay of humans and food is at the core of HFI. In their review of HFI, Altarriba Bertran et al. [14] give an overview of the field. While the publications are almost equally divided between attributing "agency to technology" and using "technology to support people in their agency", there is an imbalance in the focus: 66% of the contributions are oriented towards functionality and 34% towards experience, within the latter, individual experience (22%) was examined more often than social aspects (12%). Deng et al. underscore the importance of integrating technical innovation with a nuanced understanding of human experiences to redefine our interactions with food, calling for a holistic approach that values emotional and social dimensions of food interactions [86]. Mueller et al. [264] emphasize the multidisciplinary and complex nature of HFI, underscoring the

need for collaboration across various fields to advance technology, user experience, design practices, and ethical considerations. They name 10 grand challenges, with the challenge "HFI for and as Sustainable Practice" touching on the work of this thesis.

Within the realm of HFI, the majority of research concerning food sharing practices is aimed at addressing food waste through the redistribution of surplus food [110, 66, 260]. This body of work tends to prioritize the consumption aspects of food practices over the production side. However, there has been a noticeable shift in recent years, with an increasing number of studies emphasizing the role of food in achieving transformative ambitions (e.g., [180, 264]). This shift marks a growing intersection with the field of SHCI, indicating a broadening scope of research that encompasses both the social aspects of food and the promotion of sustainability through food practices.

This thesis contributes to this emerging field with a human-centered view of how to support sharing practices as part of the cooperative and collaborative aspects of food practices. Thus, it follows a growing body of literature which argues for the importance of understanding practices, routines and habits to support change, e.g. [67, 69, 131, 282, 342, 349].

2.3 SHCI and food

A notable trend among SHCI researchers involves moving from designing systems tailored for individual use to adopting more collaborative methodologies [90, 303, 180]. This shift is exemplified by a departure from the predominantly individual-centric persuasive design [123, 63], towards investigating how ICT can, for instance, facilitate community garden collaboration [383], as well as how community food projects leverage socio-technical advancements to aid in establishing urban food commons [261]. Critical evaluations have been conducted on persuasive design concerning sustainability [42, 210], particularly focusing on its long-term impacts [330, 331, 3]. Knowles et al. [210] highlight the importance of SHCI in achieving a sustainable future, critiquing the prevalent focus on individualism within this field. They outline two primary strategies pursued in SHCI research: one advocating for grad-

ual, incremental changes and the other pushing for comprehensive, systemic transformations. They call for more radical approaches to drive sustainability, noting SHCI's potential in fostering citizen engagement and facilitating collaboration among community members [211].

A synthesis of research across SHCI underscores a pivotal shift towards a practice-based approach [63]. The collective insights from research [69, 88, 271, 282, 342, 349] advocate for SHCI to prioritize cooperative practices. This shift acknowledges the complex interplay between technological innovations and sustainability goals, suggesting that these objectives can coexist and reinforce each other. Silberman et al. [342] highlight a common challenge where technological advancements in HCI may conflict with sustainability aims. They argue for integrating sustainable practices like collaborative consumption and DIY activities into HCI to support social movements and enhance civic engagement. In the field of SHCI, there is a growing trend that emphasizes the importance of collaborative interactions with technology [342]. This shift from individual to cooperative engagement is seen as a crucial strategy for effectively mediating and supporting initiatives aimed at addressing the intricate challenges we face in environmental, social, and economic spheres [159]. The promotion of action research and participatory involvement is seen as key to realizing these objectives [392, 165, 164]. Strengers [349] explores eco-feedback systems' role in promoting sustainable individual behaviors, particularly in energy and water use. The study reveals limitations in these systems' effectiveness, suggesting that long-term sustainability requires a deeper understanding of resource usage contexts and practices. Simply providing eco-feedback is insufficient for fostering sustainable practices without a comprehensive grasp of the underlying sociocultural dynamics. Brynjarsdóttir et al. [42] stress the importance of considering the sociocultural context in which sustainability practices occur. They critique persuasive eco-feedback technologies for lacking an understanding of the people they aim to influence. This perspective points to the necessity of grounding technological innovations in the lived experiences and cultural practices of their users to effectively address sustainability challenges.

The idea of 'connected sustainability' [274] places a strong emphasis on the community aspect of sustainable practices. This concept explores how digital

technologies can serve as a catalyst for collective action, focusing on grass-roots movements and communities committed to sustainability and seeking broader changes in political, economic, and societal spheres. It includes examples of digital tools that foster social networks, link individuals to their communities and like-minded peers, or assist communities in sustaining and expanding their practices and connections. In these discussions, HCI researchers propose that digital technology should be strategically leveraged as a supportive infrastructure for fostering social interactions, rather than being seen as a direct solution to sustainability challenges [228, 328].

Summed up, the findings collectively underscore a crucial narrative in SHCI research: technology alone cannot drive the shift towards sustainable practices. Instead, a nuanced understanding of cooperative practices and the sociocultural context is essential. This approach advocates for designing technology that supports and enhances sustainability through community engagement, shared understanding, and active participation, rather than relying solely on technological innovation or persuasive techniques. Such an approach not only aligns more closely with the goals of sustainability but also fosters a more inclusive, participatory, and context-aware application of HCI principles.

This ties into a broader research trend that explores the dynamic relationship between consumption and production, notably through the lens of "prosumption" [310]. This term describes practices that blend consuming and producing, particularly in areas like food [252, 259] and energy [152, 253] sectors. Recent initiatives have focused on empowering individuals to actively participate in local food systems as 'food citizens' [295]. This involves democratic engagement in local food hubs, where individuals can contribute to and influence their local food environment. Additionally, there is support for urban foraging [88], which encourages people to explore and utilize food resources available in their urban surroundings. These efforts are designed to enhance the sustainability of food systems, encourage active participation in food production and sourcing, and strengthen community bonds through shared food-related activities. By enabling 'growth on the ground' [295], these initiatives

aim to create more resilient, sustainable, and democratically-engaged food communities.

The increasing popularity of growing food in home [145] and community gardens [133] is largely attributed to the numerous benefits it offers individuals, both tangible and perceived. These benefits include the promotion of health and nutrition, closer connection to nature, and the creation of opportunities for social engagement [402] and overall well-being [137]. This movement towards agriculture at a local level not only contributes to physical health but also fosters community engagement and emotional satisfaction.

Heitlinger et al.'s research [169, 170, 172] over a decade illustrates the transformative role of SHCI, the Internet of Things (IoT), and blockchain technology in promoting more equitable, sustainable urban food systems. Their work highlights the emergence of grassroots urban food-growing communities as a response to urban food security challenges, emphasizing the importance of participatory design and technology in enhancing community engagement and environmental sustainability [170]. By integrating IoT in urban agriculture [169] and proposing blockchain for equitable food value exchange [172], their research marks a significant shift towards recognizing food as a communal resource and underscores the need for a cultural transformation in our relationship with food and ecosystems [172]. Heitlinger et al. [172] advocate for a more-than-human perspective, emphasizing inclusivity, diversity, and the collective benefit of all species in the food system. Despite potential challenges, their work offers a blueprint for using technology to foster sustainable and fair food practices.

Prost [293] and Prost et al. [294, 295] delve deeply into the concept of food democracy, advocating for equitable access to healthy, sustainable, and culturally relevant food through the integration of technology in community empowerment. This work spans the creation of local food networks in socio-economically deprived UK areas, employing the Open Food Network software for facilitating online farmers' markets. This approach not only supports alternative food movements but also critically examines the inherent tensions between environmental sustainability, social justice, and economic viability. The studies underscore the complex interplay of designing for food democ-

racy within the SHCI sphere, focusing on systems change and participatory action research to navigate the challenges of local food distribution, governance, and the empowerment of community voices. By blending insights from fieldwork and theoretical frameworks, Prost et al. highlight the multifaceted nature of food democracy, emphasizing the need for a holistic view that includes social and economic justice alongside democratic governance in the push for sustainable food systems [294]. By focusing on technology as a means to bolster community ties and actions, HCI scholars highlight the potential for digital tools to contribute significantly to the collective pursuit of a more sustainable, equitable, and interconnected society.

The literature presented discusses alternative models to traditional food systems. However, in their recent literature review, Doggett, Bronson, and Soden [91] remind the field that HCI research is contrasting two future visions for food systems: the conventional profit-oriented production model and an alternative model that emphasizes sustainability and community-led practices. Their research calls for a nuanced examination of the sociotechnical imaginaries shaping HCI research in agriculture, advocating for a broader consideration of diverse perspectives and the complex interplay between technology, sustainability, and community practices in shaping the future of food systems.

2.4 Sharing Food

In recent years, the practice of sharing food has increasingly been connected with the pursuit of creating societies that are not only more sustainable but also more equitable. These practices are viewed as vibrant alternatives to the traditional market economy, challenging the prevailing capitalist framework by prioritizing community and collective well-being over individual gain and profit. In the following I explore the idea of sharing, highlighting the challenges that the sharing economy presents to global capitalism and review the current HCI research related to sharing food.

2.4.1 Concepts of sharing

Albinsson and Perera [11] have made a strong case for distinguishing sharing from mere exchange, emphasizing that sharing events often lack a direct economic or monetary value. Their research delves into collaborative consumption and the organization of non-monetary sharing events, like Really Really Free Markets (RRFMs). Such initiatives are celebrated not only for their ability to facilitate sustainability but also for their role in fostering community bonds and raising critical awareness about the issues of overconsumption.

In this context the terms "sharing" and "gifting" share similar meanings and are blurred [28, 219, 345]. The challenges in defining these practices precisely, coupled with their significant overlap, lead to categorizing the resource redistribution activities explored in this thesis under the umbrella term "sharing" for practical purposes.

Belk [24] defines sharing as a communal act of distribution that can enhance community bonds, conserve resources, and generate synergy. He contrasts sharing with private ownership, prevalent in market transactions and certain forms of gift exchange involving personal property. Sharing involves multiple individuals collectively enjoying or bearing the cost of a resource or item. In doing so it influences social and cultural norms [24, 195]. These norms can either mitigate envy and foster community or lead to dependency and engender feelings of resentment. Belk [27] further differentiates between inclusive communal sharing ('sharing in') and the allocation of resources to outsiders or as a singular event ('sharing out'), highlighting the variability in intimacy and connection inherent in sharing practices.

Within the discourse on reciprocity, scholars debate the nuances of expected returns [191, 209]. While some forms of reciprocity do not anticipate immediate or equivalent exchange, fostering a reliance on communal trust and future support ('generalized reciprocity') [255, 149], others argue that genuine gift-giving avoids any expectation of reciprocation [102, 146, 365]. Recent literature [189, 219, 233] has explored how sharing and care intertwine with reciprocity, noting the discomfort or obligation that can arise from accepting gifts without direct compensation. This complexity is evident in large-scale

food sharing initiatives, where the act of sharing can simultaneously embody gift-giving, non-commercial exchange, and charity, each carrying distinct expectations of non-material appreciation or no expectation at all [31].

Clear et al. [67] highlight the critical role of engaging individuals in transforming food consumption habits towards sustainability. They suggest enhancing the accessibility and attractiveness of sustainable food choices to encourage a shift to eco-friendly diets amidst a landscape dominated by large-scale food production systems. Their work supports the exploration of alternative, eco-conscious supply chains, including the promotion of local food economies [67], as a strategy to alter prevailing market structures.

This discussion aligns with broader conversations around the concept of the 'sharing economy' - a term without a universally accepted definition, also known as 'collaborative consumption' [36]. These discussions extend to examining the impact of a 'zero-marginal-cost' society [309] on traditional capitalist models. Critiques of the sharing economy have particularly focused on its commercial underpinnings [81, 234]. Norton et al. [271] underscore that food system unsustainability is inherently linked to inequality, highlighting the necessity for stakeholders within the food system to reclaim control over food production processes. The current concentration of production control in the hands of a few global corporations exacerbates disparities and sustainability issues across multiple dimensions. Landwehr et al. [223] delve into a case study that demonstrates how reclaiming food sovereignty can merge production, distribution, and sharing practices, with ICT playing a pivotal role in supporting these endeavors. Their research in Community Supported Agriculture reveals how ICT facilitated a demand-driven approach, fostering trust in the farm and strengthening community bonds.

This thesis seeks to blur the traditional economic lines between 'rival' and 'non-rival' goods [54, 265], challenging the notion that the use of goods by one individual inherently limits availability for others. We propose a shift towards recognizing goods in a more communal or shared context. In line with that, Norton et al. [271] advocate to work with social movements aimed at food sovereignty in a local context within the appropriate policy frameworks,

highlighting the importance of collaborative efforts towards systemic change in food systems.

2.4.2 Sharing Food in HCI

The interest in creating self-sufficient communities, where individuals are empowered to grow their own food rather than relying on large-scale agricultural systems, is on the rise [247]. This shift is paralleled by growing concerns over issues such as the conservation of biodiversity and the reduction of food waste. These concerns have catalyzed a surge in grassroots initiatives across the globe, dedicated to pioneering more collaborative and sustainable food systems through sharing practices [247]. Studies have delved into the variety of these movements' socio-technical practices, including online food hubs [295], digitally facilitated seed sharing [169], Internet of Things (IoT) applications for urban foraging [88], initiatives aimed at providing food to the underserved [92], virtual networks for urban gardening [104], and efforts to locally share surplus food [29, 61, 132].

Food sharing practices are analyzed within the broader context of the sharing economy, which encompasses diverse models of collaborative consumption [110]. Yet, most research related to food sharing practices is concerned to utilize food sharing to redistribute food waste or surplus (e.g., [395, 82]. Micheline et al. [251] highlighted three distinct models of food sharing: commercial, charitable, and community-based, noting the varied motivations and configurations within these models. Many such efforts focus on ecological goals, like waste reduction, or social aims, such as community building or tackling food scarcity, with a significant number operating on a non-profit basis [79], especially aiming at redistributing food to those in need [82, 362]. Yet, redistributive efforts can also foster a sense of agency and community among participants, who are seen not just as consumers [30], but as active participants or 'food citizens' [295].

Berns et al. [28, 29, 30] explored the dynamics of local surplus food sharing, showing how collaborative community actions - such as collecting, sorting, and redistributing food - can transform wasted food into a shared community resource, symbolically turning a commodity into a gift [28]. Their subsequent

research [29] delved into the importance of queuing in food sharing, revealing its role in managing attendance and embodying values like fairness and community activism. They also considered how digital strategies could reimagine queuing in a way that aligns with community values [30]. In the context of food sharing communities, the crucial role of technological resources has been extensively documented by Davies across a diverse array of platforms [80].

Grassroots communities, like those involved in food sharing initiatives, serve as excellent illustrations of self-governance when tackling various issues. The discussed work emphasizes the role of socio-ecological technologies in fostering social change within food sharing. However, there is a noted gap in these communities' involvement in designing the tools they use, raising questions about the equity of design processes [73]. Manzini and Coad [242] advocate for a model where the inherent creative and design abilities of grassroots members are recognized and utilized, challenging the traditional designer-led approach. It is important to acknowledge that technology's effectiveness in supporting activist movements hinges on widespread adoption. This explains the prevalence of Facebook among grassroots communities and activist movements, as shown in [28, 132]. Mainstream technologies, like social media platforms (Telegram in our case), offer widely accessible and easily adoptable templates for participation. This is the case despite their role in being identified as key factors in the erosion of democratic values [222, 317]. Notably, initiatives like Foodsharing.de have successfully leveraged both custom and mainstream digital platforms to facilitate food saving and sharing at a large scale, demonstrating the potential of ICT to support these movements effectively.

2.5 Scaling local efforts

The critical examination of consumption and production within the global capitalist system has been ongoing, highlighting the benefits of local resource utilization for community-based economic systems. This perspective, championed by thinkers like the economist Schumacher [329], who argued for “production from local resources for local needs is the most rational way of

economic life” thereby promoted technology tailored to community needs. He advocated for self-reliance over global dependency. Similarly, Illich’s concept of ”tools for conviviality” challenges the undermining of traditional societies through modern economic practices, suggesting a reversal in the design of tools to enhance personal and community autonomy in production [190]. Recent discussions in the academic and design communities have increasingly focused on the challenges presented by platform capitalism, notably its emphasis on scaling for profit. These discussions have led to a critical examination of co-design practices [18], suggesting a shift towards models that emphasize shared resources and collective ownership [35]. A noteworthy perspective in this debate is provided by Poderi [287], who advocates for viewing platforms not as proprietary systems designed for profit maximization but rather as commons. This approach is exemplified by the use of Free and Open-Source Software (FOSS), which Poderi [287] highlights as a leading example of a platform operating as a commons. This paradigm shift encourages the PD community to rethink traditional models of design and development, promoting a more inclusive, community-oriented approach that aligns with principles of sustainability, equity, and shared ownership.

At the core of the SHCI discussion, according to Hirsch et al. [180], is the focus on small-scale food production. They argue that “a positive use of interactive technologies would be to encourage such trends [i.e., the rise of alternative food movements] as a means of bridging divides between ourselves and the natural world” [180]. In this context Laforge et al. [217] highlights the tension between grassroots movements and their local sustainable food systems, and the dominant food regime characterized by productivist, industrial, and neoliberal policies. They identify four distinct types of interactions between government and farmers: containing, coopting, contesting, and collaborating, affecting the potential of local food in transitioning to sustainable agri-food systems.

Grassroots initiatives are recognized for their innovative approaches [335, 176] and capacity to drive sustainability [117, 386]. Yet, the challenge remains in fully understanding and leveraging technology within these movements, not just for coordination but also for fostering identity, action, and engagement [274]. Recent research [220] cautions against a simplistic view

of scaling, urging a nuanced understanding of community dynamics and the diverse strategies they might employ towards sustainable change. According to Lampinen et al. [220] and in line with post-growth philosophy [337], growth may be neither preferable nor feasible for organizational sustainability of grassroots initiatives. A study of a Danish organic food community, as documented by Bødker et al. [48], revealed the evolution of such communities through three stages: their formation, daily operations, and periods of renewal. In parallel, Biørn-Hansen and Håkansson [32] distilled three key design strategies from interviews with leaders of sustainability-oriented communities: leveraging existing resources and infrastructures, encouraging collaboration among grassroots initiatives, and empowering communities with both technology and the knowledge to use it effectively.

2.6 Research gaps

Previous studies have substantially covered the role of digital technologies in promoting sustainable food practices (e.g., [172]), including the redistribution of surplus food to minimize waste [29]. However, there appears to be a gap in understanding how a socio-technical design can further support the transition from mere redistribution to fostering sustainable food practices at the community level [30]. This includes exploring the potential of technology to enhance prosumer activities [310], where community members are both producers and consumers, contributing to a more sustainable and resilient local food system.

While there is evidence of technology's role in facilitating community engagement and collaboration (e.g., [228, 227, 128]), less is known about how socio-technical design can support food saving and sharing communities to negotiate their rules and governance structures [29, 30]. This includes understanding the dynamics of decision-making, conflict resolution, and the establishment of norms and values that guide their practices. Investigating these aspects can provide insights into designing more inclusive and equitable technological interventions.

The related work highlights the importance of involving users in the design of the tools they use [100, 188, 266], suggesting a gap in equitable design

processes [73]. Research is needed to explore how participatory design practices can be applied in the development of digital tools of large grassroots movements like Foodsharing.de that are designed to serve local communities, ensuring that these tools reflect the needs, values, and aspirations of the community members they aim to serve.

Finally, there is a need to further understand the scalability of local grassroots efforts in promoting sustainable food practices supported through technology. This includes examining the challenges and opportunities presented by digital platforms and tools in expanding the impact of local initiatives towards addressing global issues [132, 144, 158], while maintaining their community focus.

In sum, the research gap encompasses how digital technologies can not only support the logistics of food redistribution but also empower communities to establish sustainable food practices that are equitable, participatory, and aligned with the principles of food sovereignty and justice. This entails a comprehensive approach that considers the socio-technical dynamics of food sharing initiatives, the negotiation of community rules, and the design of inclusive technologies that facilitate both local action and broader systemic change.

3 Research Approach

3.1 Research context

Foodsharing, Foodsharing.de and Foodsharing Siegen

Founded in Germany in 2012, Foodsharing is a pioneering initiative aimed at reducing food waste and fostering community spirit through its dedicated platform, Foodsharing.de. This innovative approach allows grassroots communities to save and share surplus food, making significant strides in environmental sustainability and social responsibility. Reducing the waste of resources is the main motivation behind Foodsharing. Anyone can participate in the movement regardless of formal need, as described in the Foodsharing wiki:

“The main goal of Foodsharing is to reduce the waste of the earth’s precious resources. [...] In realizing these goals, there can be the great side effect that the rescued food also supports those in need and promotes projects. However, the aim of Foodsharing is not to provide security of supply for those in need.” [2].

The movement often emphasizes not just the environmental benefits of reducing food waste, but also the social aspects of sharing and community-building. At the heart of the Foodsharing movement are the Foodsavers, a network of over 172,000 registered volunteers (as of March 2024). These individuals collect surplus food from around 15,500 partnering food businesses, ranging from local grocers to large supermarkets. In addition to the collectors, there are 613,000 Foodsharers who do not collect food from businesses but can still share food via the ‘food-basket-function’ on the platform. Users can use this function to upload pictures of the food they would like to give away. These offers are displayed to other users as well as on a map (Figure 1) as food baskets and can be requested. The food-basket-function has been used more than 346,000 times via the platform.

The platform’s impressive reach includes over 369 districts and cities, primarily in German-speaking countries, highlighting its role as a crucial infras-

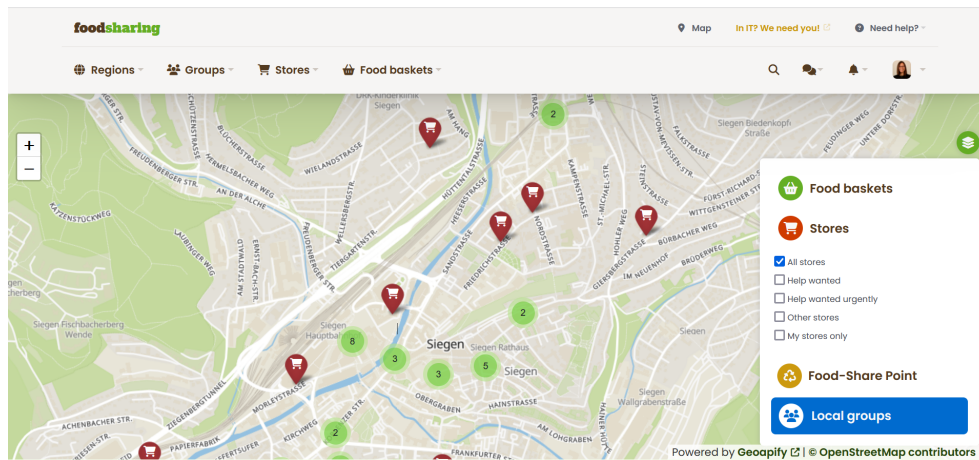


Figure 1: View of the foodsharing.de map for the city center of Siegen

structure for organized food rescue and sharing in these regions. Described by Morrow [261] as a “food-saving logistics and redistribution platform”, Food-sharing.de meticulously organizes the collection and redistribution of excess food. Foodsavers can sign up for pick-up slots (Figure 3) created on team pages that are dedicated to a specific business (Figure 2), ensuring a structured and efficient rescue process. The rescued food is usually products with an expired best-before date, fruit and vegetables with flaws or surplus baked goods. However, goods that have to make way for new products or have been removed from the range are also passed on to the Foodsavers. The rescued food can be used privately or passed on to others. The Foodsavers only redistribute food that is safe to eat. This redistribution is exclusively free of charge. Food past its use-by date or food with mold will be sorted out. From the time of collection, responsibility for further use is transferred to the Foodsaver [1].

Rescued food can be distributed online using the food-basket-function. Another way of distributing food is via public SharingPoints (called SharingHut24/7 in chapter 6) in the form of fridges, shelves and boxes. These are usually located in publicly accessible places, and anyone can bring and take food. People are reached regardless of the platform or other technology and the rescued food is made available to the public. There are currently 1,300 SharingPoints in Germany, Austria, Switzerland, and the Netherlands. Updates from SharingPoints can be posted via the Foodsharing platform so

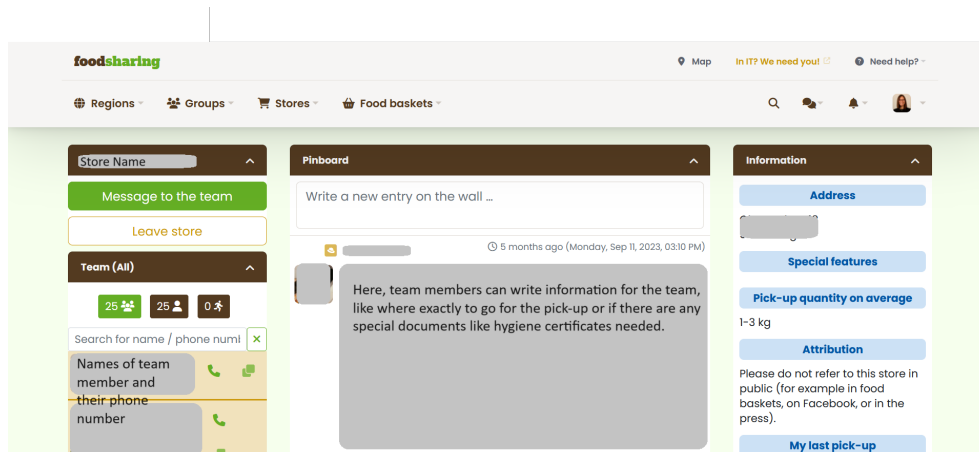


Figure 2: View of a store on the foodsharing.de platform

that the current content can be viewed online. The SharingPoint pages are public and can be viewed without registration.

Foodsharing operates on a decentralized model. It employs elected volunteer ambassadors to oversee district operations, including coordination, public relations, event planning, and collaborations with businesses. Store coordinators lead teams of Foodsavers in various businesses. Despite the decentralized structure, all districts in Germany, Austria, Switzerland, and the Netherlands adhere to shared rules and values, as documented in a comprehensive wiki. The initiative takes pride in its social responsibility and educational efforts, focusing on sustainable environmental and consumer practices. Unlike traditional food banks, Foodsharing operates unbureaucratically, relying on the rather independent and non-commercial actions of Foodsavers, coordinated through Foodsharing.de.

The Foodsharing.de platform is collaboratively developed by volunteer developers and community members. Despite a large user base, active participation in platform development is limited, akin to many open-source projects. A core team of around six developers leads the effort, facing challenges such as high turnover and complex communication dynamics between developers and users.

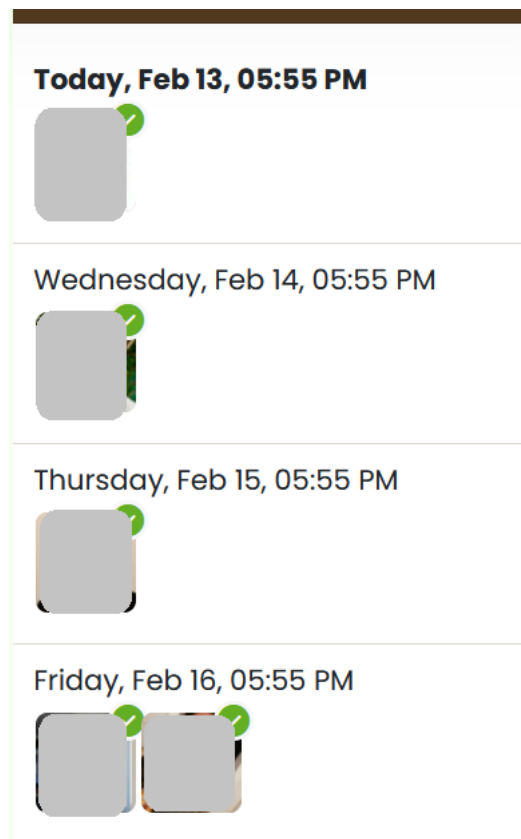


Figure 3: View of the pick-up slots

In Siegen, a vibrant Foodsharing community of over 400 members collaborates with 67 businesses to rescue food. This community holds monthly meetings for decision-making and established 4 SharingPoints, and in partnership with the association Lebensmittel-Teilen e.V., organizes cooking and social events using rescued food. ‘Foodsharing Siegen also assists neighboring towns in establishing their own Foodsharing communities.

Previous research on Foodsharing conducted by Rombach and Bitsch [314] delves into the motivations behind participation in Foodsharing.de, highlighting that members are primarily driven by the desire to reduce food waste, combat overconsumption, and underscore the value of food within the context of Germany. This study reflects a growing awareness and activism against food wastage, with participants seeking to make a tangible difference through

their involvement. Schanes and Stagl [321] further refine this understanding by categorizing the motivations for participation into five distinct themes: emotion, community, personal reward, social solidarity, and achieving specific goals. This categorization sheds light on the multifaceted reasons individuals engage in food sharing, emphasizing not just the environmental and ethical considerations but also the personal and communal benefits that come with participating in such initiatives. Ganglbauer et al. [132] focus on the development of Foodsharing and its effectiveness in minimizing food waste, particularly highlighting the unique online-to-offline community dynamic that characterizes the movement. Their research underscores the significant role of ICT in enabling individuals to make a difference both globally and locally, thereby fostering a 'glocal' relationship. This relationship bridges the gap between global concerns and local actions, empowering participants to contribute to sustainability efforts in meaningful ways.

Siegen isst bunt, Lebensmittel-Teilen e.V. and Urban Gardening in district Siegen-Wittgenstein

In 2020, the city of Siegen became the birthplace of a food-initiative known as 'Siegen isst bunt', which translates to both 'Siegen eats colorfully' and 'Siegen is colorful'. This initiative, characterized by its grassroots nature and inclusive ethos, later led to the formation of the 'Lebensmittel-Teilen e.V.' association.

A pivotal achievement of this community has been the establishment of five community gardens, including one in a living-lab. Here, in partnership with the University of Siegen and the city of Siegen, people from diverse cultural backgrounds have come together to engage in a variety of activities. These include constructing raised garden beds, hosting cooking evenings, sharing food, plants and seeds, as well as conducting workshops on food education and sustainable development. The essence of these interactions is centered around self-empowerment and fostering intercultural and intergenerational exchanges on an equal footing.

The journey of Siegen isst bunt involved 15 regular organizers and the participation of over 200 others, contributing in various capacities. Early work-

shops focused on the vision of the movement, highlighting the importance of building community connections through mutual learning, inclusivity, and the integration of diverse generations and cultures. This approach is encapsulated in its efforts to be inclusive, inviting people to contribute in ways they feel most comfortable. The organizational approach of Siegen isst bunt is marked by its sensitivity to hierarchy. Participation is always encouraged and supported, focusing on empowering individuals rather than enforcing structured task management or coordination through digital tools. Although attempts at using digital artefacts or Kanban boards for coordination were made, the emphasis has remained on supporting self-organized processes.

For internal communication, Siegen isst bunt primarily utilizes three digital tools: the Wechange platform (an open-source tool owned by a cooperative, offering project management and networking functions used by communities committed to sustainability), various Telegram group chats for instant messaging, and video chats (primarily via Zoom). Additionally, a Facebook page and an Instagram account are used for outreach and engaging the broader community.

As the primary organizers of Siegen isst bunt shifted their focus to establishing and maintaining the newly founded association Lebensmittel-Teilen e.V. (literally translated 'Food-Sharing'), the use of the name Siegen isst bunt for the community's efforts ceased. Instead, attention turned more towards the activities and development of Lebensmittel-Teilen e.V.. The Lebensmittel-Teilen e.V. association to this day plays a pivotal role in promoting various causes in Siegen, including environmental protection, landscape conservation, consumer protection, and public education through food sharing initiatives. Key activities include rescuing and (re-)distributing food, supporting community kitchens and gardens, and providing nutrition education. Cooking evenings using rescued food have been central to this community, serving as a platform for open community meetings and discussions on sustainable food practices. The initiative to deal with residual food waste in the communal kitchen led to the establishment of a compost system, which laid the groundwork for the first urban garden.

Collaboration is at the heart of these initiatives. Lebensmittel-Teilen e.V. joined forces with ‘Verein für soziale Arbeit und Kultur Südwestfalen (VAKS e.V.)’ and other partners in the ”Urban Gardening Kreis Siegen-Wittgenstein” project (translated: urban gardening in district of Siegen-Wittgenstein). This funded project, spanning from February 2021 to January 2023, aimed to make a green space in Siegen a publicly accessible community garden. This endeavor led to the formation of a network of urban gardens across the Siegen-Wittgenstein district. The different community gardens are more than just spaces for cultivation; they are centers for resource and knowledge sharing. Network partners participate in workshops, contributing and gaining expertise. A robust digital ecosystem supports this network, encompassing Telegram groups, Facebook, Instagram, and a dedicated website. This facilitates interaction among existing members and outreach to potential newcomers.

A significant stride in this network’s development is the ”Hammer Garden: Green Classroom, Open Space and Community Garden” project. Since February 2023 this funded project provides a physical space for network partners to disseminate and enhance their knowledge. The Hammer Garden is surrounded by various associations and institutions focused on social and cultural matters. The garden’s role as a communal meeting point and activity space is further strengthened through collaboration with these entities. Additionally, local schools and kindergartens benefit from the garden as a green learning space, especially valuable in areas where such facilities are scarce.

Additional projects that have developed in association with Siegen isst bunt and Lebensmittel-Teilen e.V. include a weekly food (re-)distribution event, documented in the chapter 6. Another initiative, ‘Vegetables Seek a Home’, is explored in chapter 5. Furthermore, there are several events focused on sharing seeds and crops, as well as the unique ’Tomato Festival’. This festival celebrates the best-tasting tomato grown in Siegen, offering attendees the opportunity to take home seeds from their favorite variety. The impact and effectiveness of these projects in Siegen have not gone unnoticed. They have been honored with several accolades, including the 1st Engagement Award North Rhine-Westphalia 2021, the 1st Homeland Award of the City of Siegen 2022, and the 2nd Environmental Award of the City of Siegen 2022. These

awards underscore the significant contributions of these initiatives to community development, environmental sustainability, and social cohesion.

3.2 Methodology

This chapter presents a methodology that amalgamates practice-based and action-oriented research with the socio-informatics perspective of the Siegen school. This multifaceted approach is instrumental in exploring the role of socio-technical design in supporting grassroots communities, particularly in the realm of sustainable food practices. This methodology provides a comprehensive framework for understanding and contributing to the field of HCI and community-based sustainability initiatives.

Central to this thesis is the harmonization of practice-based methodology and action-oriented research, as elucidated in [166] and [394]. This approach is particularly adept at addressing real-world issues, as it involves active collaboration with communities to foster “collaborative activist-community interventions” [164]. In line with post-normal science principles [129], this methodology is employed in contexts of uncertain facts and high-stakes scenarios, necessitating urgent action.

One key component of the methodology is the socio-informatics approach [394], which bridges the gap between social dynamics and information technology. This perspective aids in understanding the social and organizational contexts that shape and are shaped by technological systems. It emphasizes the need for practice-based design, considering the end-users’ social realities in the development of information systems.

The socio-informatics approach seeks to explore and understand the relationship between societal change and the design of meaningful IT artefacts in support of human actors. This endeavor led to shifts in the epistemological stance of applied computer science towards a practice-based design research paradigm. Socio-informatics was developed as a discipline that systematically deals with the design of ICT artefacts, considering not only formal technological criteria but also the quality of their interdependency with the social systems they are applied to. This approach is characterized by a critical and

self-reflective perspective on design practices and research activities, incorporating insights from social sciences, humanities, economics, and law into the traditional realms of computer science and engineering.

The socio-informatics methodology involves a strict praxeological dedication, focusing on social practices in which ICT artefacts are applied and used. This perspective acknowledges that the application of ICT artefacts stimulates social systems to challenge and change established practices in a non-deterministic process. Therefore, socio-informatics requires a methodological combination of social science insights with design-oriented knowledge. The methodology adopted here reflects these principles, emphasizing the integration of empirical and participatory design elements over an extended period. This approach is grounded in the concept of Grounded Design, Design Case Studies, Integrated Organization and Technology Development, and other frameworks developed within the socio-informatics community. It represents an inclusive research agenda aimed at addressing diverse social practices, their associated societal challenges, and potential design opportunities.

3.2.1 Data Collection and Analysis

This thesis represents the culmination of extensive research, involving a variety of data collection methods tailored to the research objectives. While the methods are detailed in the respective publications, this section offers a concise overview of the data collection and analysis methodologies employed throughout the research.

The research primarily utilized qualitative methods to explore the intricacies of community practices. This included conducting semi-structured interviews and participant observation. Semi-structured interviews were particularly valuable, allowing for the generation of reliable, comprehensible, and goal-oriented information while maintaining flexibility [41]. Participant observation further enabled direct engagement with individuals and objects within their natural environment [45].

Insights were frequently captured during gatherings and workshops, e.g. through collaborative techniques such as note-taking on post-its, which were

then displayed on walls for collective viewing and discussing. Personal documentation of observations in fieldnotes and meeting notes, typically recorded during or immediately following these interactions, added another layer of depth to the data collection process.

These methods collectively yielded rich, detailed data, shedding light on the community's dynamics, perceptions, and socio-technical practices. For the analysis, Braun and Clarke's thematic approach [39] was adopted, involving the coding and examination of data, especially of interviews and field notes. This analysis began after the initial data collection and was iteratively refined as new research data emerged. The action-research approach of the study guided "cycles of inquiry that included planning, action, and reflection", ensuring continuous design, implementation, and evaluation of the actions undertaken [164]. This iterative approach was key to developing socio-technical support that not only aligned with but also effectively met the evolving needs and preferences of the community.

3.2.2 Reflections on Positionality

As mentioned in the Motivation section (chapter 1.1) of this thesis, my extensive involvement with international grassroots movements and local grassroots communities spans several years. This experience includes collaboration with groups involved in the design and development of open-source applications, as well as with local communities who utilize these applications. In Siegen, my contributions have led to the establishment of various initiatives, projects, and non-profit organizations. These endeavors include activities like food saving (such as Foodsharing.de), the creation and upkeep of community gardens, communal kitchens, seed swapping, and food (re-)distribution. The driving force behind these initiatives has been a reevaluation of the global food supply issue, with a concentrated focus on local responses.

Reflecting on the insights of Teli et al., who articulate the vital role of designers as intermediaries within community contexts [358], I have embraced a multifaceted role in my work. As a design-oriented thinker, my objective has extended beyond traditional problem-solving [194] to include the amalgamation of varied perspectives and knowledge pools into the design discourse.

This approach recognizes the richness that diversity brings to tackling design challenges. Furthermore, as an active member of the community I serve, I contribute not only by facilitating the inclusion of diverse viewpoints but also by integrating my own insights and experiences into the design process.

This dual capacity enhances the design endeavor, ensuring it is deeply informed by a broad spectrum of understandings and experiences. It aligns with the evolving view of design as a collaborative and inclusive practice where the designer's role is not only to propose solutions but also to weave together the collective intelligence and perspectives of the community.

My second supervisor Prof. Dr. Gunnar Stevens once said in a conversation I was present at: "Typically, PhD students only become activists once they have joined the team of socio-informatics. But with Philip it was the other way around: he is an activist who also became a researcher.". My active role as a food activist and as a nine-year participant in the German Foodsharing movement positions me favorably to contribute to an understanding of the transformation towards sustainable food practices. This dual role includes responsibilities such as coordination and organization of daily tasks and events, ensuring an immersive and engaged research experience. As a researcher deeply involved in community activities, I maintain a reflective stance, ensuring ethical data collection and analysis. This dual role as an activist and researcher offers unique insights while necessitating a vigilant approach to maintain objectivity and academic integrity.

Ethical considerations were paramount in this research, adhering to the guidelines established by my university. This included ensuring anonymity and obtaining the necessary permissions for data usage. All participants were made aware of my active role and the research activities involved. Interviews and data collection processes were conducted in line with privacy and data protection requirements, employing pseudonyms for the participants.

Part II

Collected Findings

The second section of this dissertation comprises the publications that form the foundation of this work. Each chapter in this section has been previously published in peer-reviewed journals or presented at conferences and has undergone slight adjustments to fit the format of this thesis. Chapter 4 discusses how ICT can support the transition to a vegan lifestyle, emphasizing the co-evolution of practices and ICT artefacts and the importance of understanding this relationship to navigate the complexities of social practices and change. Chapters 5–7 draws on experiences with the grassroots community in Siegen, highlighting the role of ICT in enabling community-based food resource sharing, the negotiation process of (re-)distributional justice, and the dynamics between the local community and the designers and developers of Foodsharing.de.

4 Going Vegan: The role(s) of ICT in vegan practice transformation

Abstract

With the debate on climate change, topics of diet change and the reduction of animal products have become increasingly important in both public and academic discourses. However, sustainable ICT studies have so far focused on individual aspects, in particular investigating the criticized persuasive design approach. We argue for a broader perspective on the role(s) of ICT, one that helps in identifying opportunities to support consumer practice transformation, beyond motivational aspects. Based on retrospective interviews with 16 vegans, we argue to understand practice transformation as co-evolution of practices and ICT artefacts, as this perspective helps to understand how tensions arising from complex entanglements of practices, socio-material contexts, and communities can be resolved. Rather than a motivational process, we observe various roles of ICT artefacts co-evolving with practices: Ranging from initial irritation, to access to information about vegan practices, to the learning of vegan food literacy, to the negotiation of a vegan identity, and vegan norms at the intersection of the ‘odd’ and the ‘norm’.

4.1 Introduction

“A shift in the social norm of meat consumption is a transition that is repeatedly called for in climate change policy discourse. Yet this rarely sets out practically how such reduction might be achieved and, surprisingly, has yet to look to vegans as a knowledge resource.” [373]

From an ecological perspective, Veganism, once considered to be something over-ethical and nearly religious, has taken on new significance as the ecological consequences of diet choice have become more apparent. Nowadays, it is acknowledged that dietary choices have significant consequences for sus-

tainability [147, 366]. Compared to a regular omnivorous diet, veganism usually causes a much lower carbon footprint [320, 374] and is associated with health improvements [312]. Indeed, “the Intergovernmental Panel on Climate Change (IPCC) includes a policy recommendation to reduce meat consumption” [325].

This raises the question of how ICT could support the transformation of omnivorous consumer practices towards plant-based practices. Sustainable ICT research has hitherto been dominated by a ‘persuasive’ perspective focusing on rational [294] and sluggish consumers [123]. These approaches usually have a positive short-term impact on the motivation to change behaviors, but their long-term impact is uncertain [42, 93, 240, 330, 331]. The argument is that we need to understand, in more detail, how people construct sustainable practices themselves and how such perception is shaped by their socio-material environment [150, 332].

Addressing these issues, research on (non-)sustainable practices has emerged as an alternative lens [294]. This lens was applied to energy consumption (e.g., [42, 150, 330, 331, 332]), and also food waste [130], food sharing [132], and recently organic food consumption [201]. Yet, where studies on the transition to vegan practices exist, they mainly originate from social science, neglecting the role of ICT artefacts [291, 372, 374].

Research Gap: While there is a rich body of knowledge about ICT in pro-environmental behavioral change and nudging, as well studies on sustainable consumer practices in general, less is known about practice theories in action and ICT not just for motivational aspects but for the long-term transformation of consumer practices [168, 294].

It is exactly this knowledge about the complex evolution of entangled practices and the involvement of ICT artefacts that is important if design is for successfully supporting sustainable transformation [163]. However, the question of how “technology [can] promote reflection on diet [and sustainable practices] more strategically over longer periods?” remains unanswered. In light of this research gap, we address the research questions of ‘How to support vegan practice transformation with ICT artefacts?’ and ‘How do these ICT artefacts co-evolve with practices in the transition towards vegan practices?’.

To answer these questions, we conducted a qualitative study with 16 participants, using semi-structured interviews. The focus was on vegan food practices, as food consumption is acknowledged for the high environmental impact and is more present in daily practices than buying clothes for example. Furthermore, diet is often the starting point for veganism [203]. Nonetheless, we provide related information on other consumption fields and discuss the extension of vegan design towards a broader inclusion of other consumption infrastructures. We used Shove et al.'s [340, 341] and Twine's work [373] together with work on appropriation [192, 347] as a theoretical lens to understand the role of ICT artefacts in long term sustainable practice transformation.

From this retrospective perspective on practice transformation, our findings (as summarized in Figure 4) show that rather than a motivational process, we should understand practice transformations as a co-evolution of practices and ICT artefacts. We observe co-evolving artefacts ranging from initial irritation, to access to information about vegan practices, to the learning of vegan food literacy, to the negotiation of a vegan identity, and vegan norms at the intersection of the 'odd' and the 'norm'. While our results at first sight only contribute to the study of vegan practices, we argue that co-evolution is a helpful lens to study and design for sustainable practice transformation in general, especially in the light of increasing awareness of the importance of green issues.

4.1.1 Transforming Practices and Forming New Practices

Practice-theoretically informed ICT interventions found a deeper understanding of sustainable consumption practices and the socio-material context that shapes them [62, 130, 131, 294]. This lens has been used to uncover ICT design opportunities, such as food sharing as a means to procure and dispose of food [132], studying sweet spots in consumption practices to prevent food waste [130], or opportunities for other food-related practices, such as gardening [237], foraging [56], and recently, organic food consumption [201].

Practices, in general, are understood as the "routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood" [306].

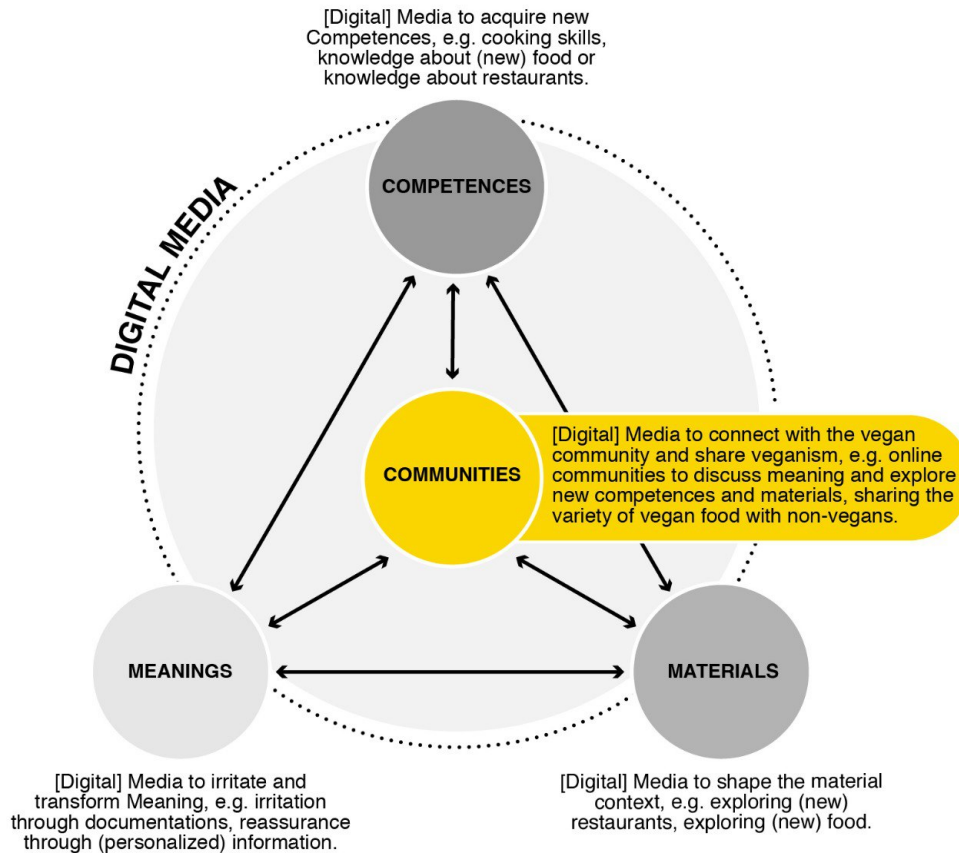


Figure 4: Summary of Going Vegan Findings.

Beyond this rather broad definition, one can distinguish between materials, competences, and meanings of a practice [340, 341]. Meanings are understood as the “symbolic meanings, ideas and aspirations” [341]. It is related to what Reckwitz calls mental activities, emotions, and motivational knowledge [306]. Competences are understood as skills and know-how, practical knowledge, or techniques [341], for example, knowing how to prepare a particular recipe [369]. Lastly, Materials refers to “objects, infrastructures, tools, hardware and the body itself” [341]. They are related to Reckwitz’ [306] notion that “things [. . . and] objects [are] necessary components of many practices”. Given this framework, the question of how to transform practices emerges. In daily consumer routines, the elements are connected stably, creating a kind of

equilibrium [347]. A change of one of the elements creates an imbalance, resulting in a “crises of routine” [306]. For the resulting dynamics, Shove et al. [341] distinguish between practices, proto-practices, and ex-practices. Practices are the well-established and unconsciously performed routines. Proto-practices are practices that are not yet incorporated by the person because relevant elements are not yet appropriated or not yet linked. In contrast, ex-practices are practices that have been abandoned because one of the links has broken [341].

Based on this understanding, interventions aim to destabilize practices and reestablish new practices. However, still due to the complex entangled nature of practices [130] and how sustainable practices are still considered as something ‘odd’ [163] as the benefits of “good individual choices” [130] are not always recognized equally, designing and understanding these interventions is not straightforward. As most research hitherto has studied practice from a prospective standpoint, we lack strategies on how to transform practices in the long term [67], solving the tensions arising from the entanglement of practices [130, 216] and departures from the ‘norm’ [75, 163]. Indeed, this problem has been seen across a range of contexts, including car-free mobility [163], simple living [186], and water-reduced bathing [216].

4.1.2 Appropriation of ICT Artefacts

Hasselqvist et al.’s [163] work on transformation towards car-free mobility practices already highlights that practice transformation comes with the appropriation of new artefacts. For example, the usage of a planning tool to find suitable routes for the new vehicle. As stressed by Stevens and Pipek [347], such making use is a dual process that changes both the object and the subject. The adoption includes acquiring new competences through informal learning, resulting in a transformation of the practice itself [94, 95]. However, it is not only the practice itself but the ecology of ICT artefacts that is dynamically adapted to the introduction of new artefacts, e.g., abandoning other artefacts or establishing of joint usage [47]. Appropriation is thus closely related to what Engeström [106, 107] calls expansive learning. Expansive learning mainly happens in the wild, where neither the learning goals

nor the learning activities are defined in advance but are open-ended. It starts with the diffuse feeling of a need and the reflection of inner contradictions in the situation at hand (unsatisfactory state), followed by exploring and trying out new options and ideas (excited state) and finally finds a new equilibrium in a stable state [47].

Appropriating new artefacts and learning new practices does not happen in isolation but involves enculturation into a community of practice [53, 283, 284]. With the ongoing performance of a practice, the community implicitly communicates knowledge, values, and identities that can be learned by newcomers. Members share their commitment to the community as well as the competences, materials, and meanings, “in short a shared practice” [390]. Several studies [16, 196, 338] have demonstrated that practitioners do not need to be co-located and that newcomers can also become enculturated by participating in virtual communities of practice.

ICT artefacts play a twofold role in the process of appropriation, expansive learning, and enculturation. They are objects of appropriation [47, 347], but at the same time, they are also the medium as they support practice transformation [163].

4.1.3 Sustainable Food Consumption Practices and Veganism

Veganism includes a general exclusion of animal products, e.g., in food, cosmetics, and clothing [203]. Besides the ethical reasons cited for veganism, criticism on industrial large-scale livestock farming, health considerations, and environmental protection can be motivations for vegans [203, 374]. In particular, greenhouse gas emissions are strongly correlated with animal consumption [278, 320].

Twine [374] shows how, for diet transition, different modes of food change are entangled with the adoption of vegan practices, ranging from substitution to the exploration of new dishes and products, as well as the adaptation of competences relating to the new material (food). Such change is reflected in the ‘veganization’ of meals with plant-based substitutes for animal products or a shift towards two-part vegetable meals instead of a tripartite arrangement

around meat as the main ingredient [374]. Adopting Shove et al.'s [340, 341] practice lens, Twine [373] identifies essential elements that constitute new vegan practices. Their framework highlights the interaction of new competences, such as vegan cooking skills or knowledge about eating-out options, the new materials, e.g., the vegan food substitutes or the restaurants themselves, and the meaning of veganism in respect of pleasure, health, and/or ethical behavior [373]. Thus, a vegan diet transition not only affects eating, but also other practices, such as cooking or buying food.

As practices should be understood within their socio-material context, it is worth broadening the scope towards the environment vegan practices are currently conducted in. In general, vegan practices, as other anti-consumer movements that deviate from regular consumption patterns, can be referred to as a niche practice. This perspective highlights the gap between regime consumption infrastructures and the needs of niche practitioners [75]. Not only from a practice-perspective but also based on the number of vegans in Germany [203] and other European countries such as the UK [374], vegans remain a niche with a little over 1 percent of the population. In other countries such as Spain or France, the number remains even lower [87].

However, the situation is changing; over recent years, a continuous rise in the number of vegans could be observed [203, 296]. This change is resembled in an increasingly growing market for vegan products and restaurants. Also, the market for media such as books is growing [296]. Here, it can be assumed that a similar trend can be observed for other media. In a similar vein, the vegan label (issued by a European Vegan NGO [296]), as well as other private labels [296], are increasingly established. For non-food consumption domains labeling is not yet widespread, but evolving [296]. However, there are various different labels, that not always follow a transparent and consumer-friendly definition of veganism, nor are all products labeled [138].

From a governmental and consumer protection perspective, this topic of regulating vegan labeling and facilitating consumer choice was neglected for a long time. Until today, there had been no governmental label and only a few years ago the German federal states agreed on a definition for the term 'vegan' [138]. The situation is similar on a European level, where no binding

definition for vegan food exists [138]. Sustainable consumption, against the background of this market-based policy-making, is mostly treated as a consumers' responsibility and a matter of informed choice, rather than a topic for pro-vegan or pro-environmental policy [248]. For Germany and France, consumer protection even goes in a different direction. In 2018, the German Federal Ministry of Food and Agriculture issued legislation that complicates the naming of substitutes, e.g., 'vegan sausage' [115]. In France, we found rulings than ban 'meaty' names for substitutes [52].

Not only from a legal perspective but also from a western cultural perspective, meat consumption is traditionally understood as a symbol of prosperity and wellbeing [372]. In the media, consuming animals and speciesism is reproduced as the norm [68]. This positive perception is also reflected in the negative reactions to 'vegetarian day' policy suggestions for public canteens. In 2013, the German Green Party suggested introducing a 'vegetarian day' in German public canteens, however their idea was broadly commented by public media as "an ideological lifestyle dictatorship' or 'a disenfranchisement of citizens'" [248]. Similar reactions to veganism were studied for UK media, that perpetuate vegan marginalization and bias [68]. Despite its positive aspects, veganism is still arguably perceived by many as somewhat abnormal and characterized by a puritanical view of life [372]. Such an attitude places vegans in the position of explaining and justifying their 'niche' practice [75] in their social environment. Various strategies can be identified as to how vegans deal with this kind of social pressure. The intentional choice of vegan partners (also called vegan sexuality [291]), for instance, aims to avoid such conflicts, at least within the partnership. There are also more inclusive behaviors such as the cooking and presentation of vegan dishes to show non-vegans the benefits that can be gained from vegan meals, attempting to trigger a change of values [372]. In summary, it can be stated that vegan practices are increasingly conducted, which follows an increasingly growing market and more and more labeling of products. Still, from a governmental and a consumer protection perspective, there is no clear support for veganism and the related issue. In a similar vein, despite the growing number of vegans, practitioners remain a niche that has to justify its anti-consumerism and face social pressure.

4.2 Materials and Methods

To answer our research questions, we conducted semi-structured interviews with vegans in Germany. Our qualitative sample of 16 vegans was recruited through a snowball sampling procedure [272]. We started our recruitment with vegans from the extended social network of the authors and social media. The main criterion for participation was the maintenance of a vegan diet (based on the participants' self-images). We explained to participants the purpose of our research and informed them about the (anonymous) storage of data on university computers and use for research only. Further, we emphasized that participation was voluntary and that they could choose at any time to discontinue. Afterward, participants gave us their informed consent. We also ensured that the sample matched the socio-demographic structure of vegans in Germany: Vegans in Germany are 80% primarily female [203], have an average age of 31 [203], tend to have a higher formal education [312], and tend to live in urban areas [312]. This tendency of vegans to be female, young, and educated is also reflected in our participant sample (see Table 1).

Our interview guideline covered the participants' vegan diet and lifestyle (e.g., duration, self-image, further dietary restrictions, motivation), reflection on artefact use alongside their dietary changes (including both artefacts still in use, but also once used), and reflection on how their practices (Planning, Procurement, Preparation, Eating, Disposal) changed in the course of going vegan.

The interviews took between 13 and 50 min (Ø: 25 min). Afterward, the interviews were transcribed and coded using Catma (CATMA—For Undogmatic Textual Markup and Analysis (<https://catma.de/>)). The interview data were analyzed using thematic analysis [39]. Twine's work [373] together with work on appropriation [192, 347] is used as an initial template of codes [207]. During our inductive analysis, we especially drew upon the notion of the dynamic evolution of practices [341], the importance and appropriation of artefacts as part of vegan practices, as well as the transitions implicated. After each iteration, we discussed the codes and developed themes collaboratively. Note that, for the presentation of results participants' quotes were translated to English, and location information was anonymized.

No.	Age	Gender	Education	Job	Household	Residence
P1	17	Female	Student (high school)		With Family	Suburban
P2	17	Female	Student (high school)		With Family	Rural
P3	21	Female	Student (bachelor)		Flat Sharing	Urban
P4	21	Female	Student (bachelor)	Translator	Flat Sharing	Urban
P5	22	Female	Student (bachelor)	Assistant in Finance	Flat Sharing	Urban
P6	22	Female	University Degree		Alone	Urban
P7	23	Female	Apprenticeship	Laboratory Assistant	Alone	Suburban
P8	25	Female	University Degree		Alone	Urban
P9	26	Female	University Degree	Job seeking	Alone / With Family	Urban / Rural
P10	26	Female	University Degree	Assistant	Flat Sharing	Urban
P11	27	Female	University Degree	HR Manager	Alone	Urban
P12	29	Female	University Degree	Public Servant + Sports Teacher	With Partner	Urban
P13	26	Male	Student (bachelor)		Alone	Urban
P14	28	Male	University Degree	Commercial Clerk	Alone	Urban
P15	29	Male	Apprenticeship	Accounting Clerk	Alone	Urban
P16	31	Male	Apprenticeship	Mid-Level Employee	With Partner	Rural

Table 1: Participants Going Vegan.

4.3 Results

4.3.1 Irritation and Reassurance

At the beginning of the vegan diet transition, the media immediately takes on an essential role in unfreezing established beliefs, meanings, and interpretation schema. While the first contact with a vegan diet is often due to exposure to documentary resources, leading to a questioning of one's diet, more critical is the role of media in establishing personal feasibility.

4.3.1.1 That is not True?

Asking about reasons and drivers of the transition towards a vegan lifestyle, P1, P3, and P10 reported that the first contact was mainly by video platforms such as Netflix and YouTube.

“There have been several, but for example the classic Netflix documentaries like *Cowspiracy* for example or *Earthlings* and on YouTube there’s a lot of stuff like that ... and also channels of private people pushing stuff like that.” P3

Documentaries such as *Cowspiracy*, *Earthlings*, *The End of Meat*, and *What the Health* were repeatedly mentioned in the interviews as a critical experience, e.g., by participants P3, P4, P8, and P9. Our participants found themselves confronted by such documentaries and related pro-vegan information resources serendipitously. For example, P15 could not in the first instance believe the facts shown in the documentaries and dismissed them as ‘propaganda’. Such confrontation constitutes a ‘friction’ or ‘irritation’, which prompts reflection. Those terms refer to raising the self-reflection about previously unreflectively conducted practices. Where this occurred, we refer to the ‘unfreezing’ of practices. P4, P8, P9, and P11 also mention friends and acquaintances as triggers for questioning established food consumption practices. P14 also mentioned the importance of specific events such as the lasagna horse meat scandal in 2013 [391]. That event was his initial reason for rethinking his food consumption practices.

“In any case, the use of media played a big role because I also started with it. Those were mainly videos, videos about the vegan diet from different sources that I started watching, I motivated myself with those videos at the beginning where it was still difficult for me. I watched videos and different pictures and yes, in any case, the media pushed me to go on, and yes I gathered further information from the media about how a healthy vegan lifestyle can be maintained.” P1

P1's quote shows that various sources of information were used not only to validate the given information, but also to obtain even more details about the general feasibility of the diet. Hence, videos, which are, for example, accessed via YouTube, played an important role as did traditional print media. Indeed, the initial confrontation with health and livestock farming issues (especially animal suffering and dying) was frequently followed by a more intense encounter and exploration.

4.3.1.2 Does Veganism Work for Me?

In addition to the motivation mentioned by participant P1, the acquisition of nutritional skills and knowledge surrounding the maintenance of a vegan lifestyle also played an important role. P7 described how she received hints from YouTubers on nutrition and dietary supplementation, which reassured her, both about the feasibility and about the existence of a broader community. Besides the rather general information about the feasibility of a vegan diet, there was a demand for nutritional information. That information was gathered from YouTube, where different channels provide information that can be accumulated and measured by personal experience with a vegan diet. Another mode was mentioned by participant P12, who read books to triangulate information sources, thus aiming to make sense of the need for nutrients alongside the characteristics of food items.

“I think that it is difficult with your nutrients because as a vegan you have to make sure that you have all the nutrients and so on and it is also not necessarily so good to take vitamin B12, I mean continuously. It is excreted by the body. But it is not good to consume a permanent oversupply of it. I think I have no concrete idea, but I think that the nutrient thing, that it is important, because it is ultimately about your health. And you have to be reminded regularly that you have to do a blood test, that you just know if something is missing in your diet. I think that would be helpful, but I don't have a specific approach.” P13

P13's example shows her high degree of uncertainty regarding the correct amount of vitamins, especially vitamin B12, which is probably one of the most critical nutrients when maintaining a vegan diet since it only rarely occurs in plant-based food [205]. She explained how a blood test once a year ensures that the vegan diet meets bodily needs. This uncertainty demonstrates a desire for tailored and personalized information about one's diet and whether the dietary needs in question are being met.

“Just to get a balanced diet. For example, beans, berries, other fruits and then it says how many portions you need. Then there are the vegetables. Other vegetables. Greens or what's it called, cabbage, beans. Or just nuts. Whole grain, grain, water, sports. Vitamin B12. Vitamin D, water. And so on and so forth. I've tried that before, for a while. Well, that's not so comprehensive now, it's just an approximation, for example: One serving is 60g hummus. Zack. That's it. When you've eaten that, you tick it off. Exactly here you have to eat three portions a day. Zack. Here you need one portion, how many berries are here, for example, frozen or fresh—60 g. It's just so coarse. A rough guideline, so that you stop, yes.” P15

Instead of blood tests, 6 of our 16 participants started to use diet trackers. Those tools helped them, especially at the beginning of their transition, to increase their awareness about what food to eat in which amounts, but also to prove the feasibility of their diet to themselves. Nonetheless, the use of those devices was relatively brief for some participants due to the substantial effort required to track the food intake. Participants P7, P9, and P10 explained how stopped using diet trackers because of the high workload entailed. Participant P15 stated that he stopped tracking and now “really hates” it, because it was “time-consuming”, although he admitted that a tracker could support “rough guidelines” for one's nutrition.

Some participants seemed to dive straight into the vegan diet, while others described a step-by-step approach. P1 explained that she adopted a vegan lifestyle “from one day to another” and that she had never dealt with a vegan

diet before. Therefore, she did not eat a balanced diet for the first month but acquired insights into “how such a healthy, vegan lifestyle can work out” by watching videos. Participant P11 began her vegan diet with a “vegan week”, in which she made explicit and conscious choices every day, all geared to getting better informed about how a vegan perspective is constituted. During that time, she discovered a website by PETA ZWEI and signed up for 30 days of “vegan kick-start” in which she was supported by the organization. P11 found it helpful to get an organization newsletter every 2–3 days that she could respond to as well as a personal contact, to whom she could address questions.

4.3.2 Learning New Competences and Exploring Materiality

Once our participants had abandoned their former diet, they faced several practical problems. Restaurants and cafe’s are not necessarily vegan-friendly or beloved treats and recipes might include non-vegan ingredients. (Digital) media played a critical role in acquiring practical knowledge and exploring food, especially where to find it, answering questions such as the following.

4.3.2.1 Where can I Eat Vegan Food?

As a result of the change in diet, many previously visited restaurants were no longer suitable for the new vegans. To find more options, our participants used various websites, apps, and blogs (e.g., from PETA). Further sources for help were acquaintances and friends (P3, P11).

“In fact, over the Internet. I don’t know, I sat down and googled for some time. Vegan restaurants in (big city) and surroundings and there are actually unbelievable many in (big city).” P1

The quote shows how P1 rediscovered her environment with the help of Google and how she was surprised about how many vegan options there were in her neighborhood. Eight of the 16 participants used HappyCow or Vanilla Bean, which offer information created by other users and show different vegan options on a map. They use these apps to find vegan or vegan-friendly

restaurants and cafe's. Even so, they highlighted that they now primarily used these apps in foreign places.

“Yes, definitely. That's HappyCow, I own the free version and especially when I'm traveling, or when I'm in a city where I don't know any vegan places.” P11

This seems to be a general pattern for using such apps and websites: After the initial exploration of the surrounding neighborhood in the city of residence, regular use decreases over time. As the degree of familiarity with these features of the locality increased, the information provided by these apps was internalized. Apps of this kind continue to be used, unsurprisingly, when visiting unfamiliar locations.

A little surprising was that our participants did not use the resources of this kind to find vegan-friendly stores and supermarkets. Instead, the participants mostly continue to shop for their vegan foods in regular chain-supermarkets as well as known organic supermarkets. Only P5 stated that she occasionally bought special vegan food online.

4.3.2.2 What can I Eat?

In much the same way, the material quality of food was also rediscovered in vegan practices.

“I think CodeCheck definitely, that was a big thing for me, that I could always scan the... this barcode then and then it was in there whether it is vegan or whether it is maybe vegan or was tested on animals. That was a super big help, but after a while it is marginalized, because then I knew what is vegan and meanwhile it's everywhere anyway. That means the time helped me there also a little bit.” P11

Participant P11 described the difficulty of a transition from relatively carefree shopping to shopping or consumption with a more considered approach to

the ingredients and properties of the food. Participants P3, P4, and P7 also described how artefacts, especially CodeCheck, helped in gathering further information about the product. However, according to nine participants, an initial assessment here is also possible by simply looking at the ingredients and allergens of a product, or solely at vegan-trade-signs. However, the former is not always valid because, as participant P3 stated, some products use flavoring substances, e.g., lard in potato chips, that is not declared in the ingredient list.

“You learn so much from the ingredients and then you’ve looked at the product 5 times, then you know what’s in there, it’s vegan and it’s okay. Or with things like marzipan, you look on the ingredients list one time and then you eat it all the time. Just because there’s a label, no just because there’s no label on it doesn’t mean it’s not vegan. You have to pay attention to the ingredients and eventually you know it by heart.” P1

Similarly, to exploring food ingredients 5 participants explained how they try to reduce leather and animal fibers when buying clothes. While these participants did not report on any ICT support for checking the material of clothing or showing plant-based clothing stores, trade-signs and material lists are a good starting point for the purchase decision.

This information also has a direct effect on food- or product-specific knowledge in the sense of a competence, which is sufficient for most consumption situations, so that the medium subsequently loses its significance for daily practice, as the example of participant P13 shows. However, five participants explained that media such as CodeCheck or Google were still used in situations of uncertainty, e.g., when buying an unfamiliar product.

4.3.2.3 What can I Make from My New Food?

Participants described how they needed information on how to prepare vegetables as well as how to include them into dishes. This information was usually accessed by simply searching the internet for recipes or specific tutorials on how to prepare the vegetable as well as looking at vegan cookbooks.

“Yeah. Also. Within the last year, after I started to eat vegan, I’ve learned about so many new vegetables that I simply got to know, which I did not know before. You always see the whole variety of vegetables, but how can I prepare this at all. That wasn’t even clear to me. Meanwhile, I know how to do it, so I do it gladly, really. Vegetables that I have never processed or never bought. That I see now so ok it is just the season and then I like to buy it and then I look online. What can I do with it at all and then. Partly the meal I cook depends on the vegetables I buy. So, I’ve always been experimental about what I do with all that stuff.” P5

The example of participant P5 shows how this additional mode of food exploration is supported by (digital) media. She explained how she discovered a whole new variety of vegetables that were previously not included in her diet. Besides the exploration of new vegetable possibilities, dishes, in general, seem to be transformed from a three-part meal towards a two-part meal, as Twine [374] already mentions in his work. This change was described by participants P7, P8, and P11. They explained how they usually cook some source of carbohydrate, e.g., potatoes or rice and some vegetables with it. P11 further highlighted beans as an addition to the vegetables.

“But if I have a special idea, for example, I wanted to bake a banana bread then I just google “banana bread vegan” and click on any recipe from a blog, those are mostly blogs I didn’t know.”
P8

When it comes to the ‘veganization’ of formerly known dishes, the internet is, as the examples of participant P8, P10, P12, and P16 show, a good source for recipes. The internet provides enormous variety and, moreover, a variety that is coded to vegan interests. Participant P10 explained how he searched the internet for recipes of beloved childhood meals and inspiring meals from restaurants to ‘veganize’ them by finding a vegan version of the recipe. The same applies for inspiration for more complex weekend dishes or dishes prepared for friends or family. To prepare them, special vegan blogs, Google,

Instagram, or YouTube cooking channels are visited to get some inspiration, as seven of our participants explained. P5 described how she, at first, had difficulties in making use of the whole variety of vegan recipes. Thereby, they had some “trusted” blogs, from which they get, from their perspective, healthy recipes, as participants P8 and P10 state. An additional mode of inspiration and food exploration is, of course, the usage of vegan-style cookbooks as several participants explain, e.g., P11.

4.3.3 Community and Sharing Veganism

Prior work [291, 372] already highlights how vegans negotiate and exchange the experiences of their diet with other vegans but also with the omnivorous majority. Since our participants were often the only vegans in their circle of acquaintances, artefacts helped them to connect with other vegans, but also to share and negotiate their practices with others.

4.3.3.1 Connecting with Other Vegans

With the transition to a vegan diet, media, especially social media such as Facebook, are used to make contact with like-minded people. As six participants show, this contact can take place on a purely digital, passive basis, in the sense of receiving information about offers of local supermarkets, inspiration, or recipes. Participant P11, however, often asked questions and engaged in exchanges, as the Facebook group was seen as a place of mutual understanding, where vegans are safe from being “flamed by somebody”. Understanding and security were also taken up by participants P1 and P7 in the context of finding a vegan community. The reasons were the annoying questions about their diet or the lack of understanding on the part of non-vegan people.

“I’m also a member of a vegan [Facebook] community. (big city) vegan, that’s the name. There you sometimes get a notification when a new restaurant opens or when there are special offers or something like that.” P14

Besides the example of participant P14, participant P11 mentioned how she learned new cooking skills and formerly unknown ingredients from such a group, e.g., making macarons with aquafaba (liquid remaining after chickpea cooking) as a substitute for eggs. At this point, interestingly, the aforementioned vegan groups have a strong local connection, usually containing the city or region name as well as some sort of vegan identifier. Besides the names, the content of these groups is also tied to the local context at least to some extent. While nutritional information is universally valid, information about restaurants and retailers is only of value for the local community. Furthermore, food infrastructures participants reported on various other consumption infrastructures that are exchanged in the community. These range from clothing stores, locations of leather-free furniture, or shoes without an animal-based glue. At this point, the variety of consumption infrastructure resembles veganism if often not only a matter of food consumption, but is also entangled with various other consumption practices, for which we yet found no ICT designs, but the appropriation of social media to exchange such information.

However, this exchange was not always successfully established, as participant P6 explained. She described how she tried to join an online community but found it difficult to get in touch with the other vegans. This difficulty is primarily because—despite the perceived expectation of non-vegans—being a ‘member’ is not always straightforward. Where membership of such online groups is successfully established, it is sometimes used to establish ‘offline’ contact.

“Yeah, so that is just called vegan regulars’ table ah and there was. I was once joining such a running group the somehow called good night running group or something like that. And there you always meet at full moon here at (locality) and run five kilometers or so and then make a donation for some animal welfare project. And there were mostly vegans, too.” P7

The example of participant P7 shows that regulars’ tables are often formed, which put a stronger focus on face-to-face exchange and information retrieval.

Apart from this, however, there are also people meeting for other leisure activities, such as the good night running group, a run against animal suffering. In this respect, the media has less of an informative function but more of a mediating role, which enables people to find like-minded people who, for instance, share similar eating habits.

4.3.3.2 Sharing Veganism

Within “the mode of performing veganism in a demonstrative manner that draws omnivores or vegetarians into the sensual experience of vegan food” [372], participant P8, as well as six other participants, explained how pictures of home-made vegan food were shared, as were photos of food from restaurants via Instagram to a broader public or with friends via messengers such as WhatsApp. The example of P8 shows how she hoped that the sharing of the sensual experience through the visual representation of her food motivated others to try a vegan diet. However, the sharing of food experiences was not always tied to a sense of motivating or persuading others to change their diet. Participant P10 explained how she uses pictures and recipes to “break with prejudices” about her vegan diet.

“I think subconsciously, one has always a little bit of hope that one can maybe motivate someone to try it for themselves. And because I maybe want to show the people that vegan food can be totally great and doesn’t mean abandoning anything.” P8

The quote from P8 shows her desire to share the perceived positive characteristics of vegan dishes and diet. Similarly, Participant P5 started her own Instagram account to share pictures of her vegan food. She explained that the ongoing questions “what can you still eat?” motivated her to share the variety of food that she consumes. She and participant P7 argued that they got positive reactions and significant interest from their audience who, they suggested, are often astonished by the fact that the meal was made without animal products and even that friends sometimes stated that they wished they could eat the food as well. In the circle of friends and acquaintances, however,

food was not exclusively shared via digital media in the form of pictures. Six participants also described how they made a special effort when they cooked for others to improve the sensual experience of the prepared dishes.

“I think only once, when I was at the Christmas market, there at a vegan food truck and then I just posted a picture, but under the cloak of ‘Christmas market’ and not with the tag ‘vegan’.” P11

The desire to promote veganism is not universal. The example of participant P11 shows that not all participants share their vegan diet via Instagram with the public. While in the beginning, she wanted to convince people within her family and friends that they should reduce the share of meat within their diet, she nowadays shares her experiences without a specific reference to veganism. Thus, the “cloak of Christmas market” allows her to share the experience without explicitly telling a broader public about the details of her diet and therefore aligning with the (omnivorous) majority’s narrative interests.

4.4 Discussion

While prior research studied the role of artefacts for changing entangled practices from a prospective perspective [130, 216], our research provides insights on how vegan practices and artefacts co-evolve from a retrospective perspective.

In contrast to TTM [292], co-evolution is not a stepwise process, but requires multiple iterations of learning, exploring, and adjusting practices in a dialectic relationship with artefacts. However, there seems to be some ‘unfreezing’ of change, as an initial step in triggering the “crises of routine” [306], that creates the need for new artefactual use [47] and a desire to rethink practices [341]. From there on, a continuous, iterative learning of practices and adapting of artefacts begins, with a constant tinkering as new issues arise. Eventually, co-evolution will come to a new ‘more’ stable and satisfactory state, where vegans become comfortable with their status and familiar with the various sources that enable this stability. Nevertheless, this has to be achieved in a

context where veganism is still regarded as ‘odd’, at least by some. Negotiating the relationship with more ‘normal’ practices is a constant challenge.

This view draws on prior research [130, 163, 216] that highlights the evolutionary nature of practice transformation as well as research on dynamic artefact ecologies [47, 199], that shows the interrelationship and changing nature of artefacts. However, our work adds to this perspective, by arguing that artefact ecologies and practices should be understood in their mutual relationship manifested as a co-evolution, rather than individually, when designing for sustainable practice transformation. This co-evolution is presented in Figure 5.

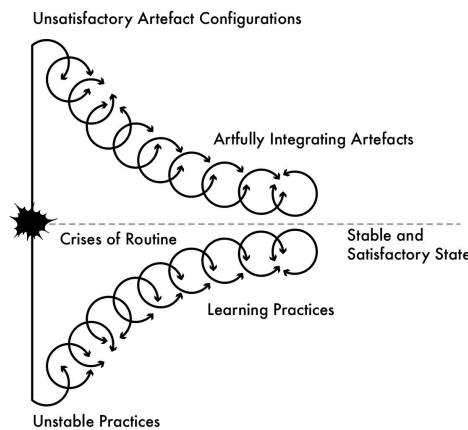


Figure 5: Co-Evolving Practices and Artefacts (inspired by [230]).

From this perspective, artefact ecologies are not only dynamic [47] as new resources are found, but are also adaptive to the changing needs as people ‘become’ vegan. This is redolent of Becker’s [23] famous paper on marijuana use, where he demonstrates the cultural practices required to become a competent user.

4.4.1 Co-Evolution from a Perspective of Practices

From a perspective of evolving vegan practices, meanings, competences, materials [373, 374], and communities [291, 372] are underpinned by a dynamic ecology of artefacts contributing to the incorporation of elements and a progressive stabilization of use.

For meaning, the role of artefacts slightly shifts with the evolution of vegan practices. With the initial confrontation, we observed that artefacts helped to unfreeze the existing, routinized non-vegan practices by questioning established beliefs, views, and meanings. There are some parallels with persuasive approaches [400], even if none of the participants mentioned the use of persuasive and gamified technologies, e.g., eco-feedback to motivate and sustain diet-change. Instead, we observed something that could be called persuasive rhetoric. For instance, documentaries about veganism use persuasive rhetoric to raise people's awareness about veganism and confront viewers with the negative effects of meat consumption and livestock farming. To validate the information seen in documentaries, our participants were making use of different information sources. For instance, some participants used diet trackers or medical tests to verify information consumed or practices explored. In particular, the reassurance of the personal feasibility of the diet went hand in hand with testing to understand what veganism means for oneself and one's body.

Overall, we saw that the old interpretation schema is not suddenly and entirely replaced by a new one. Instead, meaning shifts over time. Most participants did not have a complete commitment to veganism as an alternative diet in the beginning but proved the feasibility and practicability of veganism with their ongoing evolutionary practices. When stabilizing, reflection turned to moral commitment, exhibited in various forms of sharing meaning with vegans as well as non-vegans.

For materials, we can distinguish between two mutually related areas: First, the materiality of practices, including physical performances, tools used, goods, infrastructures, etc., and second, how such materiality becomes relevant to practice.

For the first, we observed, in keeping with Twine [374], how some participants changed their diet patterns by substituting non-vegan products to veganize recipes and changed from the tripartite structure towards meals that consisted of vegetables and carbohydrates only. Our participants also abandoned a variety of practices involving certain materials such as visiting non-vegan restaurants and buying non-vegan food. For the second, our study reveals

that artefacts help to compensate such loss by supporting the exploration of potential new materials, such as providing access to unknown vegetables, substitution recipes, or raising awareness of vegan-friendly restaurants.

For competences, as outlined by Twine [373, 374], we also observed that a change of competence was linked to and mediated by changed material use. Vegan newcomers must acquire new competences in many areas, such as finding and preparing appropriate food, appropriating existing vegan infrastructures, such as vegan-friendly restaurants in their neighborhood, or figuring out how to make use of online recipe databases. Additionally, appropriate behaviors and actions must be learned and explored, e.g., how to stay politely when the own practice is commented by others or how to offer food to non-vegans without being the ‘killjoy’ [372]. Here, artefacts do not only serve as an ‘awareness’ tool, but also help people to incorporate new elements into their practice. They not only provide facts and information about veganism, but also what Pipek [283] calls appropriation support. For instance, cooking videos show how to perform practices such as substituting eggs when baking macarons.

For communities, artefacts play an important role in connecting vegan newcomers and experienced practitioners either online or (less often) offline. Vegans are sometimes confronted with the reaction by an omnivorous norm, ranging from the merely unhelpful to offensive reactions [372]. Against this background, it is not surprising that social and symbolic support becomes important. Our participants actively searched for like-minded people as they presented a kind of safe space to develop and try out a new vegan identity and role model. They actively oriented to the presentation of their lifestyle as ‘valued’. However, as noted by Warde [385], such communities do not just provide symbolic support, but constantly negotiate rules and norms towards a mutual understanding of how the practice has to be adequately performed.

In contrast to this inner orientation, prior research [186, 163] pinpoints the co-existence and tension of ‘norm’ and ‘odd’ practices. Our study shows that the two are linked in a dialogic relationship. Our participants, as newcomers to vegan practices, negotiate meanings and share knowledge and positive experience with their omnivorous families and friends. Similar to the conflicts

and justification strategies (see [291, 372]), presenting perceived advantages of the new, vegan diet seems to be aimed towards decreasing prejudice and exploring ways to co-exist, e.g., cooking for both vegan and non-vegan guests.

4.4.2 Co-Evolution from a Perspective of ICT Artefacts

We can observe how the composition of the artefact ecology changes with the ongoing incorporation of practices, enabling iterative learning steps that then cause a reconfiguration of artefacts.

Artefacts as irritation and reassurance tools are important especially at the beginning of practice transformation, as they trigger “crises of routine” [306] by productive confrontation [347], for example when challenging existing beliefs about one’s diet when watching documentaries or reading about a food scandal. This irritation leads to a tension that unfreezes existing convictions and dismantles existing linkages between the practice elements, preparing the ground for the emergence of new proto-practices (see [341]). Still, the reconfiguration of the artefact ecology with such media in use does not automatically lead to a practice transformation. At this point, either new artefacts need to be iteratively incorporated or artefacts need to be used in different ways as new practices evolve.

However, from time to time, tools to reassure become important again. This is similar to Engeström’s cycle of expansive learning [106, 107]. In our results, this is shown in the notion of ‘reflecting on the process’ by vegans, providing reassurance e.g., when identifying new meals as sufficiently nutritious by means of diet trackers or reflecting on diet change in more general terms by blood tests after a certain time.

Artefacts as information and learning tools play an essential role in recreating new linkages by exploring a ‘vegan’ material environment as well as supporting knowledge and competence building. Foundation for this exploration, is visibility of practices and the entangled infrastructures, that would otherwise remain hidden within an omnivorous practice regime. As the example of restaurant search shows, applications and information sources, such as HappyCow, are intensively used in the early evolution of vegan practices, but

their use diminishes over time. Similarly, learning recipes or scanning food becomes less important when competences and materials are incorporated, and practices stabilize.

Although certain artefacts seem to decrease in importance with developing environmental familiarity, they re-emerge into the ecology when traveling to an unknown location or stumbling upon a new product when grocery shopping.

Artefacts as communication tools connect vegan newcomers with an (online) community of practice. For example, when tensions with the omnivorous ‘norm’ practices arise, communication tools provide a means for reassurance and defensive strategy. They also provide for more active use, such as exchange about new food, restaurants, or preparation techniques. While communication was mostly online, some communities’ activities shift to the ‘offline world’. In those cases, communication tools enable the formation of an offline community, but once friendships and regular meetings are established, it became less important.

From a more general perspective, the artefact ecology shifts in very contingent ways. Use can be thought of as a kind of “bricolage”—tinkering, exploration, and reassurance, characterized by discontinuities and situational factors. This bricolage has been demonstrated in other contexts [7, 347], sometimes referred to as artful integration [352, 353], or creative consumption [60, 181]. Thereby, change to the ecology of ICT artefacts follows the logic of making vegan practices and practice transformation more convenient. In the beginning, it is the lack of routinization that is supported by ICT, while in later transformation, convenience is provided by again incorporating tools to deal with unusual situations. Still, convenience and the usage of ICT cannot be understood as a luxury problem but as a support of fundamental daily routines and the satisfaction of basic needs when infrastructures and practice elements are invisible. Based on early work on veganism [229], we assume that a lack of such visibility induced by technology would raise the perception of barriers to vegan practices as opportunities, e.g., in the neighborhood, would remain invisible. From a practice theoretical perspective on the technologies, this goes along with media as part of practice, to change meanings, learn com-

petences, explore materials, and enculturate into communities [373]. These different role(s) that are part of practice [373] and their iterative contribution are in contrast to motivational design research that aimed to motivate rational consumers with enough motivational and informational resources [42, 294]. Still, motivation is one aspect of practices, as the documentaries that accompany early vegan practice transformation show. However, these just provide some basic torque for transformation that would quickly decrease if the appropriation of a socio-materiality would be difficult.

CodeCheck, for example, was not designed for vegans. Still, it has become common practice in vegan communities to use it as a tool to determine more details about product ingredients and to avoid unintentionally buying and eating non-vegan food. The search for vegan-friendly restaurants presents another example of such creative consumption: There are specifically designed apps such as VanillaBean or HappyCow for this purpose. However, we also observed that participants adopt appropriate filtering strategies to obtain information about vegan restaurants when using Google and/or Google Maps. In addition, single artefacts are used in combination to support the evolution of practice transformation, as the reflection of the new vegan cooking practices by means of diet tracking shows.

4.4.3 Designing for Co-Evolution of Vegan Practices

Our research uncovered the use of various ICT artefacts along with the practice transformation of Going Vegan, still, there are several blind spots in current design to be addressed by future research and design. Although we argue that no single ICT design transforms practices like a 'magic-bullet', novel and vegan sensitive design could contribute to small steps towards vegan practices and the appropriation of such.

Designing for Value Tensions between Livestock Farming and Consumed Reality: By now design research focused on small changes of practices, e.g., by encouraging organic food consumption [201] or reducing food waste [130]. Often these studies aim to raise awareness about the lived reality of consumption and the therefrom caused environmental impacts [168]. For veganism, to the best of our knowledge, no such study was conducted [168].

While our research observed value tensions between the realities of livestock farming and consumer values, as well as information on perceived barriers of change, to cause reflection on consumption patterns, it remains unclear how to successfully design for encouraging (more) plant-based consumption. An interesting approach is the various challenges, e.g., Veganuary (<https://uk.veganuary.com/>). However, also linking effects of own consumption patterns to the conditions of livestock farming, environmental, and health impacts might be promising. At this point, tying up to previous work on visualizing organic food consumption [201] shows paths for awareness-raising designs. Still, vegan design needs supply-chain information, e.g., place of origin, living conditions, and transport conditions. Furthermore, how to communicate and design such information remains an open gap between research on vegan practices and environmental psychology.

Designing for Visibility of Consumption Infrastructures: While our research observed various tools to increase visibility and learning of consumption infrastructures, these still only cover restaurants and supermarket food. To facilitate practice change, future design should focus on other infrastructures, such as clothing and cosmetics or furniture. Thereby, it is not only about the products, but also entangled services, such as hairdressers that offer plant-based cosmetics or clothing companies that do not test their colors on animals. Given that our research mainly focused on food, future design research first needs to understand the visibility and perception of such infrastructures, especially against the background of satisfying the basic needs of daily life. Indeed, recent work on the practice of food teaming shows how a perspective on consumption infrastructures, their perception, substitution, and visibility is helpful to inform design [295].

Designing for Tradeoffs with Family and Friends: Having discussed the idea of more infrastructure aware design, still, it remains open how to bridge the gap between expectations of family and friends and their practice [372] e.g., on what a proper eating-out location is and one that is vegan friendly. By now, there are apps such as HappyCow for vegans and tools such as FourSquare or TripAdvisor that are used by regime practitioners. Bringing both ICT designs together to allow finding places, where vegans and their family and friends are satisfied, should be addressed in future research. More strongly including

the making of trade-offs in such filtering and search mechanisms for infrastructures could reduce social tensions, decrease the perception of vegans as killjoys, and finally facilitate diffusion as barriers between practices are reduced.

Designing for Label and Ingredient Transparency: Against the background of missing European or national issued legislation on a consumer-friendly definition of vegan products and labels [138], future design should research current efforts of vegans to check and discuss ingredients, in particular with apps such as CodeCheck, to provide a transparent and unique interface for checking vegan qualities of products. An additional feature of this could be the inclusion of social, information e.g., vegan negotiations in social media about products. Bridging social information on products, ingredients tables, producer information, and transparent label information together could be an improvement of current services. Also, non-food products should be included in the related databases, as this is currently a blind-spot.

Designing for Learning Taste and Substitution: A particular blind-spot of current vegan design is substitution and the learning of new tastes. Already in the 1950s, Becker [23] showed how learning new practices comes with the learning of taste. In addition, Twine [374] also observed how vegan practitioners over time transition from an omnivorous regime taste to a celebration of plant-based foods. However, design does not yet support such iterative exploration of vegan foods. Recommender systems, although yet not designed for special diet requirements [370], offer the technological foundations to understand current consumption and recommend foods for the future. Therefore, future research should bridge the gap between the basic ideas of self-actualization and sustainable consumption in recommender systems and the process of learning new tastes. Here, it could be tied up to and extended on research that already explored recommendations based on flavor components [9]. For example, recommendations could start with substitutes that fit into beloved recipes and taste like meat, e.g., supermarket burger substitutes and then gradually shift and prepare towards pulses, tofu, and other vegan options. With such mechanisms, not only taste, but also competences, could be learned over time.

4.4.4 Designing for Co-Evolution of Sustainable Practices

Veganism might appear to be a somewhat narrow focus of interest, but we want to argue that it forms part of a developing, and increasingly important nexus of practices associated with ‘green consumerism’ and even ‘anti-consumption’ [33]. As we have seen, veganism is associated with complex and co-evolving practices and artefacts. An understanding of these new constellations from a more general perspective should bring attention to the same co-evolution if we are to design for sustainable practice formation in general. For other practices associated with green consumption [130, 163], designing for change might require the same understanding of many learning iterations co-evolving with artefacts and how they integrate with emerging communities of practice.

Designing for Crises of Routine: As most of our participants highlighted a specific event or documentary that caused a “crises of routine” [306], persuasive design and gamification still might play an important role, as a starting point for co-evolution. Although these approaches are critiqued for not considering the socio-material context [150, 332], we observed that triggering initial change is often a function of ‘awareness prompting’. That is, exposure to documentary and other formats can trigger this crisis of routine. Certainly, initial triggers of one kind or another seem to play an important role. The routines of Hasselqvist et al.’s [163] participants, for example, were brought into crises by challenging them to not use their cars anymore. How best to incorporate such triggers into design is an open question, since there will be ethical and other issues to contend with, as we cannot simply adopt showing slaughterhouse content. Persuasive design might, at these early stages, remain a viable proposition.

Designing for Iterative Learning of Practices: Once change is initiated, rather than designing for practice transformation as ‘absolute change’, we should focus on smaller iterations of learning the materials and competences for the new practice, as an appropriation of niche infrastructures. This involves exploring the infrastructure of restaurants and stores nearby, learning which ingredients are vegan, and building new cooking competences. However, evolving knowledge and competences change use, as with the restaurant tools we

describe above. Similar evolutions can be seen with the move to car-free mobility [163], where appropriate travel planning tools are appropriated, used, and then abandoned. Another element of this process is the monitoring or tracking behavior as a reflection on the process that we observed with diet trackers and is also highlighted in other research [130].

Designing for Artful Integration and Alignment: However, what is currently evident is that there is no integrated provision for these heterogeneous practices, nor for different learning strategies. Multiple artefacts exist and are used but no current facility exists for integrating them. This is similar to the work of Ganglbauer et al. [130] who show that changing food-wasting practices needs multiple interventions. Therefore, design should be flexible enough to be abandoned, recombined, and used in completely different ways, in short enabling artful integration by the users. On the other hand, designers can use the dialectic relationship with tools to resolve tensions arising from the entanglement of practices, e.g., diet trackers to change the meaning of vegan meals and recipes to learn the necessary competences to, in short, align the appropriation of artefacts and the learning of practices.

Designing for Tension between the Odd and the Norm: Design should be sensitive about the niche existence of practices and the difficulty arising from being perceived as the “odd” [163], “going against the [. . .] society” [186] or the “killjoy” [372]. Therefore, rather than breaking all ties to the ‘norm’ practice and its community, design should reconcile both, e.g., designing for ‘veganization’ of meals in omnivorous recipe apps, rather than directly providing completely new and unfamiliar recipes. This is similar to Hasselqvist et al. [163] who already suggest including sustainable modes of traffic in regular planning tools, creating visibility of alternatives, rather than providing for separate and already decided use. In addition, it is exactly this tension that causes some instability of niche practice even after most of the learning has happened. Here, design can play distinct roles, on the one hand by creating safe spaces for the community, allowing for support, reinforcement [186], and temporary withdrawal, and on the other hand, allowing for productive exchange between the different communities. Both artefact usages have been observed in our study, with participants using online groups to be not exposed

to commenting by the ‘norm’ and at the same time sharing pictures of vegan meals to create visibility for their ‘niche’ and decrease prejudice.

Co-Designing with Practitioners: Lastly, we want to reflect on the retrospective perspective of our research and the reflection on ICT usage along the practitioners’ transformation journeys. For this purpose, we want to come back to the quote we used at the beginning of this paper: “Yet this rarely sets out practically how such reduction might be achieved and, surprisingly, has yet to look to vegans as a knowledge resource.” [373]. While the idea of studying practices [130, 168, 294] and involving practitioners [307] is not a new one, often the starting point of design is the research of unsustainable practices. This usually leads to designs that just cover the first iterations of change, such as increasing the motivation of consumers or raising awareness about their unsustainability [168, 294]. At this point, we do not want to argue that unsustainable practitioners should not be included in the co-design process, but that complementing design ideas with success stories and the experiences of already sustainable practitioners will allow for a more nuanced understanding of barriers of transformation, ICT designs that are practice-proven, and blind-spots in the ICT ecology.

4.5 Conclusions

Our research uncovered how vegan practices and the usage of ICT artefacts co-evolve. While our results at first sight only contribute to the study of vegan practices, we argue that co-evolution is a helpful lens to study and design for sustainable practice transformation in general. From this perspective, the role of persuasive design and gamification should be reconceptualized as a trigger for the “crises of routine” and reassurance when doubts arise. Understanding the role of different artefacts in knowledge and competence acquisition, and in supporting membership of evolving communities of practice, we suggest, has been under-rehearsed and will require ever more attention as sustainability becomes part of the mainstream agenda. Furthermore, we argue design should focus on the border between the ‘norm’ and the ‘odd’ to foster learning, exchange, and to support the negotiation of elements. Finally, we discussed how a retrospective perspective and learning from success stories

complements practice research to inform design. For veganism, in particular, we formulate paths for future design and research:

- Designing for Value Tensions between Livestock Farming and Consumed Reality, to encourage plant-based consumption practices and raises awareness about the gap between values and consumed reality.
- Designing for Visibility of Consumption Infrastructures, that make vegan-friendly infrastructures and therefore vegan materiality visible, not only for restaurants and food but also for clothing, cosmetics, and various other services of daily life.
- Designing for Tradeoffs with Family and Friends, to allow bridging that gap between omnivorous and vegan practices, such that leisure time activities and shared usage of infrastructures is facilitated.
- Designing for Label and Ingredient Transparency, to support easy access to the information on vegan qualities of products and its labels against the background of social meanings of what veganism is about.
- Designing for Learning Taste and Substitution, to support the exploration of vegan substitutes, recommend new foods with awareness to the practitioners' taste, and iteratively support the acceptance of vegan foods especially protein sources and the learning of related competences.^f

Reflecting on current ICT designs and the needs of the community, it is worth mentioning that a focus on food practices is a good starting point, as most participants' individual transformation journeys started from food practices.

However, with the ongoing transformation questions of veganism and the relation to other consumption domains arose, such as clothing and even furniture. Therefore, design should broaden the perspective and besides food encourage a holistic perspective on veganism and related designs. Still, detailed investigation into design ideas and the related practice(s) is needed to sharpen the ideas presented here.

Our results are limited by the fact that we interviewed vegans, who successfully managed to undergo a practice transition. Therefore, in future work, it will be interesting to focus on participants who are either still uncertain about their diet change or who attempted unsuccessfully to transform their practices., e.g., through the absence of technology. At this point, it is of particular interest to quantify the impact of ICT in future work. Furthermore, the absence of elderly people, who might have different artefact ecologies, and the small sample size, limits our work. The elderly group, given demographic change, should not be underestimated when aiming for sustainable transformation. Also, for the background of quantifying the impact of ICT for practice change, recruiting a representative and bigger sample should be addressed in future research.

In light of the urgent need to transform our (diet) practices [147, 366], our work contributes to both theory and ICT design: Regarding theory building, our findings shed light on the transformation of consumer practices by making aware about the co-evolutionary process of using ICT artefacts in making consumer practices vegan and in general more sustainable. Our study uncovered common patterns of self-reflection, learning, and enculturation together with the adoption of new goods and infrastructures and how this transformation is accompanied by ICT. Regarding ICT design, we inform to broaden the scope of ICT to go beyond persuasion. We aim to inspire designers to develop interventions that support a shift towards more vegan and other sustainable consumption practices.

5 From Surplus and Scarcity toward Abundance: Understanding the Use of ICT in Food Resource Sharing Practices

Abstract

Food practices have become an important context for questions around sustainability. Within HCI, SHCI and HFI have developed as a response. We argue, nevertheless, that food practices as a social activity remain relatively under-examined and further that sustainable food practices hinge on communal activity. We present the results of action-oriented research with a grassroots community committed to sustainable food practices at a local, communal level, thereby demonstrating the role of ICT in making food resource sharing a viable practice. We suggest that the current focus on food sharing might usefully be supplemented by attention to food resource sharing, an approach that aligns with a paradigm shift from surplus to abundance. We argue for design that aims to encourage food resource sharing at a local level but that also has wider ramifications. These ‘glocal’ endeavors recognize the complexity of prosumption practices and foster aspirations for ‘deep change’ in food systems.

5.1 Introduction

Food is more than simply consumption. It connects people through their social need for solidarity [343] and sharing food serves as the “bedrock of human civilization” [82], linked to fundamental aspects of sociality, including emotional affect, care and empathy, and social solidarity [197, 200]. Grimes and Harper [153], for instance, demonstrated the celebratory aspects of food sharing. Similarly, Comber et al. [69] have drawn attention to the situated aspects of food sharing in the home. Nevertheless, the literature on food sharing to prevent food waste mainly deals with the redistribution of surplus for consumption [251], either as ‘charitable’ activity [92] or a form of ‘gift giv-

ing' [28, 29]. Arguably, less attention has been paid to 'innovative' forms of food sharing in relation to the possibility of what we will call 'food resource sharing' (see Table 2).

Food Sharing	Food Resource Sharing
- Esp. foods and food products	- Esp. seeds, crops, plants, soil, fertilizer, etc. to produce food and reproduce food resources
- Current focus on redistribution of surplus	- Including knowledge, expertise, recipes, etc.
- 'Sharing for money'; 'Sharing for charity'; 'Sharing for community' [251]	- Including spaces for communal gardens and other activities
- Current theme of 'scarcity'	- 'Sharing for community' striving towards self-sufficiency
	- Emerging theme of 'abundance'
→ Consumption-oriented	→ Prosumption-oriented

Table 2: Juxtaposing Food Sharing and Food Resource Sharing

In what follows, we describe a small-scale local initiative which aims to encourage local production, arguing that there are lessons to be learned from such studies. They provide a needed conceptual focus on alternative approaches to both consumption and production and offer a potential route to systemic change. Our objective is to refocus attention away from notions of scarcity towards a cooperative view of both consumption and production practices. Thus, our research aims were threefold:

1. To describe alternative, cooperative, local food production activities
2. To reconceptualize HFI in relation to both consumption and production
3. To examine the role of ICT

Our work responds to the demand for a 'deep change' in food systems in terms of "values, consumption and production practices, as well as politics allowing for deliberation and grassroots mobilization" [386]. As part of this 'deep

change’ (a blanket term for transformation/transition), “grass-root organizations promote and engage consumers and small-scale producers in adopting non-conventional practices of producing and consuming food” [386]. Grass-roots initiatives open up spaces for participation, using bottom-up and decentralized approaches [141, 335].

In this paper we aim to examine how HCI can best deal with challenges to the global food supply chain. Such challenges have been brought into sharp relief through disruptions due to Covid, the recent disruption to grain supplies resulting from the war in Ukraine, and the effects of global warming on crop failure. They are, as Moore [256, 257], puts it, an aspect of the ‘capitalocene’. Fostering local food production brings with it several benefits, not least in terms of community development and ecological and economic sustainability. Moreover, the growing of such local initiatives may become scalable with the support of new technology. Below, we investigate local food resource sharing practices as part of a small, action-oriented research project within a local grassroots community (Foodroots Community), connected to a larger grassroots movement called ‘Foodsharing’ [132]. In the context of the local community the ‘chili-sharing project’ (Chili Project) emerged, in which a number of chili plants were given to adoptive parents. Participants were invited to join a Telegram group in order to support the growth of a community of interest [121].

Our contribution does not provide specific implications for design, but rather proposes a novel space regarding ‘abundance’. We describe this as an approach to food resource sharing. We should stress here that we are not arguing against redistributive efforts (indeed, other elements of our project work engage in redistributive activities)¹ but argue for increased focus on community building. This brings benefits others have remarked on [29, 92] and is more marked if food redistribution is linked to other sustainable food practices, particularly productive practices such as community cooking or gardening. The paper recounts, then, a broadly evaluative study of local food resource sharing, the implications of this sharing, and the tension between the focus on redistri-

¹These include a twice-weekly redistribution of food rescued through Foodsharing which takes place next to a newly established community garden, regular cooking and meeting nights (supplied with rescued food), or a free store where all items are offered free of charge.

butional surplus and that of local production. In keeping with the principles of the sharing economy, we advocate for a non-rivalrous approach towards abundance. Our understanding of food resource sharing involves a complex engagement with prosumption (see e.g., [286]) in sustainable food practices at a local and communal level. In relation to the urgent need for a ‘deep change’ in food systems [386], we discuss how ICT might support the scaling up of small localized to ‘glocal’ efforts. Although grassroots initiatives can lead to sustainable practices [335, 386], if they are to do so at a scalable level, we need to understand their various practices, the related challenges, and the different roles that ICT might play [274, 354, 359].

5.2 Background and Related Work

There are pressing and powerful reasons to see food redistribution as only one part of the challenges associated with global food supply chains. Food systems currently account for 21-37% of total greenhouse gas emissions [245]. For this reason, the 2021 Glasgow Declaration at cop26 “brings together all types and sizes of local authorities” to declare their “commitment (...) to tackle the climate emergency through integrated food policies and a call on national governments to act”.² Both consumption and production within a nexus of global capitalist production have been subject to critical scrutiny for some time. Schumacher [329], an economist famously responsible for an economics ‘as if people mattered’, argued that “production from local resources for local needs is the most rational way of economic life”, thereby promoting an idea of technology that was appropriate to the scale of the community. In a similar vein, Illich [190] proposed ‘tools for conviviality’, in order to “give people tools that guarantee their right to [...] independent efficiency” [190]. More recently and in specific relation to food production, it has been pointed out that food shortages and food insecurity are largely a consequence of capitalist wealth production [10, 235, 271].

²https://www.glasgowdeclaration.org/_files/ugd/fe8dc_673ef074e0dc49769cad57f538c6333c.pdf

5.2.1 Human-Food Interaction

Within HCI, the field of HFI has engaged with these issues historically on the basis of support for problematic individual experience (see [14] for a review). We found that food sharing practice research within HFI mainly engages with the avoidance of food waste through redistribution. Notable examples include a longitudinal assessment of ICT tools developed to recover and redistribute food surplus [66] and design implications as they relate to food systems and food waste [131].

A growing body of literature argues for the importance of understanding practices, routines and habits in order to support change, e.g., [67, 225, 339]. In line with this, the relevance of sociality is becoming more recognized. Dombrowski et al. [92], for instance, point out that food sharing, in order to be effective, requires provision and needs to be matched in some way. An important element of their work is that they draw attention to the complex factors that govern food resources and their allocation. They also note the work of ‘gleaners’ in relation to food production. Prost et al. [295] detail the collaborative work undertaken in “planning, prototyping and launching a food hub”. Berns et al. [28, 29, 30] demonstrate the social factors that govern alternative food distribution policy in a Copenhagen grassroots initiative, drawing on the metaphor of ‘gifting’ to examine the meanings that volunteers attach to their work and the practical methods they adopt to support community goals and values.

Norton et al. [270] conclude from their five-year ethnographic study with two grassroots sustainable agriculture communities that “[d]eveloping information systems based on the values and practices of sustainability communities [...] has the potential to transform the information system landscape to one that can support the design and development of sustainable agriculture, if not to one that is broadly sustainable and equitable”.

5.2.2 Sustainable HCI: Consumption and production

In the wider literature [61, 110, 321] as well as in related contributions to HFI and SHCI, the redistribution of surplus food has become a topic of some

interest [29, 66, 132]. Surplus food redistribution in the context of food sharing generally means that edible food is collected before being thrown away and then passed on to individuals, organizations or communities [83]. In investigating ICT-mediated food sharing initiatives in 468 urban areas and 91 countries, Davies and Legg stated that “much of the established food sharing, such as emergency food relief, focuses on the redistribution of food products to those in need” [82], which Michelini et al. frame as ‘sharing for charity’ [251].

After more than a decade of SHCI research, the community is still conflicted with regard to definitions of sustainability and thus also with regard to how HCI can address it [211, 212, 342]. The importance of the interplay between economic, ecological and social levels is now acknowledged among sustainability scholars [297]. This was recognized in the “three pillars” of sustainability in the 2002 United Nations Declaration on Sustainable Development [378]. Hirsch et al. reflect that the convergence of these factors has been overlooked due to “an emphasis on (predominantly urban and middle-to-upper-class) consumer behavior” [180]. A focus on persuasive design [123] that aims at small changes in consumer behavior and small corrections to the way people can achieve their ambitions has also been dominant. Persuasive design in regards to sustainability has been reviewed critically [42, 210], especially with regard to long-term effects, e.g. [330, 331].

In this context, research has progressively focused on the synergetic interrelations between production and consumption and has therefore investigated ‘prosumers’, who act in both productive and consumptive capacities [310]. In recent years, there has been an increase in research aimed at understanding and supporting prosumers, for instance, in the context of energy [152, 253] or food [252, 259]. The spread and appreciation of food cultivation in home [145] and community gardens [133] is based on real or perceived individual benefits through the promotion of health and nutritional aspects, access to nature and the creation of opportunities for social engagement [402] as well as for well-being [137]. Recent work has aimed to enable ‘growth on the ground’ in terms of the active democratic participation of ‘food citizens’ in a local food hub [295] or to support urban foraging [88].

5.2.3 ICT and Scaling

The role of IT has been explored in HCI and there are growing calls for scaling up actions that address sustainability [211]. Some contributions have sought to understand how design can support at the community level [32, 233, 234]. In examining a Danish organic food community and its artefact ecology, Bødker et al. observed three phases: becoming a community, being an everyday community and building anew [48]. Similarly, Biørn-Hansen and Håkansson identified three design implications for scaling up change based on interviews with ten sustainability-oriented community organizers [32]: (1) “design to tap into existing resources and infrastructures when possible, and try to re-define ‘original’ practices”, (2) design “[to foster] the collaboration between similar grass-root initiatives” and (3) design “to empower community organizations and similar groups not only with technical solutions but also with ICT knowledge and skills”. Practical approaches include Foodsharing, a German-speaking movement that is supported by a platform (foodsharing.de) [314, 321], a Facebook page [132] and its publicly accessible distribution sites [261]. ‘Commoning’, as it is often called [61, 261, 380], has frequently entailed innovative experimentation with ICT in the field of urban food sharing [29, 79, 82]. ICT-supported food sharing can support sustainability by increasing efficiency along the food chain [110], diversifying income streams and improving food security [82] as well as by leading to the building and maintenance of lively and meaningful social relationships [29, 30] and paving the way for new economic vitality [36, 327]. Davies et al. have demonstrated that food sharing protagonists consider “ICT as a key driver in the stretching of spaces across which sharing can take place, extending the potential for sharing beyond kinship or familial interactions to an activity that can occur between strangers or bring diverse groups of people together through new communities of sharing practice” [82]. Jaeggi and Gurven emphasize that “[f]ood sharing is a fundamental form of cooperation that [...] is particularly noteworthy because of its central role in shaping human life history, social organization, and cooperative psychology” [191]. In the context of food sharing, practices such as community gardening and urban food-growing

communities [169, 170, 171, 236] also exist, but to understand the role of ICT and scaling in this context there are still further investigations needed [14].

Addressing the issues of platform capitalism (e.g., scaling for profit), recent contributions have reflected on the positioning of co-design [18] and invite the Participatory Design community to look into the commons and commoning [35]. Poderi, for instance, bases a “paradigmatic case of platform as commons” on FOSS [287].

According to Hirsch [180], research on small-scale food production lies at the heart of the SHCI debate described above. If true, then grassroots initiatives that seek to bring about economic, environmental and social change should be a focus. These movements are a wellspring of innovation [335] and have the power to leverage the resources necessary for a transformation towards sustainability [117, 357]. Collective actions are often organized and coordinated using various digital artefacts, but HCI still lacks a wider understanding of grassroots movements and their communities, their operating cycles and the role that technology plays in shaping identity, promoting collective actions and supporting community engagement [274]. Some recent comparative work has urged caution about ‘scaling’ seen as a technical matter and shown the distinct pathways that grassroots communities can adopt in pursuit of change [220] and draws attention to the different senses in which we can talk about, in their words, proliferation, and the need to understand the ecology of practices involved.

5.2.4 Sharing economy as a challenge to global capitalism

As mentioned above, much of the current HFI research in the context of food sharing practices supports food sharing to avoid food waste. The platform foodsharing.de, a major element of the food sharing movement in Germany, exemplifies this. Ganglbauer et al. describe the early years of the grassroots movement, its Facebook page and the platform that enabled the peer-to-peer function ‘food baskets’, through which users could share food with other people. Here, too, the main motivation of the initiators and participants was to create awareness of – and thus to avoid – food waste [132]. Additional functions after a merger with another service – ‘savingfood.de’ (lebensmittelretten.de)

ten.de) – included coordinating pick-ups from food supermarkets, canteens, etc. It has been argued among volunteers and other stakeholders in foodsharing.de, however, that the platform militates against local, face-to-face meeting and further that pursuing the redistribution of surplus for profit reasons can create a market interest in maintaining food waste.

Grassroots initiatives that pursue the goal of preventing food waste, by achieving this goal, arguably make themselves unnecessary in the longer term (as stated in the wiki on foodsharing.de and in [28]; see also [368]). Thus, any wider benefits in relation to participatory and/or educational objectives are unlikely to be met if food redistribution is not linked with other sustainable food practices, such as cooking together or community gardening. The distinct separation between provider and beneficiary remains, especially in ‘sharing for charity’ [251], and a stigma is attached to ‘low-income’ contexts [273]. That is, self-sufficiency is not a significant feature of the agenda and instead remains only a means to redistribute existing – and finite – resources. Put simply, mere food sharing has an opportunity cost: the more I share with you, the less I can share with anyone else.

In this way, debates about food sharing parallel debates about the wider ‘sharing economy’ (the term has no agreed-upon definition and is also called ‘collaborative consumption’ [36]) and about the degree to which the so-called ‘zero-marginal-cost’ society [309] poses a challenge to capitalism. The debate on the sharing economy [225] has, in particular, led to the critique of its (sometimes) profit-oriented foundations [81, 234]. There is little doubt, as Norton et al. point out [270], that “[u]nsustainability in food systems is predicated on inequality. For actors in a food system to regain and retain sovereignty, they must have an ability to control the production of their own food. Currently, a few global actors control a majority of global food production; this leads to inequality and unsustainability on several levels.”

Landwehr et al. explore an example in which reclaiming food sovereignty involves precisely a confluence of production and distribution/sharing practices and the role that ICT can play in supporting these practices [223]. Moreover, at the surveyed Community Supported Agriculture, the authors discuss, ICT

was central to achieving demand orientation, which strengthened trust in the farm and ultimately the solidarity between community members.

In the following, we use the term ‘sharing’ in Belk’s sense [25, 26]. This excludes commercial transactions and the platforms upon which they are transacted. Thus, to reiterate, one part of our objective is to refocus attention away from notions of scarcity – closely allied as they are to orthodox economic conceptions of marginal utility for the consumer and marginal cost for the producer – and towards a more genuinely cooperative view of consumption and production practices – one that is associated with the concept of the ‘prosumer’ [311].

The focus on food resource sharing that we provide below aims to – at least to a degree – dissolve the distinction between ‘rival’ and ‘non-rival’ goods [54, 265]. In orthodox economics, almost all private goods are rivalrous, meaning that use by one person precludes use by another. We advocate for a move towards a view that emphasizes a more ‘public’ or shared conception of goods. As Norton et al. [270] argue, “[a] priority is to work with small, highly motivated social movements on bottom-up change toward food sovereignty, while considering the policy context”.

5.3 Context: The Grassroots Community and Its Project

Foodroots Community is a local grassroots community organized around sustainable food practices. Many of the founding members have been part of the local district of the wider grassroots movement of Foodsharing (foodsharing.de). The community has been involved in a wide range of activities which include community gardening, community cooking and food (re-)distribution. Various projects are run independently, though they sometimes overlap. Over about eight months, around 7–10 people organized communal events, came together for discussions and initiated projects that had inclusive, pluralist intentions. Over 100 other people contributed at different times and in various forms. At the beginning, two workshops on the vision of the Foodroots Community highlighted the need to encourage connections within the community through mutual learning and to foster inclusivity by encouraging people to

share and contribute what they can and especially to bring together different generations and cultures. We note that COVID-19 has, at certain points, influenced the project through physical distancing. Severe restrictions were in place for about 15 months, so engagement then necessarily took place through the use of ICT, although the people were all based in the same locality. Nevertheless, a significant part of the activities described took place after restrictions were lifted and the project has lasted for over two years. The Telegram group, in particular, proved – as we shall see – to be a significant vehicle for the various activities that surround food resource sharing. We will argue that, although its use was initially prompted by external factors, there are clear lessons here in relation to scalability.

The coordination and organizational structure of Foodroots Community is informed by ‘hierarchy sensitivity’. Participation is always welcomed and supported. Ideologically, it was felt that supporting self-empowerment processes, rather than coordinating centrally, was desirable. This was prompted by the realization that the existing platform (WeChange) was underused and that participation in organized meetings had been declining. Thus, while 2–3 online meetings per week were held early on, these were not followed up over time because many participants felt that “too much was planned and too little was done”. WeChange was largely dropped by the active organizers of Foodroots Community after some time. The overall lack of use (and maintenance) of WeChange led to an increasing focus on Telegram, in which several subgroups – for example, for construction work, cooking events or an info-channel – were created. The use of Telegram, even so, also tends to be associated with specific activities.

The idea for the Chili Project was shared by Alina, one of the active organizers, during one of the first video chats and was received enthusiastically. Alina proposed that, having grown a number of chili plants, these be shared amongst ‘adopters’. Adoptive parents were offered a digital communication platform with the aim of learning about the care, diversity and growth of plants as well as about harvesting chilies and distributing seeds. After a first brainstorming session, the contributors agreed to invite children and elderly people, in particular, because they thought that this process would involve people outside of their own ‘social bubble’. The initiators set up both, the Telegram group

and mailing list so that the participants could ask questions and the experts would then provide answers, and from the questions they would create learning modules that would help the adoptive parents with care and harvesting. From providing two different ICT-mediated ways to participate, the organizers aimed to be as inclusive as possible: Telegram was already a platform used by many sustainable initiatives in the city, while a mailing list was estimated to have the least barriers for the majority of participants. Advertising was done personally and through social media. In addition, Author One invited retirement homes, and two joined the project.

Telegram is a cloud-based messenger application that enables message exchange between users, group messaging and the channel-based distribution of information as well as third-party application integration and audio and video calls on smartphones, browser clients and desktop applications. In addition, the secret chat feature provides encrypted user-to-user messaging. These messaging capabilities have enabled communication for vast digital communities ranging from political organizations and local sharing communities to communication among friends, colleagues, and family members.

5.4 Method

5.4.1 Authors' Positioning

This study draws on an action-oriented research approach [164], defined as, “generating knowledge through applied collaborative activist-community interventions that can simultaneously contribute to local communities and add to general knowledge”. Author One has been involved in the German Food-sharing movement for seven years and worked as an activist with the designers and developers of the open-source platform ‘foodsharing.de’. About four years ago, Author One left these national and international endeavors of Foodsharing and engaged more locally with Foodsharing in city *A*. This was prompted by the desire to rethink the problem of global food supplies by focusing on what can be done locally. Therefore, the aim was to understand how to extend the scope of sustainable food practices by including food literacy, communal gardening and communal cooking and to understand what

role ICT plays in that. This involved, *inter alia*, working with the owners of three recently founded community gardens and a communal kitchen in city A. This has meant systematic, long term active involvement in the emergence of Foodroots Community. He has been substantially responsible for coordination and organization (like scheduling or moderating a meeting). For Chili Project Author One was one of three main organizers.

5.4.2 Data Collection and Analysis

To better understand food resource sharing practices, we draw on various datasets in order to provide a rich understanding of the context of Foodroots Community, from which the Chili Project emerged, and the role ICT played in food resource sharing within the Chili Project (see Table 3).

Firstly, this included data from the Telegram groups in Foodroots Community as well as the WeChange platform and recordings from video chats of Foodroots Community (a time period of three years). Members were self-recruiting- we placed no restrictions on who might wish to get involved. Personal engagement was documented by field notes. Secondly, we monitored and collected data from a mailing list and the Telegram group through which the Chili Project was coordinated. The data for the Chili Project includes the period of its start in February 2020 until the start of the second Chili Project in February 2021.

Author One conducted 21 semi-structured interviews: 20 in person (3 interviews were conducted with 2 interviewees being present) and 1 via video chat in order to gain more insight into emergent themes using an interview guide. The interviewees were participants of Foodroots Community and/or Chili Project and were asked via a private message on Telegram for an interview. The interviews covered questions about community, food (resource) sharing practices, community and sustainability as well as areas in which ICT might support (desired) practices. Furthermore, we asked interviewees about their view on contributing to a change towards sustainability on a local and global level. The interviews were 79 minutes long on average, with the shortest lasting 18 minutes and the longest 142 minutes. The interviews were transcribed for further analysis. The age of the interviewees ranged from 20 to

78 years, and the average age was 44 years. Among the respondents were 19 women and 5 men. Their professions were diverse.

We analyzed our data by drawing on the thematic analysis approach [360]. Author One repeatedly re-read the materials (especially transcriptions, field notes and Telegram conversations) and organized the material by using a fundamentally inductive approach, grouping selected data items together for similarities. The emerging themes were then discussed with the other authors and iteratively developed into the categories presented below. These processes were ongoing and took place over a long period of time, not least because new data was continually available. All quotes of the interviewees below have been translated into English from German.

Finally, our research was conducted in accordance with ethical guidelines established by the university the authors worked for, and included guarantees of anonymity and permissions for data to be used. All participants who joined the Chili Project were informed about the active role of Author One in the group. All participants to Foodroots Community were informed about Author One's research activities, and all the interviews were conducted in line with privacy- and data-protection requirements. Pseudonyms were used for both the names of the involved grassroots community and its project, as well as for the participants.

No.	Pseudonym	Age	Employment	Telegram Group
1	Michaela (f)	48	Caregiver for elderly people	Chili Project
2	Marietta (f)	40	Head of retirement home	Chili Project
3	Stephanie (f)	20	University student (social work)	Foodroots Community
4	Nina (f)	55	Nurse	Foodroots Community
5	Linda (f)	45	Social educator/ Kindergarten	Foodroots Community, Chili Project
6	Thomas (m)	31	Programmer/ self-employed	Foodroots Community

7	Luisa (f)	72	Retired; head of an internet café	Chili Project
8	David (m)	29	University student (social work)	Foodroots Community
9	Merle (f)	28	Educational assistant	Foodroots Community, Chili Project
10	Alina (f)	29	University student (agricultural sciences)	Foodroots Community, Chili Project
11	Bea (f)	73	Retired	Chili Project
12	Rosina (f)	64	Retired	Chili Project, Foodroots Community
13, 14	Tom (m) & Carina (f)	T: 29; C: 30	T: Administration; C: Teacher	T: none; C: Chili Project
15, 16	Lukas (m) & Kim (f)	L: 78; K: 71	L: retired; K: retired	none
17, 18	Paule (f) & Dennis	P: 23; D: 23	P: University student (social work); D: Nurse	P: Chili Project, Foodroots Community; D: Foodroots Community
19	Naomi (f)	25	University student (HCI)	Chili Project
20	Petra (f)	42	Kindergarten teacher	Chili Project
21	Therese (f)	78	Retired	Chili Project
22	Vera (f)	28	Development aid worker	Chili Project, Foodroots Community
23	Udo (m)	28	Social worker	Foodroots Community
24	Sandra (f)	59	Librarian	Chili Project

Table 3: Interview participants

5.5 Results

In the following, we present our results in relation to the Chili Project in order to answer the question about the role that ICT plays in the food resource sharing practices of grassroots community. Our particular focus is on the social aspects of sustainability practices that are made manifest in the interplay of humans, food and technology. The results are presented in the context of the Foodsharing movement which as we have pointed out, mainly aims to save and redistribute surplus (chapter 5.3). Author One had joined the local Foodsharing community in city_A as an action researcher aiming to orient the group towards wider food sharing practices and with a view to getting a better sense of the role of ICT as membership grew (chapter 5.4).

After the chilies were distributed, ICT opened a common space for interested participants and supported them in the sharing of food resources with each other on an ongoing basis, including resources beyond chilies, chili seeds, or experiences growing chilies. We were able to observe and elaborate below on how, with some face-to-face support (pre- and post-Covid) from the action-orientated researchers for the volunteers and guests, a Telegram group was sufficient for further food resource sharing practices to take place on a continuing basis. We argue below, in relation to the global challenges posed by capitalism (section 5.2.4) and the urgent need for ‘deep change’ in food systems [386] that there are possibilities for scalable networking effects in the interplay between local actions and global challenges.

5.5.1 Supporting the Emergence of a Community of Interest

5.5.1.1 General Insights

To adopt a chili, interested people were invited to write an email to Foodroots Community. Before the chili plant was handed over to the participants, they were asked by email if they would like to participate in Telegram and were invited to do so with a link. While most participants picked up their chili plant, some chilis were also distributed to participants’ homes or to participants ran-

domly on the street along with an invitation to also join the Telegram group and mailing list.

Of the approximately 70 people who adopted a chili-plant, 48 found their way into the Telegram group. Those participants who did not join sought no interaction with a wider community but were ‘just’ interested in getting a chili plant. There were a total of 757 messages and 388 reactions in the group over the period of time we monitored. Of the 48 participants, 5 made no contribution, 22 made less than 10 contributions, 12 contributed between 10 and 29 times, 5 contributed between 30 and 59 times and 4 contributed between 60 and 95 times. The self-designed stickers (which were drawn for the first info flyer that was handed out together with the chili plant and which was later digitalized by Vera; see Figure 6) were sent 27 times. All participants interviewed reported that they had enjoyed participating in the Telegram group, actively contributing to the conversation or checking for news every day. The conversations in the Telegram group were described as “effervescent, active and funny” by Vera, and Sandra reported that the group had “a good atmosphere”.

All participants provided their email address and were put on a mailing list. In total, two emails were sent from the organizers but received no further response. The mailing list was abandoned afterwards.

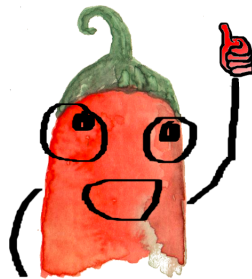


Figure 6: One of the Telegram stickers.

Over the five months of the Chili Project (see [104]), communication mainly took place via the Telegram group. Project initiators considered a video-chat function, but this turned out to be of minor interest to the participants, especially if the communication was unfocused, but some were interested in specific topics. For some participants, the Telegram group of the Chili Project

was the only purpose for which they used Telegram. For them, Telegram was their ‘chili platform’. Later, some joined the other Telegram groups of Foodroots Community, and Telegram was perceived their ‘gardening platform’. All participants who had not used Telegram before explained that they were familiar with the interfaces of other instant messengers, such as WhatsApp. All participants found Telegram easy to use, but some needed a little assistance (see below).

5.5.1.2 ICT as an Entry Point for joining a wider Community of Interest

Through their participation, the adoptive parents found an easy point of entry into the community that had formed around the Chili Project, and especially into its main means of communication, the Telegram group, in which they could determine their participation at their own pace. Furthermore, the use of ICT prompted several reflections. Merle said, “I learned quite a bit about seeds and the tips and tricks that were shared via Telegram. And I thought a lot about what I need to feel like I belong. What it’s like to get into existing groups and kind of realize what I need there, too, and what’s difficult for me. [...] And basically, how I get connected with groups that I find completely exciting at first, when I’m somehow completely new to them and don’t actually know anyone.”

Some participants found their entry point through the Chili Project into the wider community of Foodroots Community and Foodsharing, like Linda, who described herself as being curious about the urban gardening movement in city_A: “Well, for me personally, I actually found the Chili Project first, so I got to know who the people behind it were.” Linda had come to one of the communal gardens of Foodroots Community twice and also supported the emergence of another communal garden of an anarcho-syndical organization 100 meters away from Foodroots Community’s second communal garden.

5.5.1.3 The Intimacy of the Project

It soon became clear that the contributions regarding the development were not limited to the growth of the chilies, and the questions that were asked

addressed far more than chili care. Instead, the group of chili parents shared their personal reports on Telegram, describing an ‘intimate’ relationship with the plant that included, for instance, talking to it on a regular basis.

As Alina stated, “It’s very peculiar how... how personal that... that kind of personal relationship people build up with their plant... that they give it a name and are obviously very sad when their chili plant dies or has aphids or something. I think... So it definitely... We created the project that way, too. So, it’s always been like that. So, the Chili Project is a bit like... Like there is something living that is looking for shelter... and so you also do something good when you take in the plant. And also - I think a big part of it is definitely also the illustration. That personifies the plant.”

5.5.1.4 No unfamiliar ICT wanted

Since the project was designed to enable participants to share the development of their chili plant with the other adoptive parents and to get expert support on questions about their chili, it was not surprising that experience and expertise were shared in the Telegram group through texts and photos. One of the participants, Luisa, shared 18 external websites or YouTube videos about gardening and chilies. Interestingly, such content generated no responses. Participants seemed much more interested in the connection with local experts and in a local community of interest for sharing experience and expertise.

Voice messages, videos and (video) calls were not used. Sharing photos of chili plants, in contrast, supported participants’ ability to see if their chili was doing well. Merle wrote about this in the group chat: “Now that I have seen the other chilies, ours is clearly curling, or rather the leaves... what is the reason for this?” The community concluded that it was because of aphids and provided guidance to get rid of them.

While Telegram itself was easy to use for all participants, some of them explicitly did not want to use any other unfamiliar applications. Within the Telegram group, the questions asked regarding the chilies were supposed to be gathered in a Pad (a web-based collaborative real-time editor) that Alina had initiated and posted in the group in order to create learning modules from

it. Although 19 questions were collected and Alina constructed a learning module, participants reported on how they had clicked on the link to the Pad but instantly closed it because a new application had opened up. The Pad was subsequently abandoned.

As Carina stated, “It always annoys me when I have many things in different places. When I first log in, I have to get used to how the system works. [...] I always like to make just one click and then have what I need in terms of information. [...] It frustrates me when I then have such a platform again. I think the Chili Project also tried that once with [...] this, I don’t know what it was called, the extra page where the module was supposed to be created. I’ve never looked at it, for example, because that’s too much work for me. [...] When I look at it once, I get overwhelmed, and I close it again. That’s why I always like to use things that I already have. That way, it’s much easier for me to use them again somehow. [...] I don’t feel like digging into new things. I have to do that again and again at work. I have to put a lot of mental input into it, and I don’t feel like digging into something like that privately in the evening. That is only for work.”

Our findings demonstrate that Telegram offers support for people to engage in food resource sharing practices on a local level. Telegram is particularly useful for expanding these practices because it offers an easy-to-understand, minimal-overhead start for interested people. Nevertheless, it turned out that some people from the Chili Project needed a little personal support in actual face-to-face meetings, for example, to install the application or to learn how to take and send pictures. It is also important for the local context to find out which additional functions of Telegram were important for the people involved. The video function was useful for the residents of the retirement home. Furthermore, functions that are important for coordination and organization can be developed for Telegram and integrated into it because most code for the various client apps is free and open-source (under the GNU General Public License version 2 or 3), and Telegram offers an extensive API to create bots. Telegram turns out to be very useful for encouraging the sharing of resources: There are opportunities for users to list the resources they need or offer and could be connected through a matching algorithm. In urban food sharing initiatives, seeds, shoots, food products, compost, tools, land,

preparation services, kitchen devices as well as experience and expertise are especially often shared. However, Davies and Legg remind us that “[t]here are also less tangible things that are shared in relation to growing, food preparation, and eating. This includes the sharing of spaces and meals through eating together, often with the goal of creating greater social interaction, integration, or conviviality” [88]. These were manifested, in our case, through occasional meetings in urban gardens or through a ‘seed-sharing’ event, to mention two.

5.5.1.5 The Issue of shared Contribution within a voluntary Project

The first learning module was created after one month and had a colorful design and additional drawings (that again became Telegram stickers). The lack of time for Alina, however, meant that such modules were not further held. However, both she and other participants continued to send text messages with relevant information. In this context, several questions were asked and answered within the Telegram group. Alina frequently expressed to Author One that she wanted to fully dedicate herself to Foodroots Community and the Chili Project but that she had to pursue too many other tasks, especially her paying job. This raises a complex issue of rights and responsibilities among volunteers (resolved, in this instance, through funding from a subsequent project).

For the main organizers of Foodroots Community and the Chili Project, there was some discussion about the need for a degree of central organization, mainly with regard to the distribution of tasks. Some argued, in tandem, for having better ICT-supported organization and coordination of tasks. In contrast, others viewed ICT as less important and instead wanted to encourage people to come, for example, into the communal gardens and contribute right away, especially by taking on daily tasks like watering, which the main organizers often did.

Ten months after the idea of the Chili Project emerged Alina (one of the main organizers) invited the participants to join the organizational part of Chili Project for the subsequent year. Therefore, she opened up a new Telegram group and shared the invitation link in the existing Telegram groups of both

Chili Project and Foodroots Community. Following on from the first year of Chili Project, four participants and a friend of a participant joined the group, as well as four of the main organizers from Foodroots Community and two organizers who had handled the design and IT tasks the year before. Alina frequently mentioned to Author One that she could not organize the project by herself and that it was crucial that others accepted an organizational role in order to keep Chili Project alive.

The Chili Project Telegram group proved sufficient for participants to coordinate tasks so that Chili Project could enter its second year. Two video calls supported more detailed coordination, while the Telegram group was used to schedule the video calls and keep everyone updated on tasks, ask questions about tasks, receive feedback (e.g., on design), and present final results. Interestingly, the organizers agreed to extend the project to include tomato sharing. This time, participants were to be helped to find the right tomato plant for their growing circumstances and to start sharing seeds instead of pre-grown plants.

5.5.2 Networking Effects

The frequency of asked and answered questions led one of the initiators to found a new Telegram group. Alina wrote in the Telegram group of the Chili Project: “Since the little chili plant is supposed to be a companion in the cultivation of vegetables in your own garden, I find gardener questions and exchange beyond the chili plant to be totally appropriate in this group. I have been toying with the idea of opening up this type of gardener’s group for city_A for quite some time now so that people can share knowledge and resources (e.g., young plants, seeds or cooperation). I have the feeling that there is increased interest beyond this group :). So why not?! I will do it.” 17 participants from the Chili Project followed, via a posted link, this new group, making around 60 participants in all. Similarly other participants found their way into other Telegram groups that were related to sustainability efforts in city_A.

The developing network was not entirely online. Friends and relatives of the participants were also involved in the breeding of chili. One participant, Naomi, talked about how her neighbor had taken care of her chili plant at

certain times and how the plant had later been planted in her neighbor's garden because it got more sun there. Naomi also asked her father for advice several times. Furthermore, she encouraged a friend to get a chili plant.

In both retirement homes, the involvement of relatives was also significant. In retirement-home_1, whose employees had little experience with gardening, requests were made through the WhatsApp group for relatives who had plants for the new beds of about 30 square meters as well as for the mobile bed (which had been spontaneously built from a discarded garbage truck). Many relatives contributed something, with one relative participating in the joint construction of a raised bed at retirement-home_2 that had been initiated by participants of the Chili Project and Foodroots Community.

The interviewed chili parents all said that they wanted to get to know the other participants personally. Quite a few interviewees said that they had gotten to know someone through this medium and looked forward to a personal meeting, such as a communal chili cooking event. Foodroots Community organized a seed exchange in one of the community gardens, and eight adoptive chili parents from the Chili Project actively participated. Further meetings were initiated by participants of Foodroots Community, and Bea, for instance, came into a communal garden and offered a tour of wild herbs. A local youth organization invited others to participate in the "chili challenge" by caring for one of their many chilies. Later, the initiators discovered that some of the people from the youth organization had attended one of Foodroots Community's 'seed-sharing' events earlier in the year and were inspired to grow chilis from their own chili seeds to share with others, even though they had initially been unaware of the Chili Project.

The point here is that though activities had originally taken place as part of the chili-plant project, other activities sprang up and became more or less independent from the project. For the most part, networking personal relationships were crucial and ICT only played a minor role (like discussing the growth of the chili plants with relatives).

5.5.3 Global Issues and local Actions

Participants frequently talked about the scope and scale of the project and expressed the desire to see wider effects while also stressing the importance of locality. Rosina, who was committed to sustainability issues, stated, “Sometimes, I get tired and I think that everything is getting on my nerves, and I don’t want to [contribute to a change towards sustainability] anymore. There’s no point, anyway. But then, it helps to have to deal again and again with people like you at a local level.”

Through ICT, participants were able to observe activities coordinated or reported on in other Telegram groups dedicated to local sustainability efforts but also began to recognize the relevance of their activities to global challenges. Linda stated, “It’s about making a local contribution, and then another small contribution is made somewhere else, and then things snowball and get bigger. [...] So that’s where we should start. That way, no one in this world should go hungry or thirsty anymore.”

This panned out, for some participants of Chili Project, in a willingness to provide practical as well as symbolic support for Foodroots Community. Thus, Stephanie declared, “If the need is there, I will gladly join in.” Similarly, Tom stated that he was happy to support any endeavor with his skills, like building raised beds, though less willing to participate in meetings that addressed planning and coordination.

5.5.4 A local Community striving towards Abundance

Food resource sharing, as initially done in the Chili Project, opened up the space for further food resource sharing to emerge and thereby supported the development of local communities in city_A. The communities are predicated on trust in an organization in which everyone is encouraged to make a complementary contribution in order to nurture the idea of doing ‘just enough’ or of being ‘self-sufficient’, which we frame as abundance. For the Chili Project the Telegram group offered a space in which further food resource sharing was supported and participants could find a way to contribute. Participants, for instance, shared gardening expertise or help at a ‘seed-sharing’ event. In

so doing, Telegram provided a common communication base that anyone interested could join in and participate in group communication. To be sure, instant messaging on Telegram does not offer a high degree of sophistication, but for the Chili Project seemed to provide ‘just enough’ support for the burgeoning of community involvement.

5.5.4.1 Supporting Participants in sharing their Experience and Expertise

While many of the participants found their way into the Chili Project group via a link, others needed support: Hans, who the initiators wanted to win over as an expert, got involved after Author One had provided technical assistance through a personal meeting. At this meeting, he downloaded Telegram and the Chili Project group was set up to make his participation possible. Since then, Hans has answered questions regularly and has given tips on activities. When Therese and Author One met over a video chat in the context of another project, Therese asked if Author One could come by to support her in the Telegram group of the Chili Project. It was especially important for Therese to learn how to share photos of her chili with the group. She learned how to do this with the support of Author One and subsequently posted several photos. She later learned about issues such as archiving with some personal help. These two examples illustrate that for people to be able to contribute through ICT, small amounts of personal assistance from the more expert members of the community may be necessary in supporting the appropriation of ICT.

At the same time, the involvement of the retirement homes was a challenge. The management of retirement-home_1 and a caregiver from retirement-home_2 agreed to participate in the project and joined the Telegram group. While neither the home management nor the staff at retirement-home_1 had any experience with gardening, the supervisor at retirement-home_2 had already grown tomatoes and strawberries with the residents. Both Michaela and Marietta reported how happy and proud the residents were of the plants. At retirement-home_1, Marietta reported how the caregiver would hold the garden hose for watering while the residents determined where ex-

actly and how much water should be poured. Put simply, mutual learning was taking place.

Marietta said in the interview that “[...] for all of us who stand next to [the residents in the garden] every day, it is really always heartwarming, and it has already led to one or two tears... You can see the residents’ bright smiles, and they also tell me what they used to do at home and knock on my door at eight o’clock in the morning and ask when they can go back to weeding” (Marietta, retirement-home_1).

Both nursing homes found the inclusion of the residents in the Telegram group to be difficult. However, Marietta said that videos of Foodroots Community and the Chili Project could be well received by the residents if she could show them on a screen (something which has not yet been implemented). Michaela liked the idea, as well, and other pensioners from the community gardens who did not participate in any Telegram group also welcomed it. The cooperation with the retirement homes made it clear that in the context of ICT for certain people there is a need for an external ‘mediator’ who passes on information to the participants and exchanges experiences with them.

5.5.4.2 Sharing Food Resources (Goods)

For almost five months, the participants of the Telegram group continually shared food resources (goods). In total, there were ten offers within the Telegram group for the Chili Project. Furthermore, participants reported that they also shared seeds, shoots and plants in the newly founded Telegram gardening group as well as when meeting at a communal garden or a public kitchen. For the purpose of sharing, requests and offers were written, whereas a photo was usually also sent for offering food resources.

All goods that were requested or offered in the Telegram group were related to seeds, shoots or plants as well as to fruits and vegetables for harvesting. The goods that were offered were mostly unplanned and abundantly available from those offering them. Bea, for example, wrote that she could share wild garlic because it grows abundantly in her garden. Clara read that Nina had

been looking after an avocado plant, and since she had many avocado plants, she wrote to Nina privately on Telegram and gave her one.

The interview with the participants was also used to share goods related to plants. For example, Author One was given special food made from chilies or herbs several times or asked in advance whether certain plants or seeds could be taken along.

In the interviews, the respondents stated that they were not surprised that resources were repeatedly shared, and some put this down to the positive atmosphere in the Telegram group. One of the initiators, Vera, said, “It doesn’t surprise me. I know about WhatsApp groups for Foodsharing – very simple, with picture and text”, and concluded that people like to share and to help with a resource that is in surplus or abundant. Sandra also stated, “I would say I would have expected [resource sharing] to take place at least 51% of the time.”

Sharing food resources also involved other friends and relatives of the participants (see above: Networking Effects (5.5.2)). As Rosina reported, “My grandchildren liked the cherry picking, for example. They still talk about it today. That was a big hit. It was better than going to the supermarket and buying cherries, right?” The cherry picking itself was done in a private garden where someone new to Foodroots Community offered the harvest. The participants of the Chili Project were invited to join, and six came to harvest. Later, they brought fruit to other participants who could not join.

Sharing food resources was also extended by one participant to a wider circle of people. Lara initiated a ‘mobile seed fair’ (a flexible plastic post card holder with around 30 pockets that contained different packaged seeds) in order to support food resource sharing and introduced it together with Author One at a local park. For Lara, it was important to realize her idea while also removing herself from sole responsibility and giving in to a self-organized process that was supported by a tracker: “I like things to be mobile and then to keep going. So, for example, I can’t guarantee that I’ll always be responsible for it in one year or that people can get in touch with me if they want seeds. That’s just too much for me. But if people approach me, I can say, ‘Where is the mobile seed ferry right now?’ Then, I can maybe look somewhere

and say, ‘Hey, who has it right now?’ and then tell the person. Or I can say that it’s in the free shop [a local store that accepts and gives away items without the exchange of money]. And then, if I ever [...] have an event or a reading and I’d like to hang [the seed fair] next to it, I can do that. So, I like the fact that it’s as modular and mobile as possible and does not depend on individual people... because experience has shown that that always backfires [...], especially when everything is voluntary, honorary work. And sooner or later, everything shuts down. It fades away. And no one feels responsible.”

The participants of the Chili Project Telegram group coordinated the exchange of resources between themselves mainly via personal messages on Telegram. They then arranged a pick-up time and date and shared the goods. Bea, who is very sensitive about food waste and had offered wild garlic from her garden, said that she did not mind that nobody had picked it up: “I mean, it’s no big deal, [...] it will be absorbed [by the earth], and then it will be gone again. Nothing happens. Nature gets everything back. It’s not like you have to use it up.” This statement leads us to further insights about the differences between surplus and abundance: While the former requires urgent redistribution/usage, the latter draws on circular processes.

In regard to the tension between surplus and abundance, Stephanie contributed the following reflections on her food practices: “The bell pepper seeds [...], I used to throw them away. Now, I have jars everywhere with many seeds lying around. So, I think that’s good. I find that you can that... only if you already know how they grow. So, the first chili on the bush is something great, right? I think that’s good and, really, that you also deal more with the plants themselves, right?” Being a prosumer for the first time in her life, her perception of the seeds shifted from waste (surplus that would need to be saved from being thrown away, by redistributing it) towards a recognition of the value of the abundant nature of ‘home grown’ supply, in which the food resources needed are already there.

There can, on occasion, be an explicitly ideological motive for participation. This is evident when considering the role of money. Respondents said that money plays no or only a subordinate role and should have no influence on the project in the future because the connection to money could endanger the

grassroots community and movement. Tom even sees the project as antithetical to capitalist formulations since it is independent even of explicit exchange value. The Chili Project operates instead, he suggested, on a profound level of the food supply: “Who has what, and who needs what.” Tom reported that when they picked up pumpkin seedlings or offered lavender, there was no consideration of giving or asking for anything in exchange. He suspects that more chilies have been distributed than if Foodroots Community had tried to sell them. Inspired by the Chili Project, Tom and his wife Carina are considering opening their garden to others for shared cultivation.

In a similar vein Stephanie saw the sharing of chilies as a catalyst for further sharing, oriented at abundance rather than surplus: “There is a purpose behind it, after all. It isn’t just, ‘I’ll give you a chili plant’, like, because I have too many of them. It has meaning.” Similarly, Tom reported, “With the chili plants, you can achieve a very brilliant coup. It is simple, it is subliminal: People come, and everything is linked from the beginning with the basic idea of paying [the harvested chili seeds] forward, and thus with a longer temporal perspective. And there is a permanent temporal development, so people come back to the topic again and again.” (See also [231], who explore the possible roles of seasonal rhythms for the design of technologies to support temporal coordination). In terms of the role of ICT, the Telegram group prepares a sufficient opportunity for this.

Beyond seeds, plants and their harvest, Udo argued for a circular economy that supports local composting practices in order to produce fertile soil in abundance: “In my view, sustainability can only ever work in a cycle-based system. And for me, that would mean rethinking things. It would mean taking very small practical steps. That way, for example, it would be necessary for every house to have a compost bin. [. . .] Or, if you like, not even that, but that all the organic waste that is collected here should actually be processed into compost in a regenerative way in municipal facilities, communal facilities, which, in turn, are used to prepare soil or build vegetable beds.” Udo’s comments make it clear that Foodroots Community is aiming for further projects, aimed at material growth. It is doubtful, however, that the Telegram group’s capabilities are sufficient to cope with the coordinative and organizational effort that would be needed. The results make it clear that ‘abundance’ is not a

status to be achieved, but is, as it were, a continuous ideological commitment to a way of thinking about community resources, and that (ICT-)support for abundance accordingly requires further development.

5.6 Discussion

Our study provides insight into the small (often ICT-supported) contributions that local communities can make in order to impact global food system challenges via the promotion of prosumer practices. In this context, our contributions lie in describing food resource sharing practices in a local community and the role of ICT in supporting these practices, reconceptualizing the potential focus of HCI on food such that the potential of a focus on food resources and ‘abundance’ is recognized and drawing attention to the tension between redistributional surplus and abundance and the future possibility of a ‘glocal’ impact.

The study we present placed a particular focus on the social aspects of the role of ICT in food resource sharing. We know from previous work that sharing in general is a social matter and our aim here was to demonstrate the importance of sharing knowledge, sharing resources and expanding ambition when producing food resources as much as when distributing them. ‘Food resource sharing’ highlights a novel and important design space that represents an intersection of HFI and SHCI. This is because the fragility of global supply chains and their effects on climate change have major long-term consequences [256, 257]. Local activity, as we argue, has a potentially ‘glocal’ effect. If this is to be realized, however, it is important to understand what prompts people to get involved, what leads them to continue their involvement and even to expand it. The detailed examination above can be further distilled into six broad themes:

1. Firstly, continued involvement depended on affective factors. Participants regularly spoke of intimacy, caring and enjoyment.
2. Secondly, low levels of organizational work were needed and much of the proliferation of activities was serendipitous.

3. Thirdly, and in the same way, the sharing of knowledge and expertise required little in the way of structure and was in the main done through casual asking and answering.
4. Fourthly, though the project initially had a specific focus, participants took it upon themselves to widen perspectives through the sharing of other goods (various seeds, pumpkin seedlings; cherries; etc.).
5. Fifthly, our work shows that the role of ICT at this local level is one that provides an adequate resource but needs to carry with it little or no overhead.
6. Sixthly, small level of (ICT-)support from the ranks of the community can be sufficient in order to enable people to contribute to the community.

The Telegram group proved to be sufficient for the community of the Chili Project to flourish towards abundance, yet it was clear that further development of Chili Project and especially Foodroots Community will bring new needs regarding ICT. In connection with the current literature, we suggest further investigation into the role of technology in food resource sharing as it scales or proliferates beyond the immediate locality. We frame much of what we have to say around the notion of ‘abundance’ and the view that productive research can be, and needs to be, conducted into the potential of local food production capacity as part of a communal, socially organized set of activities. We do so as part of a wider argument in which, in addition to the compensatory efforts involved in surplus redistribution, we seek to support and generate full-fledged alternatives. In the context of food resource sharing as part of a local grassroots movement, this has meant that ‘self-sufficiency’ is constantly nurtured by the abundance of natural resources that are produced locally. What is shared is a great deal more than a chili plant, since knowledge, expertise, interest and community involvement also grew. In our study, ICT played a simple but crucial role in supporting these social affairs.

From surplus towards abundance:

The merging of the problem areas of ‘food waste’ and ‘food poverty’ into a

kind of win-win situation has been criticized [122, 289]. As mentioned above, HFI needs to broaden investigations into the social context and thereby identify where food sharing as a matter of practical policy seems most fruitful and what role the abundance of some food supply might play in this policy. The ‘deep change’ in food systems that we and others [386] aim to promote requires considerably more than food sharing efforts. Indeed, it is oriented around the principle that the more I share with you, the more will ultimately be shared with others – a non-rivalrous approach (see chapter 5.3). We note that, along with Berns et al. [29], this does not imply direct reciprocity. It is better thought of as entailing what Sahlins, an anthropologist, called ‘generalised reciprocity’ [319].

Food resource sharing that encourages abundant supply, we suggest, can form the foundation for sustainable food practices that transcend the limitations of food sharing seen as a distributional problem. There is, we believe, no natural shortage of the resources needed; rather, we believe that it is global capitalism that creates food poverty and insecurity and have argued that the sharing economy poses a challenge to it. Food resource sharing at a local level constitutes the first step in building alternatives. A number of benefits, as we have argued, accrue. These include the development of a shared knowledge base for participants, the building of communities of interest and the formation of a progressive, wider network effect. Such strategies also do not include compensation [26] but rather act as catalysts for engagement. Sharing an abundance of chili plants functioned in this way as the project was designed to support food resource sharing by opening up a space for abundance. The Chili Project Telegram group was enough for this, so that further food resource sharing could and did happen.

While these considerations resonate with Vivero Pol’s general ideas about ‘food as commons’ [380], the growth of communities or movements that are supported by sharing food resources has not yet played an important role since a focus on individual change prevails [386]. We agree with Hirsch et al., who argue that “a positive use of interactive technologies would be to encourage such trends [i.e., the rise of alternative food movements] as a means of bridging divides between ourselves and the natural world [...]” [180]. The resource abundance we encourage can facilitate an exchange between partic-

ipants and nature, as the caring our participants demonstrated shows. The difference between ‘food as commons’ on an individual and food resource sharing on a community level lies in the collapsing distinction between volunteer providers and beneficiaries, for here, they are one and the same [29]. Berns et al., as we have noted, suggest moving beyond a design that solely focuses on efficient exchange to one which includes social factors such as community building and supporting activism. In our work, we have further looked at supporting mutual relationships and communing [29].

In order to tackle the challenges of ‘deep change’ through different modes of food sharing, we build on the work of Michelini et al. by bringing abundance into the design context. “Sharing for community” as an identified mode for food waste redistribution [251] operates on a peer-to-peer basis in which “food sharing is managed exclusively through web platforms or apps” (with no offline replica) and can – it is argued – strengthen social networks. Although we agree entirely with the view that food resource management will depend on social networks, we feel that the exclusive emphasis on online provision comes with potential costs. We found in our observations that much of the expertise and experience of sharing was indeed done online. Much of the expansion of networks into other areas, such as community gardening or harvesting in other private gardens, however, relied on family and community links. We argue, then, for a better understanding of how family, community and other ties are implicated in whether and what technologies might prove useful if local food practices are to become more widespread.

This change requires shifting the focus from attention on food waste and individualism alone to understanding food sharing practices as socio-cultural activities that unfold in grassroots food initiatives, which connect people. In particular, we suggest studying the use and design of digital tools for cultivating food sharing practices around food resource sharing. Food resources are available in abundance, but they require mechanisms for sharing information about good practice, about corrective practices, about the heterogeneity of our relationship to food growth, and so on. Such expertise sharing, in our view, will require something of a hybrid solution along the lines of Ackermann’s Answer Garden [5, 6, 285], as we suggest below. Current research on food sharing has not always engaged with locally sharing expertise and experiences

with food production or with local food resource goods, both of which can be thought of as resources that are available in abundance.

In contrast to a focus on food waste redistribution, our results and other inquiries into food resource sharing practices [82, 169, 170, 171, 236] suggest that food resource sharing primarily entails sharing the abundantly available, not least because it might generate usable skills and expertise. This might provide alternatives to capitalist supply chains that food waste redistribution does not. Doing so, of course, will require support for the expansion of these local practices, and we deal with this below.

Technical support in the immediate context of chili-plant growing was needed or wanted only in a very limited way. Our participants were not interested in external links, but rather sought advice from people in their local community. The local community's orientation to the business of sharing experience and expertise was manifested in a 'just-enough' attitude. In this context, the instant messenger Telegram proved to provide sufficient support for these activities. However, our adoptive parents were also more than just chili-plant volunteers. Indeed, they were ready to engage with a local community of interest by sharing through the means of ICT. Whether or not the participants had a shared interest here was critical. Participants were not interested in playing with computers, nor did they want unnecessary overhead. This meant that possible functionalities, such as open-topic video chat, were not viewed as desirable because participants could not immediately see what they were for. A rather simple ICT resource, a Telegram group, was sufficient to pursue the aims of the project.

Two things are evident from our data: Firstly, participants did have a desire to share experiences and sought expertise from local practitioners where needed. Simple technical solutions proved perfectly adequate for their needs. Typically, the resources that they drew upon were themselves local, consisting entirely of people in the local community who were willing and able (sometimes with support) to provide assistance. Secondly, however, participants were often motivated to expend their food practices beyond the chili plant. They actively sought other areas in which they might pursue their food practice interests and contribute to the wider local community. This included, as

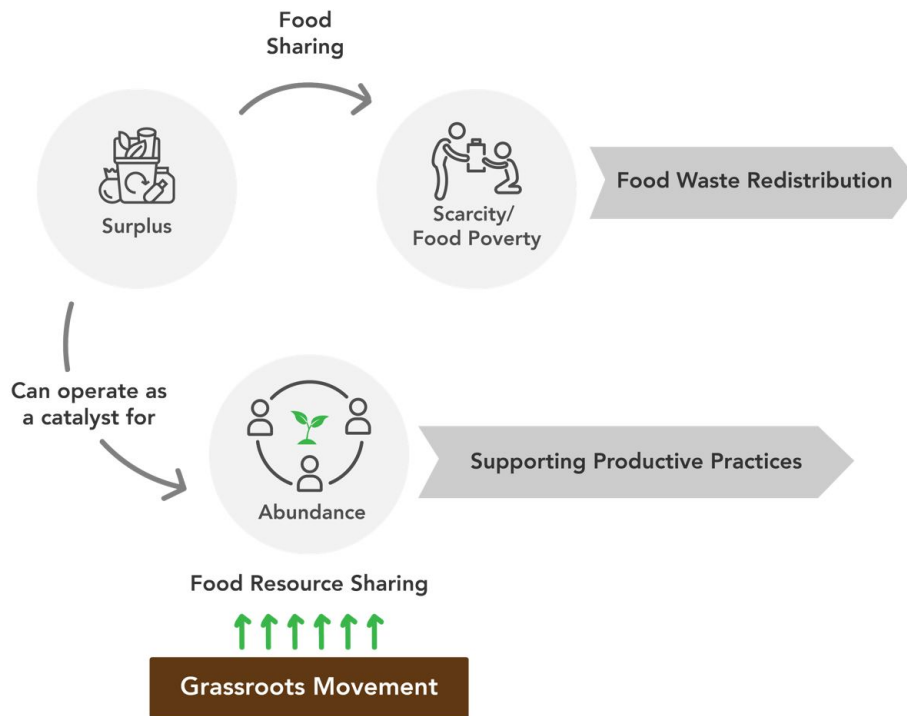


Figure 7: Food sharing and food resource sharing in the context of surplus and abundance

we have seen, the sharing of other seeds, the development of small communal gardens, and so on. Both of these factors depend on the principles that emphasize that sharing locally is about the local resilience [32] and social value of connecting people rather than about the global sharing economy, which focuses on superseding the need for social interactions like personal negotiations or codification in favor of trust in digital services [234, 233]. According to Biørn-Hansen and Håkansson, in community organizations, “ICT seems to play a more purely ‘functional’ role, whereas it is the members, their time, and dedication that is truly making spreading happening. Meeting people, spending time talking to them, and doing practical things together to share skills so that more people can act on their own, remains to be the key approach” [32]. Looking into the disparities of the global sharing economy and local community sharing, Light and Miskelly [233] point out that although lo-

cal communities might have “limited immediate economic scalability”, they nurture a “sharing culture” that focuses on environmental, economic and social issues locally, and they can have a wider impact on sustainability with ICT support for growing, spreading [32] and meshing [234]. In our case, the ‘sharing culture’ of the Chili Project was initiated by sharing chili plants as food resources and by offering an ICT-facilitated space that supported further food resource sharing in order to nurture the local community to grow towards abundance.

In addition, we suggest that a design for food resource sharing that is aligned with surplus can transcend existing practices of waste redistribution, especially in regard to ‘sharing for charity’ [251], where the stigma of ‘low income’ can hinder participation and foster dependencies. Surplus generation can act as a catalyst for deeper food resource sharing and the social activities which surround it, such as Disco Soup [357], in which saved food is collected and music is played in order to initiate a space in which people can engage in cooking, chatting and sharing (see Figure 7). For Foodroots Community, several communal cooking events with saved food from active Foodsharing members, along with dumpster diving activities, have been organized. These have, in turn, formed and fostered the idea of a first communal garden.

Complex Food Prosumers:

We have discussed how food resource sharing at a local level can contribute to a mutual, emergent understanding of sharing resources, which led to a community thriving for abundance. Our argument was in contrast that the focus on consumption in SHCI has been predicated on problems having to do with waste management and related matters and with building solutions out of these problems (like supporting ‘food poverty’). An alternative way of thinking about the issues can be predicated on the view that food and related resources are not in and of themselves scarce but become so because our practices have not, as yet, encompassed new forms of distribution. Therefore, we argue for ‘deep changes’ in the way we address design for sharing practices that would lead us from consumption towards an approach to investigating the complex prosumption practices that are interrelated with food resource sharing rather than with food sharing.

Food connects: One of the most common things that people encounter throughout their daily lives is that they have to eat and drink. Sociologist Simmel argues that eating food is “the most egoistic thing, the most unconditional and most directly limited to the individual: what I think, I can let others know; what I see, I can let them see; what I talk, hundreds can hear – but what the individual eats, under no circumstances can another eat.” However, food practices still spark a custom of being united [343].

The dual role of individual necessity and meaningful solidarity in food practices gives rise to our desired focus on prosumption practices. The encouragement of prosumption within practice-oriented SHCI has hitherto been done in the context of energy [152, 253]. In contrast to energy, food is a tangible object that brings people in their daily practice into a more intimate interaction and with important realms of sustainability, like seeding and caring or growth, diversity and perishability. SHCI plays a crucial role in understanding and nurturing these complex networks of practices [185] in order to support a ‘deep change’ towards sustainability. Discussing sustainability within SHCI, Knowles et al. conclude that “[t]he kinds of SHCI activities that seem to meaningfully contribute toward sustainability are not those that solve well defined problems, but rather those that contribute more subtly to a shift in culture or power” [211]. Even if we do not necessarily know what kind of design supports a change towards sustainability in this respect [187], “it does at least mean that we are looking in the right place for inspiration to strike” [211].

Food is inherently involved in important economic, ecological and social processes, while food sharing plays a key role in fostering social relationships and practices. We take the view that a fruitful avenue for examining what the ‘right place’ might look like involves paying attention to the synergistic interrelationships that represent less of a food cycle than a network of practices [177, 185, 224] in order to understand and support prosumption.

In connection to food sustainability, this ultimately means encouraging food resource sharing in a way that everyone can eat enough good food every day, and sustainability means encouraging food resource sharing practices in such a way that meaningful relationships with other people (social), the distribution of work and things (economic) and nature (ecological) can thrive [386].

Svenfelt and Zapico, in a similar vein, argue that research for ICT that promotes sustainable food systems needs a holistic approach [354]. This can be found by investigating food resource sharing practices.

Food resource sharing of abundant ‘material and competences’, based on our study, is a dispersed practice [130, 384] that can be seen as an important food related practice, as in growing, harvesting, processing, storing, cooking and recycling. In growing and harvesting, for example, seeds or sprouts are shared in a digital and physical space in which people can share experiences and expertise. Ganglbauer et al. stretch the design space for food waste to also include other related practices: “Designing interventions requires a consideration of the complex nexus of interconnected practices (dispersed and integrated) that define food practices” [130]. Our work demonstrates that such interconnected practices themselves grow organically (See e.g., 5.5.2 Networking Effects & 5.5.4 A local community striving towards abundance). The original – and fairly narrowly defined – purposes of our small project actually had a burgeoning effect on a wider set of sharing, building and cooperative practices.

Aiming for a ‘glocal’ impact:

Small, localized efforts support and facilitate change towards sustainable practices. Grassroots initiatives pay attention to local needs and shape the immediate contexts of daily life by inviting others to contribute to the space that they have thereby opened up [141, 335, 386]. While the contributions are local, they also contribute progressively to a global effort [132] and thereby ultimately create scalable lessons for design in the joint sphere of local and global impacts towards sustainability.

In considering the global challenges to food production, the current dialogue focuses on ensuring that there is enough food available on the supply side to feed a growing population [356] as well as on placing these economic increases on an environmental and social level, particularly in the context of sustainability and climate change [276, 290]. As pointed out, global attention to the issue of food waste is increasing, and strategies for avoiding it are being discussed [275]. The consideration of these global challenges, which affect people acutely in different economic, ecological and social ways, is of par-

ticular importance and has already led to several socio-technical innovations in connection to grassroots initiatives [335, 357]. Still, according to Svenfeld and Zapico, ICT for sustainability focuses on “increasing resource efficiency and [...] transparency and traceability” [354]. However, improvements in coordination, infrastructure or policy at a global level cannot alone support complex food practices in their local execution. ‘Deep change’ towards more sustainability requires both a global and a local level of attention [386].

For small, local grassroots initiatives and projects striving for sustainability, the question of their potential global impact and – within that – the role of ICT arises. By ‘glocal’, we mean combining local with global characteristics, as in thinking globally and acting locally [132]. Weber et al. state that within alternative food movements lies the “idea of a global network of local or regional initiatives to change the whole food system, to seed new local communities” [386]. In our case, through Author One and Foodroots Community, there has been close relationship with different actors of the grassroots movement of Foodsharing (foodsharing.de), which is active in over 369 districts/cities, mostly in German-speaking countries. The organizations of the districts/cities are independent from one another but share the platform and certain rules and values, which are documented in a wiki.

The Chili Project is a pilot project that has been introduced to other Foodsharing districts/cities in order to support its diffusion. Within both foodsharing.de and the Telegram group system, the respective ICT (foodsharing.de and Telegram messenger) could potentially compete with one another, but a tendency towards the increased use of instant-messaging providers for information, coordination and organization within the Foodsharing community can be observed. Certain chat groups co-exist on foodsharing.de and Telegram. The chat functions for members of foodsharing.de in some cities remain rather unused in our experience, whereas Telegram use has been expanding.

Much of what is needed can be facilitated without recourse to large multi-functional platforms, which deter many users. Knowles et al. argue that if a mass movement is needed for ‘deep change’, we need to explore “the role of technology in revitalizing civic participation” [211]. Our small project begins to demonstrate how this can be done. We saw above that users leave plat-

forms unused – including linked applications, like a Pad – or neglect them over time. In addition, our participants viewed their contribution to Foodroots Community or the Chili Project as voluntary and part of their free time, and as a consequence, they did not want to have to deal with the use and appropriation of new ICTs but wanted to operate in a familiar digital environment. Ganglbauer et al. discussed the potential of different ICT resources to empower “people to mobilize and to act as a ‘global-issue-based’ community” on the one hand and to support “people to form a local community of practical action” on the other hand, thereby fostering the rise of “a community that engaged in intertwined ‘global’ thinking and local acting” [132]. Our experience suggests that in a non-hierarchical community of volunteers, this may well be the case. However, it is up for further debate and research whether instant messaging – or Telegram, in particular – can support the emergence of a mass movement towards ‘deep changes’ in our daily (food resource sharing) practices. Telegram groups were a simple solution that proved to have wider network effects and supported “sustaining, growing and spreading” [32].

Light and Miskelly argue that in local sharing communities, “relational assets” emerge from a “sharing culture” (sharing practices) that can support “an ecology of mutually-supportive systems in a place” [234, 233]. Relational assets encourage solidarity and increase the likelihood of success of further initiatives. The kind of “meshing” that Light and Miskelly suggest might ultimately provide “the conditions for socio-technical infrastructures of sharing” [234]. Within these infrastructures, “adding technology to sharing initiatives is only indicative of ways that networks can be deployed to be supportive of local context, evolving cultures and collective agency. The tools are ad-hoc and responsive, like the relations being formed” [234]. It remains to be seen, however, whether such ambitions are easily realized, especially regarding meshing opportunities of the foodsharing.de platform and Telegram groups.

Biørn-Hansen and Håkansson have described the role of ICT in supporting community organizations with scaling up. This means supporting “activities that try to identify and move towards a scale beyond individually targeted interventions, where a larger impact can enable more people to take part” rather than “reaching a larger geographical area” [32]. However, for these kinds

of organizations, it is difficult to translate the excitement for socio-technical artefacts into action. Most often, the community organizations are hampered by “limited financial resources and a lack of ‘in-house’ expertise in the design and development and maintenance of digital systems”.

Nevertheless, a striking feature of small, local endeavors is that they do not require sophisticated technological support to form a community of interest and to let sustainable practice flourish. Our own investigations demonstrated that overly complex functionalities and multiple applications acted as something of a deterrent to local engagement. Participants gravitated towards a lightweight solution in Telegram, where they sought advice from people in their locality rather than from external links to information. This is not to downplay the role of communications technology. Our experience is that there has been a small but visible organic growth in our community of interest that is sustained by communication media, which provide a variety of knowledge- and expertise resources and support food resource sharing. The implication, in design terms, is that any proposed application must be simple enough that a variety of people can use it with minimal overhead while being sophisticated enough that users can move in and out of groups with distinct but related interests. Our data demonstrate that a simple project with chili plants can generate interests that move beyond these plants – interests in community gardening, in the sharing of other plant materials, in the desire to be better educated about some matters and in support for the evident pride that people take in their progress (all supported by the Telegram group of the Chili Project and the other Telegram groups of Foodroots Community). Nevertheless, we should note that a more sophisticated ICT policy for grassroots initiatives might become more necessary over time as tasks and activities increase and membership grows. Here, we come to the question of scale, and this, we feel, is where design opportunities abound, because “[w]hen grassroots initiatives attempt to scale beyond the level of a very basic technological platform, the pre-existing trust and social capital benefiting from their local focus might not be sufficient” [359]. How can design support scale in a way that communities can grow towards abundance and spread new seeds for further communities to emerge? Here, scale is more than the aggregation of individual contribution and instead lies in the nourishment of a “sharing cul-


ture” [233] that offers ways for people to take part by making a contribution [32] and make their contribution count on a glocal level. Resonating with Rossitto et al. [315] we do not believe that this lies in measuring members’ interaction with digital platforms or providing administrators with the means to quantify individual contributions, because “designs that quantify care, and classify membership status [are considered] as ways that can introduce external motivations, and promote competition and individualism instead of mutual care and well-being” [315]. In terms of design, it is necessary to support “complementary social and participatory processes” in addition to technical infrastructures [295]. We demonstrated above that there is a clear need for local spaces (like community gardens) as well as local expertise sharing and that this sharing will magnify as and when opportunities for food ‘prosumption’ also increase. The retention of a local element, however, seems crucial. Answer Garden [5, 6, 285] is by now a well-known approach to the problem of questions and answers of varying complexity and, to us, points the way towards the maintenance of local contact. Systems like Answer Garden can be designed to provide brief answers to questions, which allows them to be used at a local level, where human expertise in response to more complex enquiries is required.


5.7 Conclusion


We argued above, based on a small-scale study of food resource sharing practices, that there is a need to broaden HFI beyond a concern for food waste management (surplus) and towards the potential of abundance. A design for food resource sharing that is aligned with surplus can transcend existing practices of waste and dependency. For the future design of sustainable food systems, it is important that design act as a catalyst for deeper food resource sharing by sharing local resources that are abundant (like the chili plants in our project) or, as in the case of Disco Soup [357], in which food that would otherwise be thrown away is used to open up a space in which people can meet to cook, chat and share. The abundance framework encompasses the thriving of a local food community that is nourished by sharing food resources, which, in turn, evokes the sharing of more food resources.


In promoting this approach, we point to a number of advantages. These include active community involvement rather than a provider–beneficiary relationship, the development of skills and expertise that would otherwise not exist and the potential over time to provide alternatives to orthodox conceptions of global supply chains and the economic orthodoxies that underpin them. We argued that, at a purely local level, ICT has relevance but that simple solutions are adequate and ‘just enough’ to support a community’s growth towards abundance. It is important, at this level, to set the barriers for engaging in the ICT infrastructure and the physical sphere as low as possible. Telegram (instant messenger) proves to offer good support in that regard.


KEY TAKEAWAYS

- 

‘Food resource sharing’ and ‘abundance’ highlight a novel design space that represents an intersection of HFI and SHCI.
- 

We should promote a more genuinely cooperative view of consumption and production practices – one that is associated with the concept of the ‘prosumer’. Care and support for others is a key element.
- 

Food resource sharing can transcend the limitations of food sharing seen as a distributional problem. It encompasses new forms of distribution.
- 

For ICT, the challenges are to make these contributions count on a ‘glocal’ level. ‘Scale’ is where design opportunities abound. Local activity contributes progressively to a global effort and thereby ultimately creates scalable lessons for design.
- 

A focus on abundant resources promotes the non-rivalrous approach of ‘the more I share with you, the more will ultimately be shared with others’.

Figure 8: Key Takeaways

Nevertheless, there were clear indications in our work of a desire to move beyond the single focus provided by adopting chili plants. Based on the research of Ganglbauer et al. on the grassroots movement of Foodsharing, we discussed the potential of a community project to become ‘glocal’ (by supporting local actions within global thinking) [132]. Gradual expansion towards a ‘glocal’ approach will require more sophisticated solutions, which we see as being situated within hybrid systems. Our research suggests that care and support for others in order to enable them to make their contribution is a key element in designing for abundance in food systems. Within abundance – and within the ‘just enough’ commitment – lies the community, which shares its abundant resources with its members and which promotes the non-rivalrous approach of ‘the more I share with you, the more will ultimately be shared with others’.

In order to enable people to contribute to the community and to thus free themselves from their dependencies both on others and on the food system (e.g., by distributing surplus in the mode of ‘food sharing for charity’ – i.e., food for the ‘outside’, or by encouraging those being cared for and who do not have tasks within the community in the investigated retirement home to make a contribution), a small level of support from the ranks of the community can be sufficient. In the retirement home, the assisted individuals contributed with their practical knowledge to the flourishing of a newly founded garden. Small assistance in using ICT brought two participants to the community to share their knowledge. The aim here is to reduce dependencies and strengthen interdependence. This interdependence is nourished by small local contributions. Here, for ICT, the challenge is to make these contributions count on a ‘glocal’ level.

In regard to the grassroots project on which our study focused, ICT of a relatively simple kind was sufficient to make food resource sharing a viable practice. Our findings revealed that the Telegram group facilitated and encouraged food resource sharing practices on a wider scale than originally envisaged, thereby nurturing a “sharing culture” [233]. Telegram offers a low-threshold entry into the organization of grassroots communities and thus allows people to find their first entry point into projects and the community at their own pace.

The investigation into food resource sharing practices promises to be a fruitful field for SHCI scholars both in understanding and supporting ‘deep changes’ towards sustainability. Food sharing has played and still plays an important role in fostering ecological, economic and social aspects in the development of human civilization [82, 200]. Developing a more holistic view towards sharing practices in SHCI, we argue, requires us to engage with the complexity of networks of (inherently social) practices that are oriented towards food as a resource and that can be both produced as well as consumed at the local level in order that ‘glocal’ abundance might ultimately be achieved (see Figure 8).

In future research, we will further explore how ICT can help the project to thrive and scale up and especially how to understand how the diffusion of

the project in many other Foodsharing cities/districts succeeds. In so doing, we will focus on how ICT can support abundant local food production whilst continuing to attend to the issue of the distribution of such resources. Food is only abundant if it gets to the people who need it. ‘Scaling up’ will change communities’ ICT needs and practices. Furthermore, we will investigate how food resource sharing effects – and especially enables – new forms of food sharing that are oriented towards ‘sharing for community’ and take place both online and offline.

6 (Re-) Distributional Food Justice: Negotiating conflicting views of fairness within a local grassroots community

Abstract

SHCI and HFI research have developing interest in preventing food waste through food sharing. Sustainability requires attention to both the opportunities and challenges associated with the building of food sharing groups engaged in the redistribution of food but also in developing a wider agenda which includes, for instance, the local production of food resources. In this paper, we argue for a better understanding of the different conceptions of ‘fairness’ which inform volunteer and guest practice and in turn mediate community-building efforts. We examine the practices surrounding ‘Sharing-Event’ and challenges faced to sustainability by the heterogenous, and sometimes contested, commitments of the people involved. We further consider how ICT provided opportunities for explicit examination of ideological differences concerning what ‘sharing’ might mean. Our findings show that community building is dependent on the negotiation of different values and purposes identified. We derive recommendations for action-oriented researchers ultimately concerned with systemic transformation.

6.1 Introduction

Food sharing practices have grown to be an important context for sustainability issues. Within HCI, research into SHCI and HFI [14] has developed in response. We have argued [104] that the technology-centric focus that currently predominates research within HFI [14] needs broadening to include more research on collaborative aspects, because sustainable food practices depend on emergent communal activity. We present a practice-based view exploring how food sharing can be organically supported and how community building can be sustained. Supporting cooperative food sharing practices, as we shall see,

involve mitigating conflicts that arise when different notions of fairness come together.

In this paper we aim to describe and analyze how sharing food is done in a specific context and how it is connected to other sustainable food practices. We show how ideological tensions to do with ‘fairness’ play out and suggest how the use of digital artefacts may, in time, resolve some of these tensions. The specific context is *SharingEvent* and *SharingHut24/7*, local food sharing initiatives in Siegen (Germany) that are connected to the wider *Foodsharing.de* movement. Supporting sustainable food practices and community building here can mean rather more than simply giving out food, as we shall see. In examining the distinct ideologies and beliefs which inform practices around *SharingEvent* and *SharingHut24/7* we suggest we can inform design spaces. Our action-oriented research suggests that the issue of (re-)distributional justice and community building is especially relevant.

Our perspective aligns with Weber et al. [386] who advocate for “deep change” (a catch-all term for transformation/transition) in food systems in terms of “values, consumption and production practices, and policies that enable grassroots consultation and mobilization”. Taking into account local needs, grassroots initiatives shape the immediate context of daily life [141], opening spaces for participation and contribution [169, 236]. These movements are a source of innovation and have the power to mobilize the resources needed for change towards sustainability [117, 335, 357] and “encourage and engage [...] consumers and small producers in adopting unconventional practices for food production and consumption” [386]. Although the importance of grassroots initiatives in the shift toward sustainable practices is well known [335, 386], there is space to address the diversity of their practices and the different roles ICT can play [274, 354, 359].

Previous work, most notably that of Berns et al. [28, 29, 30], has shown how a food surplus became a form of gift-giving, but not without some challenges. The moral implicature of this transformation was the cultivation of a food sharing community. Values like supporting mutual relationships and commoning thus came to dominate within a group of volunteers. The importance of this lies in the idea of generalized reciprocity [319], such that anyone

can contribute and anyone can receive without the expectation of immediate and equivalent payback. For community building, however, an ideal scenario is that everyone can make some kind of contribution, though not necessarily in material kind. This turns out, in practice, not to be entirely unproblematic in that other normative principles, such as appropriate queuing behavior, also come into play. Indeed, we will argue that two broadly distinct views of fairness are visible. The first is predicated on the allocation of scarce or surplus resources, and the second on a challenge to orthodox notions of giving and receiving aimed at encouraging local production rather than simply consumption. There are, we suggest, tensions between them. Below, then, we endeavor to answer the following research question: How can ICT support sustainable food practices in the context of a local community engaged in sharing rescued food in a normatively mediated, and contested, situation?

Our findings highlight issues such as stigma, social norms, proper conduct, fairness and lack of food literacy as challenges to community building. At the same time, several community-oriented food practices, such as community gardening, emerge that can support sustainable food practices. SharingEvent and SharingHut24/7 have played into the emergence of a community where common resources and knowledge are being shared and evolved.

In the discussion, we derive five different notions of fairness: Charitable, Contribution-oriented, Equality-based, No-waste, and Systemic Fairness. We then discuss the negotiation of the conflicting notions of fairness and the role of action-oriented researchers therein. We propose that supporting the negotiation process is of paramount importance to build and sustain the community, in and through the development of its artefact ecology [47, 48]. Our contribution to HCI, then, is an assessment of the role of ICT in the context of community building for food and food resource sharing, and the challenges faced as communities grow and different conceptions of fairness come into play.

6.2 Related Work

The paper draws on two related strands of HCI scholarship. Previous investigations into food production and consumption practices within SHCI provide a backdrop to situate our contribution.

6.2.1 Food in SHCI: From Individuals to Collectives

In recent years, the topic of sustainable food production and consumption has burgeoned among HCI researchers [159, 271]. Work in this space has investigated food practices as relevant sites for the design and evaluation of digital technologies. Internet technologies are playing an important role in addressing more sustainable behaviors around food through an increasing number of mobile apps designed to reduce domestic waste [13, 69, 114], or to encourage people to reflect on their everyday grocery shopping from social and ecological perspectives [363, 367]. However, many HCI scholars appear to have shifted focus from systems designed for individuals to more collective approaches. For instance, departing from the highly individualized persuasive design approach, research has highlighted how ICT can support the co-evolution of more sustainable eating practices [225], or how community food initiatives employ socio-technical innovations to support the creation of urban food commons [261, 262].

Moreover, numerous research papers [69, 88, 131, 271, 282, 342, 349, 382] suggest a need for a practice-based approach to SHCI research which centers cooperative practices. For instance, work by Silberman et al. [342] highlights how technological innovation in HCI can often collide with sustainability goals, but argue that engagement with sustainable practices such as “collaborative consumption” and “do-it-yourself activities”, can enable both goals to co-exist by supporting social movements and promoting of civic engagement. The authors promote methods such as action research and participatory involvement as useful to achieve these goals. To give a concrete example from a similar domain, Strengers [349] conducted a study on the potential impact of eco-feedback systems for individual behavioral optimization by giving users feedback on their water and energy use. The results identified weaknesses

in the impact of such systems and concluded that, for sustainable practices to be achieved in the long term, it is necessary to understand how and why certain resources are used and in what context the practices around them are embedded. The mere information disclosure of eco-feedback systems does not necessarily lead to sustainable practices [349]. Brynjarsdóttir et al. [42] similarly emphasize the need to include the context in which sociocultural practices take place to effectively address sustainability challenges. Arguing that, persuasive eco-feedback approaches are, in themselves, problematic without an underlying understanding of people.

In contrast, the concept of ‘connected sustainability’ [274] emphasizes a focus on community. Here the authors explore the role of digital technologies in supporting collective action by investigating grassroots movements and communities that share a strong sustainability agenda and the desire for political, economic and societal change. Examples include tools that build and maintain social networks, that connect individuals with their communities and others with similar goals, or tools to help communities to maintain and extend their practices and connections. In such contexts, HCI scholars argue that digital technology should be appropriated as an infrastructure to support social interactions, rather than as a solution in itself [228, 328]. Le Dantec defines infrastructures as “the integration of social and technical resources through a network of [reconfigurable] attachments” [228].

This is echoed in recent scholarship [220] which outlines how flexible digital infrastructures allow community initiatives proliferate by replicating the same ideas in new ways across different contexts. Relatedly, Knowles et al. [210] draw linkages between SHCI research and the concept of a sustainable future while criticizing individualism in SHCI [211]. The authors identify two dominant approaches within SHCI research: (1) sustainability through incremental change and (2) sustainability through systemic change. They argue that more radical concepts are needed and present ways in which SHCI can contribute to sustainability. For instance, they suggest that SHCI can also make a contribution in the area of citizen participation and enable coordination among citizen actors [211]. Clear et al. suggest that in HCI, people need to be involved in a cultural shift around food consumption [67]. They say, “[o]nly by making the sustainable easier, more acceptable, more ‘normal’, [can we]

achieve a large-scale transition toward sustainable diets” [67]. Currently, large food operations dominate the market. Alternative models of supply need to be considered for sustainable practices (e.g., alternative local food economies [295]). Furthermore, HCI can assist in the design of citizen platforms that address local food consumption or promote urban communities that grow food [67]. In connection to this, research has increasingly emphasized the synergistic interrelations between consumption and production, often referred to as prosumption practices [310]. In recent years, research has progressively aimed to understand and support prosumers [310], who act in both consumptive and productive capacities, for instance, in the context of food [252, 259] and energy [152, 253].

To summarize, past work has unpacked the role of digital technologies in creating more sustainable behavior and practices around food from waste management applications designed for individual use in the home, to more distributed systems that connect and mobilize grassroots and activist collectives, and support practices of ‘prosumption’. Moreover, a shift in focus from designing for individual behaviors to collective practices was identified where researchers widened their remit to capture the contextual and relational complexities of food practice sustainability. Our research is situated at the intersection of SHCI and HFI looking into sustainable human-food practices, and identifies the challenges that need to be met (see chapter 5.3) if we are to encourage more just food systems [386]. Therefore, in this paper we build on the existing literature by unpacking processes of (re-)distributional justice in relation to community building.

6.2.2 Food Sharing in HCI

The desire for resilient communities, where residents produce their own food rather than depending on industrial food production, is growing [247]. Similarly, issues such as food waste and biodiversity are becoming ever more significant. As a result of this (and reflecting the aforementioned interest in more collective approaches to food system sustainability), many grassroots initiatives are popping up around the world [247]. A number of recent studies have unpacked the sociotechnical practices of such movements in different

forms, for example, web-based food networks [295], digitally mediated seed sharing [169], IoT systems to support urban foraging [88], systems to deliver food resources to people in need [92], online urban gardening networks [104], and food sharing initiatives that (re-)distribute surplus food within their local communities [29, 61, 132].

The practice of food sharing has been investigated as part of the sharing economy encompassing a variety of collaborative consumption models [110]. A recent paper by Michelini et al. [251] identified three emerging models of food sharing: for profit, for charity, and for community. However, even within these models the motivations and sociotechnical configurations of initiatives vary. Many initiatives are centered around ecological concerns such as reducing waste or biodiversity, or social factors, such as strengthening a community or addressing problems of food insecurity. A large proportion of initiatives are non-profit [79], and within those non-profit initiatives many focus on the redistribution of food products to those in need [82]. Regardless of the model, food sharing as a practice is undertaken for and with others, reshaping relations with both human and non-human entities, and with tangible (e.g., food) and intangible (e.g., knowledge) resources [247]. Such bottom-up approaches to food (re-)distribution have the potential to give those involved more agency and to be seen as food citizens instead of mere consumers [295].

Related work by Berns et al. [28, 29, 30] investigates the complexities associated with sharing surplus food within a local community economy and illustrates collaborative practices that can transform how we perceive and value food. For example, the authors argue that through collective practice of community volunteers collecting surplus food, sorting it, and sharing it, food that would have otherwise gone to waste is re-invested and transformed from being a commodity to a gift [28]. Building on this, later work by the same authors [29] explores queuing as a central practice of sharing food in that it demonstrates how the community deals with the practical issue of managing the flow of attendees while also speaking to how core values such as fairness and activism are organized. The authors go on to investigate design spaces for alternative queuing mechanisms at face-to-face food sharing events, exploring the role digital technologies and values can play in re-framing meanings usually associated with queuing. This avoids polarized narratives of efficiency

versus socially-centered views of sociotechnical queuing practices [30]. Relatedly, a study by Landwehr et al. [223], investigated the use of ICT for the distribution of food according to community values in the context of community supported agriculture, framing it as the mediation between consumers' wishes and the constraints of local agricultural production.

Grassroots communities, such as food sharing initiatives, are good examples of how people self-govern to address diverse concerns and the above work highlights how social change in food sharing can be built with the use of socio-ecological technologies. Yet, the members of grassroots communities rarely participate in the design of the tools they use and some argue that positioning designers as "in charge" of design processes is inherently problematic and unjust [73]. This resonates with the work of Manzini and Coad [242], that calls for the 'expert' designer to recognize and utilize the design expertise that grassroots initiatives already enact through what they call "diffuse design" - meeting the innate creativity and design capacity human beings have when confronted with new problems. However, it must be noted that technology can only support activist movements if enough people use it. This is one of the reasons why Facebook is widely used by grassroots solidarity and activist movements (see [132] and [28] for example). Widely used mainstream technologies such as social media (in our case: Telegram) provide templates for participation that are broadly and readily available, and easily adopted despite being one of the prime agents credited with undermining democracy [222, 317]. Collaborative engagement and social networks are particularly conducive to this, it is suggested [79]. It is common for platforms such as Facebook and Telegram to simply be used as a means of organizing later face-to-face food and food resource sharing events (see [29] and [104] for example). A major initiative which depends heavily on ICT is that of Foodsharing.de, a German-speaking movement [314, 321] that is supported by a bespoke platform (Foodsharing.de), as well as a Facebook page [132]. The platform supports publicly accessible (re-)distribution sites (like SharingHut24/7), peer-to-peer food sharing (Foodsharer), as well as food saving (Foodsaver), and had over 512,000 registered users as of September 2022.

Past work has investigated the motivations and sociotechnical practices of various types of food sharing initiative across different contexts and locations.

Moreover, existing work in this space has highlighted how the use of digital technologies are interwoven with community practices, sometimes reflecting the values of members and sometimes in tension with these values. Our work connects to research on the social aspects of food sharing, especially on sharing surplus food as a communal activity. Building on similar distributional challenges identified in other food sharing communities, our work refines this by developing a clear framework with which fairness can be understood and by exploring opportunities that ICT might provide for negotiating fairness and food sharing events, and by exploring community building through generalized reciprocity [319].

6.3 Method

6.3.1 Authors' Positioning

The project has thus far involved 28 months of research (22 months for AuthorOne, 12 months for AuthorTwo), using a practice-based [394] and action-oriented research approach [166]. AuthorThree and AuthorFour have conducted research in closely related communities and have contributed extensively to our mutual understanding of the evolving nature of what communal resources might be. The research involved active and ongoing collaboration with the community and was conducted in order to iteratively develop “collaborative activist-community interventions” [164]. Action research is suitable for research “with people experiencing real problems in their everyday lives” [164]. The action-oriented approach aims to generate “local solutions to local problems” [164] and allows us to think carefully about the roles of ICT in the context of a local community where (re-)distributional justice is contested. As Funtowicz and Ravetz put it, post-normal science is a “[...] problem-solving strategy that is used in the case of uncertain facts, controversial values, questions of great importance and an urgent need for action” [129]. Scientists involved explicitly give up fictions of objectivity during their activist engagement, and, in an integrated social process, ensure the quality of their findings through a community of experts drawn from civil society [97]. In this way, extended facts and an extended spectrum of knowledge and values provide

contextualized solutions, whose emphasis is less on generalizability and more on transferability. Because of its democratic and collaborative approach, it is particularly relevant for us as activists and researchers and supports answering our research question: “How can ICT support sustainable food practices in the context of a local community engaged in sharing rescued food in a normatively mediated, and contested, situation?”. In order to answer it, our aim is, on the one hand, to investigate the materiality of current practice in the food sharing group and how it is established by the habitus, discourses, artefacts, and use of space by participants [178]. On the other hand, AuthorOne and AuthorTwo see themselves as food activists, who are committed to the transformation of food practices towards sustainability, both locally and globally. Both have been actively involved in the German Foodsharing movement for over eight years and currently support a local Foodsharing community (with AuthorOne having close connections to the designers and developers of the Foodsharing.de platform and AuthorTwo being a representative and leading Foodsharing Siegen with two other Ambassadors). Their day-to-day commitments within the initiatives of SharingEvent and SharingHut24/7 include taking up responsibilities for coordination and organization (like scheduling, moderating or taking the minutes of a meeting). Both were actively involved in all interconnected practices (see chapter 5.3). The volunteers were continuously kept informed that AuthorOne and AuthorTwo were collecting and analyzing data. In addition, with the Homeland Association and the local university, they established a living-lab (see e.g., [331]) for research on sustainability in a local context.

6.3.2 Data Collection and Analysis

Our qualitative data includes informal conversations and field notes that were written up by AuthorOne and Author Two during and at the end of each session in which they were active participants. Likewise, a survey and brainstorming session were conducted during a SharingEvent about six months into the project. The nine semi-structured interviews with 15 participants were taken in months 8-9 and lasted between 18 minutes and 2.5 hours with an average time of 64 minutes (see Table 4). The focus there was on opportu-

nities and challenges involved in potential development. Similarly, the roles of ICT were a central theme of the interviews. Interviews were also conducted with Foodsharing Ambassadors from another city (Giessen) to provide points of comparison. Semi-structured interviews offer the possibility to generate reliable, comprehensible and goal-oriented information and insights whilst allowing for flexibility [41].

Interview	Participants	Role	Duration (Hours)
#1	1&2	Administrative Worker at the Homeland-Association; Chairman of the Homeland-Association	0:18
#2	3&4	Volunteers of the SharingEvent	0:28
#3	3-8	Volunteers of the SharingEvent	1:21
#4	9-12	Foodsharing-Ambassador in different city	2:36
#5	7	Volunteers of the SharingEvent	1:48
#6	13	Guest of the SharingEvent	0:31
#7	14	Volunteers of the SharingEvent	1:11
#8	1	Administrative Worker at the Homeland-Association	0:24
#9	15	Guest of the SharingEvent	0:38

Table 4: Interviews and participants

Participant observation was another component of this research. This allows researchers to engage with people and objects already involved in the practices [45]. The interviews and field notes were coded and analyzed with Braun and Clarke's thematic analysis [39]. After the initial data collection, analysis began and new research data were collected iteratively. AuthorOne and AuthorTwo organized two hybrid workshops on the theme of (re-)distributional justice for the SharingEvent with twelve participants who were encouraged to write down notes on why they participated in organizing the SharingEvent, collectively cluster them into themes and discuss them together. Both authors also participated in numerous organizational meetings taking place of-

fline, online and in hybrid form (e.g., in the communal garden, via Zoom or the Organizational Team’s Telegram group) and had access to PAD (a web-based collaborative real-time editor) material. According to the action-research approach we followed “cycles of inquiry that include planning, action, and reflection, in which the action being undertaken is continually designed and evaluated with research results emerging throughout these cycles” [164]. Thereby themes were generated from the codes and iteratively became more evident to subsequently derive into design spaces. Here, the question of who gets what, why and when and corresponding negotiation processes between the helpers and also other participants, such as the guests, came to the fore, which led us as researchers to work on conceptualizing (Re-)distributional Justice together with the community. All quotes below have been translated into English from German.

6.4 Context

In March 2020, the Covid-19 pandemic led to a temporary closure of local food banks. Food banks here typically responded to need by providing low-cost food to those who can demonstrate that they were in need. The loss of low-cost food posed a major problem for many citizens who had previously taken advantage of the food bank’s services. As a consequence, the ‘Homeland-Association’, a club devoted to the maintenance of local traditions and associated with different charitable projects, started temporary food (re-)distribution in a garage. AuthorOne became involved in the project early on, approaching the Homeland-Association and offering his support and subsequently assisting in the work. Food had typically been obtained through donation and through the (sympathetic) supermarket next door, which had a policy of giving away surplus food to the Homeland-Association. The Homeland-Association had then provided food at certain times each day. The main issue then was to coordinate (re-)distribution of the food and some problems arose. The first people to arrive usually took several big bags of food, so there was not always enough left for others. Subsequently the newly formed association, ‘Solidary Neighborhood Help’ (SoliNa), who had started another food (re-)distribution center elsewhere in Siegen joined forces with

the Homeland-Association. Every day, free food was given out to citizens without having to meet any poverty criteria. This involved both food donations and food rescued by Foodsharing from cooperating food businesses.

In the meantime, and in addition, the volunteers had established an independent SharingHut24/7 (local hut for food sharing that can be accessed by everybody right around the clock) and a twice-weekly public (re-)distribution (SharingEvent) of rescued and other food (resources) in front of a social store (where donated products are resold cheaply). The focus of this project, for the organizers, increasingly became sharing food with an eye to (re-)distributional justice. That is, towards some sense of equity and, more importantly, community building. This dovetailed with other projects, such as the community garden of the Homeland-Association, which is only 20 meters away from the SharingEvent and SharingHut24/7. Developing these nodes in a potential resource sharing network was a major ambition of the two main authors.

6.5 Results: Challenges and Opportunities

Our findings revealed several features of the food sharing initiatives that had consequences for community building. These we analyze in relation to indigence, fairness, wider food-related practices, community building, and the role of ICT.

6.5.1 Free Food linked to Indigence

Moral judgments about the SharingEvents were commonplace. Helpers both in Siegen and in Giessen experienced judgment about entitlement or otherwise:

“I’ve sometimes talked to people and they’ve said they don’t go there because they think their need is less. And then you always have to explain ‘we are left with a lot of food every time and then have to take it to the [SharingHut24/7] again’.” (Respondent 10, Foodsharing Ambassador from Giessen)

SharingEvent is often perceived as a kind of food bank. The structure of the SharingEvent in Siegen perhaps reinforces this view since it takes place in front of or below a social store in a local area in which a lot of people live in precarious circumstances. Guests are not always aware that everyone is invited to participate in the project and it is explicitly linked to sustainable food practices. Respondent 7 describe this perception:

“[...] especially because then it is often said that we are the food bank. That’s how you notice that people first think that these are donations.” (Respondent 7, helper at SharingEvent in Siegen)

The food redistribution of the food banks is closely connected with stigmatization and shame [98, 204, 273]:

“I would like to be able to send my mother and say ‘what do you want to traipse to the weekly market again now, when you can look there first’. Without that... it’s still a bit of ‘oh yes, but that’s also a bit embarrassing’ for everyone.” (Respondent 13, guest at the SharingEvent in Siegen)

Making the ‘sharing’ goals and ideas behind SharingEvents and SharingHut24/7 understandable to outsiders was a challenge. Not least, as one volunteer said, “with people who are in need, community is not the primary goal.” (field notes 21/06/2022). Despite the emphasis on food rescue in promotional material, in both the Facebook and Telegram groups, inquiries were made about whether proof of need was necessary or how much the food costs.

6.5.2 Fairness in the Sharing of Food (Waste)

The perception of fairness, or ‘justice’ came up again and again in the context of SharingEvent and SharingHut24/7. Interestingly, such perceptions differed markedly. In both the Foodsharing cities of Siegen and Giessen guests and helpers had quite distinctive viewpoints. This was consequential when the organizers of the SharingEvents in both Siegen and Giessen decided to introduce rules for the SharingEvent in order to (re-)distribute food in a way that

they saw as fair. The main principle behind the rules was that everyone who comes to the SharingEvent could take food with them. The reason for the introduction of the rules in Siegen was that guests who came first had taken so much that there was little left for those who arrived later:

“[...] our experience showed that the early arrivals filled up their bags. They probably did not eat or use all of that food and the others who were then later [at the SharingHut24/7] then got nothing at all, so unfortunately that didn't work at all.” (Respondent 3, helper of the SharingEvent Siegen)

The introduction of rules evoked further challenges. This led to discussions about how fairness might be best conceived, and whether, for instance, size of family should be a consideration:

“The justifications were often understandable: ‘I have four children; I have five children at home’. It is difficult to say something against it, but on the other hand you have other people standing there who are also hungry. That was a real dilemma, it was difficult. You knew you were doing the right thing, but it felt wrong.” (Respondent 3, helper at SharingEvent Siegen)

Nevertheless, bearing in mind that an overarching goal of the Foodsharing movement is to prevent food waste, it was felt by some Foodsharing members that it does not matter who gets how much food as long as there is no waste. For the organization, that overrides other considerations:

“The main goal of Foodsharing is to reduce the waste of precious resources on earth. [...] While implementing these goals, there can be the great side effect that the rescued food also supports those in need and promotes projects. Foodsharing, however, does not have as a goal to provide security of supply for those in need.” (Foodsharing Wiki that provides general information and rules on Foodsharing.de)

Another perception of fairness concerns contribution. In general, Foodsharing volunteers pick up the surplus food from supermarkets and bring it to the SharingEvent. Yet, the Foodsavers as well as the volunteers at the SharingEvent could take what they want first. This was justified by the extra contribution they make, especially if financial cost were involved. This, however, conflicted with the principle that everybody, volunteers or guests, should have the same chance of being first. In Siegen, a (re-)distribution system developed over time, in which the helpers of SharingEvent hand out the food as well as food resources (like seeds, soil or crops), while the guests stated what food (resources) they would like. An assessment is made by the helpers based on the amount of food (resources) on hand and the number of guests that day and is based on a collective judgment. Helpers could intervene when guests want to take ‘too much’ and point out that there are other guests. Debates about proper procedure continued, however, and two workshops were conducted to identify different views of fairness and establish some policy consensus. During the workshop it became clear that the concept of (Re-)Distributional Justice was an issue that correlated strongly with views concerning the group itself. After discussion, the group identified the relevant themes as ‘poverty relief, education, meeting people, improving the world, from redistribution to sharing, avoiding food waste, saving resources, personal benefit/added value’. Most of the staff members emphasized connecting with others and tackling environmental problems (sustainability issues around food). Most disapproved of the ‘first come, first serve’ approach, as it did not produce the desired community effects and did nothing to fuel other ongoing projects.

Because volunteers faced several issues with this system, the organizing group collectively ruled that a ‘draw’ system will be implemented “so that there is no two-class society” (Telegram Organizational Group 03/04/2022). Slips of paper with random numbers were distributed in the queue to determine order (shuffled) in the queue. The queueing system was iterated in order to resolve some difficulties, which had to do with several family members sometimes being in the queue or there being too few tokens to allocate to everyone, and a ‘gamified’ version was introduced, using a memory-card game to draw the order, and also, before the SharingEvent started, all participants had the opportunity to decide on a special food prize from the food to be distributed

to the last person whose memory card is drawn. The new queuing system makes the (scarcity creating) anti-cooperative practice (investing time to be the first) impossible and mitigates against competitiveness. In addition, the SharingEvent was perceived by all participants as much more entertaining. Since the previous queue was no longer necessary, a semicircle formed around the SharingEvent, in which all participants stood and waited excitedly to see whether the equivalent of their memory-card was drawn.

At a local level, then, perceived scarcity of supply determined judgements about fairness. Some mitigation occurred when AuthorTwo became more present and had introduced the first version of the shuffled picking-order (inspired by [29]), through which volunteers and guests had the same chance of being first. There is an implicit moral authority that comes with face-to-face contact that, at least to some extent, moderates what can otherwise be selfish behavior. The workshops sensitized the community to their different perspectives on the purpose of the SharingEvent. Through the workshops and in the weekly meetings in the community garden before the SharingEvent, common rules were iteratively established with all interested parties. Both action-oriented researchers consciously avoided any imposition of their perception of fairness onto the community. The visible sensitivities that arose from face-to-face interaction prompted volunteers to deliberately interact more with the guests, especially in the period before the SharingEvent opened (Covid-19 had previously discouraged this). We can see this as, in embryonic form, embodying a recognition of the need for certain communal values to be made explicit. Yet, tensions are recognized, and when they arose during the SharingEvent or in online discussion, the action-oriented researchers addressed it right away and initiated face-to-face meetings for all interested parties.

6.5.3 SharingEvent/SharingHut24/7 as a Hub for other Sustainable Food Practices

It was intended that SharingEvent as well as SharingHut24/7 should serve as a locus for other sustainable food practices (see Figure 9).

In the two cities we describe, activists have created a number of loosely linked activities and resources. Respondent 7 considers the link to the community

garden, for instance, to be important because food literacy can be conveyed through involvement in the community garden:

“[One] idea was, that exists through the garden, to introduce people to the [SharingHut24/7] and to the garden, because planting food is also a food literacy, to know in general what does a plant need, how long does a plant need, how much space does a plant need, how much sun, how much water, etc.” (Respondent 7, helper at the SharingEvent in Siegen)



Figure 9: SharingEvent and SharingHut24/7 as a hub for other sustainable food practices

For some, the local production of food was bound up in a critique of capitalist modes of food production. Community gardens, well-established in Siegen, formed part of this wider agenda, and efforts were made to link the gardening activities to food resource sharing. The distribution of seedlings was one such

effort. Many fruits and vegetables grown in the gardens were often distributed in the SharingEvent and guests have been encouraged to come and dig up their own. Biological waste from the SharingEvent is recycled in the garden. The community garden also acted as a space where people could wait for the SharingEvent to start. Helpers suggested that food and drink could be brought to the garden as well. Though these signs were and are only early signs they do point to the possibilities inherent in the developing network. Food production activities have become more common. In both Foodsharing cities, there were examples of guests bringing canned food back to SharingEvent to share. A helper of SharingEvent in Siegen, for instance, brought several jars of apple jelly to SharingEvent after noticing the apples in the community garden had not yet been picked. Several times a woman brought cake which her mother had baked. She was happy when “it reached the right people”. These were people who explicitly wanted to support the SharingEvent.

“There was one who took something, then he baked a cake [from it]. He also boiled [the] things down and distributed them again the next time. He had fun with it.” (Respondent 12, Foodsharing Ambassador in Giessen)

The SharingEvent and the SharingHut24/7 offer the possibility to make people aware of the organization of Foodsharing in general. People who want to get involved in Foodsharing get a low-threshold introduction through the SharingEvent:

“There is a community, there’s food, it’s quite cozy, they’re nice, and when you grasp the idealism or the ecological idea behind it, then the entry hurdle is quite low.” (Respondent 12, Foodsharing Ambassador in Giessen)

A wider issue related to food waste is that of food literacy. During the SharingEvents in Siegen, it became clear that many people were not aware of how much edible food is thrown away every day. It is argued that SharingEvents can contribute to increasing appreciation for food [28] and can highlight problems in the current food system [79]. SharingEvents provide a new infrastructure that can lead to already discarded food undergoing a value shift from

“garbage” to “edible food” [79]. Uncertainties, however, exist during the SharingEvent when dealing with food that has passed its best-before date. There is a lack of knowledge about whether food can still be consumed. The helpers often provide information during the SharingEvent and explain that the best-before date does not mean that the food is inedible. The difference between sell-by and use-by dates are not understood. Furthermore, there is opportunity to spread knowledge about keeping and revitalizing fresh food:

“[...] then the things also don't look so fresh, so many also really have this 'it all has to look tip-top, otherwise I don't want to use it'. So about crooked carrots [...] or sometimes a bit limp salad, I mean, that is also quickly fresh again. [...] I think that really has to sink into the consciousness a bit more.” (Respondent 13, guest at the SharingEvent)

Also, some guests lack basic cooking skills:

“That is also something we noticed at the very beginning, when so many vegetables came and there was a demand for ready-made meals and you first had to explain how vegetables had to be cut and what they were and we ourselves were partly puzzled: 'okay, something new again, these are turnips, this is mangold'.” (Respondent 7, helper at the SharingEvent in Siegen)

This relates closely to community support activity objectives, in that people who pick up food often do not know how it can or should be prepared. One helper pointed out that, partly because of the queuing system, he did not find time to explain preparation properly. Several invitations, via Telegram, were issued to communal cooking events. One guest, who was a cook, offered cooking class evenings and to provide recipes. Remarking on a large number of left-over bread rolls, she noted, “You could still make super bread dumplings out of that!”. The Homeland-Association also runs a restaurant six times a week, where people can buy a three-course meal at a reasonable price. Finally, SharingEvent and SharingHut24/7 are linked to a local Free-Shop (people bring goods for free and volunteers place it outside on an open

place for anyone to take). Here, guests are also directly approached and invited to participate and contribute.

In order to use the potential of the SharingHut24/7 as a hub to link other projects, further work is needed. There is an evident ambition, only as yet realized in part, to fulfil wider objectives by strengthening links between various groups so as to pursue the objective of building community. At very least, the SharingEvent has become a node in this network, one which serves to increase awareness of different elements.

6.5.4 Supporting the Formation of a Community

The community that evolves can be understood as a Community of Interest [121], “defined by their collective concern with the resolution of a problem”. Here, different people come together who have a common interest. The heterogeneity of the group can lead to a valuable exchange, but can also make a common understanding of goals difficult [121]. In our case we saw a tension between “sharing for charity” and “sharing for community” [251]. SharingEvent offers potential for community building, and some research does show that volunteer food sharing contributes to a sense of community [238]. The experience of community is shared by an Ambassador from Giessen:

“What is super nice about the [SharingEvents], what also attracted me to it a lot, is this community thing, that you somehow came together, that you also always met the same people there, the same Foodsavers, also the same people who always took food, so that we always made a bit of a happening out of it.”

Yet, the Foodsharing Ambassador from Giessen goes on:

“That became more and more anonymous over time, which is a pity, it became more and more ‘oh that’s just work for us’ and less you come together and see each other and meet, there are already friendships and relationships that were lost over time, which I

think is a pity.” (Respondent 9, Foodsharing Ambassador from Giessen)

This echoes the experiences from Siegen. Action-oriented researchers repeatedly saw a threat to themselves and other people of being overwhelmed by routine responsibilities for coordination and organization at the expense of the overarching goals they set out with. For the growth of the community, the wider inclusion of interested people is important. Support for community engagement can be variously for tasks for everyone to take on, or more complicated tasks that volunteers might accept. We aimed to provide a space for all interested people to support the SharingEvent, for example with musical contributions. Conducive to community building was the interweaving of the SharingEvent into various sustainable food and resource sharing practices, both in the area of sustainable food consumption and local production, and the sharing of knowledge and skills (chapter 6.5.3). Volunteers from the SharingEvent participated regularly in the Free-Shop, joined Foodsharing and took further responsibilities there or learned about activities in the community garden together. Numerous guests subsequently helped out regularly at SharingEvents and became involved in other practices around SharingEvent and SharingHut24/7.

In the first 28 months, the community grew steadily. In addition to students and retirees, homeless people, people with disabilities and people from precarious living situations quickly became involved. In addition, post-Covid-19 the community has made continuous efforts to overcome language barriers. To this end, texts and videos were distributed or shown in different languages during the SharingEvent and attempts were made to engage people in conversation. As the months went by, it became apparent that there was more and more participation from people with immigrant backgrounds, e.g., by bringing homemade food or helping with set-up and dismantling things.

6.5.5 ICT-Systems: Conflicting use of Foodsharing.de, Telegram and Facebook

With regard to ICT, minimal overhead was very important. Volunteers and helpers do not see computer literacy as high on their agenda. Tools were quickly dropped when some members had difficulty. The community coordinated its work through an artefact ecology [47, 48], described as “[...] multifaceted, dynamic and pending on what the members bring to the table, as well as on particular situations of use” [48]. ICT (Text, Audio & Video) supported the efforts of the helpers in a variety of ways, depending on the purpose in view (see Table 5).

ICT	Target Group	Primary Role	Participants (Jan '21/ Sep '22)
Telegram group for organizational matters	Helpers of the SharingEvent	Coordination; daily exchange of helpers	30/42
Public Telegram Group	Everybody who is interested in SharingEvent and SharingHut24/7	Updates on the SharingHut24/7 and SharingEvent; sharing food with each other; discussions on ‘fairness’	111/237
Zoom	Helpers of the SharingEvent	coordination; exchange of helpers	6-9/0
Pad	Helpers of the SharingEvent	Shift schedule: self-organized fill in of helpers, who helps when; coordination of the key; collection of topics, to do, doing, done; collection of links to protocols	0/0

Facebook Page	Anyone interested in the topic of “food waste and food sharing”	General information (e.g., about food waste)	242/357 (Likes)
Facebook Group	Anyone interested in SharingEvent and SharingHut24/7	Addition to the Telegram group for people who do not use Telegram	126/91
Foodsharing.de	Foodsaver	Coordination of food saving at food establishments; information about SharingHut24/7	261/323
Telegram group for communal gardening	Helpers of the communal garden	Coordination of work, information, picture-sharing	Not yet established/40
Television: Videos in different languages	Guests at the sharing event	Explaining the SharingEvent and invite people to participate	0/15-40

Table 5: Use of ICT, their primary role, and their target audience

Even so, some conflicts arose over time as to which applications and/or platforms were most suitable for certain purposes. In general, the platform Foodsharing.de offers the functionality to support coordinating activities. Nevertheless, a Telegram group was opened at the beginning so that the helpers for the SharingEvent and SharingHut24/7 could coordinate with each other. In addition, a ‘shift plan’ PAD was created on which the helpers for the SharingEvents registered and organized their work. The PAD fell out of use because many of the helpers had access difficulties or the PAD display was too

small on their smartphone. Personal inquiries take place almost entirely in the organization's Telegram group. There was a clear desire from SharingEvent helpers to again use a shift schedule or slot function (similar to the slot function on the Foodsharing platform to coordinate who picks up and when in the corresponding supermarket-pickup-team).

Various ICT systems are used in connection with the SharingEvent and SharingHut24/7 to coordinate helpers and as a source of information for guests. Both the Foodsharing platform and Telegram groups are used for these purposes. There were, however, challenges associated with the Foodsharing platform. Use of the platform required users to understand how it functioned, which turned out to not be straightforward for some. Respondent 13 found the Foodsharing platform through the Google search engine, but she had trouble finding her way around. She describes that she found the map with publicly accessible redistribution sites (like SharingHut24/7), but then suddenly ended up in other cities:

“I think I just entered something with Foodsharing Siegen and then it came up and I'm just, I have to admit unfortunately, not so good with all these technical media and then I'm always tinkering around. But somewhere I got further in this Foodsharing platform, up to this map, where you could see these locations and then [...] I accidentally tapped on something.” (Respondent 13, guest at the SharingEvent in Siegen)

Furthermore, it was not clear to respondent 13 how exactly the Foodsharing platform worked. She could not tell if she had to become a member or if she had to take the Foodsaver quiz (mandatory quiz about rules and hygiene information in order to use the platform as a Foodsaver). At the same time, she emphasized that she is not very good with digital media:

“It wasn't really clear to me, do you have to [become] a member first, or can you look there otherwise, or do you have to take this test first, or not? But it may also be because I'm just not that into using things like that.” (Respondent 13, guest at the SharingEvent in Siegen)

After this experience, she stopped using the Foodsharing platform. Other users of the Foodsharing platform also felt overwhelmed. An Ambassador from Giessen reports that she gets frequent feedback from new Foodsharers suggesting that people are not coping well with the platform:

“[...] at the newbie meetings there were, yes, several times ‘yes I haven’t dealt with the platform yet, it’s too highly technical for me’.” (Respondent 9, Foodsharing Ambassador from Giessen)

Davies et al. emphasize that many grassroots initiatives have limited resources to invest in complex technology [81] and in this instance it appears that the Foodsharing.de platform was developed by and for people with a greater level of knowledge than most.

Non-use by some key individuals caused some difficulty. Food collection was sometimes difficult because individuals were not registered on the platform and therefore were not able to collect surplus food. One helper was particularly annoyed when he learned that large quantities were available to be picked up, but little had arrived at the SharingEvent. This was because too few helpers were registered on the Foodsharing platform and thus did not receive notifications from the supermarket-team on Foodsharing.de, which coordinated the pickups. Equally problematic is that the platform has a hierarchy of rights and privileges which makes coordination difficult.

The Foodsharing Wiki stresses that communication should be done via the platform as much as possible, but this became largely poured into the breach. This is justified by the fact that this is the only way to ensure that all members are reached. But disadvantages include that time-critical messages such as delays in pickups are not seen in time. The Foodsaver has to actively check the platform for current status updates. For such reasons, Telegram groups for communication, in addition to the platform, are used. The public Telegram group in Giessen has about 2300 members as of September 2022. It is used to share the current status of the SharingEvent and to update current food status at different SharingHut24/7s. Similarly, a public Telegram group was started in Siegen named ‘Food SharingHut24/7 Siegen-Achenbach’ and was

launched on October 6, 2020. Comments about the relative merits of the platform and the messaging system include:

“The Foodsharing Telegram group is much more active. It is not only used for updates, but everyone can post ‘I myself have something to give away’ or something like that, and that’s what some Foodsavers do: [...] they post either ‘I’m giving it away’ or ‘It’s right there’, so that they immediately give it from person to person.” (Respondent 11, Foodsharing Ambassador from Giessen)

Telegram groups were also used to strengthen community building. The Foodsharing platform was seen as too static for community building:

“[...] this Foodsharing platform is not suitable for social community building in my eyes. It’s too slow, it’s too static, and you need an email address and a browser and you can’t get it pushed to your phone.” (Respondent 11, Foodsharing Ambassador from Giessen)

“The [public Telegram] group fosters a sense of community regardless of age, social class, or cultural background.” (Online survey participant 5, 50-61 years)

Updates on the public Telegram group, which are published either in the form of photos and/or text, can be made by any member of the group. It is preferred to other messaging systems:

“We have a Facebook account and Instagram account I think. We have tried to do this in a similar way, but in the end, there is simply not enough workforce to look after it. [...] With Facebook, you then have to assign the admin rights, [...] then it becomes confusing at some point.” (Respondent 9, Foodsharing Ambassador from Giessen)

In addition, there is a separate Telegram group to support the coordination of pickups and instant communication with some cooperating companies in both

cities. Delays in pickups or company-specific information are communicated via these groups:

“[...] I still have a separate Telegram group for each business/supermarket, which I ideally have to join, so that I can manage and communicate time-critical things and so on.” (Respondent 9, Foodsharing Ambassador from Giessen)

In sum, a simple messaging system with limited functionality is in general preferred to the more sophisticated platform because it is easy to use and makes coordinating work much more straightforward.

6.6 Discussion

The literature [67, 88, 131, 271, 282, 342, 349, 382] attests to the fact that there is more than one approach to food sustainability and that there is sometimes a tension between them. Our results show how these tensions manifest locally and originate from different notions about purposes and values. We could identify two broad notions concerning the purpose of SharingEvent and SharingHut24/7. One is associated with the management of scarce or surplus resources and the other with a much wider concern for a transformation towards sustainable consumption and, equally importantly, production. This latter view is associated with a concern for community building.

Besides a series of practical challenges, the practices of SharingEvent and SharingHut24/7 in this context are heavily mediated by sometimes conflicting values. Consequently, we subdivide the two perspectives further according to the values involved, in particular those resulting in conflicting notions of fairness – or (re-)distributional justice – which we will explicate in the following section.

Our work is not predicated on adjudicating these versions, but more on supporting a space for healthy debate, and for opening up opportunities for engagement. Technological support for community building, in other words, can act to mitigate the tensions we otherwise see. That is where we see the primary outcome of the action-orientation of our research (see chapter 6.3.1).

6.6.1 Aligning Purposes through Community Building

Direct resolution of the partly conflicting notions of fairness we identify is not our aim, nor to forcing an ICT system onto the community that embodies what we deem to be fair. We are committed to the view that it is up to the community to resolve the tensions that arise. Nevertheless, we argue that community building is, in the longer term, the way to minimize, if not eradicate, these tensions. For the community to scale up and not to fracture it requires, we argue, the alignment of different purposes evident in our data. These can be summed up in the following way. They roughly map onto the two main groups, those of guests and volunteers. However, this mapping is neither strict, nor do the people involved necessarily hold only one of these partly conflicting notions.

Firstly, a notion of **charitable fairness** comes into play. Such a view sees those who are indigent as having priority. We see this both explicitly in the discussions and implicitly in the reasons visitors give for why they should be favored. This view also implies that those who benefit should take what is offered. A variant of this was manifest in the old queuing system, in which participants could invest their time by arriving early (an issue that also arose in work by Berns et al. [29, 30]), in that it encouraged a competitive attitude towards available food.

Conversely, there are arguments that the volunteers that contribute by saving or (re-)distributing the food surplus should have priority (see also, Berns et al. [29, 30]). This transactional conception is sometimes explicitly arranged by volunteers. We call this notion **contribution-related fairness**.

A different view emphasized the idea of **equality-based fairness** and was the basis for later versions of the queuing system. In this, no privilege was attached to arriving first to any conception of the ‘deserving’. Instead, every participant that arrived at the SharingEvent had equal chances. There was general approval of this new approach, though some argued for a combination of the equality-based and the charitable.

Common to the above three notions of fairness is a conception that the issue to be dealt with is the distribution of scarce resources. On the Foodsaver’s side,

however, these resources are not perceived as scarce, but as a surplus that ought to be distributed in order to not go to waste. Foodsharing proclaims this fourth notion of **no-waste fairness**, according to which the main goal is that no food is wasted and therefore it does not particularly matter who consumes it. Such an organization aims to make itself unnecessary in the longer term (as stated in the wiki on Foodsharing.de).

These four notions are united in their conception that the purpose of the SharingEvent is, in some variant, the management of resources that are perceived to be either scarce or conversely available as a surplus. A different conception, mainly held among some of the volunteers, is that the purpose of the SharingEvent, and their engagement in general, is directed at more sustainable food practices. This purpose implies a fifth notion of **systemic fairness**. It entails an awareness of an unfair global food system that combines local activism with a ‘glocal’ stance [132] according to which the community building activities are much more than just recreational. The systemic view of fairness holds to a much wider concern with the network of beliefs, ideologies and material circumstances which ultimately might result in sustainable consumption and, equally importantly, production. As we have argued elsewhere [105], scarcity is in large part a function of particular modes of production and consumption. Put differently, food and related resources are not in and of themselves scarce but become so because the practices of food management involve neither new forms of production nor distribution.

Part of the work of local initiatives is then, or should be, to provide creative alternatives. In contrast, ‘sharing for charity’ as Michelini et al. [251] frame the charitable view of fairness, is contentious for various reasons. The rigid distinction between provider and beneficiary can stigmatize as being relevant only in ‘low-income’ contexts. This creates a barrier to participation because people want to avoid that stigma [98, 204, 273]. By indirectly valuing indigence the, in our words, charitable notion of fairness risks reproducing it. Furthermore, if beneficiaries perceive themselves at the receiving end of a unidirectional process, no shared ideology or cooperative community engagement is facilitated among them. Kessl et al. [204] point out that social exclusion and food assistance are highly connected: “Giving excess food/surplus to those in need does not only not tackle the very reasons for their depen-

dency. It is over and above [...] ‘a one-way street of charitable supply’”, because a sharp separation between beneficiary and provider persists. They further argue, “[h]aving no choice but to take the leftovers of others’ choices is what social exclusion and disaffiliation mean” [204]. We saw community discussions about whether even that choice was ‘fair’ or not.

The tensions inherent in these different views are manifest in very pragmatic ways. Viewing the purpose of the event and the management of engagement as a function of scarce resources and/or surplus as against a more systemic view leads to different priorities. This is evident in the different uses to which technologies such as the Telegram groups as against Foodsharing.de were put. Telegram groups were regarded as easy to access and use, and flexible enough that they could incorporate a range of interests and views, in contrast to Foodsharing.de which was associated only with coordination of pickups. Given that activists often have little interest in technology, the flexibility of Telegram was vital:

“This Telegram group I definitely find very uncomplicated and I am truly quite dumb with such things. So, if it’s not straightforward, then I don’t like to use it.” (Respondent 13, guest at the SharingEvent in Siegen)

Meshing [234] the ICT used for SharingEvent and SharingHut24/7 with other local sustainable food practices (like communal cooking, communal gardening or the Free-Shop) outside of Telegram presents challenges, especially when it comes to Foodsharing.de. We have observed that communication is shifting from Foodsharing.de to Telegram, while the coordination of pickups remains on the platform. While only a few volunteers appropriated the rather complicated platform of Foodsharing, minimal overhead was what led to the success of Telegram. If a volunteer had difficulties with some ICT, the community supported its appropriation, but also dropped certain ICT, like the PAD, when more members had difficulty. Related work on infrastructuring [228, 328] demonstrates how knowledge and skill intersect with technology use. Norton et al. [270] argued, for the agricultural communities they investigated, that members can find technology distracting. They primarily desire more fruitful interaction with other people and with nature, and are therefore

more inclined to be selective in their use of technology [270]. Aligning the different purposes of technology and supporting the community in its use of artefact ecologies [47, 48], then, will need community building.

For the long-term success of an organization, community building is, we firmly believe, necessary. This must, by definition, begin with social encounters. Therefore, the proposed design must furnish a space for creation and maintenance of valuable personal relationships [32]. From spring 2022, sitting together before a SharingEvent and especially reflecting on the last event, brainstorming new ideas for design iterations, and coordinating the upcoming event was regularly done in the communal garden with more and more guests showing up or bringing self-made food to share. Likewise, the cooking events, especially in the context of the Free-Shop, in which members of the SharingEvent also volunteered, serve to build new relationships within the community. Furthermore, the communal garden can actively contribute to the creation of a community that grows food locally and shares knowledge and resources together. Along with this, the technology must support the long-term resilience of a project and “ITs [...] should work within their selective use values” [270]. This especially so since, in the context of SharingEvent and SharingHut24/7, people regularly join and leave the project, ways must be found to preserve knowledge, routines and information so that subsequent members can draw on them. This is the only way to promote sustainability [32].

While different views on fairness are negotiated within the community, we as action-oriented researchers must be careful to not “just dump technology on people” [44]. A gentle nudge is all we can aim for. Norton et al. conclude: “Developing information systems based on the values and practices of sustainability communities [...] has the potential to transform the information system landscape to one that can support the design and development of sustainable agriculture, if not one that is broadly sustainable and equitable” [270].

6.6.2 The Role of Action-Oriented Researchers

It follows from what we have described that we cannot and do not provide short term solutions. A more systematic treatment of the approach we took and the emerging consequences will be the subject of another paper as the community further develops. Our work contributes to a more general consideration of fairness in design by showing that different conceptions of fairness produce different outcomes in important ways. Other fairness related discussions within the broader field of HCI recently revolve around algorithmic fairness, understood as decision-making of (mostly AI powered) algorithms that are perceived to be just [279]. Algorithmic fairness is always reliant on underlying context-specific perceptions, which qualitative HCI studies (e.g., [119]) seek to uncover.

If design is inevitably about change [187], then the direction of change is very much relevant to our design decisions, and the tensions we describe inform both challenges and opportunities that arise. The issue of (Re-)Distributional Justice turns out to be fundamental here, while also appearing in other contexts of food surplus allocation and beyond (see e.g., [223]). This boils down to a frequently raised discussion on “who gets what, why and when?”. The answer, however, turns out to be highly complex, in that the people involved often understand the value of justice, or fairness, differently. In addition, suggestions about the (re-)distribution carry implicit ideas about what should be valued and thus rewarded or supported.

We have made no attempt to design a technological tool implementing those notions of fairness precisely because community building cannot be imposed. We draw on a large body of past work [17, 77, 89, 198, 228, 328] that demonstrates how sustainability and civic challenges are better approached by innovative use cases rather than “technological quick-fixes” [198]. We argue that scaling (Re-)distributional Justice in accordance with sustainability is not a matter of technological implementation but that “it is possible to imagine and design change at a broader level of community engagement” [198].

Therefore, instead our action-orientation is aimed at supporting this process of community resolution and more broadly reflecting on design opportunities

(and anti-designs [315]) together with this Community of Interest [121] (see chapter 6.5.2 and 6.5.4). To consider a design that allows the community (both visitors and volunteers) to settle tensions themselves, we propose the following design recommendations from our engagement as action-oriented researchers:

- Support community engagement through contribution, by offering tasks that are easy to take on, helping volunteers take on more complicated tasks, supporting the sharing of skills and resources, and opening up a space for complementary contributions. Contributing to a collaborative project fosters meaningful relationships and relieves the workload of other helpers in the long run (see chapter 6.5.4).
- Facilitate engagement with the day-to-day problems of people and embody ‘care’ for the community [84] rather than keeping “an emotional distance that enables the researcher to produce an organized account by playing down the disorienting messiness of everyday experience” [246]. Communicate appreciation to every single person for ‘being there’ at least as much as for their contribution to the project (see chapter 6.5.4).
- Maximize opportunities for participation in activities and discussions taking place offline and online. Technological assistance can be provided, often with little effort (e.g., downloading an app or sending an invite-link for a Telegram group; see chapter 6.5.5).
- Support initiatives from anyone who wants to discuss issues, like (re-)distributional justice. Address actual instances of tension between different perceptions of fairness when they take place. Try to show the different points of view in an understandable way and support the acute and long-term communication for their alignment. Open up spaces in form of meetings and workshops and maintain them, especially through regular invitation and an appealing design (e.g., the regular meetings in the community garden before the SharingEvent).
- Moderate decision-making processes and subsequent design choices regarding what notion(s) of fairness the community wants to commit

to (e.g., the implementation of the memory-card game to support the equality-based notion of fairness).

- Facilitate cooperative rather than rival engagement, e.g., through entertainment and gamification. As Riar's literature review shows gamification can achieve various "psychological outcomes such as fun, enjoyment, collective intentions, positive user experience and emotions, as well as social outcomes such as relatedness, increased group cohesion, collaborative skills, altruism, social identity, group norms and other group dynamics" [308].

Simply redistributing surplus food has nothing to do with sustainable practice. Our focus has been very much on transforming conventional food practices: because, as one participant put it, "saving and redistributing food only tries to alleviate the symptoms of a sick food system" (field notes 23/01/2022). To get to the root causes, transformational change needs to start with local food practices. The integration of local socialized bodies as active parts of transformative food practices works well in a community, prompted by activist intervention, that is striving towards abundance. We have argued elsewhere, that abundance and commitment to 'just enough' fosters the non-rivalrous approach that 'the more I share with you, the more will ultimately be shared with others' [105]. A simple change in the communal logic of practice from rivalrous to sharing can set a bunch of transformative food practices in motion. The question is, how to establish an awareness of the differences between managing the surplus of an unsustainable system and fostering sustainable practices that create abundance? Abundance in the context of community building means that everybody is invited to make a complementary contribution where possible. Abundance lies in the 'just enough' of sufficiency. Surplus food, if it is not scarce, creates a utopian space as Bogusz and Holtappels describe in the context of methods of performative sociology [34], where there is more than enough free food for everybody. When surplus food is deployed as a gift to a community it can act as a catalyst for sustainable food practices in communities striving towards abundance [105] (like 'disco soup', an event where surplus food is cooked together [357]).

Yet there remains a tension in the activists' endeavor, in that they want to leave the unsustainable mainstream formation of practice behind and integrate local people into an assembly of sustainable food practices through the means of surplus to motivate the attendee group towards community engagement. The activist group uses the surplus of the mainstream formation of food practices, but at the same time seeks to transform it. So, neither the activist group, nor the group they aim to recruit, might want – in the short term – to get rid of the mainstream formation of food practices, since the transformative practices of food sharing, in a sense, depend on its 'waste'. Here we argue with 'third space knowledge' of Bogusz and Holtappels [34] and 'post-normal conversation science' of Buschke et al. [43], activists can open up a room in which deep change [386] towards sustainability can take place and be experienced, especially where a diverse group can negotiate sustainability issues during their daily life commitments. The intended practices of transformation start from the display of a demonstrably central issue: food waste. Around that, activists can open up the possibilities for engagement by prompting awareness of the issues around redistribution, inviting others to join and to contribute. As we have shown above, the diverse group shares different values and purposes that are negotiated in a community building process. Transformation is about bringing a mix of practices, issues and possible solutions (different values) together to be negotiated and then to be tried out. We aim to support certain community practices that foster a change towards more sustainability (long term transformation). There will be no 'perfect starting point', no 'right way' towards transformation, and no 'either or' (0 or 1) within transformation. Rather we, as action-oriented researchers, need to support the plenum of social practices during a process of post-normal science [97].

6.7 Conclusion

This paper has investigated the different notions of fairness being negotiated in a local grassroots community that regularly shares 'rescued' surplus food and food resources in a SharingEvent and supports SharingHut24/7, where everyone can put and take food (resources) at any time. Through 28 months of action-oriented research we have gained insights into the practices involved

and the roles that ICT plays, especially in supporting sustainable food practices in a normatively mediated, and contested, situation. Thereby, this study contributes to research on sustainable food practices in the context of HFI, focusing on the social aspects of food (resource) sharing.

Our findings show that issues such as fairness, stigma, social norms, and lack of food knowledge present challenges. Likewise, various possibilities became clear, such as the use of a community garden and common cooking events to support sustainable food practices. *SharingEvent* and *SharingHut24/7* have contributed to the emergence of a community where common resources and knowledge are shared and developed. Digital artefacts have been used to coordinate, provide information, and support community building, but also to facilitate discussion of issues of justice in food (re-)distribution. A public and organizational Telegram group as well as other ICT were introduced to further support coordinating practices around the *SharingEvent* and *SharingHut24/7* and keep the sharing practices open and dynamic.

We have derived five different conceptions of fairness in play: Charitable, Contribution-oriented, Equality-based, No-waste, and Systemic Fairness. Subsequently we reflected on the alignment of the conflicting notions of fairness and the role of action-oriented researchers within the negotiation process taking place. Regarding the design of ICT, we suggest that in order to align the different purposes of *SharingEvent* and technology, and support the community in the use of its artefact ecology [47, 48], facilitating the negotiation processes of community building is paramount.

From our stance, redistributing rescued food surplus is connected to a wider agenda to transform consumption-oriented practices and embrace sustainable food resource spaces. Here, diverse groups share different values and purposes in order to promote prosumption and abundance, ultimately fostering a deep change in food systems [386].

7 In Between Users and Developers: Serendipitous Connections and Intermediaries in Volunteer-Driven Open-Source Software Development

Abstract

Technology plays a pivotal role in driving transformation through grassroots initiatives, which operate on a local scale while embracing a global perspective on sustainability. Consequently, research emerged within SHCI, aiming to derive design principles that can empower these movements to scale their impact. However, a notable gap exists in contributions when addressing scalability of large FOSS projects. This paper aims to present our endeavors as action-oriented researchers with the voluntary-driven Foodsharing.de movement, focusing on a local community, the open-source developers and their connections. Within a community of 585,000 users and only a few developers that is dedicated to save and share surplus food, we explore the concepts of ‘intermediary experience’. We also introduce the notion of ‘serendipitous connections’, highlighting the unintentional yet beneficial associations that can arise from the collaboration between developers and users.

7.1 Introduction

In the context of various global challenges there is arguably an urgent need to identify effective strategies for transitioning towards sustainable practices. Grassroots initiatives have emerged as a pivotal force exploring social innovation (see e.g. [15]) within local communities, e.g. opening up possibilities for ‘deep change’ in food systems [386]. Nevertheless, if such ambitions are to be realized at scale, it seems obvious that ICT will be implicated in some way. Especially in regards to food sharing communities the importance of technological resources has been attested to by Davies across a variety of platforms [80]. Given the largely anti-hierarchical and democratic nature of grassroots initiatives, however, the involvement of users in the design of relevant tech-

nologies will be central. FOSS projects are one way forward. They emerged as a response to proprietary software practices [85], aiming to promote collaboration [8], transparency [218], and community-driven innovation [118]. They serve, at least potentially, as a means of supporting grassroots initiatives, as recognized in the fact that HCI has paid increasing attention to supporting grassroots initiatives and their FOSS projects [141, 142]. Marsan et al. [243] state that “sharing, helping and caring are [...] the foundational values of the FOSS services field”, meaning that FOSS can be an alternative to using proprietary software and social media. Since grassroots initiatives often encounter resource constraints and other challenges in relation to their specific needs and values [32] they often currently rely on social media [28, 132, 315], even though it might compromise fundamental grassroots values.

FOSS projects depend on voluntary contribution from developers. Developers, however, are sometimes motivated to “scratch their own itch” [304], meaning pursuit of individual interests. They may equally address user grievances, bugs, and feature requests. Users, on the other hand, can be a great asset in initiating discussions [173]. However, we currently lack an understanding of how to support user participation in open source development for grassroots communities at scale [76]. Our research questions, then, are:

1. What strategies are currently in play to bring developers and users together in FOSS projects of large grassroots communities?
2. How might these strategies be further improved?

Hence, we investigate the large Foodsharing movement in order to understand what supports FOSS project work, especially in regards to the mediating work done with users and developers.

7.2 Related Work

The following chapter offers an in-depth exploration of various dimensions within FOSS projects, with a specific focus on Foodsharing.de. It examines the intricate interplay between users and developers, shedding light on their motivations, confronting challenges, and unveiling power dynamics. The

chapter delves into the concept of 'Developer Experience,' as well as frequent difficulties experienced in FOSS projects. Furthermore, it scrutinizes user engagement, emphasizing the significance of user input, effective communication, and the hurdles faced by average users. The chapter also scrutinizes the sustainability of FOSS initiatives, navigating power structures, and addressing unique challenges pertinent to expansive grassroots communities. To contextualize the FOSS discourse, we establish a link between SHCI principles and FOSS projects. It underscores the role of technology in supporting sustainable lifestyles and propelling grassroots initiatives.

7.2.1 Contribution to Open-Source Projects

Existing research has shown that, in open-source projects, the developer community may be quicker in fixing errors than proprietary software vendors, who tend to cover up flaws [37]. Additionally, open-source communities are quickly responsive to users' needs [350]. Open-source developers are usually intrinsically motivated and see their work as a way to improve their coding skills [140]. Hars and Ou [160] also highlight external rewards like expected future returns such as self-marketing and improved competencies as a source of motivation.

Shah [336] suggests that developers often join projects because they notice a specific need that is not met while using the FOSS project. Many need-driven contributors then continue to participate due to reciprocity, obligation, or a desire to fit the norms of the community but often leave after a short span of contributions. More than half of the long-term contributors (meaning that they contributed for more than two months) reported that participating in the FOSS project became a hobby-like activity to them [336]. Many interviewees emphasized the freedom and creativity they found in the community, along with the significance of both feedback and a friendly atmosphere within it.

Open-source software projects are often described as onion-like: A small group of developers as the core, a group of committers who support the core team, but have to ask for permission for major changes, a group of contributors who report bugs and supply minor fixes, and those users that are not involved in coding [299]. Gasparini et al. [135] show that in popular open-

source projects, 87% of users do not contribute to the project at all, 10% contribute occasionally and 3% contribute a lot. The authors base their analysis on the “90-9-1 rule for participation inequality” in online communities [268]. As a project matures, the technology used becomes more complex, and only those who have been part of it for a while fully grasp it [381]. If these few were to leave without either documenting or otherwise sharing their knowledge, FOSS projects would soon diminish [96]. As the size of the developer community correlates with the success of a FOSS project [51], maintaining and retaining developers is crucial. Experienced developers can act as mentors for (developer) newcomers and can help them to integrate into the developer community [111]. Still, building on the work of Reagle [305], Poderi [287] points out that FOSS projects have to keep in mind not only accessibility to newcomers, but also the advanced technical needs of long-term contributors.

Fagerholm and Munch [109] employ the concept of ‘Developer Experience’ as “a concept that captures how developers think and feel about their activities within their working environments, with the assumption that an improvement of the developer experience has a positive impact on software development project outcomes”. In open-source projects, Fagerholm [108] notes that newcomers can be supported through an onboarding process and through mentoring by experienced developer community members. Those that had such support proved to be more efficient than those who did not, contributing more, and engaging in collaborative activities and communication [108]. Morales et al. [258] conducted a literature review about ‘programmer experience’ involved in both OSS and proprietary software development. They show that experience depends on technical and social skills that the programmers have in order to carry out tasks and integrate into the developer environment. They also stress the importance of usability in programming environments, which affect a developer’s intrinsic motivation to participate in a project.

Nevertheless, FOSS projects are associated with a number of challenges. It can be difficult to attract and retain volunteers [298], who are necessary to keep workload under control. Onboarding requires extensive documentation when experienced developers leave [96, 120], which happens on average after a year [336]. Even though FOSS projects are often described as egalitarian

[299], power imbalances exist in open-source projects: Participants have different roles, and there is often a ‘benevolent dictator’ who has the power to decide which merge requests are authorized to go into the code [156]. This benevolent dictator has power over other participants. Putting the notion of power in relation with usability design in five case studies, Rajanen and Iivari [299] show that conflicts between developers and the usability team (a team of students deployed by the researchers) representing the users are common. These were caused by the usability team being unable to “get to the decision-making arena” or being ignored when they were able to access it.

7.2.2 User Engagement and Participation in FOSS Projects

Allowing users to participate in the design process has been central to HCI concerns [100, 188, 266], especially as FOSS projects usually lack professional UX designers [19]. The PD movement, it is argued, aims to ensure “that those who will use information technologies play a critical role in their design” [313] and usually has political or social change objectives [157]. Haskell and Graham [162] link PD and FOSS projects and note that while both endeavors contrast in many ways, PD projects have mediated FOSS, for example by independently redesigning the dashboard of a platform. Krüger et al. [215], however, found that in some communities, the objective of PD is not enough, and the researchers were preoccupied with the notion of care a lot more than they anticipated. Additionally, Simonsen and Hertzum [344] note that PD projects were mostly restricted to small-scale experiments. In large-scale projects, Cozza and Antonella De Angeli [74] note that social, material, and technical heterogeneity create difficulties for the success of a project and propose to increase engagement by including the steps of scaffolding (including temporary, portable, and flexible solutions in order to adapt to a groups fluctuating participants, needs and features) and infrastructuring (“a multifaceted notion referring to interrelated technical, social and organizational arrangements involving hardware and software technologies, standards, procedures, practices and policies“ [74]) in the process. Lampinen et al. [220] suggest that instead of simply scaling the use of technology, proliferation, “a concept that emphasizes how something gets started and then travels in per-

haps unexpected ways”, might be more fitting for grassroots communities as it accounts for the dynamic changes and developing needs.

The user base is known to be a factor in the sustainability of a non-profit oriented FOSS project as it allows the provision of new feature ideas and is a source for potential new contributors [287]. User input is central to the success of software projects [19, 21], though developers can also contribute to beta-testing [214]. Users are described as “a huge resource for bug reporting and usability testing” [188]. Continuous communication between users and developers is therefore crucial. However, users often do not know how to contribute to a FOSS project and feel overwhelmed by the GitHub environment [175]. Therefore, Rantalainen et al. [302] note that developers should keep communication as open and transparent as possible without it becoming overwhelming for them.

Past research shows that in forums where changes to a certain open-source software are discussed, users most often initiated as well as answered threads as compared to developers and organizers [174]. In comparison to these other groups, users also showed the most positive attitude, but lacked confidence in their communication [174]. Cheng and Guo [58] also report a high level of over-generalized assumptions, which in turn led to lengthy discussions. However, Terry et al. [361] report that developers often have to dig deeper to understand the user’s problem and needs and add that this is especially relevant as the interviewed developers sometimes do not themselves use the software they are working on and therefore do not have a lot of domain expertise. Bratteteig and Wagner [38] have shown that users often need additional training in order to participate in designing IT artefacts.

A large user base can help with feedback and support developer engagement [351] as well as increase the probability that users contribute by supporting the developers or becoming developers for the project [59]. However, maintainers on GitHub and GitHub-style platforms have noted that, especially with a large user base, user support is an “overwhelming and never-ending chore” [140]. They also reported that some users, especially in large projects, can be disrespectful or entitled. However, core users, who are users that are closely connected to the project and who can provide positive and high-quality feed-

back, can also be a large factor in motivating developers where there is no motivation through financial reward [361]. The authors stress that core users and developers having direct interpersonal relationships increases developers' motivation to work on usability issues. Nichols et al. [267] note that in FOSS project culture, average users often lack the technical understanding to even report bugs or usability issues, while developers are arguably less inclined to focus on such problems because they are already, relatively speaking, expert users.

7.2.3 Sustainable HCI and FOSS Projects

In recent years SHCI has witnessed a notable shift towards practice-oriented design approaches [69, 88, 131, 271, 282, 342, 349, 382]. This shift emphasizes the integration of sustainability principles into the actual practices and activities of users, designers, and other stakeholders involved in the design process. Practice-oriented design in SHCI recognizes the complex social and cultural contexts in which they are situated. It involves engaging with users and other stakeholders to understand their needs, values, and practices in relation to sustainability.

Mankoff et al. [241] distinguish between sustainability in design and sustainability through design. Sustainability in design refers to e.g., the artefact's lifespan, its energy use, or re-use of devices; sustainability through design is defined as supporting sustainable lifestyles through the use of technology on the individual, group and society level. DiSalvo et al. [90] provide a review of genres, axes of difference and emerging issues in the field. In relation to SHCI, Merendino et al. [249] discuss the importance of FOSS projects and open hardware for repairing artefacts, reducing hardware waste, and minimizing the risk of obsolescence. Brewer [40] suggests that software developed in HCI should be made available through GitHub for everybody to use and adapt to their needs, which allows scaling of solutions. Through the creation of technical artefacts and FOSS projects that support grassroots initiatives, they can play a crucial role as a catalyst in facilitating the transformation towards sustainability [117, 335, 357].

7.2.4 Past research on Foodsharing.de

Rombach and Bitsch [314] conducted interviews with members of the German Foodsharing.de community in order to analyze motivations behind their participation in the movement. They found that members wanted to “reduce food waste, to act against overconsumption, and to promote the value of food and food commensality within Germany” [314]. Schanes and Stagl [321] show that members’ motivation to join Foodsharing can be divided in five categories. These include emotion and morality, sense of community, personal reward such as free food, social solidarity and achieving desired goals.

Ganglbauer et al. [132] presented Foodsharing in detail to the CSCW and HCI community in 2014, notably in their study of the Foodsharing Facebook community. Their contribution concerns the early years, when the platform Foodsharing.de enabled a peer-to-peer function called ‘food baskets’, through which users could share food with other people. In this context as well, the primary motivation of both the initiators and participants was to mitigate food waste and foster awareness of this issue. Foodsharing.de expanded subsequently through the merger with the platform Lebensmittelretten.de (literally ‘savingfood.de’). With the merging, the function of pick-ups (coordinating pick-ups from food supermarkets, canteens, etc. with a team) was implemented into Foodsharing.de. Meanwhile, saving food has overtaken peer-to-peer food sharing (in September 2023, 7,278 pick-ups per day and 1,367 peer-to-peer sharings per week were coordinated.)

In their study, Ganglbauer et al. [132] examined how various ICT resources hold the potential to empower individuals in two distinct ways. Firstly, they may enable people to mobilize and unite as a ‘global-issue-based’ community, fostering a sense of collective purpose and action on a global scale. Secondly, these resources can facilitate the formation of local communities focused on practical action, encouraging people to come together and address local challenges. The research highlights, then, the emergence of a community that seamlessly blends ‘global’ perspectives with localized initiatives, promoting a ‘glocal’ relationship between global thinking and local engagement [105]. The situation with Foodsharing.de is made more complex by the fact it has both an online and an offline user base. While all users are registered on the

platform, not all of them use it beyond registering for pick-ups. We will take a closer look at the functionalities of the platform in chapter 7.3.1.

Concluding our exploration of related work, we have delved into a rich body of literature that highlights who is contributing to FOSS projects and in what way. Therein we reflected on literature regarding participation and user-developer cooperation and posited a relationship between SHCI and FOSS. FOSS projects can contribute as a vital force in fostering the transformation towards more sustainable practices. However, how to enhance participation in the intersection of FOSS projects and extensive grassroots initiatives dedicated to ecological concerns remains uncertain. Existing research, as we have shown, has not dealt with the problem of user involvement in an open-source project by a large-scale grassroots community where ideological tensions are manifest. In this paper, we present such a case: The Foodsharing movement. In connection to the presented related work, we set the frame to illustrate deeper insights into how developers and users of an open-source platform connect and how collaboration can be supported.

7.3 Context

7.3.1 Foodsharing.de

The Foodsharing movement first emerged in 2012. Its aim is to reduce or stop food waste by cooperating with stores such as supermarkets, bakeries or cafés and picking up still edible food that would otherwise be thrown away. Once a user registers on the website, they become a Foodsharer, but in order to be allowed to pick up surplus food, they have to do a quiz which, inter alia, asks about appropriate behavior in picking up and storing food. After a number of introductory food pick-ups together with more experienced community members, the user becomes a Foodsaver.

The Foodsharing.de platform facilitates food pick-up coordination with over 7,200 daily pick-ups across Germany, Austria, and Switzerland. Users register for pick-ups using designated slots. Districts, each led by elected ambassadors, oversee overall management, while store coordinators handle store

communication. Users also privately share food via over 1,300 weekly food baskets (see [132]). Forums and working groups foster discussions on topics like district management, food waste education, privacy, fundraising, sustainability, and political campaigns. The open-source platform, initiated in 2012 by a single developer in a ‘quick and dirty’ manner, supports these efforts.

7.3.2 Participating in the Foodsharing.de Design Process

Even though non-profit organizations usually also need some form of revenue in order to pay for organizational expenses [350], the Foodsharing movement has committed to a money-free approach. The servers used for the website are donated. The voluntary nature of Foodsharing.de and its development efforts results in a communication and policy-making process that may exhibit, as we shall see, a degree of unpredictability.

Over the years, the platform has faced various problems similar to those described above, especially concerning the high turnover rate and difficulties attracting volunteers, which is why there is a button next to the login form titled “In IT? We need you!” (see Figure 10). Currently, there are about six active developers and five volunteers in first level support, who do not contribute to code but help with technical problems and questions from users, with some overlap between the groups. Users can contact support when they have any technical difficulties like slots for pick-ups not opening automatically, logging in or any troubles with the quiz.

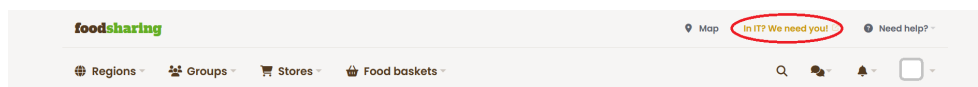


Figure 10: Header of the Foodsharing.de platform

One working group in Foodsharing.de is entitled the ‘product team’. This is the place where users can discuss features they would like to see on the platform and possibly get input from developers on what is already being worked on. The ‘product team’, which was originally supposed to be a link between users and developers, currently (September 2023) has about 270 members.

Once a feature has been sufficiently discussed, a poll is launched which is supposed to help the developers in knowing whether the feature is truly wanted and which specifics the community would like to see included. When the poll is completed, the results are added to a list with feature requests in the forum which is meant to help developers find a task. The ‘product team’ may make suggestions but has no means to force the developers to implement the requested features. However, developers may implement features even though the community has decided that at this point, they do not need or want them. Once a developer has prepared a code to implement or improve a certain feature, it is checked and commented on by other developers. In this way, the feature is iteratively revised until no more comments are made. Of course, developers are free to work on their own ideas without community input.

When a new feature is committed, it is first implemented in the beta version of the platform. This platform is accessible to everybody (beta.foodsharing.de), but not widely used. Developers and users of the beta website can give feedback about features in a dedicated forum (‘beta forum’) so that bugs and other problems can be corrected before the feature is released on the official platform. A visualization of the different actors can be found in Figure 11.

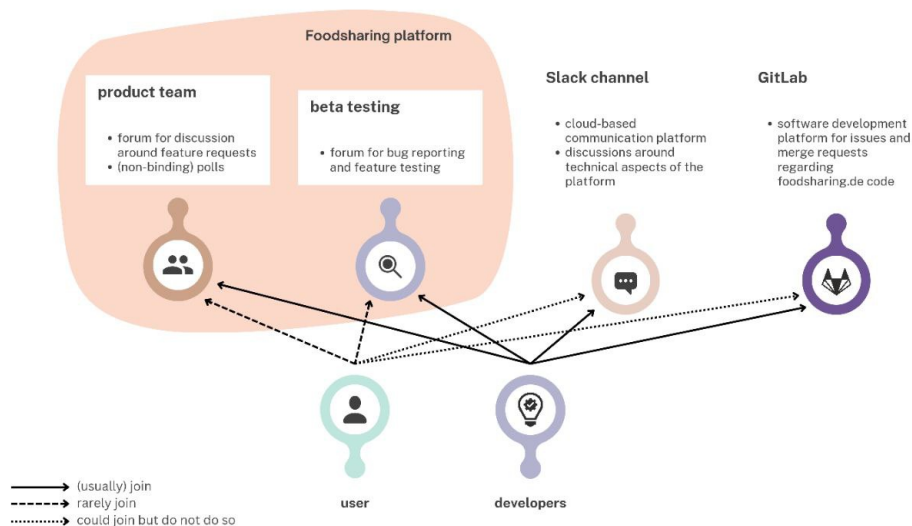


Figure 11: Actors in Foodsharing.de platform design

7.4 Method

7.4.1 Author's Positioning

As action researchers, our approach to supporting and enhancing the collaboration between grassroots initiatives and developers embodies a proactive and solution-driven stance, wherein we actively seek to foster an environment conducive to sharing, caring, and social innovation. We do this through “cycles of inquiry that include planning, action, and reflection, in which the action being undertaken is continually designed and evaluated with research results emerging throughout these cycles” [164]. The authors have been members of the Foodsharing community for 1-10 years. Author1 has also been a member of the IT support department of the platform since early 2023, Author2 has been connected to Foodsharing developers for eight years, Author4 has been an ambassador in a local Foodsharing community for three years, and Author5 has been practicing food sharing in various places around Europe.

7.4.2 Data Collection and Analysis

Through active involvement, including conducting interviews with local Foodsharers and developers, as well as analyzing field notes generated from forum discussions and meetings (online and in person), we aim to comprehensively explore and understand the complex dynamics and intricacies of collaborative practices between users and developers. We do so to understand better what improvements might be made to the communication processes between users and developers in this context.

We conducted 20 semi-structured interviews with members of the local Foodsharing community in City_A, a town with about 100,000 inhabitants and a Foodsharing community that has been active for several years, with developers of the platform and with members of the online ‘product team’ community (see chapter 7.3.1). As a result of our engagement with the local community, we had the opportunity to privately approach certain members for their support. Consequently, we opted for convenience sampling within this particular group. After a call for interviewees in the developer Slack channel, a cloud-

based communication platform that allows teams and organizations to collaborate and communicate effectively, we were able to interview two developers who then named other people that either we messaged or who messaged us. For this group, we therefore used a snowball sampling approach.

During the interviews, we asked Foodsavers about their experiences with the platform, what their needs concerning the platform are, and about the communication between developers and users. Developers were asked about internal processes during development, their experiences with communication both within the developer team and with the users, and their work on the platform. The roles of the interviewees as well as their pseudonyms can be found in Table 6. Interviews were subsequently analyzed using a simple inductive analysis protocol such as that suggested by Thomas [364]. This involves condensing raw textual data into a brief, summary format; establishing links between the research objectives and the summary findings derived from the raw data; and developing a framework of the underlying structure of experiences or processes that are evident in the raw data. Agreement was reached through regular discussion by the authors both in formal meetings and more casually during ongoing work. The interviews had a mean length of 74:45 minutes, with the shortest being 55:45 minutes and the longest being 103:55 minutes long. Interview quotes from 19 out of 20 interviews have been translated to English from German, one was conducted in English.

Additionally, we read through relevant forum discussions on the foodsharing.de platform (especially the ‘product team’ and beta testing forum) in a time span of one year. Furthermore, we participated in numerous local community meetings over the course of four years as well as in three online meetings regarding platform development, the most relevant one being held by a developer with the aim of improving collaboration between users of the ‘product team’ working group and developers. By participating in these meetings, we gained an understanding of underlying processes and historical background information as well as established our role as action researchers.

Pseudonym	Role
Foodsaver_1	Local Foodsharing member
Foodsaver_2	Local Foodsharing member, district ambassador
Foodsaver_3	Local Foodsharing member
Foodsaver_4	Local Foodsharing member, district ambassador, member of 'product team' and beta working group
Foodsaver_5	Local Foodsharing member, district ambassador
Foodsaver_6	Local Foodsharing member
Foodsaver_7	Local Foodsharing member
Foodsaver_8	Local Foodsharing member
Foodsaver_9	Local Foodsharing member
Foodsaver_10	Local Foodsharing member
Foodsaver_11	Local Foodsharing member
Foodsaver_12	Local Foodsharing member
FS_member_1	Foodsharing member, member of 'product team' working group
FS_member_2	Foodsharing member, member of beta forum
FS_member_3	Foodsharing member, member of 'product team' working group, district ambassador
Developer_1	Developer, Foodsharing member, member of 'product team' working group
Developer_2	Developer, Foodsharing member, member of 'product team' working group
Developer_3	Developer, (inactive) Foodsharing member, member of 'product team' working group
Developer_4	Developer
Developer_5	Developer, district ambassador, member of 'product team' working group

Table 6: Overview of interviewee pseudonyms and their roles

7.5 Results

Below, we discuss the users' relationship with the developers, obstacles to communication, and perspectives on workflow on the platform. These perspectives vary with motivation, knowledge, and expertise.

7.5.1 User Perspective

7.5.1.1 Who the Users Think the Developers Are.

For local interviewees, there was little awareness that, or how, the platform needed to be programmed and maintained, but rather represented to them a “given thing”. When asked about the developers, our interviewees saw them as part of the movement, as “people like us, who want to change something” (Foodsaver_5). Several local members did not know who the developers were at all, for example whether they were part of the Foodsharing community or an external IT service. One local interviewee (Foodsaver_4) knew about the ‘product team’ and the beta working groups as he is an active member of both. Only this interviewee knew that developers occasionally create forum threads in the beta testing working group with new features in order to ask the community to find bugs and give feedback.

7.5.1.2 Getting in Touch.

Getting in touch with the Foodsharing developers is rather counterintuitive. Clicking the “In IT? We need you!” button next to the login field leads to a page in English, which invites the user to join the team in developing, with links to an introduction to the code, the development blog, their GitLab page and their Slack channel. Communication between the developers happens exclusively via Slack. A separate user account is needed for both Slack and GitLab.

Out of twelve local user interviewees, only Foodsaver_4 knew about the Slack channel (but had not joined it yet), the ‘product team’ and beta working groups. This interviewee also worked in the IT field himself and had previ-

ously written some tools for their personal use of the Foodsharing platform to e.g. support the administration and involvement of newcomers. Others did not know how to get in touch and had varied assumptions. Interestingly, six interviewees assumed that Foodsaver_4, the member who worked in IT, was also in contact with the developers or mentioned that they would ask him if they had any questions or suggestions concerning the platform. Since he is also an ambassador for this Foodsharing district, some interviewees assumed that they could get in touch with the developers through their local ambassadors. The idea behind this was that the ambassadors could act as intermediaries for requests in order that there was no unnecessary duplication.

FS_member_1 is very active in the ‘product team’ working group. He knew that some developers are active in the working group as well and has had chats with them via the public forum and private messages. He noted that in discussions, developers would sometimes send private messages instead of continuing to debate on the forum:

“Sometimes, I had the impression that they were trying to move the discussion out of the public domain and into private spaces. In such instances, I made an effort to reiterate my points in the public forum, hoping to elicit public feedback as well, because I believe that public discussions are essential for transparency.”
(FS_member_1)

Some local interviewees presumed the existence of an email address specifically dedicated to contacting the IT department. While there is an email address that appears to serve that purpose, it actually directs inquiries to the platform’s IT support department. It is the correct contact if users experience bugs, but if they want to propose a new feature, the support team sends them to the ‘product team’ working group. Even though many connection points exist, eleven out of twelve local user interviewees were not quite sure how to get in touch, but eight also explained that they would rather not do it. This has different reasons. The reason that was mentioned most often was that they did not know anything about coding and were not willing to learn more about it:

“I don’t see myself as an IT person, because coding is not my cup of tea and I keep away from it because I’m not interested in understanding how all of this works and I have enough things going on in Foodsharing, which to me are more important than familiarizing myself [with IT].” (Foodsaver_2)

At the same time, this led to users not feeling qualified enough to contact the developers:

“And then I kept consulting with Foodsaver_4 whom I know has some knowledge, and he also provided the appropriate words and composed the text and communicated it. It would be nonsense if I did it myself.” (Foodsaver_5)

Other interviewees would not want to get in touch because the developers work voluntarily:

“[The “In IT? We need you!” button] [...] has strengthened my suspicion that they’re completely understaffed and that there are three, four people who take over the task of 20, so to speak. Because that also covers my experience from the local projects. So, that we have been too small a group for years for the many tasks and always struggled to somehow get the [things done] and if then still someone from the outside came and said what you’re doing is not enough then my reaction would be to say [...] do it yourself.” (Foodsaver_1)

In short, participation, in some views, is characterized by its absence: the 90-9-1 principle in action [268].

Lastly, interviewees did not want to get in touch when they encounter any bugs or other problems because they thought that somebody else already must have done it: “Yes, I could actually write to the IT people, that was my inhibition threshold, I always thought, [...], someone must have already told them or you yourself know that [there is a problem].” (Foodsaver_3) We understand this as diffusion of responsibility [78].

7.5.2 Developer Perspective

7.5.2.1 Joining the Developers Group.

The developers we talked to, with one exception, are also part of the Food-sharing community, some of them even in advanced roles like ambassadors or working group administrators. While some interviewees have worked in IT before, others learned coding through the Foodsharing platform. One interviewee had found their way to the developer community through a gathering in 2014 that aimed to bring the German Foodsharing platform worldwide. Most of our interviewees stated that they joined the developer team because they saw the call for help either in a forum or on the top of the website as visible in Figure 10. One interviewee stated:

“And then I thought, well, it sounds a bit arrogant, but I thought that everyone can pick up food somehow. Programming is only possible if you have prior knowledge. So maybe I can get involved a little more, help more.” (Developer_1)

This somewhat elitist perception is also observed in the literature [267].

When a new member joins the developer Slack channel, it is helpful for them to have somebody they can contact if they have any questions. We interviewed one member who sent a message to everybody in the Slack channel to ask them whether they needed any help in what they are working on or would like to work on. This member reported generally positive responses to his approach. Now, newcomers are invited to the weekly developer calls and are occasionally messaged by experienced developers.

Additionally, a former member of the developer team we interviewed set up a blog for newcomers to learn how to use the developing environment. This interviewee said that when he joined the team, he was very confused as to how the process worked and therefore decided to create an introduction to the developer environment and developing processes for newcomers.

Our developer interviewees often said that the original code was messy and hard to understand. This might be a problem for new volunteers, as was described by Developer_1:

“Yes, [I had] technical difficulties in the sense that this Foodshar-ing code is terrible, actually, it’s completely confusing because many people have contributed to it over time. [The first devel-
oper] wrote something at the beginning, the next person came along and said, ‘Oh, I’ll add something here and there.’ And it has become an organic thing and grown. And when you sit in front of it for the first time and think, ‘Oh God, what should I do there?’ I think the difficulty lies in this initial hurdle, that it is completely confusing.”

Continuity is a constant problem: One interviewee mentioned that while he was an active member of the developer community, he noted that developers would often become burnt out by their voluntary tasks. This is why he would have liked to see an environment that is more focused on developers’ mental health and community care:

“I would like a more care centered community way of organizing where you put people’s wellbeing and mental health and the emo-tional connection as a central part and try to institute practices that support that because quite a few people got burnt out and left the project, like there’s one person in particular who I’m thinking of that was really distressed by and frustrated with the developer experience, he wasn’t happy. Like I stayed chatting with him. It kept a private chat line where I was, you know, trying to be more supportive and focusing on wellbeing. But as a community, I don’t think that was present enough.” (Developer_4)

7.5.2.2 Task Coordination.

The Foodsharing developer community uses GitLab as a way to organize their work. On this website, projects are divided into issues and merge requests.

Issues are problems that have arisen during the use of the platform, merge requests are either solutions to issues that developers have worked on after feedback from users of the platform or new features they came up with themselves. Issues are tagged with levels of difficulty (among others), meaning that new and interested developers can use these tags to find an issue to work on that fits their skill level.

Developers are free to spend as much time on projects as they want. They can also choose the project themselves, either from a GitLab issue, their own ideas, or the ‘product team’ working group, but also from discussions within the developer team as to what is currently urgent to fix. However, one of our interviewees said that the developers frequently just ‘scratch their own itch’:

“On the other hand, the programmers implement what they would like themselves or what they personally consider meaningful for the platform. That’s what gets implemented first, and things that are not well-received may not be implemented at all.” (Developer_2)

Our interviewees also said that a priority for them now is to renew the code on the platform so that it is easier to find their way around it. This, of course, is not visible to the users, so that there sometimes is the impression that the developers do not work on the platform:

“And it was important to me to create transparency so that we have a clear cycle and make visible what is happening in the IT department. Because a lot was happening, repeatedly, without any transparency. And then, there would be a big release, and people would see, oh, a lot has changed here. And after two weeks, the complaining would start again, like, ‘Oh, nobody is doing anything here.’” (FS_member_3)

An issue that regularly cropped up was that discussions in the ‘product team’ concerning project ideas were seen by participants as overly lengthy. Originally, it was planned that there would be at least one person or a focus group with user and IT knowledge who would write a concept of the planned feature

once it has been voted upon. Yet, this currently does not always happen, leading to developers who might want to work on a new feature having to read the whole discussion in order to find out the specifics. By now, there is a list of feature requests in the ‘product team’ working group which developers are free to look at. Yet, one of our user interviewees reported that it was not used:

“I just want to have the feeling that what we discuss actually reaches the IT department and gets implemented. I developed a list in the ‘product team’ where I sorted all the voting results by outcome, and I basically said, ‘Here, if you want to know what user preferences are, refer to this list’, because there was always the response that individuals approach them with various requests, and they don’t know if those individuals truly represent the community’s interests or not. So, I provided a representative compilation of what we voted upon. [...] However, I feel that the developers don’t pay any attention to this at all.” (FS_member_1)

In a meeting with participants of the ‘product team’ working group and developers it was also stated that some developers are not part of the ‘product team’ working group or do not even have an account on the platform. This leads to another problem: If developers do not use the platform themselves, they are not familiar with the practices they would like to support through the platform. In a similar vein, the different roles in the community (like ambassadors or store coordinators) are mirrored on the platform, as they have different rights, for example when it comes to being able to see more private information like a Foodsaver’s address. This means that a developer who only has the rights of a Foodsaver might not know what would be helpful for ambassadors or store coordinators.

Lastly, interviewees stressed the importance of personal exchange with members of the community to find issues to work on. This can happen on either the regular meetings most Foodsharing districts have or in private chats with users. Some interviewed developers also volunteer(ed) as ambassadors for their districts and therefore are close to user feedback.

7.5.2.3 Receiving a Salary.

There is some disagreement about what the impact of the fact of unpaid commitment might be. As one local Foodsaver put it:

“I believe they do it voluntarily, I assume that now. Honestly, I don’t know if Foodsharing pays anyone, I’m not sure. Although, if they do, I would find it justified. For instance, someone who programs a website – I don’t know much about it, but I assume it involves a lot of work, and it’s not a one-time thing. You have to update it, fix errors, and that’s why I think it’s okay to say that someone should be employed for that purpose.” (Foodsaver_9)

Yet, developers indicated that, although they had discussed this topic, they did not feel that they would be any more motivated if paid. On the one hand, a variety of opinions were expressed in the grassroots movement, with members saying that a salary would facilitate greater member participation as well as increased availability for engaging in (especially unpopular) Foodsharing activities. On the other hand, members argued that Foodsharing.de has been a money-free organization since its beginnings in 2012 and changing that would make it lose some of its integrity. The volunteer character has important ramifications insofar as it confers an interdependence on all participants’ contributions regarding the sustainability of the movement, while each volunteer is independent in the nature of their contribution. Thus, voluntariness affects communication.

7.5.3 Decision-making Structures

7.5.3.1 Within the User Community.

After adequate discussion in the ‘product team’ working group, meaning that no more points are added to a summary of the discussion, the admins of the working group create a poll where users can vote on specifics of new features with a choice between +3 (heavily in favour) and -3 (heavily against). The resulting score helps clarify which features are asked for the most and which

are rejected. However, the scale is different from scales that one can find normally, as it starts with +3 on the left and ends with -3 on the right. This has led to some users entering their answers incorrectly, and the vote cannot be changed. Once the voting is finished, the results are added to a feature request list in the working group forum.

A case where this has created issues is the newly added functionality called ‘commitment statistic’, which depicts where a Foodsaver has, e.g., picked up food in the last weeks and where they plan to do so in the current and following weeks, how often they have picked up food on short notice, and how often they have cleaned a public food redistribution site. This feature was introduced to the ‘product team’ forum by an admin who noted that it had not been discussed or voted upon at all. About a month later, the developer opened a thread in the beta forum to discuss any beta testing-related issues, disregarding the exchange in the ‘product team’ forum. The discussion that followed in both the ‘product team’ and the beta working group showed that users were not in favor of the new feature or its specifics and a resulting survey showed that a majority of users did not want it. Still, the developer who worked on it included the commitment statistic in the next platform update, leading to further discussions about power distribution and decision-making processes. The ensuing discussions happened on GitLab and Slack on the developer side and the aforementioned working groups on the user side. Users were unhappy with how little their requests were acknowledged, while developers discussed the lack of transparency towards users.

7.5.3.2 Within the Developer Community.

After a developer has worked on an issue or new project and before the new code is transferred onto the platform, it is transformed into a merge request and at least two other developers should check the new code. Yet, there sometimes seem to be arrangements within a smaller group of developers:

“There are indeed some personalities in the IT field who have been around for a long time and are very controversial because they sometimes push their own will, implementing things as they

see fit. They form a small clique that commits it, and then it goes onto the website, even though the ‘product team’ says, ‘But we don’t want it like this, we want it differently.’ Nevertheless, it is done that way.” (Developer_2)

In a similar vein, it occasionally happens that none of the developers agree with the new code. This can lead to discussions surrounding the code as well as developers not wanting to work on it anymore. Because of this, merge requests may not be included in the code. There currently is no workflow in place to attribute to these cases.

Unlike other FOSS developer communities, Foodsharing.de does not seem to have a ‘benevolent dictator’ who has the last say on new or improved code. However, there are different roles with different rights in the developer team. It was stressed that merit as well as trust are important when it comes to gaining these rights, which is consistent with what is already known about open-source developers [108]:

“Yes, at the beginning, I didn’t start programming immediately; I also helped in IT support on a supraregional level. Then, after about one and a half to two years, I said I would like to be able to help more somehow, but some things require more rights. So, I asked [another developer] whom I had met at a Foodsharing festival [, . . . if] it would be possible to have organizational rights. He said they try to handle it very sparingly, but since they already know me personally, it worked out.” (Developer_3)

Additionally, FS_member_1 feared that some members of the IT community did not want newcomers to join as they could obstruct these cliques and therefore limit the clique’s power:

“I think sometimes, there are also individuals where I believe they simply want to continue pushing their ideas and perhaps are afraid that if there are too many people involved in the development, some might contradict them in some way.” (FS_member_1)

7.5.4 Obstacles to Communication

As has been described above, one way to get in touch with some of the developers is through the ‘product team’ working group. However, there are only about 270 members in the group – out of more than 580,000 members of the Foodsharing.de platform.

While communication through the beta and ‘product team’ working groups is sometimes effective, not all developers (want to) engage in conversation. In the past, there have been instances where users and developers had their conflicts when it came to what features the platform should include. We also noted that users sometimes misunderstand developers, as they have a different communication ‘language’. For example, when a user asked about the status of a feature request, they were asked to ‘create an issue’. While the developer probably meant an issue on GitLab, the user emailed the support department with a reminder of the requests, who subsequently was confused as to what the user was asking. FS_member_1 believed that established developers (unintentionally) build barriers to newcomers through this unshared language as well:

“I think there is simply no understanding of the barriers involved. For example, they say just create an issue, but how the hell do you create an issue? That’s something that should always be explained somewhere. [...] But there is this assumption that it should be obvious and that one must somehow figure it out. And if you can’t figure it out, then you simply don’t deserve to have any influence.“

Every Foodsharer is invited to join the Foodsharing Slack channels. Yet, only very few do so. FS_member_1 observed that this is probably because they need to create an account on the platform in order to participate:

“So the instructions [for joining the IT team] end with ‘just sign up there,’ as they have created their own websites, which says something like, ‘Here, we are the IT department’. But honestly, I

can't figure out these sites either. So, for me, the transition didn't work out, and I don't think I'll give it another try."

However, FS_member_1 mentioned that when he wanted to talk to developers, he messaged them directly on the platform, but they often took a long time to answer or asked him to continue the talk on Slack.

7.5.5 (Surprising) Personal Connections

Some surprising connections between users and developers were observed. In one instance, FS_member_2, who works as a UX Designer, created visualizations from 'product team' forum discussions and shared them with both the users on Foodsharing.de and the developers on Slack. This volunteer had noticed that she could contribute her skills to the Foodsharing.de context:

"I didn't even think that I could really get involved there [...]. But there was interest. So, I said I could make a suggestion to him, and we often talked on the phone and such, so that was the first approach." (FS_member_2)

She is currently interviewing users about their experiences with the platform. This way, she allows the developers to get extensive feedback on what is working well and what is not. However, at this point, she notes that she is only collaborating with one developer as the others have rarely interacted with her visualizations. So far, she is satisfied as an intermediary between the 'product team' and developer. Both report that they find value in their collaboration.

A second example concerns FS_member_3, a user who saw the call for help and joined the developer Slack channel. He reports:

"And I said, if there are really simple tasks that just require time and someone who pays close attention but not much programming knowledge, like what someone called "monkey work" back then, then I would be the right person for it. [...] So, I received a little introduction, [...] where it was said that it needed to be done anyway, but none of us have the time or the desire to do it right now. [...] Then, I had someone there who mentored me a bit."

In their collaboration FS_member_3 made a serendipitous connection between his skillset and a further contribution: He initiated a regular meeting for the developer team through video calls in order to exchange ideas, the status quo on current projects, or to motivate each other. FS_member_3 describes finding his role as an intermediary as follows:

“I didn’t study IT or anything, what I studied was Protestant theology and so I ended up at the interface between ‘I can grasp complex issues and render them in the simplest possible terms and bring them into a discourse’, in other words, at the interface between IT and the users.”

Further unexpected examples of intervention by the local community include Foodsaver_4, who works in IT. Foodsaver_4 has developed a tool that takes care of newcomers to support the local team but has not shared it with the developers yet. He also has been actively discussing in the beta testing and ‘product team’ forums. He does not, however, see himself as part of the Food-sharing IT department. Nevertheless, several local interviewees mentioned that they would approach him about difficulties or ideas they had with or about the platform. After being told this, Foodsaver_4 started thinking about whether he could be an intermediary between the local community and the developers. Yet, to this point, he has not fully engaged in this role as an IT contact person due to other local responsibilities as an ambassador.

Foodsaver_9 is also familiar with IT, which is why she reads the release notes to see what has been changed on the platform with the last update. In her job, she engages in beta-testing, but up until now, she has not had the opportunity to do so on the Foodsharing.de platform. While she also mentioned that if she had any queries about the platform, she would speak to Foodsaver_4, she said that she could imagine helping with beta-testing and UX design, but that she wanted to avoid being overworked.

These examples show us that contributions to a FOSS project encompass more than just code. They can emerge in diverse ways, such as UX designs, proof-reading or creating transparency. What we have labelled as surprising is tied to a notion of serendipity. This is evident in the way users, without setting it

as a clear goal, find themselves acting as intermediaries through their collaborative efforts with others.

7.6 Discussion

Our contribution, which we discuss in more detail below, is to examine the challenges that need to be met when open-source development takes place at scale in a grassroots community like Foodsharing. As stated, the user group which relies on the platform is about 580,000 members in size. Further, they are effectively all unpaid volunteers. If, as the literature suggests, open source coding is ideologically driven and, if, in much the same way, food sharing efforts are ideologically based, understanding how two related, but distinct, commitments intersect with each other is worthy of investigation. It has clear implications for the way in which technology is designed and implemented in such contexts.

We have noted that unsuccessful communication between users and developers of the Foodsharing.de platform creates tensions for the voluntary movement which depends heavily on the use of ICT. Movements like this face both opportunities and challenges. While ICT enables efficient mobilization and communication, tensions related to inclusivity and platform fragility arise. Reliance on a single sophisticated platform may lead to vulnerability and the exclusion of technologically marginalized groups. Additionally, a small group of developers as found on Foodsharing.de can easily become overwhelmed with feature requests and essential maintenance duties. If developers leave as a result, long-term viability is jeopardized. The “invisible work” [346] of sustaining the platform and renewing outdated code is often overlooked by users, leading to frustration on both sides with developers not feeling recognized and users not seeing any progress made.

Our results show that the relationship between the two groups of users and developers is clearly an issue, compounded by the size of Foodsharing.de and the fluid nature of the volunteer population working on an open-source platform. Grudin [155] has described how (here in the context of product design), “the problems in achieving and benefitting from user involvement [...] stem

from typical divisions of responsibility and development processes”. Given the continuing concern for democracy in the PD movement, and the relevance of it in our context, it is important to understand exactly why user participation at scale is difficult, and how despite this, progress might be made. Still, our context differs from other PD investigations, especially because it does not entail complex divisions of professional responsibility and deals with a large grassroots movement that maintains its own platform and its communities’ artefact ecology. Furthermore, it is particularly resource-constrained. While PD aims to support usability through participants’ engagement [37], there are well known challenges to usability in the context of open-source development (see e.g. [167, 173, 269, 371]), especially in our case some developers did not see involving users as high on their agenda except from bug testing. We contend that there has not been sufficient examination of participation at scale and broader requirements elicitation within a large, non-professional, volunteer-driven open-source environment. We are not the first to note that participation at scale is problematic (see e.g. [20, 76]) and what we have recounted demonstrates the particular issues that occur when there is little or no professional involvement, and little in the way of organizational or project structure. In a recent paper, Zahlsen et al. [399] review the literature on scaling PD and point out that PD projects tend to be of limited scale and complexity. They identify seven types of challenges that resonate with our findings from Food-sharing.de: (1) Involving users, (2) Ensuring continuous user engagement, (3) Handling user heterogeneity, (4) Capturing and utilizing insights, (5) Applying participatory methods, (6) Acquiring appropriate project conditions for PD, and (7) Maintaining democratic control.

Consequently, our objective is to explore the opportunities and challenges we have identified and provide a more detailed discussion of the novel design implications outlined below. We have shown above how the values and practices of two overlapping communities of practice clearly impact on collaboration between developers and users. From a user perspective, the platform is critically important although it forms part of a wider community artefact ecology [48], including WhatsApp, Telegram or publicly accessible redistribution sites for surplus food [103].

For most users, development processes were something of a ‘black box’. They for the most part reported that they did not know who the developers were or how to get in touch with them. Users typically did not know that they could participate in discussing ideas for platform development through the available channels such as Slack, GitLab or the ‘product team’ forum. Rather than engaging with the development, all users were interested in saving food and some also in organizing a team or district. While so far only a few users actively engage with development, in the context of participation at scale we have to find ways to support access without adding too much overhead in it.

Developers, though, were mainly concerned with the technical difficulties they encountered. They did not seem too interested in collaboratively designing the platform and solving UX issues together with users, which is a common problem in FOSS projects [188, 300, 361]. They identified and dealt with issues arising, largely through GitLab. Developers were not always keen to read through lengthy discussions in the ‘product team’ forum, and some were not registered on the platform, and thus unfamiliar with the practices of the community. The obstacles in communication lead to conflicts in negotiation processes as well as in decision-making regarding how and what to design and develop (see commitment statistic). Differing ways, words and platforms for communication additionally hinder successful interaction and cooperation. Yet, our data reveals opportunities for ICT and action-oriented HCI researchers to support the rather distinct communities of practice between users and developers to overcome their separation, foster connections and sustain these relationships. We will expand on this below.

Most strikingly, from our data we derive a notion of serendipity in what drives the beneficial communication between users and developers. Serendipity refers to a beneficial coincidence or discovery that occurs unintentionally. ‘Knowing who knows’, as has been reported in organizational contexts, can be crucially important (see [154, 301]), and in our case especially to support intermediaries. Supporting serendipitous connections, then, needs to be done and below we reflect on ways in which it can be supported.

7.6.1 Supporting Serendipitous Connections

As we illustrated in chapter 7.2.3, grassroots communities and FOSS projects are an important topic in SHCI. Foodsharing.de, a movement created to stop or decrease food waste, highly depends on a well-working platform. As a successful FOSS project needs both a large developer base [51, 59] and an active and dedicated user base [19, 21, 287, 351], for us as action-oriented researchers the question arises on how to support the sort of surprising connections we have described as serendipitous.

The concept of serendipitous connections emphasizes the unintentional yet beneficial associations that can emerge as a result of collaboration between users and developers as presented in chapter 7.5.5, highlighting the surprising connections that occur. It suggests that two or more parties come together to work on a project or endeavor, not because they set out with the specific intention to collaborate, but because circumstances or events led them to realize the potential benefits of working together. It implies a fortuitous alignment of interests, skills, or resources that naturally leads to a collaborative effort, and all parties involved find value or benefit in the collaboration. In reflecting on these serendipitous connections, we aim to expand the understanding of user involvement in FOSS projects.

In open-source projects, the voluntary nature of participation in principle encourages a diverse and global community to contribute their expertise and knowledge. However, as users engage with the open-source software, they may encounter challenges, requirements, or innovative ideas that prompt them to seek assistance from the developer community. Conversely, developers, driven by a passion for problem-solving and code improvement, may proactively engage with users to understand their needs better. In these interactions, serendipitous connections emerge when users and developers collaborate beyond the immediate scope of a specific issue. Our results show that a local Foodsaver (Foodsaver_4) is already in contact with developers and the interview with us prompted him to envision being a connection point for the local community. Likewise, some in the community expect him to be able to take on this role ('knowing who knows' [154]). In order for Foodsaver_9 to find her connection to the developers and to contribute with her beta testing skills,

we feel that there needs to be a facilitation that we as researchers who have contact with both groups could provide. In this dynamic domain, we can envision part of our future role as researchers, poised to share further insights with the HCI community. Just as we observe serendipitous connections from the local user group toward programmers, other users provided support elsewhere: FS_member_3 who claims that his skillset as a pastor, especially as an intermediary, brought him to facilitate the programmers' meetings as well as transparency towards users. FS_member_2 did not establish contact with the developer team but engaged with a sole developer to support him through her UX design skills.

Serendipity cannot be intentionally designed. Yet, our results prompt the question of whether we can design a setting that is conducive to serendipity. To foster serendipitous connections in voluntary-driven open-source projects, communities must actively encourage and cultivate an inclusive and collaborative atmosphere. This, we suggest, is a very specific kind of knowledge sharing issue [4], involving understanding the nature of the community artefact ecology [48] and facilitating its development by providing seamless interaction between users and developers. It has been argued, for instance, that Wikis and similar web applications provide precisely this kind of engagement, valuing every contribution, regardless of its scale, and nurturing an environment where serendipitous connections can thrive [277, 280, 281]. Hence FOSS projects can discover novel solutions, potential applications, or creative workarounds that were not initially envisioned. In our case, a socio-technical design that facilitates the alignment of the diverse purposes associated with communication channels, as also discussed in [103] will be needed. Socio-technical because the 'design' of the rights and responsibilities of the product group are as important as the design of the channels through which it operates. The challenge lies in the tension about the primary channel for discussion related to platform development: On the one hand certain developers advocate for a shift to Slack, emphasizing its direct and intuitive nature. On the other hand, a significant portion of users either remain unaware of, or do not want to appropriate or engage with the Slack channel. Developers may not fully grasp the users' reluctance or inability to adopt new software. We contend that personalized and local support is crucial, leveraging the connections we

describe. We suggest this responsibility might be better suited for intermediaries rather than developers, as the latter are already overwhelmed with user demands, as previously reported [136].

While the artefact ecology of Foodsharing comprises several channels that have the potential to facilitate serendipitous connections, they are infrequently utilized. The reasons behind this limited usage vary, encompassing factors such as users' unawareness of these channels, a lack of coding knowledge and motivation to learn coding (as also seen in Nichols et al. [267]), as well as concerns about overwhelming developers with feature suggestions [136] and the diffusion of responsibility among users we noted in our interviews (see chapter 7.5.1.2). Within the 'product team' working group, we have observed an apparent reluctance of developers to engage in collaboration with a broader user base. This is exemplified by developers opting for private messages to intermediaries rather than continuing discussions on the 'product team' forum. Developer_3 clarifies his preference for direct communication with individual users, stating:

“There is a lack of personal exchange, only communicating through a forum. Too much information gets lost there. As a developer, it's challenging to prioritize and determine what is truly important in such a setup.” (Developer_3)

This situation, however, results in users feeling disregarded in the development process. Such experience can impede the occurrence of serendipitous connections and reinforce the power imbalance within FOSS. Deriving specific design implications that promote serendipitous connections in communication channels, particularly within forums like the 'product team,' especially in relation to intermediaries, and facilitating their communication without overwhelming developers, remains a task for future research.

Nevertheless, a design that supports serendipitous and emergent connections is not enough. It involves levels of care which are admirable, but no systematicity. Regardless, it is important to sustain these connections. We suggest that a conception associated with what is termed 'intermediary experience' might further facilitate collaboration in a more systematic way.

7.6.2 Intermediary Experience (IX)

Members within the Foodsharing.de movement frequently serve as intermediaries between users and developers. In this role, they encounter a range of challenges, including feelings of frustration and being overwhelmed. For example, FS_member_1 frequently reviews the forum to determine whether a recently posted issue has already been discussed in the past, expressing frustration when Foodsavers think their idea is entirely novel or unique. FS_member_3 had left the developer team after a dispute concerning the implementation of the commitment statistics (see chapter 7.5.3.1). These challenges prompt us to inquire further about how design can provide support to these intermediaries. As a result, we introduce the novel concept of ‘intermediary experience’ (IX) in connection with ‘user experience’ (UX) and ‘developer experience’ (DX). Unlike the well-established notions of UX and DX, which have long been recognized and studied in the field of design and software development, IX has not been examined.

IX addresses a broader perspective on sustaining connections that have formed serendipitously and/or intentionally. Therefore, IX encompasses the holistic journey of designing a product from inception to delivery while simultaneously including the concepts of PD. As we have seen, however, appeals to PD are not yet sufficient in a context where a largely unstructured and heterogeneous community is at work. Therefore, we advocate further inquiry into the notion of IX.

From our stance, IX delves into the experiences and challenges encountered by designers, product managers, users, and cross-functional teams throughout the entire product development lifecycle when trying to mediate between users and developers. It seeks to understand the collaboration, decision-making, and creative processes that shape the product’s design and its alignment with values collectively negotiated within the community. IX is intrinsically connected to both UX and DX and aims to sustain serendipitous connections.

In our case, we see opportunities to support the intermediary experience of two local Foodsavers, Foodsaver_4 and Foodsaver_9. Both mentioned that

they would be interested in helping but feared becoming overwhelmed with the task. In order to support their intermediary experience, additional research is needed to explore the balancing act between their local commitments and their potential to support the platform's development.

In Foodsharing.de, intermediation is formally put into practice by the 'product team'. Communication there is only a qualified success, for the reasons we have given, especially regarding negotiation processes and decision-making. Some developers express a felt lack of respect by the 'product team', citing instances such as the developer who contributed the commitment statistic and withdrew from the 'product team' forum when user feedback indicated disapproval of both the feature and their exclusion from the decision-making process. Likewise, intermediaries in the 'product forum' feel like the developers do not acknowledge and value the 'product team' forum's contribution. Conversely, intermediaries in the 'product team' forum perceive a lack of acknowledgment and appreciation from developers for their contribution. This raises a pertinent question for future research: How can we foster appreciation for formal intermediation formats through design?

Furthermore, our findings prompt us to explore, in future research, how positive experiences for intermediaries (like Foodsaver_4 and Foodsaver_9) outside the 'product team' forum can sustain serendipitous connections. A seamless collaboration between design, development, and user research teams can ensure that user needs and preferences can be translated into the final product. Looking at Foodsharing.de, serendipitous connections and IX emerge as important elements in the platform's maintenance and creative development processes. Given that the 'product team' working group is too extensive to serve effectively as intermediaries, and that conflicting interests impede efficient communication, a smaller and more cohesive group of intermediaries with defined responsibilities could enhance the prospects for successful collaboration.

Summarizing the discussion presented, we suggest including the opportunities of serendipitous connections and IX in the design of platforms dedicated to sustainability. It is clear to us that knowledge sharing tools which recognize specific skills, levels of motivation and commitment, and adherence to

broadly democratic principles, will be needed. How this might be done will be the subject of future papers.

7.6.3 Limitations

Although we have confidence in our contribution to the understanding of FOSS projects and user engagement within the field of SHCI, we do see a limitation in that our interviews were with members of one Foodsharing district (City_A) in what is a highly dispersed national network. In other communities, for example, awareness of development processes might be different as some developers are very active in their respective districts.

7.7 Conclusion

In this paper, we have taken a deep dive into issues surrounding communication, developer work, and user participation in the Foodsharing movement. We have noted that while local Foodsavers were mostly not aware of the work done by the development team or the ‘product team’ working group, members of the working group often did not feel included in the development process. Developers expressed frustration concerning the recognition of their work and the communication with users. We stress the importance of intermediaries between the two groups, which are often found through serendipitous support created by users and developers collaborating even after the initial reason for getting in touch was resolved. Intermediaries usually helped the communication between users and developers by becoming a mediator and keeping both groups’ needs in mind. We conclude that an environment that is open for communication and multidisciplinary collaboration facilitates the opportunities of serendipitous support and ultimately increases the sustainability of FOSS projects.

Further research in other districts and within the online community could help in widening the understanding of the concepts we have elaborated on in this paper. A closer look on shared characteristics of linkage persons would contribute to an understanding of how an intermediary experience can be designed in order to foster communication between different stakeholders.

Part III

Lessons Learned

The third section of the thesis synthesizes and concludes the findings relative to the overarching goal of the study, which is to identify how design can support grassroots initiatives engaged in addressing surplus food issues and to discern what design implications can be derived for a transformation towards sustainability. This analysis is crucial for understanding the intersection between design, grassroots initiatives, and sustainable practices, particularly in relation to practical issues and transformative ambitions.

8 Discussion

Each of the publications in this thesis sheds light on aspects of the relation between socio-technical design and food system change with an emphasis on grassroots initiatives. Chapter 4 explored the various ways in which ICT can support and facilitate the transition to a vegan lifestyle. It discussed the co-evolution of practices and ICT artefacts, exploring how insights into this dynamic can aid in addressing the complexities and tensions inherent in the interplay of practices, socio-material contexts, and communities. Chapter 5-7 insights are derived from engaging with the grassroots community in Siegen and the wider grassroots movement of Foodsharing. Chapter 5 delved into the influence of ICT in fostering community-based food resource sharing, underscoring the design space of abundance. Chapter 6 presented a detailed examination of how (re-)distributional justice is negotiated within a heterogeneous community, highlighting the importance of community building to align the diverse purposes of technology and support community-driven development of artefact ecologies [46, 47, 48, 199]. Chapter 7 explored the relationships between the local Foodsharing community and the designers and developers of the free and open-source software (Foodsharing.de) they use for coordinating and organizing their community practices. This study uncovered serendipitous connections, highlighting the role of intermediaries, and introduces the concept of ‘intermediary experience’.

The aim of this section is to reexamine the findings and evaluate them in the context of the research questions and the existing body of literature. As previously detailed in part I (see chapter 1.2), the two research questions are interconnected, and all the studies presented contribute to addressing both questions.

The discussion encompasses two closely related aspects. Firstly, it delves into the role of socio-technical design in community building within these grassroots contexts, examining the initiation and negotiation processes that are pivotal in their daily practices. Furthermore, this segment addresses how socio-technical design principles can aid in scaling and growth. Following this, the discussion transitions to examining the shift in grassroots initiatives

from merely saving and sharing surplus food to engaging in more comprehensive food resource sharing practices (for a comparison of 'food sharing' and 'food resource sharing', please see chapter 8.2). It underscores the importance of surplus and abundance as key design spaces to inform food system change, viewing surplus as a catalyst for broader transformative ambitions. This part of the discussion intricately outlines the role of surplus and abundance within the design framework and proceeds to investigate the design implications at the intersection of practical issues and transformative ambitions, with a particular focus on the blending of consumption and production practices, often referred to as prosumption. This is exemplified through the experiences of the Siegen grassroots community, where these interrelated practices significantly shape and influence community dynamics and objectives.

8.1 Supporting Grassroots in Surplus Saving and Sharing

The paradigm of socio-informatics [394] aims to provide comprehensive support for the respective practices with a special focus on the design of technical artefacts that interact with these practices. In the scope of my study, I employed the support paradigm as a framework for examining grassroots initiatives dedicated to saving and sharing surplus food.

In my efforts to support grassroots initiatives, I found that the fascinating, hands-on work of saving, redistributing, and sharing surplus food occurs through a series of face-to-face practices and interactions, without the use of digital mediation. Interactions with technology were limited to coordination and organizational tasks, the intricacies of which have already been unpacked in previous studies (e.g., [316, 270, 223, 170]). Reflecting on socio-informatics [394] and on Schrock's work on civic technology [328], it becomes evident that within grassroots communities, design need not focus solely on digital innovations but rather on fostering social change. In this context my exploration identified three critical areas of community building - initiation, ongoing negotiation, and scaling - each offering unique insights into the design spaces that emerged as significant through the research.

8.1.1 Community Building

In the research on vegan practice transformation (chapter 4), practice transformation refers to the process of adopting and integrating new habits and lifestyles, specifically veganism, influenced by ICT. This transformation is not merely dietary; it involves learning new skills, acquiring knowledge, and embracing the values of veganism. ICT is pivotal in this transition, providing essential information, aiding skill development, and strengthening community ties. The paper highlights how ICT artefacts evolve alongside these practices, playing a crucial role in both initiating and sustaining this transformation towards sustainable living. This journey is marked by a gradual deepening in understanding and practicing veganism, shaped by available digital tools and resources.

In this scenario, the community's role is critical. It offers support, sharing of knowledge, and a sense of belonging, all vital for those transitioning to or sustaining a vegan lifestyle. For newcomers to veganism, the community is a valuable resource for learning, adapting, and incorporating vegan habits into daily life. It also provides social support, assisting individuals in overcoming challenges and remaining committed to veganism, thereby easing the overall transformation process. The study highlights the significant role of community in achieving transformative goals and underscores the necessity of community building in the processes I engaged in Siegen.

The evolving community around food (resource) sharing in Siegen can be conceptualized as a Community of Interest [121], which is typically defined by a shared focus on resolving a specific problem. In such communities, individuals with a common interest come together. The diverse nature of the group's composition can be a source of valuable exchange and variety in perspectives. However, this heterogeneity also has the potential to complicate the process of reaching a mutual understanding of goals and objectives within the community [121]. This duality highlights the importance of effective communication and collaboration in managing and leveraging the diversity of the group to achieve common aims.

Community building [226, 244] refers to the process of creating or enhancing a sense of community among individuals within a specific area or with a common interest. This process involves fostering relationships, encouraging collaboration, and creating a shared sense of identity and belonging among members. The research pointed out, that at the core of this process for grassroots communities is networking and relationship building, serving as the backbone of community engagement. It encourages individuals to connect, communicate, and form lasting bonds, thus creating a supportive network. Integral to this is the negotiation of shared goals and values, uniting members under a common purpose and fostering collective motivation. Active participation and collaboration are equally essential, involving community members in decision-making processes and various activities. This not only benefits the group but also strengthens the sense of belonging and ownership. Similarly important is ensuring inclusivity and diversity within the community, acknowledging and respecting varied voices and perspectives to create a welcoming environment for all. Support and empowerment of community members are fundamental, helping them access resources and develop skills. This nurtures a supportive atmosphere conducive to growth. Lastly, sustainability is vital, requiring the establishment of systems and structures that ensure the community's long-term success and relevance.

Key aspects of grassroots community building that are relevant to a socio-technical design accordingly include (1) Networking and Relationship Building, (2) Negotiating shared goals and values, (3) Collaboration and Participation, (4) Inclusivity and Diversity, (5) Mutual support and Empowerment, and (6) Sustainability.

These aspects take on different dimensions depending on the phase of the community building in which they are considered. When studying a Danish organic food community and its associated artefact ecology, Bødker et al. [48] identified three distinct phases in the community's evolution. These phases are:

1. **Becoming a Community:** The initial phase of community development is focused on the formation and establishment of the community.

This stage is marked by bringing together individuals who share common interests and goals, which forms the foundation for the community's growth. As indicated in [48], the early efforts in this phase typically involve utilizing readily available resources and platforms, such as Facebook, to connect like-minded individuals and initiate the community.

2. **Everyday Community Work:** During this phase, the community reaches a point of stability and establishes its daily routines and practices. It is characterized by the strengthening of relationships, clarification of roles, and standardization of activities, which contribute to a sense of consistency and predictability in how the community functions. In the case of the Danish organic food community, as detailed in [48], this phase was particularly focused on managing the core operations of the community and dealing with the weekly tasks. A key aspect of this stage involved practical problem-solving, as the community members worked to adapt to the constraints of their available digital tools [48].
3. **Building Anew:** The final phase is marked by the evolution and transformation within the community. This stage involves a thorough reassessment and potential reorganization or expansion of the community's activities, goals, and structures. Such changes are typically prompted by either internal developments within the community or external shifts in the broader environment. As noted in [48], this phase presented the community with challenges akin to 'growing pains' as it underwent expansion and evolution. A key aspect of this period was the continual evolution of the community's needs, which led to a requirement for new functionalities in the digital tools they utilized [48]. This stage was distinctly characterized by the community's active engagement in designing and developing digital tools that were more adequately equipped to meet their growing and changing needs and operations [48].

These three phases illustrate the dynamic nature of community development, showcasing how communities adapt and evolve over time, particularly in the

context of organic food and sustainable practices. Research on artefact ecologies delves into the study and design of technological systems, emphasizing their relation to sociocultural contexts [199, 46, 47]. This field pays special attention to how different artefacts, both physical and digital, are interconnected and interdependent. It explores how these artefacts are used within their specific contexts and how their combined use can give rise to new properties or functionalities [49, 379]. This approach to understanding technological ecosystems highlights the importance of seeing artefacts not just in isolation but as part of a complex web of relationships that shape their use and significance. Building on this foundational understanding, later studies, such as those by Korsgaard et al. [213], introduce the concept of collective artefact ecologies. These studies reveal that the formation of artefact ecologies within communities is often an organic process, emerging from the diverse contributions and knowledge of community members. Such ecologies can feature interactions between artefacts that are complementary, or sometimes even conflicting, demonstrating the dynamic nature of these systems [49]. This research underscores the importance of context in designing and understanding artefact ecologies, arguing that effective creation and management of these systems rely heavily on the deep, local knowledge and expertise of community members [379]. Furthermore, artefacts within these ecologies are frequently selected and modified by the members of a collective, suggesting that the design of artefact ecologies is a collaborative and adaptive process [213]. This perspective challenges traditional views of artefact-user interaction, proposing instead that artefact ecologies should be considered as instances of design in their own right.

In the subsequent sections, drawing on the concept of artefact ecologies in the communities' evolution [48] I will delve into the initiation phase of community engagement, the negotiation processes that unfold in the community's daily life, and the community's scale and growth.

8.1.1.1 Initiation

The initiation of a community marks the birth of a collective entity, a process where individuals with shared interests, values, or goals come together to

form a cohesive group. This transformative journey begins with the spark of a common purpose or a shared vision, igniting the desire for collective action and mutual support. As these individuals converge, a unique cultural tapestry is woven, rich in shared practices, especially traditions, languages, rituals, and norms that define the community's identity.

The research shows that this process is not merely about gathering people; it is about nurturing a sense of belonging and creating a space where each member feels valued and understood. The formation of a community involves the delicate interplay of responsibility, communication, and collaboration. Persons, who take up responsibilities, often emerge to guide and inspire, but the true strength of a community lies in the active participation and contribution of its members.

In the digital age, ICT and digital artefacts have become pivotal in the initiation and development of communities (see e.g. [206, 70, 143]). These modern tools act as cornerstones, transforming how individuals connect, interact, and build collective identities. The emergence of social media platforms, online forums, and various communication technologies has revolutionized the traditional concept of community formation, transcending geographical boundaries and enabling the vast creation of global networks [388, 389, 387, 57]. They provide a shared space for expression, collaboration, and knowledge exchange, fostering a sense of belonging and shared purpose. Through these platforms, members can contribute diverse perspectives and resources.

The initiation of the grassroots community in Siegen began with the reinvigoration of the local Foodsharing community, as outlined in chapter 1.2. In its early stages, Foodsharing Siegen functioned primarily as an organization for collecting surplus food. However, in this initial phase, there was little in the way of actual community building, such as joint activities, discussions, or collective decision-making. The platform Foodsharing.de was rather utilized to create teams associated with specific supermarkets and to coordinate those individuals to collect the excess food.

The transformation into a more cohesive community began with the organization of cooking evenings, initially in personal living spaces and later in a communal kitchen. These gatherings became a catalyst for forming a stronger

community bond. Following these cooking events, a series of workshops open to all interested individuals were conducted. These workshops provided a platform for community members to discuss matters of importance to the community and to decide on projects they wanted to undertake.

Given the limitations of the Foodsharing.de platform, which offered only a static chat function, and considering that not all participants were registered on Foodsharing.de, a Telegram group was established to be more inclusive and effective. This group also served as a medium for more dynamic and immediate communication among community members, facilitating the ongoing development and coordination of community activities and projects. This shift to using Telegram exemplified the community's evolving communication needs and the adaptation to more suitable digital tools to support its development.

In the early stages of the community's development, the WeChange platform (a cooperative-owned open-source software integrating twenty-two functionalities for project management and networking, primarily utilized by groups dedicated to sustainability) was initially adopted but later found to be underutilized. Similarly, the community organizers noted that although there were about 2-3 online meetings each week at the outset, this frequency did not sustain over time. This decline in engagement was attributed to a perception among participants that there was an imbalance between planning and actual implementation, with the sentiment being that "too much was planned and too little was done". Consequently, WeChange gradually fell out of favor with the active organizers of the community and also online meetings became less. This change in approach resulted in a greater reliance on Telegram as the primary communication and coordination tool for the community. Within Telegram, several subgroups were established to cater to specific interests and activities, such as construction work, cooking events, community gardening, and an information channel.

During the initial stages of the Chili Project, the Telegram messaging app played a pivotal role in coordinating activities and maintaining connections among community members, particularly amidst the challenges posed by

COVID-19 restrictions. The project started with the distribution of pre-grown chili plants, eventually expanding to encompass a wider range of food resource sharing activities, thereby broadening the community and its scope of action.

Participants who adopted chili plants were invited to join a Telegram group, where they could share experiences, receive expert information, and ask questions. Telegram became a vital tool for exchanging experiences and resources, offering a platform for advice, tips, and encouragement in chili plant cultivation and care. This facilitated a personal connection among participants, as they shared detailed experiences about their chili plants, creating an inclusive environment that welcomed individuals from various generations and cultural backgrounds. Despite the central role of Telegram, it was recognized that not all community members were equally adept at using this technology. Personal assistance and support were often provided to help some members engage more effectively with the ICT tools.

Within the Telegram group for the Chili Project, a web-based collaborative real-time editor, known as a Pad, was introduced. This tool was initiated by a participant, who aimed to compile questions about chili cultivation and develop learning modules from these inquiries. While 19 questions were successfully gathered and a learning module was created, the Pad ultimately saw limited use. Participants reported that although they clicked on the link to the Pad, they often quickly exited it due to the inconvenience of opening a new application. This user experience issue led to the eventual discontinuation of the Pad as a tool within the project. Another participant voiced her frustration regarding the need to use multiple platforms and the challenge of acquainting herself with each new system. She expressed a preference for a more streamlined and consolidated approach to access information. This feedback highlights a common challenge in community-based projects where the introduction of multiple or complex digital tools can sometimes hinder rather than facilitate engagement and learning, underscoring the need for simplicity and accessibility in technology.

It was observed that external content shared within the group, such as external links to growing advice, did not elicit any responses from the partici-

pants. This lack of engagement suggested that the community members were more inclined towards direct interaction with local experts and a community of interest in their vicinity for exchanging experiences and expertise. This preference indicates a stronger interest in personal, localized connections and knowledge sharing, rather than relying on more impersonal, external sources of information. It highlights the value placed on community-based learning and the importance of fostering local networks and relationships in grassroots communities.

Additionally, the research delved into how initiatives such as the SharingEvent (weekly event, in which surplus food was redistributed and food resources were distributed) and SharingHut24/7 (a food hut available to everyone 24/7 for sharing) act as pivotal platforms for initiation of a community. The Sharing-Events actively cultivate a sense of community among those involved. The study (chapter 6) underscores the critical role of interactions among community members in fostering a sense of belonging. Proactive engagement among volunteers and with guests, both before and during the events, is fundamental in initiating and reinforcing community connections. Additionally, the integration of food sharing practices with other sustainable activities, such as community gardening and seedling distribution, plays an important role in furthering participant engagement.

In the context of initiating grassroots communities and movements, I propose a design approach that integrates the community's socio-technical artefact ecology [46, 47, 48, 199] with the concept of 'prefigurative technology'. This idea is closely linked to prefigurative politics, a concept central to anarchist thought, which is based on the belief that social movements should reflect the values and practices of the desired future society in their current operations. Prefigurative politics emphasizes enacting the change a grassroots initiative seeks to achieve in society within its own practices and structures, instead of postponing these ideals until after a future revolution or transformation [193]. It emphasizes a unity between means and ends [148, 239], advocating for practical, immediate and direct action [126]. This approach includes building alternatives to existing institutions, like international food chains, and simultaneously challenging them. An example is the Communal-Cooking-Events

in Siegen using surplus food, leading to the establishment of composts for the remains of the chopping and subsequently to communal gardens. Yates [396] identifies five key components: collective experimentation, creation and sharing of political meanings, establishing future-oriented social norms, consolidating these in movement infrastructure, and spreading ideas and goals. This approach to design would involve creating socio-technical systems that not only meet the current needs of grassroots communities but also embody and advance the future societal changes these groups aim to realize.

As awareness of the desirability of prefigurative technology grows within a community, there is a nuanced balancing of values and needs related to practical concerns alongside transformative ambitions. This balancing act takes place within the intricate framework of the community's artefact ecology. In this context, community members and organizers weigh the practical functionality of technology against its ability to reflect and promote the community's broader transformative goals. This process involves careful consideration of how each technological tool or platform aligns with the community's values and objectives, ensuring that the chosen approaches not only address immediate practical needs but also contribute to the community's vision for broader societal change. This approach underscores the importance of understanding and navigating the complex interplay between technology, community needs and values, and long-term aspirations within the socio-technical landscape.

If there is the possibility to choose a platform in the initial phase of the community, there are platforms, which inherently reflect values such as transparency and open collaboration in their design. Diaspora, Mastodon or Matrix could be appropriate choices. However, it is also possible that platforms which might initially seem at odds with the fundamental values of grassroots initiatives, such as Facebook or Telegram, could serve as effective starting points to build the community artefact ecology [46, 47] that resonates with community needs and values in a prefigurative sense. Similarly, platforms that seem to be well used today, can contradict the prefigurative notion, e.g. because they are too highly structured and thus not responsive to changing needs, e.g. inclusivity. The critical factor in prefigurative technology is not the intrinsic assessment of a technology, but the evaluation of a complex ecosys-

tem comprising various actors, artefacts, and their interrelations, addressing both the now and the future. The future, after all, may require scaling and flexibility in as-yet-not-wholly-understood ways. For instance, despite its contradictions to the values of grassroots initiatives, Facebook might still play a role in their prefigurative artefact ecology due to its inclusivity and widespread reach. This approach requires a nuanced understanding of how different technologies can be leveraged to support the overarching goals of a community, even if they do not perfectly align with all of its ideals. While platforms like Facebook offer valuable support for community-led sharing initiatives, facilitating organizational tasks such as event advertising [28] and enabling broader audience reach [82], research has also highlighted a critical concern [317, 222]. These tools, despite their utility, can sometimes clash with the foundational values of the communities they serve. This discrepancy raises important questions about the alignment between digital platforms and the ethos of community members, underscoring the need for a careful consideration of the tools we adopt in pursuit of community engagement and support [132, 317].

Prefigurative technology is characterized more by how it is utilized within (shifting) socio-technical ecologies than by its physical attributes. This perspective shifts the emphasis from the tangible aspects of the technology to its function in fostering community engagement, challenging existing norms, and fostering the development of transformative practices. Essentially, it is about leveraging technology as a tool for embodying and advancing the ideals and aspirations of the community, rather than focusing solely on its technical features or capabilities.

The concept of prefigurative politics, and consequently prefigurative technology, does face criticism. Critics point out that it can sometimes be restrictive and exclusionary, demanding a high level of commitment and strict adherence to certain practices and values [179]. This rigidity could potentially alienate those who are unable or unwilling to meet these stringent requirements. Additionally, there is a concern that prefigurative politics, and by extension prefigurative technology, may become detached from the larger context of social and economic justice struggles, focusing too narrowly on specific community practices and ideals [71].

Despite these critiques, the essence of prefigurative technology lies in its potential to challenge established power structures and hierarchical systems and to manifest the principles and values of a desired future society in current practices. Yates emphasized the significance of prefigurative politics in fostering the reproduction, mobilization, and coordination of social movements [397]. For a design that effectively addresses the socio-technical artefact ecology of a community with a focus on prefigurative technology, it is essential that the design is applicable not only during the initial stages of grassroots communities and movements. It should also be relevant and adaptable for their daily operations (see chapter 8.1.1.2), as well as for their scaling and growth phases (see chapter 8.1.1.3). This approach ensures that the technology remains functional, supportive, and aligned with the evolving needs and dynamics of the community at every stage of its development, from inception through to expansion.

8.1.1.2 Negotiation processes in daily work

The research showed, that as the community evolves, it encounters challenges and opportunities that shape its character and direction. How it responds to these moments of adversity and triumph further cements the bonds among its members, forging a resilient and adaptive collective. The cohesion of a community, therefore, is a dynamic and ongoing process, a journey of building relationships, fostering trust, and creating a shared future. Throughout the research with grassroots initiatives, negotiation processes play a crucial role, serving as a key mechanism for resolving conflicts, making decisions, and establishing norms and agreements that reflect the diverse interests and needs of community members. This is echoed by Chopra et al. [64] who highlight the importance of addressing disagreements, divergences, and frictions in community food-growing projects to achieve collective resilience.

In the study on the SharingEvent (chapter 6) I highlighted these negotiation processes. The research identified barriers like stigma, social norms, proper conduct, fairness, and lack of food literacy as challenges to building a cohesive community around food (resource) sharing practices. The study emphasized the complex interplay of fairness, rules, engagement, and inclusion in

building communities around food sharing initiatives and the sense of community among participants. It also highlighted the role of ideological tensions around 'fairness' and how digital artefacts could potentially alleviate some of these tensions over time.

The concept of (re-)distributional justice within the SharingEvent and SharingHut24/7 was a central theme, indicating that different values and purposes within the community depend on the negotiation of fairness within their daily work of sharing surplus food and food resources. This negotiation process, evident in the organization of food sharing events and the introduction of rules to ensure perceived fairness, like volunteers would not be allowed to have a first pick on the food, is crucial for community building and sustenance. The introduction of these rules itself leads to further negotiations about the conception of fairness, such as considering family size when distributing food. Face-to-face contact among community members helped to moderate what could otherwise be selfish behavior, as the moral authority implicit in these interactions prompted volunteers to engage more with guests, especially before the event. The research notes the importance of interaction among community members, especially in the period before the SharingEvents. During this time, regular meetings within the interconnected community played a crucial role. The face-to-face interaction is seen as a way to foster a sense of community and address tensions that arise due to differing perspectives on fairness. The debates about proper procedures for food (resource) sharing also led to the organization of workshops. These workshops were instrumental in identifying different views of fairness and establishing some policy consensus within the community.

At its core, the negotiation process of fairness within the community revolves around the fundamental question of "who gets what, why, and when". Through the research, I was able to identify five distinct perceptions of fairness that pertain to the redistribution of surplus food and the distribution of other food resources:

1. **Charitable:** This perspective views fairness in terms of providing food to those in need, emphasizing the charitable aspect of food (re-)distribution.
2. **Contribution-oriented:** From this viewpoint, fairness is related to the contributions individuals make to the food sharing process, such as collecting and (re-)distributing food. Those who contribute more might be seen as deserving more benefits from the (re-)distribution.
3. **Equality-based:** This approach to fairness focuses on ensuring that everyone has equal access to the (re-)distributed food, regardless of their contribution or need.
4. **No-waste:** This perspective prioritizes reducing food waste above other considerations. Fairness, in this context, is seen as ensuring that no food goes to waste, regardless of who receives it.
5. **Systemic Fairness:** This view considers the broader system and looks at fairness in terms of how the food (re-)distribution process can support systemic changes towards more sustainable and equitable food systems.

These perspectives illustrate the complexity and diversity of views on what constitutes fairness in food (re-)distribution, reflecting the varied motivations and goals of individuals and groups involved in food sharing initiatives, as also illustrated by Berns et al. [29, 30].

In my action-oriented research approach, I focus on guiding and facilitating the community's own resolution of the conflicting notions of fairness I have observed, rather than directly solving these issues myself or imposing an ICT system that reflects my own perspective of fairness. I firmly believe that resolving these tensions is a responsibility that belongs to the community itself. However, I emphasize that long-term community building is an effective strategy to potentially minimize or even eliminate these tensions.

For a community to successfully scale up (see also chapter 8.1.1.3) and avoid fragmentation, it is essential to align the various purposes and motivations evident in the data. This alignment is crucial for maintaining cohesion and

ensuring that the community's growth is sustainable and inclusive. I advocate for a process where the community collectively navigates these differing viewpoints, seeking common ground that respects and integrates diverse perspectives. This strengthens the community and ensures its development aligns with the collective vision and values of its members. From the research I therefore recommend:

1. **Support Community Engagement:** Encourage active participation by offering tasks that are easy to start with and assist volunteers in taking on more complex tasks. Promote the sharing of skills and resources and provide opportunities for complementary contributions, which foster meaningful relationships and distribute the workload.
2. **Embody Care for the Community:** Focus on engaging with the day-to-day challenges faced by community members, showing appreciation for each individual's presence and contributions.
3. **Maximize Opportunities for Participation:** Facilitate participation in both offline and online activities and discussions, providing technological assistance as needed.
4. **Support Initiative for Discussion:** Encourage open discussion on issues like (re-)distributional justice, addressing instances of tension and supporting acute and long-term communication for alignment of different viewpoints.
5. **Moderate Decision-Making Processes:** Guide the community in decision-making and subsequent design choices about which notions of fairness to commit to.
6. **Facilitate Cooperative Engagement:** Encourage cooperative interactions through entertainment and gamification, which can lead to positive psychological and social outcomes [308].

As different perspectives on fairness are deliberated within the community, my responsibility as an action-oriented researcher is to approach technology

implementation with caution. Action-oriented researchers must avoid the pitfall of “just dumping technology on people” [44], as this can be counterproductive and may not align with the community’s needs or values. Instead, an action-oriented researcher’s role is more about providing a subtle encouragement or a ‘gentle nudge’ towards adopting appropriate technological implementations. In the research, I adopt a holistic perspective that considers the wider context in which technology is embraced and utilized with the communities artefact ecology, moving away from a narrow, product-centric approach to design, as advocated by Manzini and Coad [242]. This stance is in harmony with critical discussions that question techno-solutionist narratives, such as the work of Jensen et al. [194], or work that explores the nuanced question of ‘when not to design’ as highlighted by Baumer and Silberman [22], and considers ‘inaction as a design decision’, a concept put forth by Homewood [182]. I consciously refrained from designing a technological tool that explicitly implements those notions of fairness, recognizing that community building is a process that cannot be imposed or artificially engineered. True community development arises organically from the interactions, shared values, and collective efforts of its members. Imposing a specific technological solution with pre-defined notions of fairness could potentially inhibit this natural process of community growth and self-determination. My approach acknowledges that while technology can facilitate and support community development, it should not dictate or overly influence the fundamental dynamics of community building. This perspective ensures that the community remains at the forefront, with technology serving as an aid rather than a directive force in the community’s evolution.

Norton et al. offer a valuable insight in this context that the research insights of this thesis resonate with: “Developing information systems based on the values and practices of sustainability communities [...] has the potential to transform the information system landscape to one that can support the design and development of sustainable agriculture, if not one that is broadly sustainable and equitable” [270]. This statement underscores the potential of thoughtfully designed information systems that resonate with the values and practices of sustainability-focused communities. Such systems can significantly contribute to shaping a landscape of information technology that not

only supports sustainable food practices but also promotes broader sustainability and equity. This approach advocates for a more nuanced and value-driven development and implementation of technology, ensuring that it serves as a tool for positive transformation.

Another negotiation process around fairness regarding the daily work of the community, which particularly intrigued me, centered on the theme of equity in contributions within the Foodsharing.de platform. This discussion was catalyzed by the introduction of two notable features on the Foodsharing.de platform: the cherry-picking rule and the commitment statistic.

1. **Cherry-Picking Rule:** This rule allows local Foodsharing Ambassadors to manage the distribution of pick-up opportunities at high-demand supermarkets. It limits the number of pick-ups each Food-saver can undertake within a certain timeframe at these locations. The intention behind this rule is to prevent a situation where certain Food-savers monopolize the most sought-after pick-up spots, thus promoting a more equitable allocation of these opportunities.
2. **Commitment Statistic:** This feature offers insights into the participation levels of community members, accessible by Ambassadors and Store Coordinators. It tracks various forms of engagement, such as the number of pick-ups, involvement as a Store Coordinator, participation in meetings, or maintenance tasks like cleaning a SharingHut24/7. The visibility of this data aims to promote equitable participation within the community by highlighting individual contributions and encouraging balanced involvement.

In the local community of Siegen, there are ongoing discussions about potentially linking the commitment statistic to the cherry-picking rule. Such a system could allow Foodsavers to earn pick-up slots in exchange for completing community tasks, like monthly cleaning of a SharingHut24/7. This approach aims to create a more reciprocal relationship between community contributions and access to resources. However, a comprehensive analysis of these features and the surrounding negotiation processes is an area for

future research. Such an examination would delve deeper into the impacts and implications of these platform changes on community dynamics, fairness perceptions, and member engagement. Understanding these elements is critical for assessing how such platform changes influence and shape community practices and equity.

8.1.1.3 Scale and growth

Scale and growth in grassroots initiatives encompass the expansion of grassroots initiatives, along with their respective projects, in terms of impact and reach. In the research focusing on the Chili Project (chapter 5), I delved deeper into the aspects of scale and growth, specifically examining the role of ICT in supporting the grassroots community in its scaling efforts. This scaling encompasses not just geographical expansion but also activities that enable broader participation and create a larger impact. Through my investigation I acknowledged the challenges faced by the community, such as limited financial resources and lack of expertise in digital systems, echoing [32]. Interestingly, the findings suggest that small, local endeavors do not necessarily require complex technological support to form a community of interest and allow sustainable practices to flourish.

Participants in the study discussed the scope and scale of their projects, expressing a desire for broader effects while stressing the importance of local actions. The concept of achieving ‘glocal’ impact - a blend of global and local perspectives – therefore was explored, emphasizing how small local contributions can have significant glocal impact. This glocal approach, thinking globally while acting locally [132], underscores the necessity of addressing sustainability at both the global and local levels. This involves engaging with complex networks of practices oriented towards an abundance of food resource and food (see chapter 8.2), which can be both produced and consumed at the local level. The idea is that while global coordination, infrastructure, and policy are crucial, they alone cannot fully support complex food practices in their local execution. Therefore, deep change [386] toward more sustainability requires attention at both the global and local levels. This approach is particularly relevant for small local grassroots communities and projects

striving for sustainability, which need to consider their potential global impact and the role of ICT in this context. A core challenge for ICT here is to make small, local contributions count.

The case of the Chili Project illustrates how local activities contribute progressively to global efforts, creating scalable design lessons. Simple ICT was sufficient for scaling food resource sharing practices beyond initial expectations. The project has seen remarkable expansion, with new groups related to gardening forming on platforms like Telegram, indicating increased community engagement and interest in sustainability, especially sustainable food practices. Furthermore, the project's reach has extended beyond its initial core community. It involves a diverse range of participants including friends, relatives, local organizations and notably, residents of retirement homes. This involvement of extended networks signifies not just the growth of the project, but also its ability to connect with and engage different segments of the community thus amplifying its reach and impact. It illustrates how a focused initiative like the Chili Project can evolve a broader scope, fostering community bonds and shared interests in sustainability and gardening.

The study in chapter 5 notes that as tasks, activities and membership grow, there might be a need for a more sophisticated ICT policy. Further scaling will alter the ICT needs and practices of communities. When communities scale beyond basic technological platforms, existing trust and social capital might not suffice to adopt more sophisticated platforms, presenting design challenges for supporting systems that allow for growth. The study highlights that fostering local food production, potentially scalable with new technology, offers several benefits, including community development, and ecological and economic sustainability. Light and Miskelly [234, 233] highlight the unique position of local communities in the context of sustainability and scalability. They note that while local communities might not have immediate economic scalability, they cultivate a sharing culture with a focus on addressing environmental, economic, and social issues at the local level [233]. This culture, though locally rooted, can have a broader impact on sustainability, particularly when supported by ICT for growing, spreading [32], and meshing [234, 221]. Their view resonates with the findings: The sharing culture in

the Chili Project, which began with sharing chili plants and providing an ICT-supported space, fostered additional food resource sharing and contributed to the growth of the local community. Yet, our study raises questions about the feasibility of seamlessly meshing platforms like Foodsharing.de and Telegram groups.

Light and Miskelly discuss how local sharing communities develop "relational assets" from their sharing culture [234, 233]. These assets become foundational in creating an ecology of mutually supportive systems within a community. This suggests that the meshing of various initiatives and systems could lay the groundwork for comprehensive socio-technical infrastructures dedicated to sharing [234]. Incorporating technology into sharing initiatives like the Chili Project demonstrates how networks can support the local context, evolving cultures, and collective agency. The tools used in such contexts, like the Telegram group, are typically ad-hoc and responsive, mirroring the dynamic relationships they facilitate.

While communities aim to support activities that scale beyond individually targeted interventions to enable larger impacts, challenges exist regarding appropriate platforms (see also prefigurative technology in chapter 8.1.1.1). Community organizations often struggle with limited financial resources and lack in-house expertise in the design, development, and maintenance of digital systems [32]. However, as already noted, small local endeavors do not require sophisticated technological support to form a community of interest and let sustainable practice grow and flourish. This underscores the potential of grassroots communities to foster significant change in a glocal context through simple, locally-focused actions and the supportive utilization of technology.

The Chili Project serves as a prominent example of the growth within the Foodsharing Siegen community, particularly illustrating the transition from merely sharing surplus food to embracing broader scope of sustainable food practices. This expansion and its implications are set to be further explored in the following chapter.

8.2 From Sharing Surplus Food towards Food Resource Sharing

In this chapter, we take an in-depth look at how grassroots communities transition from simply saving and sharing surplus food to engaging in a wider range of sustainable food practices, especially encompassing food resource sharing. This exploration begins with the design spaces of surplus and abundance. This involves looking at how surplus food, often seen as a problem, can actually serve as a catalyst for sustainable practices. The discussion then extends to how the notion of abundance represents an ongoing ambition for the community, driving it towards more sustainable and holistic food practices. The chapter proceeds to examining the interplay between practical challenges and transformative ambitions.

In the realm of sustainable food practices, from the research two practices come into focus: Food Sharing and Food Resource Sharing. Despite their apparent similarities, these practices embody different philosophies, methodologies, and outcomes.

Food Sharing primarily involves the distribution of foods and food products. This practice has been centered around the redistribution of surplus food items (see e.g., [395, 82]). It encompasses various forms, including 'sharing for money', 'sharing for charity', and 'sharing for community' [251]. The underlying theme of food sharing is often scarcity. In essence, it is a reactive approach, responding to the issue of surplus and the immediate needs of food distribution in communities where food is not equitably accessible. Food sharing is consumption-oriented, emphasizing the end use of food products by the recipients.

In contrast, **Food Resource Sharing** extends beyond the mere distribution of consumable food. This practice focuses on sharing essential resources like seeds, crops, plants, soil, and fertilizer, crucial for producing and reproducing food resources. It encompasses the sharing of knowledge, expertise, and recipes, as well as providing spaces for communal gardens and other related activities. The central idea is 'sharing for community' [251], with a strong inclination towards achieving self-sufficiency. An emerging theme in

food resource sharing is 'abundance'. Unlike food sharing, this approach is prosumption-oriented [310], implying that the participants are involved not just in consuming food but also in its production. It encourages a sustainable cycle where communities can grow and share their food, creating a system of mutual support and resilience.

This chapter highlights the role of socio-technical design in supporting the community and especially the community members to become more than mere recipients of surplus food but active contributors to the production and sharing of food resources. This shift in perspective from consumption to a broader involvement in sustainable food practices highlights a more integrated approach to community engagement. Overall, this chapter seeks to provide a nuanced understanding of how surplus sharing initiatives can evolve into more comprehensive sustainable food practices, and the role of design in facilitating this transformation.

8.2.1 Design Space of surplus and abundance

The design space of surplus and abundance emerges when the practical concern of surplus redistribution intertwines with a future vision for sustainable food practices, especially emphasizing sharing and caring practices fundamental to community development. This space ultimately creates opportunities for engagement and supports a conducive environment for sharing and caring practices to scale.

In the upcoming chapters, my focus will be on dissecting the distinct yet interconnected realms of surplus and abundance in the context of community-driven sustainable food practices. This exploration will be structured as follows: We will first examine the specific characteristics and efforts associated with managing surplus food. This includes understanding the immediate challenges and strategies required for the effective redistribution or utilization of excess food within communities. Subsequently, the discussion will transition to the concept of abundance. Here, we will explore how abundance is not just about the availability of resources but about establishing circular, sustainable processes that ensure long-term resource regeneration and sharing

within the community. The later part will delve into how surplus and abundance are interconnected. We will explore how the practical management of surplus food can serve as a catalyst for communities to transition towards a state of abundance. This section will also highlight how practical issues in surplus management intertwine with transformative ambitions for sustainable food systems [386], shaping the community's approach to resource sharing and overall development. Therefore, this part of the discussion will focus on how community members evolve from being passive recipients of surplus food to becoming active contributors for a sustainable food ecosystem. We will explore the design implications of this shift for the community, particularly how it affects the approach to food resource sharing and contributes to the broader sustainability goals of the community. Through the following subchapters, I aim to provide a comprehensive understanding of how grassroots communities navigate the challenges and opportunities of surplus and abundance. By examining their distinct aspects and the synergies between them, along with the critical role of consumption and prosumption practices, we can gain insights into the dynamic processes that drive sustainable community development.

8.2.2 Surplus food as a practical issue

At its core, surplus food refers to excess food that is produced, processed, and distributed, but not consumed [275]. One of the primary concerns associated with surplus food is waste [184]. This phenomenon emerges at various stages of the food supply chain, from agricultural production to end-consumers [72]. Globally, a significant portion of food produced is never consumed, leading to wasteful resource utilization and environmental impacts [12, 72]. This waste occurs for various reasons, including overproduction, inefficiencies in distribution and storage, strict aesthetic standards for produce, and consumer purchasing and eating habits [250, 50, 113]. The environmental implications are profound; food waste contributes to greenhouse gas emissions, unnecessary water usage, and land exploitation [324].

To tackle this issue of food surplus, research in the fields of SHCI and HFI has largely focused on understanding how design can facilitate the effective

avoidance of food waste [130, 398, 13]. Research aimed at redistributing food surplus primarily engages with food sharing practices [82, 251, 161]. Notable examples include ethnographic fieldwork regarding the organization of face-to-face sharing events by a volunteer-run food sharing community in Denmark [29] and design implications as they relate to food systems and food waste [110].

Despite the plentitude of food production, millions around the world suffer from hunger and malnutrition [124]. The concept of using surplus food to address the paradox of food waste and food insecurity has been widely discussed in academic and policy circles, where it is presented as a possible solution through its donation and distribution to those in need [362, 134, 263]. Yet, in line with [122, 289] the research of this thesis criticizes the merging of food surplus and food poverty into a win-win solution, arguing for a broader investigation into food sharing policies and the role of food resources in these policies.

In the research of this thesis, the concept of 'sharing for charity', as framed by Micheline et al. [251], presents a charitable view of fairness within the SharingEvent and has sparked contention for several reasons (see also chapter 8.1.1.2). This model, often seen in initiatives, dedicated to surplus redistribution, creates a distinct division between the providers (those who give) and the beneficiaries (those who receive), leading to several critical issues:

1. **Stigmatization and Contextual Relevance:** The rigid distinction between provider and beneficiary can inadvertently stigmatize those on the receiving end, especially in 'low-income' contexts. This stigmatization can create a barrier to participation, as people may want to avoid being labeled or seen in a certain light [98, 204, 273]. The association of food sharing solely with charity and poverty can limit the broader acceptance and participation in such initiatives.
2. **Reinforcement of Indigence:** By indirectly placing value on indigence, the charitable notion of fairness can risk perpetuating the very conditions it aims to alleviate. This approach may reinforce a dependency

dynamic, where beneficiaries continually rely on the surplus or excess from providers.

3. **Lack of Reciprocal Engagement and Shared Ideology:** If beneficiaries perceive themselves as merely at the receiving end of a one-way process, it does not foster a sense of shared ideology or cooperative community engagement. This unidirectional model misses the opportunity to build a more inclusive and participatory community ethos.
4. **Connection Between Social Exclusion and Food Assistance:** Kessl et al. [204] highlight the close relationship between social exclusion and food assistance. The act of giving excess food to those in need, without addressing the root causes of their dependency, perpetuates a one-way street of charitable supply. This approach maintains a clear divide between the beneficiary and the provider.
5. **Impact on Choice and Social Affiliation:** The lack of choice for beneficiaries, who must accept whatever is provided, underscores a form of social exclusion and disaffiliation. Being relegated to accepting leftovers of others' choices symbolizes a lack of agency and participation in society [204].

The research on Foodsharing and its approach to surplus food saving and redistribution provides a nuanced view of the movement's objectives and the broader implications of its practices. According to the Foodsharing Wiki, the primary goal of the Foodsharing movement is to reduce the wastage of Earth's resources, with the redistribution of surplus food to those in need being a beneficial side effect, rather than the main objective. This distinction is crucial in understanding Foodsharing's approach and ethos. The movement adheres to a principle of 'no-waste fairness' (see chapter 8.1.1), emphasizing the consumption of surplus food by anyone, regardless of their economic status, to prevent waste. While the overarching notion of fairness within the movement emphasizes the goal of ending food waste, the actual practices facilitated by the Foodsharing.de platform tend to focus primarily on the saving of surplus food. The platform, as a tool, is primarily designed to manage the logistics of surplus food collection and its redistribution. This involves connecting

individuals and organizations with surplus food to those who can utilize it, thereby preventing waste. However, this approach, as noted, primarily addresses the immediate issue of surplus food without necessarily engaging in broader strategies to reduce food waste at its source or transform the food system as a whole. While the redistribution of surplus food offers immediate benefits, the research of this thesis critically points out that such actions alone do not constitute sustainable practice. The primary concern here is that focusing solely on redistribution addresses the symptoms of a flawed food system rather than its underlying causes. It does not fundamentally change or improve the system's inefficiencies.

Yet, in the local Foodsharing community, there are efforts to go beyond just redistributing surplus food. Volunteers advocating for systemic fairness (see chapter 8.1.1.2) are initiating projects around the Foodsharing community that are environmentally sustainable, economically viable, and socially equitable, like the Chili Project (chapter 5) or SharingEvent (chapter 6). These include efforts to reduce food waste at the root cause of a flawed food system by promoting local, sustainable food production in community gardens. An innovative approach observed in the research involves using surplus food as a catalyst for sustainable food sharing practices. For instance, communal cooking events where surplus food is used to cook meals together not only utilize excess food but also foster community engagement and sustainable practices. This approach transforms surplus food from a mere redistributed commodity into a resource that brings people together and promotes sustainability. In the upcoming chapters, I will elaborate further on how surplus food can act as a catalyst for sustainable food sharing practices.

In sum, the issue of surplus food is complex, requiring urgent action for redistribution while also necessitating a reevaluation of the methods and impacts of such redistribution. The critique [98, 204, 273] of the charitable model in food sharing [251] highlights the need for more inclusive, participatory, and sustainable approaches to addressing food surplus and insecurity. The research underscores the importance of rethinking our food systems in a holistic manner. The issue of surplus food is a convoluted one, straddling environmental,

social, and economic domains. It challenges us to rethink our food systems, from production to consumption and from local to global (glocal).

8.2.3 Abundance as a continuous ambition

The pursuit of ‘deep change’ in food systems, as the research along with others suggests [386], extends far beyond the realm of merely sharing food surplus. It encompasses a comprehensive transformation towards sustainable and equitable food practices. This change involves utilizing surplus as a means to foster a community-oriented approach to food, emphasizing practices in which consumption and production blend into local prosumption practices. The projects in Siegen exemplify that sharing within the community goes beyond just rescued food. It involves the sharing of foundational resources necessary for food production, including seeds, arable land, and knowledge. Such sharing extends to recipes and the cultivation of a community that continuously shares its resources to ensure sufficiency.

Abundance, as addressed in the research, is distinguished from surplus. While surplus implies an overflow or excess, abundance is about being full in the sense of sufficiency or ‘just enough’. It is linked to the innovative design space of ‘food resource sharing’, where the focus is on the sufficient availability of resources rather than their scarcity. Contrary to the conventional notion that resources are scarce, the research posits that the necessary resources for sustainable food practices are present, particularly in the local context of grassroots communities aspiring towards abundance. The concept of abundance emphasizes the dissolution of traditional roles of providers and beneficiaries, fostering a more integrated and mutual relationship between community members and their environment. This perspective challenges the traditional scarcity-surplus dichotomy, suggesting a shift in how resources are perceived and utilized. The idea of abundance represents a dynamic where resources are viewed as neither scarce nor surplus but as sufficient. This sufficiency is not just in terms of quantity but also in quality, fostering ongoing community well-being and resilience. Abundance, in the research, is portrayed not as a static state of having enough but as an ongoing ideological commitment to a community-centric approach to resource management where the community’s

needs are met without overexploitation. This viewpoint advocates for a continuous process of sharing and sustainability, rather than a finite goal to be achieved.

The concept of abundance is a transformative approach to resource sharing within communities, especially in the context of food systems. This idea is rooted in the principle of non-rivalrous sharing, where sharing resources with one person is viewed as contributing to a broader culture of sufficiency that benefits the entire community. This principle suggests that the act of sharing by one individual can lead to more extensive sharing within the community ('the more I share with you, the more will ultimately be shared with others'). This approach is in stark contrast to a rivalrous dynamic where resources are perceived as scarce and competitive, leading to hoarding and wastage. Drawing from Sahlins' concept of 'generalized reciprocity' [319] the research highlights that sharing within a community does not always equate to direct or immediate reciprocity, as also noted by and Berns et al. [29]. Instead, it fosters a communal culture where the act of sharing benefits the collective over time, rather than focusing on immediate returns for the giver. By adopting this approach, communities can cultivate practices that are collaborative, sustainable, and equitable. It encourages a shift in perception from viewing resources as individual possessions to be hoarded, to seeing them as communal assets to be shared for the collective well-being. This perspective has the potential to significantly transform community dynamics. It promotes a transition from individualistic, consumption-driven behaviors to a more community-focused, sustainability-oriented approach. This shift is crucial in addressing not only the issue of food waste but also in fostering a sense of community solidarity and mutual support. The adoption of non-rivalrous sharing and generalized reciprocity in food systems can lead to more sustainable resource management. It ensures that resources are circulated within the community, minimizing waste and maximizing utility for all members.

The discourse on the role of food in fostering community growth and the emergence of alternative food movements ties into Vivero Pol's broader concept of 'food as commons', [380] yet there is an observation that such community-centric initiatives have not gained significant traction primarily due to the prevailing emphasis on individual change [386]. This perspec-

tive aligns with the argument put forth by Hirsch et al. [180], who advocate for the positive application of interactive technologies to support and amplify these alternative food movements. They suggest that such technologies could serve as a bridge connecting people with the natural world, thereby fostering a deeper understanding and appreciation of our interdependence with nature [180].

The concept of resource abundance, which is encouraged within these movements, aims to facilitate a symbiotic exchange between participants and nature. This is evident in the actions of the participants, whose caring gestures, especially with their adopted chili plants (chapter 5) reflect a profound connection with and stewardship of the natural environment. A notable shift observed in initiatives like the Chili Project and SharingEvent is the blurring of lines between those who provide resources and those who benefit from them. In these contexts, the distinction between volunteer providers and beneficiaries diminishes, highlighting a model of food resource sharing that is inherently communal. This model exemplifies the essence of 'food as commons' [380] at a community level, where the act of sharing transcends individual contributions and becomes a collective endeavor, reinforcing the unity and shared identity among participants.

In the study of the Chili Project within the context of designing for abundance, has identified a need for design that promotes the sharing of food resources at a local level, yet with far-reaching implications. This encompasses addressing the intricacies of prosumption practices and nurturing the desire for 'deep changes' in food systems [386]. It also calls for an extended examination of how design can amplify the sharing of food resources beyond local boundaries. Here, ICT plays a pivotal role in elevating these initiatives from local to 'glocal' scales (as also discussed in 8.1.1.3), underscoring the significance of grassroots communities in sustainable endeavors. The concept of glocal abundance emphasizes the vital role of local food production and community activities, intertwined with global perspectives [132], in consistently achieving sufficiency. Chapter 5 provides a thorough analysis and insights into how ICT can support community-led food sharing initiatives aimed at achieving abundance. As emphasized before, the Chili Project promoted a "sharing culture" [233] that began with the distribution of chili plants as a food resource.

In the context of the Chili Project an examination was conducted on how minor, locally-based contributions, aided by ICT, could have a substantial impact at a global, or 'glocal', level. In the focused grassroots project, basic ICT was adequate to turn food resource sharing into a feasible and scalable practice, exceeding initial expectations. Participants in the project began to share and request additional resources, particularly seeds, through a Telegram group. This method of sharing food resources cultivates a culture of sharing and interdependence among community members. In the Chili Project, Telegram functioned as a vital communication platform, effectively supporting various community endeavors like gardening and seed-sharing events. This digital tool created a digital environment for those adopting chili plants to participate in food resource sharing, thereby fostering a community geared towards abundance.

Telegram was utilized as a straightforward yet impactful tool, fostering a community of interest [121] centered around food resource sharing practices. Telegram's contribution to the grassroots community was particularly noteworthy for providing an easy entry point into community organization. It allowed individuals to engage with projects and the community at their own pace, creating an inclusive atmosphere. The platform served as a hub for members to offer and request resources, promoting a culture of mutual aid and support.

The research indicates a significant potential for further exploration into how design and technology can support and enhance sustainable practices in food resource sharing. Future developments could include more advanced platforms, management tools, and systems that strengthen community engagement, coordination, and collective efforts.

The concept of abundance challenges established economic principles and promotes inclusivity and equitable resource distribution. It thrives on regular communal events, fostering community building and shared responsibility, and orients toward an idealized future emphasizing sufficiency. The emerging projects and practices evoke tensions and negotiation processes as they involve the suspension of the usual economic rule of acquiring goods and ser-

vices in a value-equivalent exchange for money. Instead, "exchange value", the foundation of capitalist economy, is replaced by sharing and caring practices concerned with innovative forms of gifting [28]. The emphasis on abundance involves encouraging communities to actively engage in sustainable practices, such as local food production, sharing resources, and collaborative activities. This engagement is key to nurturing a sense of abundance and sustainability within the community. This collaborative effort brings about the development of rules governing actions. Yet, the interpretation of these rules varies, contributing to the evolution of practices within the space (see chapter 8.1.1.2). The notion of abundance challenges traditional views of resource management and paves the way for more holistic, community-centric food practices.

8.2.4 Intertwining practical issues and transformative ambitions

In the grassroots community examined, the practical issue of surplus redistribution is intertwined with transformative ambitions, leading to the creation of spaces where new societal norms and practices are explored and developed. These spaces emerge as grassroots communities self-organize around practical challenges, particularly emphasizing sharing and caring practices as a means to effect transformative change. Surplus acts as a catalyst, supporting sharing and caring practices that are essential for community building and broader transformative aims. In our local context, through Foodsharing, surplus becomes a tool for fostering a sense of sharing, as it places people in a position to give to others, starting circles of sharing and caring.

The concept of 'surplus as a catalyst' is exemplified in the Chili Project. The project operates on a profound level of food supply, focusing on what is available and what is needed, rather than on explicit exchange value. The community had too many pre-grown chilis and decided to give them away for free to organize an inclusive project. This approach challenges traditional capitalist formulations. For example, participants like Tom reported that when extending the scope in sharing to distributing pumpkin seedlings or lavender, there was no consideration of giving or asking for anything in return. In his opinion, this led to more distribution than if these items had been sold. Fur-

thermore, Stephanie, another participant, viewed the sharing of chilies not just as a surplus distribution but as a catalyst for further sharing aimed at creating abundance. She furthermore reflected, that this approach gives meaning to the act of sharing, transcending the idea of merely distributing excess items. The design space also illustrates the connection between surplus and abundance. Surplus is viewed as a potential catalyst for communities moving towards abundance, initiating practices and perspectives that drive communities to address immediate surplus and work towards creating a sustainable, abundant environment. This shift in focus involves looking beyond the immediate logistical challenges of surplus redistribution to envision and implement practices that foster a sustainable, communal approach to food resource sharing.

These spaces where practical and transformative goals meet allow communities to experiment with new practices and rules, promoting a culture of innovation and creativity. Initiatives like the Chili Project, SharingEvents and Foodsharing Siegen exemplify how communities tackle practical issues like food surplus and waste, while also nurturing a transformative vision through a community ethos centered on resource sharing, caring, and sustainable food practices. The research emphasizes the need for comprehensive approaches to food surplus that address not only the immediate redistribution but also the root causes of food waste. This could involve promoting sustainable food production and consumption, influencing policy changes, and educating consumers about food preserving practices.

In this context, research has progressively focused on the synergetic interrelations between production and consumption, investigating ‘prosumers’ [310] who act in both productive and consumptive capacities. This focus has led to an increase in research aimed at understanding and supporting prosumers in various contexts, including energy [152, 253] and food [252, 259]. Food, unlike energy, is a tangible object that draws people into more intimate interaction, making SHCI crucial in understanding and nurturing these complex networks [224] of prosumption practices towards sustainability. Therefore, in the realm of intertwining practical issues and transformative ambitions the nexus of consumption and prosumption practices is highlighted in chapter 5. The research suggests moving away from traditional economic conceptions of consumption and production towards a more genuinely cooperative

view. This approach is associated with the concept of the ‘prosumer’, where the distinction between rival and non-rival goods is dissolved, promoting a more public or shared conception of goods. This different perspective on the matters is based on the belief that food and related resources are not inherently scarce, but rather appear so due to our current distribution practices being inadequate. I advocate for substantial shifts in our approach to designing for sharing practices. This change moves us away from a mere focus on consumption to an exploration of complex prosumption practices, which are more intricately linked with the sharing of food resources, rather than simply sharing food. This viewpoint suggests that by rethinking and redesigning the ways we distribute and share resources, we can address the perceived scarcity and foster a more sustainable and equitable access to food.

The contrast between the Foodsharing movement’s overarching advocacy goals, specifically to eradicate food waste, and the actual functionalities supported by their digital platform, like saving and redistributing surplus food, is indicative of a widespread challenge faced by grassroots initiatives. While the advocacy aspect often encompasses a wide array of transformative objectives, the practical implementations, especially those facilitated by digital platforms, are frequently limited in scope due to restricted financial capabilities and the absence of internal expertise in the creation and development of digital systems [32].

In my specific study, the Foodsharing.de platform effectively facilitates the coordination of surplus food pickups and offers a feature for food sharing. However, it is not inherently designed to bolster community building or the broader sharing of food resources. Nevertheless, within the wider context of the community in Siegen, particularly seen in the Chili Project, the notion of sharing transcends the mere surplus to include a variety of food resources, such as seeds and knowledge. In this regard, the Telegram platform has played a crucial role. In the context of the efforts in Siegen, surplus food is viewed as a catalyst that initiates community building, wherein the sharing of resources assists the community in progressing towards abundance. This perspective highlights the potential for digital platforms not just to facilitate the redistri-

bution of surplus food but also to act as enablers of community growth and the expansion of resource sharing initiatives.

The research highlights the complexities of translating grassroots movements' advocacy into practical actions, especially in addressing systemic issues like food waste. It underlines the importance of developing strategies and tools that bridge high-level advocacy goals with on-the-ground practices, emphasizing a glocal approach. Therefore, in recent research my colleagues and I explored the dynamics between users and developers in the context of large FOSS projects, particularly focusing on the Foodsharing.de movement. We are particularly interested in understanding the communication dynamics between the local Foodsharing communities and the voluntary developers of Foodsharing.de. Our preliminary research has unveiled concepts like 'intermediary experience' and 'serendipitous connections', highlighting the often unplanned yet fruitful interactions that occur between developers and users in this volunteer-driven setting. We are now planning a Foodsharing Hackathon in Siegen, an event spanning several days where programmers, designers, and tech enthusiasts come together to collaborate intensively on software projects. This Hackathon will also feature a communal cooking event with the Foodsharing Siegen community and a presentation of the research findings to both local community members and platform developers.

Looking ahead, future research could delve deeper into how grassroots movements and communities can better align their advocacy and practices, especially developing strategies that not only redistribute surplus food but also contribute to broader systemic changes in the food system. Furthermore, we are interested how community building and especially food resource sharing can be incorporated into the platform design.

In light of the findings from this thesis, the concept of prefigurative technology (see chapter 8.1.1.1) serves as a bridge linking the current availability of surplus food and its redistribution through the platform Foodsharing.de to a future vision of sustainable food practices within the community. Telegram, as a tool, exemplifies this concept through its inclusive nature and simplicity. It has facilitated the expansion of food practices beyond the redistribution

of surplus food, supporting activities such as community gardening and collective cooking events. This is achieved even though the technology itself, like Telegram, may possess certain aspects that contradict some community values (e.g. the centralization of control in channels and groups, or no ownership of one's own data), but enables other values, like inclusivity (esp. due to its usability). In the course of an awareness of prefigurative technology, values and needs regarding practical issues as well as transformative ambitions are weighed up in the complex structure of the community artefact ecology [46, 47, 48]. By adopting and adapting technologies under consideration of a prefigurative claim, communities can navigate their current realities while progressively shaping and realizing their aspirations for a more sustainable and collaborative future, especially aiding the scaling and growth of grassroots initiatives (chapter 8.1.1.3). This approach underscores the pragmatic use of available technologies to foster community building, aligning with the broader objectives of prefigurative technology. Essentially, it is about using technology not just as a tool for practical purposes, but as an integral part of a broader strategy to realize visionary societal changes within the current operations and structures of a community.

9 Conclusion and Outlook

This dissertation has embarked on a nuanced exploration of the role of socio-technical design in supporting grassroots initiatives, particularly in the domain of sustainability through food saving and food resource sharing practices. At the heart of this inquiry is the recognition of the multifaceted role that food plays in our lives - not merely as a sustenance source but as a vital connector within social, economic, and ecological systems. Grounded in the principles of socio-informatics [394] and guided by a practice-based, action-oriented research methodology [164, 166], this work delves into the complexities of fostering sustainable food practices within grassroots communities through design.

The research is driven by two interconnected questions: how can socio-technical design support food saving and food sharing grassroots initiatives in their efforts toward sustainability (esp. initiation, daily operations, and growth), and how can it facilitate the nexus of food saving and food sharing practices with broader sustainable food practices? These questions underline the ambition to not only enhance the operational effectiveness of grassroots initiatives but also to contribute to the broader discourse on sustainability.

Adopting a socio-informatics perspective, the research framework emphasizes collaborative engagement with communities, recognizing the significance of socio-technical systems in shaping and being shaped by social dynamics. Through this lens, the research unfolds in a series of engagements with grassroots communities, particularly focusing on food saving and sharing initiatives like Foodsharing.de and the broader implications of such practices for sustainability.

The dissertation begins by framing the paradox of food waste amid hunger and the potential of community-led initiatives to address this challenge innovatively. Through the lens of socio-technical design, the research investigates how technology can support the transition from surplus food redistribution to encompassing food resource sharing practices. This exploration is motivated by the urgent need to address the global crisis of food waste and insecurity, leveraging the power of grassroots initiatives to foster change. Within this

context, the concept of 'glocal' - simultaneously global and local - emerges as a crucial perspective. It acknowledges that while the challenges of food waste and insecurity are global in scope, their responses are often rooted in local practices and innovations. By focusing on how grassroots initiatives can operate within a glocal framework, the research highlights the potential for local actions to have global implications. In essence, socio-technical design is crucial for balancing the growth of grassroots initiatives with the preservation of their community-driven approach, ensuring that scaling enhances rather than dilutes the initiative's impact and values.

The dissertation unveils critical insights into community building and the design spaces of surplus and abundance, illustrating the transformative potential of grassroots initiatives in transitioning towards more sustainable food systems. It highlights the role of socio-technical design in facilitating these transitions, enabling communities to navigate the challenges of managing surplus food and fostering an ethos of abundance and sustainability. A design approach to food resource sharing, when thoughtfully aligned with the concept of surplus, has the potential to fundamentally transform traditional paradigms of waste and dependencies into models of sustainability and mutual support. For the development of future sustainable food systems, it is vital for design strategies to serve as a bridge, fostering deeper connections within the community through the sharing of locally abundant resources. For example, one of the presented projects utilized chili plants as a focal point for sharing, leveraging a resource that is abundant within the community. Similarly, communal cooking events represent another innovative avenue, where food that would otherwise be discarded is instead used as a catalyst for community interaction, creating spaces for people to come together, cook, converse, and share experiences. This concept of abundance goes beyond mere distribution; it cultivates a thriving community ecosystem where the act of sharing food resources leads to a virtuous cycle of increased resource sharing.

The findings underscore the significance of fostering a culture of care and support within communities as a foundational aspect of designing food systems rooted in abundance. The ethos of abundance, coupled with the principle of 'just enough', catalyzes a communal spirit where resources are shared generously among members, embodying a non-competitive approach that sharing

with one person amplifies the capacity to share with others. Such an abundance framework emphasizes not just the sustenance provided by food but the communal bonds and resilience fostered through this act of sharing, painting a vision for sustainable food systems grounded in community empowerment. The exploration of surplus and abundance as design spaces offers a novel perspective on addressing food surplus and promoting sustainability. By re-defining surplus as a catalyst for community engagement and sustainability practices, the research challenges traditional notions of waste and scarcity, advocating for a model of food systems that emphasizes sufficiency, sharing, and caring.

The investigation underscores the role of socio-technical systems in supporting these community-driven efforts, facilitating the sharing of knowledge, resources, and skills essential for sustainable living. The research demonstrates that even relatively straightforward ICT can significantly bolster food resource sharing initiatives, making them both viable and effective. Through analysis, it was discovered that a Telegram group played a pivotal role in expanding the scope and reach of food resource sharing practices far beyond what was initially anticipated. Telegram's appeal lies in its accessibility and ease of use, offering a low barrier to entry for those interested in participating in grassroots initiatives. This accessibility enables individuals to engage with projects and the broader community at their own pace, removing many of the hurdles associated with more complex platforms like Foodsharing.de. The simplicity and directness of communication that Telegram provides allow for the efficient organization and mobilization of community resources, encouraging more people to take part in food (resource) sharing and other communal activities.

While the Foodsharing.de platform provides essential functionalities for coordination, its complexity and the need for a deeper understanding of its functions posed challenges for some users, leading to a preference for simpler, more accessible tools like Telegram for communication and coordination. The Foodsharing platform's technical hurdles and a preference for direct, real-time communication through Telegram highlight a broader issue within grassroots initiatives, noting the limitations of sophisticated platforms in community building compared to the more dynamic and accessible nature of Telegram

groups, which foster a sense of community and enable easy sharing of updates and food availability among members.

Although there is a clear preference for simple messaging systems with limited functionality due to their ease of use and straightforwardness in coordinating work, Foodsharing.de remains the primary platform for coordinating surplus food pick-ups, resulting in an exclusion for those who cannot appropriate the platform. In order to incorporate a wider spectrum of community needs and values, together with my colleagues I investigated the communication and collaboration of the voluntary developers of Foodsharing.de and the local Foodsharing community of Siegen. The research revealed the pivotal role of intermediaries in fostering communication and collaboration between users and developers of FOSS projects. These intermediaries often emerge through unexpected or serendipitous interactions, extending beyond the initial reasons for contact between the two groups. Their ability to mediate and maintain an awareness of the needs and perspectives of both users and developers is crucial. By serving as a bridge, intermediaries facilitate a more nuanced and effective exchange of ideas, feedback, and technical insights. Furthermore, the research underscores the value of creating an environment that is not only open to communication but also encourages multidisciplinary collaboration. Such an environment enhances the potential for serendipitous support, where the spontaneous and unforeseen contributions of users and developers can lead to innovative approaches and improvements. This, in turn, significantly contributes to the sustainability and ongoing development of FOSS projects.

The investigation of SharingEvent and SharingHut24/7 reveals that while the local community navigates challenges related to fairness, stigma, social norms, and a lack of food knowledge, it also uncovers opportunities for promoting sustainable food practices through community gardens and collective cooking events. Both SharingEvent and SharingHut24/7 have been pivotal in cultivating a community ethos centered on the shared development and distribution of resources and knowledge. Digital tools play a crucial role in this ecosystem, not only in coordinating efforts and disseminating information but also in facilitating discussions on equitable food redistribution.

The negotiation of fairness within grassroots initiatives, especially in the context of food sharing and food resource sharing practices, emerged as a significant theme in the dissertation. This complex negotiation process underscores the diverse perspectives within communities on what constitutes fair (re-)distribution and access to food resources. As the research delves into the intricacies of these negotiations, it becomes evident that fairness is not a one-size-fits-all concept but rather a dynamic and multifaceted construct that requires continuous dialogue and adaptation. The exploration of fairness within the grassroots initiatives revealed the importance of creating inclusive and participatory platforms that allow community members to voice their opinions, share their needs, and collaboratively develop guidelines that reflect the collective ethos. This approach to negotiating fairness is pivotal in fostering a sense of equity, trust, and belonging among participants, thereby enhancing the sustainability and resilience of community-led initiatives.

Through analysis, five distinct perceptions of fairness within the community were identified: Charitable Fairness, Contribution-oriented Fairness, Equality-based Fairness, No-waste Fairness, and Systemic Fairness. Each conception presents a unique approach to addressing the distribution and contribution dynamics within the community. A critical reflection on how these varying notions of fairness interact and sometimes conflict, as well as the role of action-oriented researchers in mediating these negotiations, has been a key aspect of the study.

In terms of ICT design and its role in supporting community initiatives like *SharingEvent* and *SharingHut24/7*, the findings suggest a need for technology that aligns with the community's objectives. Crucially, facilitating the negotiation processes essential for community building emerges as a paramount concern. ICT tools should thus be designed to not only support logistical and operational needs but also to enable and enrich the ongoing dialogue around fairness, equity, and sustainability in food sharing and food resource sharing practices.

By highlighting the negotiation of fairness, the dissertation contributes to a deeper understanding of how socio-technical design can support equitable and just practices within grassroots initiatives, ensuring that technology de-

sign aligns with the community's values and aspirations for fair and sustainable food systems. Throughout the study, I encountered instances, like the negotiation process around fairness where it became evident that a technological solution was either inappropriate or potentially detrimental, for instance, by obstructing natural social interactions or narrowing down the negotiation process. In an approach to enhancing the fairness and sustainability of community-driven food sharing practices, a conscious decision was made not to pursue the development of a technological tool tailored to implement specific notions of fairness. The research underscores the importance of discernment in design, recognizing that sometimes the most beneficial intervention is to refrain from introducing technology [194, 22, 182]. This decision is rooted in an understanding that the essence of community building cannot be mandated or artificially constructed through technology. This approach not only challenges conventional design wisdom but also prioritizes the well-being and genuine needs of the community over the mere application of technological solutions. This perspective underscores the belief that real and lasting change is achievable through broadening the level of community engagement, fostering a culture of participation, dialogue, and mutual respect. It is about envisioning and crafting change that is inclusive, equitable, and sustainable, leveraging the collective power and creativity of the community to identify, develop, and implement socio-technical artefacts that resonate with their values, needs, and aspirations.

Finally, this dissertation discusses how grassroots communities, through the act of surplus redistribution, intertwine practical issues with transformative ambitions, aiming to foster new societal norms and practices. This conjunction is done by creating spaces where sharing and caring are emphasized, using surplus food as a catalyst for community building and broader societal changes. Initiatives like the Foodsharing Siegen and Chili Project are highlighted as examples where surplus redistribution goes beyond merely addressing food waste, towards a more inclusive approach of resource sharing that challenges traditional capitalist models. The research suggests a shift from conventional consumption-production paradigms to a focus on prosumption, where food resource sharing is central. Through the investigation into the realm of surplus and abundance, the research seeks to inspire action-oriented

researchers to link practical issues with utopian objectives, encouraging them to engage in practical challenges while connecting them to transformative goals.

The dissertation opens several avenues for future research, particularly in exploring innovative socio-technical designs that can further empower grassroots initiatives towards sustainability. This includes developing scalable socio-technical artefacts that accommodate the evolving needs of growing grassroots initiatives, fostering inclusive and participatory design processes, and investigating new models of community engagement and food resource sharing. Future research could also delve into the long-term impacts of socio-technical systems on community building and sustainability, providing deeper insights into the transformative potential of grassroots initiatives. Envisioning the 'scaling up' of food (resource) sharing initiatives, it is clear that this expansion will necessitate adjustments in communities' ICT practices and needs. The scalability of food (resource) sharing practices introduces new dynamics and challenges, requiring innovative ICT approaches that can adapt to the evolving landscape of community engagement and resource management. Moreover, I am particularly interested in how food resource sharing can foster and enable novel forms of food sharing that are deeply embedded in the ethos of 'sharing for community'. These practices, occurring both online and offline, represent a shift towards more communal and socially-driven approaches to food sharing and food distribution. By examining the effects and potentials of these new sharing modalities, I hope to uncover insights that will not only contribute to the academic discourse on sustainable food systems but also offer practical guidelines for communities and practitioners looking to leverage ICT for food abundance and social solidarity. Additionally, future studies will aim for a design that bridges the gap between the needs of grassroots communities and the high-tech solutions often proposed by larger corporate entities [65]. It is crucial to explore the potential of integrating both low-tech and high-tech approaches to improve food (resource) sharing practices without compromising the values and principles of these communities. This viewpoint is supported by the literature review conducted by Doggett, Bronson, and Soden [91], which examines the conventional profit-oriented

versus alternative sustainable dichotomy in HCI research. They advocate for HCI research frameworks that adopt a more inclusive perspective, incorporating diverse global agricultural practices and viewpoints to address the complexities of global food systems. This research will strive to highlight the transformative power of ICT in creating more resilient, connected, and sustainable food ecosystems.

References

- [1] foodsharing Wiki - Bedürftigkeit. url: <https://wiki.foodsharing.de/bed%c3%bcfrftigkeit>.
- [2] foodsharing Wiki - Rechtsvereinbarung. url: <https://wiki.foodsharing.de/rechtsvereinbarung>.
- [3] ABRAHAMSE, W., STEG, L., VLEK, C., AND ROTHENGATTER, T. A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology 25, 3 (Sept. 2005), 273–291.
- [4] ACKERMAN, M. S., DACTERA, J., PIPEK, V., AND WULF, V. Sharing Knowledge and Expertise: The CSCW View of Knowledge Management. Computer Supported Cooperative Work (CSCW) 22, 4-6 (2013), 531–573.
- [5] ACKERMAN, M. S., AND MALONE, T. W. Answer Garden: a tool for growing organizational memory. In Proceedings of the conference on Office information systems - (Cambridge, Massachusetts, United States, 1990), ACM Press, pp. 31–39.
- [6] ACKERMAN, M. S., AND McDONALD, D. W. Answer Garden 2: merging organizational memory with collaborative help. In Proceedings of the 1996 ACM conference on Computer supported cooperative work - CSCW '96 (Boston, Massachusetts, United States, 1996), ACM Press, pp. 97–105.
- [7] ADAMS, J., AND WHITE, M. Why don't stage-based activity promotion interventions work? Health education research 20, 2 (2005), 237–243. Publisher: Oxford University Press.
- [8] AHMED, I., GHORASHI, S., AND JENSEN, C. An Exploration of Code Quality in FOSS Projects. In Open source software: mobile open source technologies, L. Corral, A. Sillitti, G. Succi, J. Vlasenko, and A. I. Wasserman, Eds., vol. 427 of IFIP AICT. Springer, Heidelberg, 2014, pp. 181–190.

- [9] AHN, Y.-Y., AHNERT, S. E., BAGROW, J. P., AND BARABÁSI, A. Flavor network and the principles of food pairing. Scientific Reports 1, 1 (Dec. 2011). Publisher: Springer Science and Business Media LLC.
- [10] AKRAM-LODHI, A. H. Hungry for change: farmers, food justice and the agrarian question, 1st ed ed. Kumarian Press, Sterling, Va, 2013.
- [11] ALBINSSON, P. A., AND YASANTHI PERERA, B. Alternative marketplaces in the 21st century: Building community through sharing events. Journal of Consumer Behaviour 11, 4 (2012), 303–315. eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/cb.1389>.
- [12] ALEXANDER, P., BROWN, C., ARNETH, A., FINNIGAN, J., MORAN, D., AND ROUNSEVELL, M. D. A. Losses, inefficiencies and waste in the global food system. Agricultural Systems 153 (May 2017), 190–200.
- [13] ALTARRIBA, F., LANZANI, S. E., TORRALBA, A., AND FUNK, M. The Grumpy Bin: Reducing Food Waste Through Playful Social Interactions. In Proceedings of the 2017 ACM Conference Companion Publication on Designing Interactive Systems (New York, NY, USA, June 2017), DIS '17 Companion, Association for Computing Machinery, pp. 90–94.
- [14] ALTARRIBA BERTRAN, F., JHAVERI, S., LUTZ, R., ISBISTER, K., AND WILDE, D. Making Sense of Human-Food Interaction. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2019), CHI '19, Association for Computing Machinery, pp. 1–13.
- [15] APOSTOLOPOULOU, E., BORMPOUDAKIS, D., CHATZIPAVLIDIS, A., CORTÉS VÁZQUEZ, J. J., FLOREA, I., GEAREY, M., LEVY, J., LOGINOVA, J., ORDNER, J., PARTRIDGE, T., PIZARRO, A., RHOADES, H., SYMONS, K., VERÍSSIMO, C., AND WAHBY, N. Radical social innovations and the spatialities of grassroots activism: navigating pathways for tackling inequality and reinventing the commons. Journal of Political Ecology 29, 1 (2022).

- [16] ARDICHVILI, A., MAURER, M., LI, W., WENTLING, T., AND STUEDEMANN, R. Cultural influences on knowledge sharing through online communities of practice. Journal of Knowledge Management 10, 1 (Jan. 2006), 94–107. Publisher: Emerald.
- [17] ASAD, M., AND LE DANTEC, C. A. Illegitimate Civic Participation: Supporting Community Activists on the Ground. In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (New York, NY, USA, Feb. 2015), CSCW '15, Association for Computing Machinery, pp. 1694–1703.
- [18] AVRAM, G., CHOI, J. H.-J., DE PAOLI, S., LIGHT, A., LYLE, P., AND TELI, M. Repositioning CoDesign in the age of platform capitalism: from sharing to caring. CoDesign 15, 3 (July 2019), 185–191.
- [19] BACH, P. M., DELINE, R., AND CARROLL, J. M. Designers wanted. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2009), D. R. Olsen, R. B. Arthur, K. Hinckley, M. R. Morris, S. Hudson, and S. Greenberg, Eds., ACM, pp. 985–994.
- [20] BANNON, L., BARDZELL, J., AND BØDKER, S. Reimagining participatory design. Interactions 26, 1 (2018), 26–32.
- [21] BANO, M., AND ZOWGHI, D. User involvement in software development and system success. In Proceedings of the 17th International Conference on Evaluation and Assessment in Software Engineering (New York, NY, USA, 2013), F. Q. B. Da Silva, N. Juristo, and G. H. Travassos, Eds., ACM, pp. 125–130.
- [22] BAUMER, E. P., AND SILBERMAN, M. S. When the implication is not to design (technology). In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2011), CHI '11, Association for Computing Machinery, pp. 2271–2274.
- [23] BECKER, H. S. Becoming a Marihuana User. American journal of Sociology 59, 3 (1953), 235–242.

- [24] BELK, R. Why Not Share Rather Than Own? The ANNALS of the American Academy of Political and Social Science 611, 1 (May 2007), 126–140. Publisher: SAGE Publications Inc.
- [25] BELK, R. Sharing. Journal of Consumer Research 36, 5 (Feb. 2010), 715–734.
- [26] BELK, R. Sharing Versus Pseudo-Sharing in Web 2.0. The Anthropologist 18, 1 (July 2014), 7–23. Publisher: Routledge eprint: <https://doi.org/10.1080/09720073.2014.11891518>.
- [27] BELK, R. Sharing without caring. Cambridge Journal of Regions, Economy and Society 10, 2 (July 2017), 249–261.
- [28] BERNS, K., AND ROSSITTO, C. From Commodities to Gifts: Redistributing Surplus Food Locally. 12.
- [29] BERNS, K., ROSSITTO, C., AND THOLANDER, J. Queuing for Waste: Sociotechnical Interactions within a Food Sharing Community. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2021), CHI '21, Association for Computing Machinery, pp. 1–15.
- [30] BERNS, K., ROSSITTO, C., AND THOLANDER, J. “This is not a free supermarket”: Reconsidering Queuing at Food-sharing Events. In C&T '21: Proceedings of the 10th International Conference on Communities & Technologies - Wicked Problems in the Age of Tech (New York, NY, USA, June 2021), C&T '21, Association for Computing Machinery, pp. 319–331.
- [31] BERNS, K., ROSSITTO, C., AND THOLANDER, J. Learning from Other Communities: Organising Collective Action in a Grassroots Food-sharing Initiative. Computer Supported Cooperative Work (CSCW) (Aug. 2023).
- [32] BIØRN-HANSEN, A., AND HÅKANSSON, M. Building Momentum: Scaling up Change in Community Organizations. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (New

- York, NY, USA, Apr. 2018), CHI '18, Association for Computing Machinery, pp. 1–13.
- [33] BLACK, I. R., AND CHERRIER, H. Anti-consumption as part of living a sustainable lifestyle: daily practices, contextual motivations and subjective values. Journal of Consumer Behaviour 9, 6 (Nov. 2010), 437–453. Publisher: Wiley.
- [34] BOGUSZ, T., AND HOLTAPPELS, M. Third Knowledge Spaces between Nature and Society: A Dialogue. Historical Social Research / Historische Sozialforschung 46, 2 (2021), 264–286. Publisher: GESIS - Leibniz Institute for the Social Sciences.
- [35] BOTERO, A., MARTTILA, S., PODERI, G., SAAD-SULONEN, J., SERAVALLI, A., TELI, M., AND M.C VAN AMSTEL, F. COMMONING DESIGN AND DESIGNING COMMONS. In Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 2 (New York, NY, USA, June 2020), PDC '20, Association for Computing Machinery, pp. 178–180.
- [36] BOTSMAN, R., AND ROGERS, R. What's mine is yours: the rise of collaborative consumption. Harper Business, New York, 2010.
- [37] BOULANGER, A. Open-source versus proprietary software: Is one more reliable and secure than the other? IBM Systems Journal 44, 2 (2005), 239–248.
- [38] BRATTETEIG, T., AND WAGNER, I. Unpacking the Notion of Participation in Participatory Design. Computer Supported Cooperative Work (CSCW) 25, 6 (2016), 425–475.
- [39] BRAUN, V., AND CLARKE, V. Using thematic analysis in psychology. Qualitative Research in Psychology 3, 2 (Jan. 2006), 77–101. Publisher: Routledge eprint: <https://www.tandfonline.com/doi/pdf/10.1191/1478088706qp063oa>.
- [40] BREWER, R. S. Three Shifts for Sustainable HCI: Scalable, Sticky, and Multidisciplinary. A SIGCHI HCI & Sustainability community workshop (2014).

- [41] BRINKMANN, SVEND AND KVALE, STEINAR. *InterViews - Learning the Craft of Qualitative Research Interviewing*, Sept. 2022.
- [42] BRYNJARSDOTTIR, H., HÅKANSSON, M., PIERCE, J., BAUMER, E., DISALVO, C., AND SENEGERS, P. Sustainably unpersuaded: how persuasion narrows our vision of sustainability. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2012), CHI '12, Association for Computing Machinery, pp. 947–956.
- [43] BUSCHKE, F. T., BOTTS, E. A., AND SINCLAIR, S. P. Post-normal conservation science fills the space between research, policy, and implementation. *Conservation Science and Practice* 1, 8 (2019), e73. [_eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/csp2.73](https://onlinelibrary.wiley.com/doi/pdf/10.1111/csp2.73).
- [44] BØDKER, S. Third-wave HCI, 10 years later - participation and sharing. *interactions* 22, 5 (2015), 24–31.
- [45] BØDKER, S., DINDLER, C., IVERSEN, O. S., AND SMITH, R. C. What Are the Activities and Methods of Participatory Design? In *Participatory Design*. Springer International Publishing, Cham, 2022, pp. 49–64.
- [46] BØDKER, S., AND KLOKMOSE, C. N. The Human–Artifact Model: An Activity Theoretical Approach to Artifact Ecologies. *Human–Computer Interaction* 26, 4 (Dec. 2011), 315–371. Publisher: Taylor & Francis [_eprint: https://doi.org/10.1080/07370024.2011.626709](https://doi.org/10.1080/07370024.2011.626709).
- [47] BØDKER, S., AND KLOKMOSE, C. N. Dynamics in artifact ecologies. In *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design* (New York, NY, USA, Oct. 2012), NordiCHI '12, Association for Computing Machinery, pp. 448–457.
- [48] BØDKER, S., KORSGAARD, H., AND SAAD-SULONEN, J. 'A Farmer, a Place and at least 20 Members': The Development of Artifact Ecologies in Volunteer-based Communities. In *Proceedings of*

- the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (New York, NY, USA, Feb. 2016), CSCW '16, Association for Computing Machinery, pp. 1142–1156.
- [49] BØDKER, S., LYLE, P., AND SAAD-SULONEN, J. Untangling the Mess of Technological Artifacts: Investigating Community Artifact Ecologies. In Proceedings of the 8th International Conference on Communities and Technologies (New York, NY, USA, June 2017), C&T '17, Association for Computing Machinery, pp. 246–255.
- [50] CANALI, M., AMANI, P., ARAMYAN, L., GHEOLDUS, M., MOATES, G., ÖSTERGREN, K., SILVENNOINEN, K., WALDRON, K., AND VIT-TUARI, M. Food Waste Drivers in Europe, from Identification to Possible Interventions. Sustainability 9(1) (Jan. 2017).
- [51] CAPILUPPI, A., LAGO, P., AND MORISIO, M. Evidences in the evolution of OS projects through Changelog Analyses. In Taking Stock of the Bazaar: Proceedings of the 3rd Workshop on Open Source Software Engineering, J. Feller, B. Fitzgerald, S. Hissam, and K. Lakhani, Eds. 2003, pp. 19–24.
- [52] CARREÑO, I., AND DOLLE, T. Tofu Steaks? Developments on the Naming and Marketing of Plant-based Foods in the Aftermath of the TofuTown Judgement. European Journal of Risk Regulation 9, 3 (Sept. 2018), 575–584. Publisher: Cambridge University Press (CUP).
- [53] CARROLL, J. Completing design in use: closing the appropriation cycle. ECIS 2004 Proceedings (2004), 44.
- [54] CASE, K. E. Musgrave's vision of the public sector: the complex relationship between individual, society and state in public good theory. Journal of Economics and Finance 32, 4 (Oct. 2008), 348–355.
- [55] CETINA, K. K., SCHATZKI, T. R., AND VON SAVIGNY, E. The practice turn in contemporary theory. Routledge, 2005.
- [56] CHAMBERLAIN, A., AND GRIFFITHS, C. Wild food practices. In Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication (Sept. 2013), ACM.

- [57] CHAYKO, M. The portable community: envisioning and examining mobile social connectedness. International Journal of Web Based Communities 3, 4 (Nov. 2007), 373–385.
- [58] CHENG, J., AND GUO, J. L. How Do the Open Source Communities Address Usability and UX Issues? In Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2018), ACM, pp. 1–6.
- [59] CHENGALUR-SMITH, I., SIDOROVA, A., AND DANIEL, S. Sustainability of Free/Libre Open Source Projects: A Longitudinal Study. Journal of the Association for Information Systems 11, 11 (2010), 657–683.
- [60] CHERRIER, H. Anti-consumption discourses and consumer-resistant identities. Journal of Business Research 62, 2 (Feb. 2009), 181–190. Publisher: Elsevier BV.
- [61] CHIES, B. M. Turning food “waste” into a commons. Practicing the Commons. Self-Governance, Cooperation and Institutional Change. XVI Biennial IASC-Conference. (2017).
- [62] CHOI, J. H.-J., LINEHAN, C., COMBER, R., AND MCCARTHY, J. Food for thought. In Proceedings of the Designing Interactive Systems Conference on - DIS '12 (2012), ACM Press.
- [63] CHOPRA, S. Designing for participatory visioning: HCI for reconciling sustainability visions with everyday practice in grassroots communities. doctoral, Northumbria University, Sept. 2023.
- [64] CHOPRA, S., CLARKE, R. E., CLEAR, A. K., HEITLINGER, S., DILAVER, Ö., AND VASILIOU, C. Negotiating sustainable futures in communities through participatory speculative design and experiments in living. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, Apr. 2022), CHI '22, Association for Computing Machinery, pp. 1–17.

- [65] CHOPRA, S., VASILIOU, C., CLEAR, A. K., CLARKE, R., HEITLINGER, S., AND DILAVER, Ö. Bottom-up visions for future of food growing in cities. International Journal of Food Design 8, Co-Creating Sustainable Food Systems (Oct. 2023), 199–226. Publisher: Intellect.
- [66] CIAGHI, A., AND VILLAFIORITA, A. Beyond food sharing: Supporting food waste reduction with ICTs. In 2016 IEEE International Smart Cities Conference (ISC2) (Trento, Italy, Sept. 2016), IEEE, pp. 1–6.
- [67] CLEAR, A. K., O’NEILL, K., FRIDAY, A., AND HAZAS, M. Bearing an Open “Pandora’s Box”: HCI for Reconciling Everyday Food and Sustainability. ACM Transactions on Computer-Human Interaction 23, 5 (Oct. 2016), 28:1–28:25.
- [68] COLE, M., AND MORGAN, K. Vegaphobia: derogatory discourses of veganism and the reproduction of speciesism in UK national newspapers1. The British Journal of Sociology 62, 1 (Mar. 2011), 134–153. Publisher: Wiley.
- [69] COMBER, R., HOONHOUT, J., VAN HALTEREN, A., MOYNIHAN, P., AND OLIVIER, P. Food practices as situated action: exploring and designing for everyday food practices with households. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, Apr. 2013), CHI ’13, Association for Computing Machinery, pp. 2457–2466.
- [70] COMUNELLO, F., MULARGIA, S., AND SARRICA, M. ICTs for Community Development: Bridging Conceptual, Theoretical, and Methodological Boundaries. American Behavioral Scientist 64, 13 (Nov. 2020), 1803–1817. Publisher: SAGE Publications Inc.
- [71] COOPER, D. Towards an adventurous institutional politics: The prefigurative ‘as if’ and the reposing of what’s real. The Sociological Review 68, 5 (Sept. 2020), 893–916. Publisher: SAGE Publications Ltd.

- [72] CORRADO, S., AND SALA, S. Food waste accounting along global and European food supply chains: State of the art and outlook. Waste Management 79 (Sept. 2018), 120–131.
- [73] COSTANZA-CHOCK, S. Design Justice: towards an intersectional feminist framework for design theory and practice. Proceedings of the Design Research Society (2018).
- [74] COZZA, M., AND ANTONELLA DE ANGELI. Scaling up the Engagement in Participatory Design: Booklet. In Proceedings of the 1st International Workshop on Socio-Technical Perspective in IS Development (STPIS'15), co-located with the 27th International Conference on Advanced Information Systems Engineering (CAiSE 2015). 2015, pp. 106–113.
- [75] CRIVITS, M., AND PAREDIS, E. Designing an explanatory practice framework: Local food systems as a case. Journal of Consumer Culture 13, 3 (June 2013), 306–336. Publisher: SAGE Publications.
- [76] DALSGAARD, P. Participatory Design in Large-Scale Public Projects: Challenges and Opportunities. Design Issues 28, 3 (2012), 34–47.
- [77] DANTEC, C. A. L., AND DISALVO, C. Infrastructuring and the formation of publics in participatory design. Social Studies of Science 43, 2 (Apr. 2013), 241–264.
- [78] DARLEY, J. M., AND LATANÉ, B. Bystander intervention in emergencies: diffusion of responsibility. Journal of personality and social psychology 8, 4 (1968), 377–383.
- [79] DAVIES, A., AND EVANS, D. Urban food sharing: Emerging geographies of production, consumption and exchange. Geoforum 99 (Feb. 2019), 154–159.
- [80] DAVIES, A. R. Urban Food Sharing: Rules, Tools and Networks, 1 ed. Bristol University Press, 2019.
- [81] DAVIES, A. R., DONALD, B., GRAY, M., AND KNOX-HAYES, J. Sharing economies: moving beyond binaries in a digital age.

- Cambridge Journal of Regions, Economy and Society 10, 2 (July 2017), 209–230.
- [82] DAVIES, A. R., AND LEGG, R. Fare sharing: interrogating the nexus of ICT, urban food sharing, and sustainability. Food, Culture & Society 21, 2 (Mar. 2018), 233–254.
- [83] DAVIES, A. R., AND WEYMES, M. Disruptive technologies? Scaling relational geographies of ICT- mediated surplus food redistribution. SHARECITY working paper 3 (2018).
- [84] DE LA BELLACASA, M. P. Matters of Care. University of Minnesota Press. Retrieved September 13, 2022 from <https://www.upress.umn.edu/book-division/books/matters-of-care>.
- [85] DELONG, J. B., AND FROOMKIN, A. M. Beating Microsoft at its Own Game (Reviewing Charles Ferguson, High Stakes, No Prisoners (1999)). Harvard Business Review, Jan-Feb. 2000 (1999).
- [86] DENG, J., WANG, Y., VELASCO, C., ALTARRIBA ALTARRIBA BERTRAN, F., COMBER, R., OBRIST, M., ISBISTER, K., SPENCE, C., AND MUELLER, F. F. The Future of Human-Food Interaction. Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (May 2021), 1–6.
- [87] DERQUI, B., GUTERMAN, H. G., GHAFARI, M., AND RODRIGO, P. The Vegan Revolution: Opportunities and Differences Across Countries. In Advances in National Brand and Private Label Marketing. Springer International Publishing, 2020, pp. 90–96.
- [88] DISALVO, C., AND JENKINS, T. Fruit Are Heavy: A Prototype Public IoT System to Support Urban Foraging. In Proceedings of the 2017 Conference on Designing Interactive Systems (New York, NY, USA, June 2017), DIS '17, Association for Computing Machinery, pp. 541–553.
- [89] DISALVO, C., LUKENS, J., LODATO, T., JENKINS, T., AND KIM, T. Making public things: how HCI design can express matters of concern. In Proceedings of the SIGCHI Conference on Human Factors

- in Computing Systems (New York, NY, USA, Apr. 2014), CHI '14, Association for Computing Machinery, pp. 2397–2406.
- [90] DISALVO, C., SENEGERS, P., AND BRYNJARSDÓTTIR, H. Mapping the landscape of sustainable HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, Apr. 2010), CHI '10, Association for Computing Machinery, pp. 1975–1984.
- [91] DOGGETT, O., BRONSON, K., AND SODEN, R. HCI Research on Agriculture: Competing Sociotechnical Imaginaries, Definitions, and Opportunities. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, Apr. 2023), CHI '23, Association for Computing Machinery, pp. 1–24.
- [92] DOMBROWSKI, L., BRUBAKER, J. R., HIRANO, S. H., MAZMANIAN, M., AND HAYES, G. R. It takes a network to get dinner: designing location-based systems to address local food needs. In Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing (New York, NY, USA, Sept. 2013), UbiComp '13, Association for Computing Machinery, pp. 519–528.
- [93] DOURISH, P. HCI and environmental sustainability. In Proceedings of the 8th ACM Conference on Designing Interactive Systems - DIS '10 (2010), ACM Press.
- [94] DRAXLER, S., AND STEVENS, G. Supporting the Collaborative Appropriation of an Open Software Ecosystem. Computer Supported Cooperative Work (CSCW) 20, 4-5 (Sept. 2011), 403–448. Publisher: Springer Science and Business Media LLC.
- [95] DRAXLER, S., STEVENS, G., STEIN, M., BODEN, A., AND RANDALL, D. Supporting the social context of technology appropriation. In Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12 (2012), ACM Press.

- [96] DUCHENEAUT, N. Socialization in an Open Source Software Community: A Socio-Technical Analysis. Computer Supported Cooperative Work (CSCW) 14, 4 (2005), 323–368.
- [97] D’ALISA, G., AND KALLIS, G. Post-normal science. In Degrowth : A Vocabulary for a New Era. Routledge, 2014, pp. 185–188.
- [98] EDWARDS, F. Overcoming the social stigma of consuming food waste by dining at the Open Table. Agriculture and Human Values 38, 2 (June 2021), 397–409.
- [99] EGAN, C., BENYON, D., AND THOMPSON, R. Permaculture as a foundation for sustainable interaction design and UX. In Proceedings of the 31st British Computer Society Human Computer Interaction Conference (Swindon, GBR, July 2017), HCI ’17, BCS Learning & Development Ltd., pp. 1–6.
- [100] EICHHORN, B. R., AND TUKEL, O. I. A Review of User Involvement in Information System Projects:. International Journal of Information Technology Project Management 6, 1 (Jan. 2015), 26–53.
- [101] EL BILALI, H., AND ALLAHYARI, M. S. Transition towards sustainability in agriculture and food systems: Role of information and communication technologies. Information Processing in Agriculture 5, 4 (Dec. 2018), 456–464.
- [102] ELDER-VASS, D. Defining the gift. Journal of Institutional Economics 16, 5 (Oct. 2020), 675–685. Publisher: Cambridge University Press.
- [103] ENGELBUTZEDER, P., BOLLMANN, Y., BERNS, K., LANDWEHR, M., SCHÄFER, F., RANDALL, D., AND WULF, V. (Re-)Distributional Food Justice: Negotiating conflicting views of fairness within a local grassroots community. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2023), ACM, pp. 1–16.
- [104] ENGELBUTZEDER, P., CERNA, K., RANDALL, D., LAW, D., MÜLLER, C., STEVENS, G., AND WULF, V. Investigating the use of

- digital artifacts in a community project of sustainable food practices: ‘My chili blossoms’. In Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (New York, NY, USA, Oct. 2020), NordiCHI ’20, Association for Computing Machinery, pp. 1–4.
- [105] ENGELBUTZEDER, P., RANDELL, D., LANDWEHR, M., AAL, K., STEVENS, G., AND WULF, V. From surplus and scarcity towards abundance: Understanding the use of ICT in food resource sharing practices. ACM Transactions on Computer-Human Interaction (2023).
- [106] ENGESTRÖM, Y. Activity theory and individual and social transformation. In Perspectives on Activity Theory, 19(38), 19-30. Cambridge University Press, 1999.
- [107] ENGESTRÖM, YRJÖ. Expansive Learning at Work: Toward an activity theoretical reconceptualization. Journal of Education and Work 14, 1 (Feb. 2001), 133–156. Publisher: Informa UK Limited.
- [108] FAGERHOLM, F. Software Developer Experience: Case Studies in Lean-Agile and Open Source Environments. Dissertation, University of Helsinki, Helsinki, 2015.
- [109] FAGERHOLM, F., AND MUNCH, J. Developer experience: Concept and definition. In 2012 International Conference on Software and System Process (ICSSP 2012) (Piscataway, NJ, 2012), R. Jeffery, Ed., IEEE, pp. 73–77.
- [110] FALCONE, P. M., AND IMBERT, E. Bringing a Sharing Economy Approach into the Food Sector: The Potential of Food Sharing for Reducing Food Waste. In Food Waste Reduction and Valorisation: Sustainability Assessment and Policy Analysis. Springer International Publishing, Cham, 2017, pp. 197–214.
- [111] FANG, Y., AND NEUFELD, D. Understanding Sustained Participation in Open Source Software Projects. Journal of Management Information Systems 25, 4 (2009), 9–50.

- [112] FAO. Food Wastage Footprint - Impacts on Natural Resources – Summary report. url: <https://www.fao.org/sustainable-food-value-chains/library/details/en/c/266219/>.
- [113] FAO. Global Food Losses and Food Waste – Extent, Causes and Prevention, 2011. url: <https://www.fao.org/sustainable-food-value-chains/library/details/en/c/266053/>.
- [114] FARR-WHARTON, G., CHOI, J. H.-J., AND FOTH, M. Food talks back: exploring the role of mobile applications in reducing domestic food wastage. In Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI '14 (Sydney, New South Wales, Australia, 2014), ACM Press, pp. 352–361.
- [115] FEDERAL MINISTRY OF FOOD AND AGRICULTURE. Leitsätze für vegane und vegetarische Lebensmittel mit Ähnlichkeit zu Lebensmitteln tierischen Ursprungs Neufassung vom 04. Dezember 2018 (BAnz AT 20.12.2018 B1, GMBI 2018 S. 1174), Dec. 2018.
- [116] FEDERAL MINISTRY OF FOOD AND AGRICULTURE. Nationale Strategie zur Reduzierung der Lebensmittelverschwendung, Feb. 2024. url: <https://www.bmel.de/DE/themen/ernaehrung/lebensmittelverschwendung/strategie-lebensmittelverschwendung.html>.
- [117] FERGUSON, R. S., AND LOVELL, S. T. Grassroots engagement with transition to sustainability: diversity and modes of participation in the international permaculture movement. Ecology and Society 20, 4 (2015). Publisher: Resilience Alliance Inc.
- [118] FERNANDES, S., AND SOARES BARBOSA, L. Collaborative Environments in Software Engineering Teaching: A FLOSS Approach. In 15th European Conference on e-Learning (ECEL 2016). Curran Associates Inc, Red Hook, NY, 2016, pp. 201–206.
- [119] FERRARO, A., SERRA, X., AND BAUER, C. What Is Fair? Exploring the Artists' Perspective on the Fairness of Music Streaming Platforms.

- In Human-Computer Interaction – INTERACT 2021 (Cham, 2021), Lecture Notes in Computer Science, Springer International Publishing, pp. 562–584.
- [120] FERREIRA, F., SILVA, L. L., AND VALENTE, M. T. Turnover in Open-Source Projects. In Proceedings of the XXXIV Brazilian Symposium on Software Engineering (New York, NY, USA, 2020), ACM, pp. 447–456.
- [121] FISCHER, G. Communities of Interest: Learning through the Interaction of Multiple Knowledge Systems. In 24th Annual Information Systems Research Seminar In Scandinavia (IRIS’24), Ulvik (2001), pp. 1–14.
- [122] FISHER, A. Big hunger: the unholy alliance between corporate America and anti-hunger groups. Food, health, and the environment. The MIT Press, Cambridge, MA, 2017.
- [123] FOGG, B. J. Persuasive technology: using computers to change what we think and do. Ubiquity 2002, December (Dec. 2002), 2.
- [124] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO), INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD), THE UNITED NATIONS CHILDREN’S FUND (UNICEF), WORLD FOOD PROGRAMME (WFP), WORLD HEALTH ORGANIZATION (WHO). The state of food security and nutrition in the world 2023. url: <https://www.who.int/publications/m/item/the-state-of-food-security-and-nutrition-in-the-world-2023>.
- [125] FOOD SECURITY INFORMATION NETWORK (FSIN). Global Report on Food Crises 2020. url: <https://www.fsinplatform.org/global-report-food-crises-2020>.
- [126] FRANKS, B. The direct action ethic. *Anarchist Studies*, (1), 13-41.
- [127] FRAUENBERGER, C., RAUHALA, M., AND FITZPATRICK, G. In-Action Ethics. Interacting with Computers, 29(2), 220-236 (June 2016).

- [128] FREDERICKS, J., CALDWELL, G. A., AND TOMITSCH, M. Middle-out design: collaborative community engagement in urban HCI. Proceedings of the 28th Australian Conference on Computer-Human Interaction - OzCHI '16 (2016), 200–204. Publisher: ACM Press.
- [129] FUNTOWICZ, S. O., AND RAVETZ, J. R. Uncertainty, complexity and post-normal science. Environmental Toxicology and Chemistry 13, 12 (1994), 1881–1885. eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/etc.5620131203>.
- [130] GANGLBAUER, E., FITZPATRICK, G., AND COMBER, R. Negotiating food waste: Using a practice lens to inform design. ACM Transactions on Computer-Human Interaction 20, 2 (May 2013), 1–25.
- [131] GANGLBAUER, E., FITZPATRICK, G., AND MOLZER, G. Creating visibility: understanding the design space for food waste. In Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia - MUM '12 (Ulm, Germany, 2012), ACM Press, p. 1.
- [132] GANGLBAUER, E., FITZPATRICK, G., SUBASI, Ö., AND GÜLDENPFENNIG, F. Think globally, act locally: a case study of a free food sharing community and social networking. In Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing (New York, NY, USA, Feb. 2014), CSCW '14, Association for Computing Machinery, pp. 911–921.
- [133] GARCIA, M. T., RIBEIRO, S. M., GERMANI, A. C. C. G., AND BÓGUS, C. M. The impact of urban gardens on adequate and healthy food: a systematic review. Public Health Nutrition 21, 2 (Feb. 2018), 416–425.
- [134] GARRONE, P., MELACINI, M., AND PEREGO, A. Opening the black box of food waste reduction. Food Policy 46 (June 2014), 129–139.
- [135] GASPARINI, M., CLARISÓ, R., BRAMBILLA, M., AND CABOT, J. Participation Inequality and the 90-9-1 Principle in Open

- Source. In Proceedings of the 16th International Symposium on Open Collaboration (New York, NY, USA, 2020), ACM, pp. 1–7.
- [136] GEIGER, R. S., HOWARD, D., AND IRANI, L. The Labor of Maintaining and Scaling Free and Open-Source Software Projects. Proceedings of the ACM on Human-Computer Interaction 5, CSCW1 (2021), 1–28.
- [137] GENTER, C., ROBERTS, A., RICHARDSON, J., AND SHEAFF, M. The contribution of allotment gardening to health and wellbeing: A systematic review of the literature. British Journal of Occupational Therapy 78, 10 (Oct. 2015), 593–605.
- [138] GERKE, M., AND JANSSEN, M. Insects as food: perception and acceptance Findings from current research. Ernahrungs Umschau (2017), 51–57. Publisher: Umschau Zeitschriftenverlag.
- [139] GERNERT, M., EL BILALI, H., AND STRASSNER, C. Grassroots Initiatives as Sustainability Transition Pioneers: Implications and Lessons for Urban Food Systems. In Urban Science (Mar. 2018), vol. 2, p. 23. ISSN: 2413-8851 Issue: 1 Journal Abbreviation: Urban Science.
- [140] GEROSA, M., WIESE, I., TRINKENREICH, B., LINK, G., ROBLES, G., TREUDE, C., STEINMACHER, I., AND SARMA, A. The Shifting Sands of Motivation: Revisiting What Drives Contributors in Open Source. In 2021 IEEE/ACM 43rd International Conference on Software Engineering (ICSE) (2021), IEEE, pp. 1046–1058.
- [141] GHOSHAL, S., AND BRUCKMAN, A. The Role of Social Computing Technologies in Grassroots Movement Building. ACM Transactions on Computer-Human Interaction (TOCHI) (June 2019). Publisher: ACM PUB27 New York, NY, USA.
- [142] GHOSHAL, S., MENDHEKAR, R., AND BRUCKMAN, A. Toward a Grassroots Culture of Technology Practice. Proceedings of the ACM on Human-Computer Interaction 4, CSCW1 (2020), 1–28.
- [143] GIGLITTO, D., CIOLFI, L., CLAISSE, C., AND LOCKLEY, E. Bridging cultural heritage and communities through digital technologies: Understanding perspectives and challenges. In Proceedings of

- the 9th International Conference on Communities & Technologies - Transforming Communities (New York, NY, USA, June 2019), C&T '19, Association for Computing Machinery, pp. 81–91.
- [144] GILES, D. B. A Mass Conspiracy to Feed People: Food Not Bombs and the World-Class Waste of Global Cities. Duke University Press, July 2021.
- [145] GIRARD, A. W., SELF, J. L., MCAULIFFE, C., AND OLUDE, O. The Effects of Household Food Production Strategies on the Health and Nutrition Outcomes of Women and Young Children: A Systematic Review: Household food production and maternal and child health outcomes. Paediatric and Perinatal Epidemiology 26 (July 2012), 205–222.
- [146] GODBOUT, J. T. The moral of the gift. The Journal of Socio-Economics 27, 4 (Jan. 1998), 557–570.
- [147] GOODLAND, R. Environmental sustainability in agriculture: diet matters. Ecological Economics 23, 3 (Dec. 1997), 189–200. Publisher: Elsevier BV.
- [148] GRAEBER, D. The new anarchists. New left review, 13(6), 61-73.
- [149] GRAEBER, D., AND SAHLINS, MARSHALL. The Spirit of the Gift. In Stone Age Economics. Routledge, 2017. Num Pages: 34.
- [150] GRAM-HANSEN, K. Standby Consumption in Households Analyzed With a Practice Theory Approach. Journal of Industrial Ecology 14, 1 (Dec. 2009), 150–165. Publisher: Wiley.
- [151] GRAM-HANSEN, K. Understanding change and continuity in residential energy consumption. Journal of Consumer Culture 11, 1 (Mar. 2011), 61–78. Publisher: SAGE Publications.
- [152] GRAM-HANSEN, K., HANSEN, A. R., AND MECHLENBORG, M. Danish PV Prosumers' Time-Shifting of Energy-Consuming Everyday Practices. Sustainability 12, 10 (Jan. 2020), 4121. Publisher: Multi-disciplinary Digital Publishing Institute.

- [153] GRIMES, A., AND HARPER, R. Celebratory technology: new directions for food research in *hci*. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2008), CHI '08, Association for Computing Machinery, p. 467–476.
- [154] GROTH, K. On knowing who knows: An alternative approach to knowledge management, vol. 0428 of Trita-NA. Stockholm, 2004.
- [155] GRUDIN, J. Obstacles to participatory design in large product development organizations. In Participatory design, A. Namioka and D. Schuler, Eds. CRC, Boca Raton and London, 2017, pp. 99–119.
- [156] GURBANI, V. K., GARVERT, A., AND HERBSLEB, J. D. A case study of open source tools and practices in a commercial setting. In Proceedings of the fifth workshop on Open source software engineering (New York, NY, 2005), Unknown, Ed., ACM Other conferences, ACM, pp. 1–6.
- [157] HAKKEN, D., D'ANDREA, V., TELI, M., AND WHEELER, B. What to do when you've been made an offer you can't refuse: what participatory design and FLOSS (free/libre and/or open source software) have to teach each other about the corporate embrace. In Proceedings of the Tenth Anniversary Conference on Participatory Design 2008 (USA, Oct. 2008), PDC '08, Indiana University, p. 292.
- [158] HANSSON, K., PARGMAN, T. C., AND BARDZELL, S. Materializing activism. Computer Supported Cooperative Work 30, 5-6 (Dec. 2021), 617–626.
- [159] HANSSON, L. Å. E. J., CERRATTO PARGMAN, T., AND PARGMAN, D. S. A Decade of Sustainable HCI: Connecting SHCI to the Sustainable Development Goals. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2021), CHI '21, Association for Computing Machinery, pp. 1–19.

- [160] HARS, A., AND OU, S. Working for Free? Motivations for Participating in Open-Source Projects. International Journal of Electronic Commerce 6, 3 (2002), 25–39.
- [161] HARVEY, J., SMITH, A., GOULDING, J., AND BRANCO ILLODO, I. Food sharing, redistribution, and waste reduction via mobile applications: A social network analysis. Industrial Marketing Management 88 (July 2020), 437–448.
- [162] HASKEL, L., AND GRAHAM, P. Whats GNU got to do with it? In Proceedings of the 14th Participatory Design Conference Short Papers, Interactive Exhibitions, Workshops - Volume 2 (New York, NY, 2016), ACM Digital Library, ACM, pp. 17–20.
- [163] HASSELQVIST, H., HESSELGREN, M., AND BOGDAN, C. Challenging the Car Norm. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (May 2016), ACM.
- [164] HAYES, G. R. The relationship of action research to human-computer interaction. ACM Transactions on Computer-Human Interaction 18, 3 (Aug. 2011), 15:1–15:20.
- [165] HAYES, G. R. Knowing by Doing: Action Research as an Approach to HCI. In Ways of Knowing in HCI, J. S. Olson and W. A. Kellogg, Eds. Springer, New York, NY, 2014, pp. 49–68.
- [166] HAYES, G. R. Design, Action, and Practice: Three Branches of the Same Tree. In Socio-Informatics, V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens, Eds. Oxford University Press, Mar. 2018, pp. 303–318.
- [167] HEDBERG, H., IIVARI, N., RAJANEN, M., AND HARJUMAA, L. Assuring quality and usability in open source software development. In 2007 First International Workshop on Emerging Trends in FLOSS Research and Development (Piscataway, NJ, 2007), IEEE, p. 2.
- [168] HEDIN, B., KATZEFF, C., ERIKSSON, E., AND PARGMAN, D. A Systematic Review of Digital Behaviour Change Interventions for More

- Sustainable Food Consumption. Sustainability 11, 9 (May 2019), 2638. Publisher: MDPI AG.
- [169] HEITLINGER, S., BRYAN-KINNS, N., AND COMBER, R. Connected seeds and sensors: co-designing internet of things for sustainable smart cities with urban food-growing communities. In Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial - Volume 2 (New York, NY, USA, Aug. 2018), PDC '18, Association for Computing Machinery, pp. 1–5.
- [170] HEITLINGER, S., BRYAN-KINNS, N., AND JEFFERIES, J. Sustainable HCI for grassroots urban food-growing communities. In Proceedings of the 25th Australian Computer-Human Interaction Conference on Augmentation, Application, Innovation, Collaboration - OzCHI '13 (Adelaide, Australia, 2013), ACM Press, pp. 255–264.
- [171] HEITLINGER, S., BRYAN-KINNS, N., AND JEFFERIES, J. The talking plants: an interactive system for grassroots urban food-growing communities. In Proceedings of the extended abstracts of the 32nd annual ACM conference on Human factors in computing systems - CHI EA '14 (Toronto, Ontario, Canada, 2014), ACM Press, pp. 459–462.
- [172] HEITLINGER, S., HOUSTON, L., TAYLOR, A., AND CATLOW, R. Algorithmic Food Justice: Co-Designing More-than-Human Blockchain Futures for the Food Commons. Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (May 2021), 1–17. Publisher: ACM.
- [173] HELLMAN, J. Improving the usability of free, libre, and open-source software through understanding participation and power. PhD Thesis, McGill University, 2022.
- [174] HELLMAN, J., CHEN, J., UDDIN, M. S., CHENG, J., AND GUO, J. L. C. Characterizing user behaviors in open-source software user forums. In Proceedings of the 15th International Conference on Cooperative and Human Aspects of Software Engineering (New York, NY, USA, 2022), ACM, pp. 46–55.

- [175] HELLMAN, J., CHENG, J., AND GUO, J. L. Facilitating Asynchronous Participatory Design of Open Source Software: Bringing End Users into the Loop. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2021), ACM, pp. 1–7.
- [176] HERMANS, F., ROEP, D., AND KLERKX, L. Scale dynamics of grassroots innovations through parallel pathways of transformative change. Ecological Economics 130 (Oct. 2016), 285–295.
- [177] HIGGINSON, S., MCKENNA, E., HARGREAVES, T., CHILVERS, J., AND THOMSON, M. Diagramming social practice theory: An interdisciplinary experiment exploring practices as networks. Indoor and Built Environment 24, 7 (Nov. 2015), 950–969.
- [178] HILLEBRANDT, F. Chapter 3 Practices – viewed from a sociological perspective. In Practice, Practice Theory and Theology. De Gruyter, May 2022, pp. 57–74.
- [179] HINES, F. Against Prefiguration: An Anarchist Iconoclasm. Anarchist Studies 31, 1 (Mar. 2023), 25–45. Publisher: Lawrence Wishart.
- [180] HIRSCH, T., SENEGERS, P., BLEVIS, E., BECKWITH, R., AND PARIKH, T. Making food, producing sustainability. In Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems - CHI EA '10 (Atlanta, Georgia, USA, 2010), ACM Press, p. 3147.
- [181] HOLT, D. B., AND THOMPSON, C. J. Man-of-Action Heroes: The Pursuit of Heroic Masculinity in Everyday Consumption. Journal of Consumer Research 31, 2 (Sept. 2004), 425–440. Publisher: Oxford University Press (OUP).
- [182] HOMEWOOD, S. Inaction as a Design Decision: Reflections on Not Designing Self-Tracking Tools for Menopause. In Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2019), CHI EA '19, Association for Computing Machinery, pp. 1–12.

- [183] HOVEN, J. V. D., AND MANDERS-HUITS, N. Value-sensitive Design. In The Ethics of Information Technologies. Routledge, 2020. pp. 329-332.
- [184] HUANG, C.-H., LIU, S.-M., AND HSU, N.-Y. Understanding Global Food Surplus and Food Waste to Tackle Economic and Environmental Sustainability. Sustainability 12, 7 (Jan. 2020), 2892. Publisher: Multidisciplinary Digital Publishing Institute.
- [185] HUI, A., SCHATZKI, T., AND SHOVE, E., Eds. The Nexus of Practices: Connections, constellations, practitioners. Routledge, London, Dec. 2016.
- [186] HÅKANSSON, M., AND SENEGERS, P. Beyond being green. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (Apr. 2013), ACM.
- [187] HÅKANSSON, M., AND SENEGERS, P. No easy compromise: sustainability and the dilemmas and dynamics of change. In Proceedings of the 2014 conference on Designing interactive systems (New York, NY, USA, June 2014), DIS '14, Association for Computing Machinery, pp. 1025–1034.
- [188] IIVARI, N. “Constructing the users” in open source software development: An interpretive case study of user participation. Information Technology & People 22, 2 (June 2009), 132–156.
- [189] IKKALA, T., AND LAMPINEN, A. Monetizing Network Hospitality: Hospitality and Sociability in the Context of Airbnb. In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (New York, NY, USA, Feb. 2015), CSCW '15, Association for Computing Machinery, pp. 1033–1044.
- [190] ILLICH, I. Tools for conviviality, 1. perennial library ed. Harper & Row, New York, NY, 1973.
- [191] JAEGGI, A. V., AND GURVEN, M. Natural Cooperators: Food Sharing in Humans and Other Primates. Evolutionary Anthropology: Issues, News, and Reviews 22, 4 (July 2013), 186–195.

- [192] JAKOBI, T., OGWONSKI, C., CASTELLI, N., STEVENS, G., AND WULF, V. The Catch(es) with Smart Home. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (May 2017), ACM.
- [193] JEFFREY, C., AND DYSON, J. Geographies of the future: Prefigurative politics. Progress in Human Geography 45, 4 (Aug. 2021), 641–658. Publisher: SAGE Publications Ltd.
- [194] JENSEN, R. H., TELI, M., JENSEN, S. B., GRAM, M., AND HARBOE SØRENSEN, M. Designing Eco-Feedback Systems for Communities: Interrogating a Techno-solutionist Vision for Sustainable Communal Energy. In Proceedings of the 10th International Conference on Communities & Technologies - Wicked Problems in the Age of Tech (New York, NY, USA, June 2021), C&T '21, Association for Computing Machinery, pp. 245–257.
- [195] JOHN, N. A. The Social Logics of Sharing. The Communication Review 16, 3 (July 2013), 113–131. Publisher: Routledge .eprint: <https://doi.org/10.1080/10714421.2013.807119>.
- [196] JOHNSON, C. M. A survey of current research on online communities of practice. The Internet and Higher Education 4, 1 (Jan. 2001), 45–60. Publisher: Elsevier BV.
- [197] JONES, M. Feast: why humans share food. Oxford University Press, Oxford ; New York, 2007. OCLC: ocm75713258.
- [198] JOSHI, S., AND PARGMAN, T. C. In Search of Fairness: Critical Design Alternatives for Sustainability. Aarhus Series on Human Centered Computing 1 (Oct. 2015), pp. 37–40.
- [199] JUNG, H., STOLTERMAN, E., RYAN, W., THOMPSON, T., AND SIEGEL, M. Toward a framework for ecologies of artifacts: how are digital artifacts interconnected within a personal life? In Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges (New York, NY, USA, Oct. 2008), NordiCHI '08, Association for Computing Machinery, pp. 201–210.

- [200] KAPLAN, H., AND GURVEN, M. The Natural History of Human Food Sharing and Cooperation: A Review and a New Multi-Individual Approach to the Negotiation of Norms. In Moral Sentiments and Material Interests: The Foundations of Cooperation in Economic Life. MIT Press, Cambridge MA, 2005, pp. 75–113.
- [201] KATZEFF, C., MILESTAD, R., ZAPICO, J. L., AND BOHNÉ, U. Encouraging Organic Food Consumption through Visualization of Personal Shopping Data. Sustainability 12, 9 (Apr. 2020), 3599. Publisher: MDPI AG.
- [202] KEMMIS, S., WILKINSON, J., EDWARDS-GROVES, C., HARDY, I., GROOTENBOER, P., AND BRISTOL, L. Changing Practices, Changing Education. Springer, Singapore, 2014.
- [203] KERSCHE-RISCH, P. Vegan diet: motives, approach and duration. Initial results of a quantitative sociological study. Ernährungs Umschau (2015), 98–103. Publisher: Umschau Zeitschriftenverlag.
- [204] KESSL, F., LORENZ, S., AND SCHONEVILLE, H. Social exclusion and food assistance in Germany. Mar. 2020. In: The Rise of Food Charity in Europe Section. Policy Press. pp. 49-78.
- [205] KEY, T. J., APPLEBY, P. N., AND ROSELL, M. S. Health effects of vegetarian and vegan diets. Proceedings of the Nutrition Society 65, 1 (Feb. 2006), 35–41. Publisher: Cambridge University Press (CUP).
- [206] KHOIR, S., AND DAVISON, R. M. iTransformation of a Digital Village: A Community Development Initiative Through ICTs. In Transforming Digital Worlds (Cham, 2018), G. Chowdhury, J. McLeod, V. Gillet, and P. Willett, Eds., Springer International Publishing, pp. 114–119.
- [207] KING, N. Using Templates in the Thematic Analysis of Text. Essential guide to qualitative methods in organizational research (2004), 256. Publisher: Sage.

- [208] KINGSTON, A. K. Feminist Research Ethics: From Theory to Practice. In: *Handbook of Research Ethics and Scientific Integrity*. Springer International Publishing, pp. 531-549.
- [209] KIZILCEC, R. F., BAKSHY, E., ECKLES, D., AND BURKE, M. Social Influence and Reciprocity in Online Gift Giving. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2018), CHI '18, Association for Computing Machinery, pp. 1–11.
- [210] KNOWLES, B. Re-imagining persuasion: designing for self-transcendence. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), CHI EA '13, Association for Computing Machinery, pp. 2713–2718.
- [211] KNOWLES, B., BATES, O., AND HÅKANSSON, M. This Changes Sustainable HCI. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2018), CHI '18, Association for Computing Machinery, pp. 1–12.
- [212] KNOWLES, B., BLAIR, L., HAZAS, M., AND WALKER, S. Exploring sustainability research in computing: where we are and where we go next. In *Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing - UbiComp '13* (Zurich, Switzerland, 2013), ACM Press, p. 305.
- [213] KORSGAARD, H., LYLE, P., SAAD-SULONEN, J., KLOKMOSE, C. N., NOUWENS, M., AND BØDKER, S. Collectives and Their Artifact Ecologies. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (Nov. 2022), 432:1–432:26.
- [214] KRITIKOS, A., VENETIS, T., AND STAMELOS, I. An Empirical Investigation of Sentiment Analysis of the Bug Tracking Process in Libre Office Open Source Software. In *Open Source Systems*, V. Ivanov, A. Kruglov, S. Masyagin, A. Sillitti, and G. Succi, Eds., vol. 582 of *IFIP Advances in Information and Communication Technology*. Springer International Publishing, Cham, 2020, pp. 36–46.

- [215] KRÜGER, M., WEIBERT, A., DE CASTRO LEAL, D., RANDALL, D., AND WULF, V. What is the Topic of the Group, Please? On Migration, Care and the Challenges of Participation in Design. Proceedings of the ACM on Human-Computer Interaction 5, CSCW2 (2021), 1–29.
- [216] KUIJER, L., JONG, A. D., AND EIJK, D. V. Practices as a unit of design. ACM Transactions on Computer-Human Interaction 20, 4 (Sept. 2013), 1–22. Publisher: Association for Computing Machinery (ACM).
- [217] LAFORGE, J. M. L., ANDERSON, C. R., AND MCLACHLAN, S. M. Governments, grassroots, and the struggle for local food systems: containing, coopting, contesting and collaborating. Agriculture and Human Values 34, 3 (Sept. 2017), 663–681.
- [218] LAKHANI, K., AND WOLF, R. G. Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects. SSRN Electronic Journal (2003).
- [219] LAMPINEN, A. The Trouble with Sharing: Interpersonal Challenges in Peer-to-Peer Exchange. Synthesis Lectures on Human-Centered Informatics. Springer International Publishing, Cham, 2021.
- [220] LAMPINEN, A., LIGHT, A., ROSSITTO, C., FEDOSOV, A., BASSETTI, C., BERNAT, A., TRAVLOU, P., AND AVRAM, G. Processes of Proliferation: Impact Beyond Scaling in Sharing and Collaborative Economies. Proceedings of the ACM on Human-Computer Interaction 6, GROUP (Jan. 2022), 41:1–41:22.
- [221] LAMPINEN, A., ROSSITTO, C., AND GRADIN FRANZÉN, C. Scaling Out, Scaling Down: Reconsidering growth in grassroots initiatives. In: Ethnographies of Collaborative Economies Conference, Edinburgh, Scotland, UK, 25 October, 2019.
- [222] LANDWEHR, M., BORNING, A., AND WULF, V. The High Cost of Free Services: Problems with Surveillance Capitalism and Possible Alternatives for IT Infrastructure. In Proceedings of the Fifth Workshop

- on Computing within Limits (New York, NY, USA, June 2019), LIMITS '19, Association for Computing Machinery, pp. 1–10.
- [223] LANDWEHR, M., ENGELBUTZEDER, P., AND WULF, V. Community Supported Agriculture: The Concept of Solidarity in Mitigating Between Harvests and Needs. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2021), CHI '21, Association for Computing Machinery, pp. 1–13.
- [224] LAWO, D., ENGELBUTZEDER, P., ESAU, M., AND STEVENS, G. Networks of Practices: Exploring Design Opportunities for Interconnected Practices. In Proceedings of 18th European Conference on Computer-Supported Cooperative Work (2020), European Society for Socially Embedded Technologies (EUSSET).
- [225] LAWO, D., ESAU, M., ENGELBUTZEDER, P., AND STEVENS, G. Going Vegan: The Role(s) of ICT in Vegan Practice Transformation. Sustainability 12, 12 (Jan. 2020), 5184. Publisher: Multidisciplinary Digital Publishing Institute.
- [226] LAZARUS, S., SEEDAT, M., AND NAIDOO, T. Community building: Challenges of constructing community. In APA handbook of community psychology: Methods for community research and action for diverse groups and issues, Vol. 2. American Psychological Association, Washington, DC, US, 2017, pp. 215–234.
- [227] LE DANTEC, C. Participation and publics: supporting community engagement. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2012), CHI '12, Association for Computing Machinery, pp. 1351–1360.
- [228] LE DANTEC, C. A. Designing publics. MIT Press, 2016.
- [229] LEA, E. J., CRAWFORD, D., AND WORSLEY, A. Consumers' readiness to eat a plant-based diet. European Journal of Clinical Nutrition 60, 3 (Nov. 2005), 342–351. Publisher: Springer Science and Business Media LLC.

- [230] LEONARD, D. A. *Managing Knowledge Assets, Creativity and Innovation*, July 2011. World Scientific.
- [231] LESHED, G., HÅKANSSON, M., AND KAYE, J. J. "Our life is the farm and farming is our life": home-work coordination in organic farm families. In Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing (New York, NY, USA, Feb. 2014), CSCW '14, Association for Computing Machinery, pp. 487–498.
- [232] LEVIDOW, L. London's Urban Agriculture: Building Community through Social Innovation. International Journal of Sociology of Agriculture and Food 24, 3 (Sept. 2018), 354–376. Number: 3.
- [233] LIGHT, A., AND MISKELLY, C. Sharing Economy vs Sharing Cultures? Designing for social, economic and environmental good. Interaction Design and Architecture(s), 24 (May 2015), 49–62. Publisher: Scuola IaD.
- [234] LIGHT, A., AND MISKELLY, C. Platforms, Scales and Networks: Meshing a Local Sustainable Sharing Economy. Computer Supported Cooperative Work (CSCW) 28, 3-4 (June 2019), 591–626.
- [235] LONG, M. A., GONÇALVES, L., STRETESKY, P. B., AND DEFEYTER, M. A. Food Insecurity in Advanced Capitalist Nations: A Review. Sustainability 12, 9 (May 2020), 3654.
- [236] LYLE, P., CHOI, J. H.-J., AND FOTH, M. Designing for grassroots food production: an event-based urban agriculture community. In Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI '14 (Sydney, New South Wales, Australia, 2014), ACM Press, pp. 362–365.
- [237] LYLE, P., CHOI, J. H.-J., AND FOTH, M. Growing food in the city. In Proceedings of the 7th International Conference on Communities and Technologies (June 2015), ACM.

- [238] MACKENZIE, S. G., AND DAVIES, A. R. SHARE IT: Co-designing a sustainability impact assessment framework for urban food sharing initiatives. Environmental Impact Assessment Review 79 (Nov. 2019), 106300.
- [239] MAECKELBERGH, M. Doing is Believing: Prefiguration as Strategic Practice in the Alterglobalization Movement. Social Movement Studies 10, 1 (Jan. 2011), 1–20. Publisher: Routledge eprint: <https://doi.org/10.1080/14742837.2011.545223>.
- [240] MAITLAND, J., CHALMERS, M., AND SIEK, K. A. Persuasion not required Improving our understanding of the sociotechnical context of dietary behavioural change. In Proceedings of the 3d International ICST Conference on Pervasive Computing Technologies for Healthcare (2009), ICST.
- [241] MANKOFF, J. C., BLEVIS, E., BORNING, A., FRIEDMAN, B., FUSSELL, S. R., HASBROUCK, J., WOODRUFF, A., AND SENEGERS, P. Environmental sustainability and interaction. In CHI '07 Extended Abstracts on Human Factors in Computing Systems (New York, NY, USA, 2007), M. B. Rosson and D. Gilmore, Eds., ACM, pp. 2121–2124.
- [242] MANZINI, E., AND COAD, R. Design, When Everybody Designs: An Introduction to Design for Social Innovation. The MIT Press, 2015.
- [243] MARSAN, J., CARILLO, K. D. A., AND NEGOITA, B. Entrepreneurial actions and the legitimation of free/open source software services. Journal of Information Technology 35, 2 (2020), 143–160.
- [244] MATTESSICH, P., MONSEY, B. R., AND ROY, C. Community Building: What Makes It Work: A Review of Factors Influencing Successful Community Building. 1997.
- [245] MBOW, C., ROSENZWEIG, C., BARION, L. G., BENTON, T. G., HERRERO, M., KRISHNAPILLAI, M., LIWENGA, E., PRADHAN, P., RIVERA-FERRE, M. G., SAPKOTA, T., TUBIELLO, F. N., AND XU, Y. Food security. In Climate Change and Land: IPCC Special Report

- on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. Cambridge University Press, Cambridge, 2022, pp. 437–550.
- [246] MCCARTHY, J., AND WRIGHT, P. Taking [A]part: The Politics and Aesthetics of Participation in Experience-Centered Design. Jan. 2015.
- [247] MCLAREN, D., AND AGYEMAN, J. Sharing Cities. MIT Press. 2016.
- [248] MEISCH, S. Knowing one's food – making food a public issue. In Know your food. Wageningen Academic Publishers, May 2015, pp. 306–311.
- [249] MERENDINO, N., LEPRI, G., RODÀ, A., AND MASU, R. Redesigning the Chowndolo: a Reflection-on-action Analysis to Identify Sustainable Strategies for NIMES Design. In NIME 2023. 2023.
- [250] MESSNER, R., JOHNSON, H., AND RICHARDS, C. From surplus-to-waste: A study of systemic overproduction, surplus and food waste in horticultural supply chains. Journal of Cleaner Production 278 (Jan. 2021), 123952.
- [251] MICHELINI, L., PRINCIPATO, L., AND IASEVOLI, G. Understanding Food Sharing Models to Tackle Sustainability Challenges. Ecological Economics 145 (Mar. 2018), 205–217.
- [252] MILLER, W. Food, water, energy, waste: an examination of socio-technical issues for urban prosumers – Part 1 (Context). Energy Procedia 161 (Mar. 2019), 360–367.
- [253] MILLER, W., AND SENADEERA, M. Social transition from energy consumers to prosumers: Rethinking the purpose and functionality of eco-feedback technologies. Sustainable Cities and Society 35 (Nov. 2017), 615–625.
- [254] MOKRANE, S., BUONOCORE, E., CAPONE, R., AND FRANZESE, P. P. Exploring the Global Scientific Literature on Food Waste and Loss. Sustainability 15, 6 (Mar. 2023), 4757.

- [255] MOLM, L. D. The Structure of Reciprocity. Social Psychology Quarterly 73, 2 (June 2010), 119–131. Publisher: SAGE Publications Inc.
- [256] MOORE, J. W. The Capitalocene, Part I: on the nature and origins of our ecological crisis. The Journal of Peasant Studies 44, 3 (May 2017), 594–630. Publisher: Routledge eprint: <https://doi.org/10.1080/03066150.2016.1235036>.
- [257] MOORE, J. W. The Capitalocene Part II: accumulation by appropriation and the centrality of unpaid work/energy. The Journal of Peasant Studies 45, 2 (Feb. 2018), 237–279. Publisher: Routledge eprint: <https://doi.org/10.1080/03066150.2016.1272587>.
- [258] MORALES, J., RUSU, C., BOTELLA, F., AND QUINONES, D. Programmer eXperience: A Systematic Literature Review. IEEE Access 7 (2019), 71079–71094.
- [259] MOREIRA, S., AND FUSTER MORELL, M. Food Networks As Urban Commons: Case Study of a Portuguese “Prosumers” Group. Ecological Economics 177 (Nov. 2020), 106777.
- [260] MORONE, P., FALCONE, P. M., IMBERT, E., AND MORONE, A. Does food sharing lead to food waste reduction? An experimental analysis to assess challenges and opportunities of a new consumption model. Journal of Cleaner Production 185 (June 2018), 749–760.
- [261] MORROW, O. Community Self-Organizing and the Urban Food Commons in Berlin and New York. Sustainability 11, 13 (Jan. 2019), 3641. Number: 13 Publisher: Multidisciplinary Digital Publishing Institute.
- [262] MORROW, O. Sharing food and risk in Berlin’s urban food commons. Geoforum 99 (Feb. 2019), 202–212.
- [263] MOURAD, M. Recycling, recovering and preventing “food waste”: competing solutions for food systems sustainability in the United States and France. Journal of Cleaner Production 126 (July 2016), 461–477.

- [264] MUELLER, F. F., OBRIST, M., BERTRAN, F. A., MAKAM, N., KIM, S., DAWES, C., MARTI, P., MANCINI, M., CECCALDI, E., PASUMARTHY, N., CLAIRE, S., JUNG, K. S., DENG, J., STEIMLE, J., KRASTEVA, N., SCHWALK, M., REITERER, H., WANG, H., AND WANG, Y. Grand challenges in human-food interaction. International Journal of Human-Computer Studies 183, C (Mar. 2024).
- [265] MUSGRAVE, R. A. Provision for social goods. In Public economics: an analysis of public production and consumption and their relations to the private sectors: proceedings of a conference held by the International Economic Association, J. Margolis and H. Guitton, Eds. Macmillan; St. Martin's P, London, New York, 1969.
- [266] NAMIOKA, A., AND SCHULER, D., Eds. Participatory design: Principles and practices. CRC, Boca Raton and London, 2017.
- [267] NICHOLS, D. M., THOMSON, K., AND YEATES, S. A. Usability and open-source software development. In Proceedings of the Symposium on Computer Human Interaction (New York, NY, 2001), E. Kemp, Ed., ACM Other conferences, ACM, pp. 49–54.
- [268] NIELSEN, J. Participation Inequality: The 90-9-1 Rule for Social Features, Oct. 2006.
- [269] NIEMELÄ, J. Impactful contributions of usability practitioners to open source software projects : a multiple case study. PhD Thesis, University of Oulu, Oulu, Finland, 2021.
- [270] NORTON, J., PENZENSTADLER, B., AND TOMLINSON, B. Implications of Grassroots Sustainable Agriculture Community Values on the Design of Information Systems. Proceedings of the ACM on Human-Computer Interaction 3, CSCW (Nov. 2019), 34:1–34:22.
- [271] NORTON, J., RATURI, A., NARDI, B., PROST, S., MCDONALD, S., PARGMAN, D., BATES, O., NORMARK, M., TOMLINSON, B., HERBIG, N., AND DOMBROWSKI, L. A grand challenge for HCI: food + sustainability. Interactions 24, 6 (Oct. 2017), 50–55.

- [272] NOY, C. Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research. International Journal of Social Research Methodology 11, 4 (Oct. 2008), 327–344. Publisher: Informa UK Limited.
- [273] OFFER, S. The burden of reciprocity: Processes of exclusion and withdrawal from personal networks among low-income families. Current Sociology 60, 6 (Nov. 2012), 788–805. Publisher: SAGE Publications Ltd.
- [274] PANTIDI, N., FERREIRA, J., BALESTRINI, M., PERRY, M., MARSHALL, P., AND MCCARTHY, J. Connected sustainability: connecting sustainability-driven, grass-roots communities through technology. In Proceedings of the 7th International Conference on Communities and Technologies - C&T '15 (Limerick, Ireland, 2015), ACM Press, pp. 161–163.
- [275] PAPARGYROPOULOU, E., LOZANO, R., K. STEINBERGER, J., WRIGHT, N., AND UJANG, Z. B. The food waste hierarchy as a framework for the management of food surplus and food waste. Journal of Cleaner Production 76 (Aug. 2014), 106–115.
- [276] PARRY, M., ROSENZWEIG, C., IGLESIAS, A., LIVERMORE, M., AND FISCHER, G. Effects of climate change on global food production under SRES emissions and socio-economic scenarios. Global Environmental Change 14, 1 (Apr. 2004), 53–67.
- [277] PEREZ, O. Collaborative e-Rulemaking, Democratic Bots, and the Future of Digital Democracy. Digital Government: Research and Practice 1, 1 (2020), 1–13.
- [278] PERIGNON, M., VIEUX, F., SOLER, L.-G., MASSET, G., AND DARMON, N. Improving diet sustainability through evolution of food choices: review of epidemiological studies on the environmental impact of diets. Nutrition Reviews 75, 1 (Dec. 2016), 2–17. Publisher: Oxford University Press (OUP).

- [279] PESSACH, D., AND SHMUELI, E. Algorithmic Fairness, Jan. 2020. In: *Machine Learning for Data Science Handbook: Data Mining and Knowledge Discovery Handbook* (pp. 867-886). Cham: Springer International Publishing.
- [280] PETRIK, K. Participation and e-democracy how to utilize web 2.0 for policy decision-making. In *Proceedings of the 10th Annual International Conference on Digital G-government Research*, S. A. Chun, Ed., ACM Other conferences. Digital Government Society of North America, Marina Del Rey, California, 2009, pp. 254–263.
- [281] PFAFF, C. C., AND HASAN, H. Wiki-Based Knowledge Management Systems for More Democratic Organizations. *J. Comput. Inf. Syst* **52**, 2 (2011), 73–82.
- [282] PIERCE, J., STRENGERS, Y., SENEGERS, P., AND BØDKER, S. Introduction to the special issue on practice-oriented approaches to sustainable HCI. *ACM Transactions on Computer-Human Interaction* **20**, 4 (Sept. 2013), 20:1–20:8.
- [283] PIPEK, V. Negotiating infrastructure: supporting the appropriation of collaborative software. *Scandinavian Journal on Information Systems* (2005).
- [284] PIPEK, V., AND KAHLER, H. Supporting Collaborative Tailoring. In *Human-Computer Interaction Series*. Springer Netherlands, 2006, pp. 315–345.
- [285] PIPEK, V., AND WULF, V. Pruning the Answer Garden: Knowledge Sharing in Maintenance Engineering. In *ECSCW 2003* (Dordrecht, 2003), K. Kuutti, E. H. Karsten, G. Fitzpatrick, P. Dourish, and K. Schmidt, Eds., Springer Netherlands, pp. 1–20.
- [286] PODDA, A., LOCONTO, A. M., ARCIDIACONO, D., AND MAESTRIPIERI, L. Exploring prosumption: Reconfiguring labor through rural-urban food networks? *Journal of Rural Studies* **82** (Feb. 2021), 442–446.

- [287] PODERI, G. Sustaining platforms as commons: perspectives on participation, infrastructure, and governance. CoDesign 15, 3 (July 2019), 243–255. Publisher: Taylor & Francis eprint: <https://doi.org/10.1080/15710882.2019.1631351>.
- [288] PONZANESI, S. Postcolonial intellectuals: new paradigms. Postcolonial Studies 24, 4 (Oct. 2021), 433–447. Publisher: Routledge.
- [289] POPPENDIECK, J. Sweet charity?: emergency food and the end of entitlement. Penguin Books, New York; Toronto, 1999.
- [290] POPPY, G. M., CHIOTHA, S., EIGENBROD, F., HARVEY, C. A., HONZÁK, M., HUDSON, M. D., JARVIS, A., MADISE, N. J., SCHRECKENBERG, K., SHACKLETON, C. M., VILLA, F., AND DAWSON, T. P. Food security in a perfect storm: using the ecosystem services framework to increase understanding. Philosophical Transactions of the Royal Society B: Biological Sciences 369, 1639 (Apr. 2014), 20120288.
- [291] POTTS, A., AND PARRY, J. Vegan Sexuality: Challenging Heteronormative Masculinity through Meat-free Sex. Feminism & Psychology 20, 1 (Feb. 2010), 53–72. Publisher: SAGE Publications.
- [292] PROCHASKA, J. O., AND DICLEMENTE, C. C. Transtheoretical therapy: Toward a more integrative model of change. Psychotherapy: Theory, Research & Practice 19, 3 (1982), 276–288. Publisher: American Psychological Association (APA).
- [293] PROST, S. Food Democracy for All? Developing a Food Hub in the Context of Socio-Economic Deprivation. Politics and Governance 7, 4 (Oct. 2019), 142–153.
- [294] PROST, S., CRIVELLARO, C., HADDON, A., AND COMBER, R. Food Democracy in the Making. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (Apr. 2018), ACM.
- [295] PROST, S., VLACHOKYRIAKOS, V., MIDGLEY, J., HERON, G., MEZIAN, K., AND CRIVELLARO, C. Infrastructuring Food Democ-

- racy: The Formation of a Local Food Hub in the Context of Socio-Economic Deprivation. Proceedings of the ACM on Human-Computer Interaction 3, CSCW (Nov. 2019), 57:1–57:27.
- [296] PROVEG. Vegan Trend Zahlen und Fakten zum Veggie Markt. url: <https://proveg.com/de/pflanzlicher-lebensstil/vegan-trend-zahlen-und-fakten-zum-veggie-markt/>.
- [297] PURVIS, B., MAO, Y., AND ROBINSON, D. Three pillars of sustainability: in search of conceptual origins. Sustainability Science 14, 3 (May 2019), 681–695.
- [298] QIU, H. S., LIEB, A., CHOU, J., CARNEAL, M., MOK, J., AM-SPOKER, E., VASILESCU, B., AND DABBISH, L. Climate Coach: A Dashboard for Open-Source Maintainers to Overview Community Dynamics. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2023), ACM, pp. 1–18.
- [299] RAJANEN, M., AND IIVARI, N. Power, Empowerment and Open Source Usability. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (New York, NY, 2015), B. Begole, Ed., ACM Digital Library, ACM, pp. 3413–3422.
- [300] RAJANEN, M., AND IIVARI, N. Empowered or Disempowered? An Analysis of Usability Practicioners’ Interventions in Open Source Projects. In Psychological Perspectives on Empowerment, J. Leroux, Ed., Psychology of Emotions, Motivations and Actions Ser. Nova Science Publishers Incorporated, New York, 2019, pp. 1–45.
- [301] RANDALL, D., O’BRIEN, J., ROUNCEFIELD, M., AND HUGHES, J. A. Organisational memory and CSCW: supporting the ’Mavis Phenomenon’. In Proceedings / Sixth Australian Conference on Computer-Human Interaction, November 24 - 27, 1996, Hamilton, New Zeland (Los Alamitos, Calif., 1996), J. Grundy, Ed., IEEE Computer Society Press, pp. 26–33.
- [302] RANTALAINEN, A., HEDBERG, H., AND IIVARI, N. A Review of Tool Support for User-Related Communication in FLOSS Devel-

- opment. In Open source systems: grounding research, S. Hissam, Ed., vol. 365 of IFIP Advances in Information and Communication Technology. Springer, Heidelberg, 2011, pp. 90–105.
- [303] RATURI, A., NORTON, J., TOMLINSON, B., BLEVIS, E., AND DOMBROWSKI, L. Designing Sustainable Food Systems. Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (May 2017), 609–616. ACM.
- [304] RAYMOND, E. S., AND YOUNG, B. The cathedral and the bazaar: Musings on linux and open source by an accidental revolutionary. O'Reilly, 2001.
- [305] REAGLE, J. Bug Tracking Systems as Public Spheres. Techné: Research in Philosophy and Technology 11, 1 (2007), 32–41.
- [306] RECKWITZ, A. Toward a Theory of Social Practices: A Development in Culturalist Theorizing. European Journal of Social Theory 5, 2 (May 2002), 243–263. Publisher: SAGE Publications Ltd.
- [307] REDANTE, R. C., MEDEIROS, J. F. D., VIDOR, G., CRUZ, C. M. L., AND RIBEIRO, J. L. D. Creative approaches and green product development: Using design thinking to promote stakeholders' engagement. Sustainable Production and Consumption 19 (July 2019), 247–256. Publisher: Elsevier BV.
- [308] RIAR, M. Using Gamification to Motivate Cooperation: A Review. ICIS 2020 Proceedings (Dec. 2020).
- [309] RIFKIN, J. The zero marginal cost society: the internet of things, the collaborative commons, and the eclipse of capitalism. Palgrave Macmillan, New York, NY, 2014.
- [310] RITZER, G., DEAN, P., AND JURGENSON, N. The Coming of Age of the Prosumer. American Behavioral Scientist 56, 4 (Apr. 2012), 379–398. Publisher: SAGE Publications Inc.

- [311] RITZER, G., AND JURGENSON, N. Production, Consumption, Prosumption: The nature of capitalism in the age of the digital ‘prosumer’. Journal of Consumer Culture 10, 1 (Mar. 2010), 13–36.
- [312] ROBERT KOCH-INSTITUT. Prevalence of persons following a vegetarian diet in Germany. Publisher: RKI-Bib1 (Robert Koch-Institut). 2016.
- [313] ROBERTSON, T., AND SIMONSEN, J. Introduction. In Routledge international handbook of participatory design, J. Simonsen and T. Robertson, Eds. Routledge, London and New York, 2013, pp. 1–18.
- [314] ROMBACH, M., AND BITSCH, V. Food Movements in Germany: Slow Food, Food Sharing, and Dumpster Diving. International Food and Agribusiness Management Review (2015). 18(3), pp. 1-24.
- [315] ROSSITTO, C., KORSGAARD, H., LAMPINEN, A., AND BØDKER, S. Efficiency and Care in Community-led Initiatives. Proceedings of the ACM on Human-Computer Interaction 5, CSCW2 (Oct. 2021), 467:1–467:27.
- [316] ROSSITTO, C., AND LAMPINEN, A. Co-Creating the Workplace: Participatory Efforts to Enable Individual Work at the Hoffice. Computer Supported Cooperative Work (CSCW) 27, 3 (Dec. 2018), 947–982.
- [317] ROSSITTO, C., LAMPINEN, A., LIGHT, A., DIOGO, V., AND BERNAT, A. Why Are We Still Using Facebook? The Platform Paradox in Collaborative Community Initiatives. Now Publishers Inc., 2021, pp. 90–109.
- [318] SAGE, C., KROPP, C., AND ANTONI-KOMAR, I. Grassroots initiatives in food system transformation: The role of food movements in the second ‘Great Transformation’. In Food System Transformations. Routledge, 2020. Num Pages: 19.
- [319] SAHLINS, M., AND GRAEBER, D. On the Sociology of Primitive Exchange. In Stone Age Economics, 1 ed. Routledge, Milton Park, Abingdon, Oxon; New York, NY: Routledge Classics,, Apr. 2017, pp. 168–258.

- [320] SCARBOROUGH, P., APPLEBY, P. N., MIZDRAK, A., BRIGGS, A. D. M., TRAVIS, R. C., BRADBURY, K. E., AND KEY, T. J. Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. Climatic Change 125, 2 (June 2014), 179–192. Publisher: Springer Science and Business Media LLC.
- [321] SCHANES, K., AND STAGL, S. Food waste fighters: What motivates people to engage in food sharing? Journal of Cleaner Production 211 (Feb. 2019), 1491–1501.
- [322] SCHATZKI, T. R. Social practices : a Wittgensteinian approach to human activity and the social. New York : Cambridge University Press, 1996.
- [323] SCHATZKI, T. R. The Site of the Social: A Philosophical Account of the Constitution of Social Life and Change. Penn State University Press, 2002.
- [324] SCHERHAUFER, S., MOATES, G., HARTIKAINEN, H., WALDRON, K., AND OBERSTEINER, G. Environmental impacts of food waste in Europe. Waste Management 77 (July 2018), 98–113.
- [325] SCHIERMEIER, Q. Eat less meat: UN climate-change report calls for change to human diet. Nature 572, 7769 (Aug. 2019), 291–292. Publisher: Springer Science and Business Media LLC.
- [326] SCHMIDT, K. The Concept of ‘Practice’: What’s the Point? In COOP 2014 - Proceedings of the 11th International Conference on the Design of Cooperative Systems, 27-30 May 2014, Nice (France) (Cham, 2014), Springer International Publishing, pp. 427–444.
- [327] SCHOR, J. B. Plenitude: the new economics of true wealth. Scribe Publications, Merlbourne, 2010. OCLC: 731880210.
- [328] SCHROCK, A. Civic Tech: Making Technology Work for People. Rogue Academic, 2018.

- [329] SCHUMACHER, E. F. Small is beautiful: economics as if people mattered. No. TB 1778 in Harper torchbooks. Harper & Row, New York, 1973.
- [330] SCHWARTZ, T., DENEFF, S., STEVENS, G., RAMIREZ, L., AND WULF, V. Cultivating energy literacy: results from a longitudinal living lab study of a home energy management system. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13 (Paris, France, 2013), ACM Press, p. 1193.
- [331] SCHWARTZ, T., STEVENS, G., JAKOBI, T., DENEFF, S., RAMIREZ, L., WULF, V., AND RANDALL, D. What People Do with Consumption Feedback: A Long-Term Living Lab Study of a Home Energy Management System. Interacting with Computers 27, 6 (Nov. 2015), 551–576.
- [332] SCHWARTZ, T., STEVENS, G., RAMIREZ, L., AND WULF, V. Uncovering practices of making energy consumption accountable. ACM Transactions on Computer-Human Interaction 20, 2 (May 2013), 1–30. Publisher: Association for Computing Machinery (ACM).
- [333] SERBULOVA, N., KANURNY, S., GORODNYANSKAYA, A., AND PERSIYANOVA, A. Sustainable food systems and agriculture: the role of information and communication technologies. IOP Conference Series: Earth and Environmental Science 403, 1 (Dec. 2019), 012127.
- [334] SERT, S., GARRONE, P., AND MELACINI, M. Keeping Food Alive: Surplus Food Management. European Journal of Sustainable Development 3, 4 (2014), 339–346.
- [335] SEYFANG, G., AND SMITH, A. Grassroots innovations for sustainable development: Towards a new research and policy agenda. Environmental Politics 16, 4 (Aug. 2007), 584–603.
- [336] SHAH, S. K. Motivation, Governance, and the Viability of Hybrid Forms in Open Source Software Development. Management Science 52, 7 (2006), 1000–1014.

- [337] SHARMA, V., KUMAR, N., AND NARDI, B. Post-growth Human–Computer Interaction. ACM Transactions on Computer-Human Interaction 31, 1 (Nov. 2023), 9:1–9:37.
- [338] SHARRATT, M., AND USORO, A. Understanding Knowledge-Sharing in Online Communities of Practice. Electronic Journal of Knowledge Management, 1(2), pp. 18-27.
- [339] SHOVE, E. Beyond the ABC: Climate Change Policy and Theories of Social Change. Environment and Planning A: Economy and Space 42, 6 (June 2010), 1273–1285. Publisher: SAGE Publications.
- [340] SHOVE, E., AND PANTZAR, M. Consumers, Producers and Practices. Journal of Consumer Culture 5, 1 (Mar. 2005), 43–64. Publisher: SAGE Publications.
- [341] SHOVE, E., PANTZAR, M., AND WATSON, M. The Dynamics of Social Practice: Everyday Life and How it Changes. SAGE Publications Ltd, 2012.
- [342] SILBERMAN, M. S., NATHAN, L., KNOWLES, B., BENDOR, R., CLEAR, A., HÅKANSSON, M., DILLAHUNT, T., AND MANKOFF, J. Next steps for sustainable HCI. Interactions 21, 5 (Sept. 2014), 66–69.
- [343] SIMMEL, G., FRISBY, D., AND FEATHERSTONE, M. Simmel on culture: selected writings. Theory, culture & society. Sage Publications, London ; Thousand Oaks, Calif, 1997.
- [344] SIMONSEN, J., AND HERTZUM, M. Sustained Participatory Design: Extending the Iterative Approach. Design Issues 28, 3 (2012), 10–21.
- [345] SPENCE, J. Inalienability: Understanding Digital Gifts. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2019), CHI '19, Association for Computing Machinery, pp. 1–12.
- [346] STAR, S. L., AND STRAUSS, A. Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. Computer Supported Cooperative Work (CSCW) 8, 1-2 (1999), 9–30.

- [347] STEVENS, G., AND PIPEK, V. Making Use: Understanding, Studying, and Supporting Appropriation. In Socio-Informatics, V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens, Eds. Oxford University Press, Mar. 2018, p. 0.
- [348] STIRLING, A. Transformations. Emancipating Transformations: From controlling 'the transition' to culturing plural radical progress. STEPS Centre, 2014.
- [349] STRENGERS, Y. A. Designing eco-feedback systems for everyday life. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, May 2011), CHI '11, Association for Computing Machinery, pp. 2135–2144.
- [350] SUBHANI, S. Is Open Source Software the Future of Software Development? International Journal of Business, Humanities and Technology 10, 1 (2020).
- [351] SUBRAMANIAM, C., SEN, R., AND NELSON, M. L. Determinants of open source software project success: A longitudinal study. Decision Support Systems 46, 2 (2009), 576–585.
- [352] SUCHMAN, L. Working relations of technology production and use. Computer Supported Cooperative Work 2, 1-2 (Mar. 1993), 21–39. Publisher: Springer Science and Business Media LLC.
- [353] SUCHMAN, L. A. Practice-Based Design of Information Systems: Notes from the Hyperdeveloped World. The Information Society 18, 2 (Mar. 2002), 139–144. Publisher: Informa UK Limited.
- [354] SVENFELT, A., AND ZAPICO, J. L. Sustainable food systems with ICT. In Proceedings of ICT for Sustainability 2016 (Amsterdam, the Netherlands, 2016), Atlantis Press.
- [355] SYMONS, M. Simmel's gastronomic sociology: An overlooked essay. Food and Foodways 5, 4 (Jan. 1994), 333–351. Publisher: Routledge
_eprint: <https://doi.org/10.1080/07409710.1994.9962016>.

- [356] TAMBURINO, L., BRAVO, G., CLOUGH, Y., AND NICHOLAS, K. A. From population to production: 50 years of scientific literature on how to feed the world. Global Food Security 24 (Mar. 2020), 100346.
- [357] TARTIU, V. E., AND MORONE, P. Grassroots Innovations and the Transition Towards Sustainability: Tackling the Food Waste Challenge. In Food Waste Reduction and Valorisation, P. Morone, F. Papendiek, and V. E. Tartiu, Eds. Springer International Publishing, Cham, 2017, pp. 303–327.
- [358] TELI, M., FOTH, M., SCIANNAMBLO, M., ANASTASIU, I., AND LYLE, P. Tales of Institutioning and Commoning: Participatory Design Processes with a Strategic and Tactical Perspective. Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1 (June 2020), 159–171. Conference Name: PDC '20: Participatory Design Conference 2020 - Participation Otherwise ISBN: 9781450377003 Place: Manizales Colombia Publisher: ACM.
- [359] TELI, M., LEWKOWICZ, M., ROSSITTO, C., AND BØDKER, S. Understanding, Promoting, and Designing for Sustainable Appropriation of Technologies by Grassroots Communities. Towards a new wave of technological activism: Sustainable Appropriation of Technologies by Grassroots Communities. In C&T '21: Proceedings of the 10th International Conference on Communities & Technologies - Wicked Problems in the Age of Tech (New York, NY, USA, June 2021), C&T '21, Association for Computing Machinery, pp. 332–335.
- [360] TERRY, G., HAYFIELD, N., CLARKE, V., AND BRAUN, V. Thematic Analysis. In The SAGE Handbook of Qualitative Research in Psychology. SAGE Publications Ltd, 2017, pp. 17–36.
- [361] TERRY, M., KAY, M., AND LAFRENIERE, B. Perceptions and practices of usability in the free/open source software (FoSS) community. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2010), ACM, pp. 999–1008.

- [362] THAPA KARKI, S., BENNETT, A. C. T., AND MISHRA, J. L. Reducing food waste and food insecurity in the UK: The architecture of surplus food distribution supply chain in addressing the sustainable development goals (Goal 2 and Goal 12.3) at a city level. Industrial Marketing Management 93 (Feb. 2021), 563–577.
- [363] THOLANDER, J., STÅHL, A., JACOBSSON, M., SCHULTZ, L., BORGSTRÖM, S., NORMARK, M., AND KOSMACK-VAARA, E. But i don't trust my friends: ecofriends – an application for reflective grocery shopping. In Proceedings of the 14th international conference on Human-computer interaction with mobile devices and services (New York, NY, USA, Sept. 2012), MobileHCI '12, Association for Computing Machinery, pp. 143–146.
- [364] THOMAS, D. R. A General Inductive Approach for Analyzing Qualitative Evaluation Data. American Journal of Evaluation 27, 2 (2006), 237–246.
- [365] THYGESEN, N. The gift economy and the development of sustainability. Local Economy 34, 6 (Sept. 2019), 493–509. Publisher: SAGE Publications Ltd.
- [366] TILMAN, D., AND CLARK, M. Global diets link environmental sustainability and human health. Nature 515, 7528 (Nov. 2014), 518–522. Publisher: Springer Science and Business Media LLC.
- [367] TOMKINS, S., ISLEY, S., LONDON, B., AND GETOOR, L. Sustainability at scale: towards bridging the intention-behavior gap with sustainable recommendations. In Proceedings of the 12th ACM Conference on Recommender Systems (New York, NY, USA, Sept. 2018), RecSys '18, Association for Computing Machinery, pp. 214–218.
- [368] TOMLINSON, B., NORTON, J., BAUMER, E., PUFAL, M., AND RAGHAVAN, B. Self-Obviating Systems and their Application to Sustainability.

- [369] TORKKELI, K., MÄKELÄ, J., AND NIVA, M. Elements of practice in the analysis of auto-ethnographical cooking videos. Journal of Consumer Culture 20, 4 (Mar. 2018), 543–562. Publisher: SAGE Publications.
- [370] TRATTNER, C., AND ELSWEILER, D. Food Recommender Systems: Important Contributions, Challenges and Future Research Directions. 2017.
- [371] TWIDALE, M. B., AND NICHOLS, D. M. Exploring Usability Discussions in Open Source Development. In Proceedings of the 38th Annual Hawaii International Conference on System Sciences (Los Alamitos, Calif., 2005), R. H. Sprague, Ed., IEEE Computer Society, pp. 198c–198c.
- [372] TWINE, R. Vegan Killjoys at the Table—Contesting Happiness and Negotiating Relationships with Food Practices. Societies 4, 4 (Nov. 2014), 623–639. Publisher: MDPI AG.
- [373] TWINE, R. A practice theory framework for understanding vegan transition. Animal Studies Journal 6, 2 (2017), 192–224.
- [374] TWINE, R. Materially Constituting a Sustainable Food Transition: The Case of Vegan Eating Practice. Sociology 52, 1 (Feb. 2018), 166–181. Publisher: SAGE Publications Ltd.
- [375] ULUG, C., AND HORLINGS, L. G. Connecting resourcefulness and social innovation: exploring conditions and processes in community gardens in the Netherlands. Local Environment 24, 3 (Mar. 2019), 147–166.
- [376] UNEP - UNITED NATIONS ENVIRONMENT PROGRAMME. Food Waste Index Report 2024, Mar. 2024. url: <http://www.unep.org/resources/publication/food-waste-index-report-2024>.
- [377] UNITED NATIONS. THE 17 GOALS | Sustainable Development. url: <https://sdgs.un.org/goals>.

- [378] UNITED NATIONS. Report of the World Summit on Sustainable Development: Johannesburg, South Africa, 26 August-4 September 2002. New York, 2002. url: <https://digitallibrary.un.org/record/478154?v=pdf>.
- [379] VASILIOU, C., IOANNOU, A., AND ZAPHIRIS, P. An Artifact Ecology in a Nutshell: A Distributed Cognition Perspective for Collaboration and Coordination. In Human-Computer Interaction – INTERACT 2015 (Cham, 2015), J. Abascal, S. Barbosa, M. Fetter, T. Gross, P. Palanque, and M. Winckler, Eds., Springer International Publishing, pp. 55–72.
- [380] VIVERO POL, J. L. Food as a Commons: Reframing the Narrative of the Food System. SSRN Electronic Journal (2013).
- [381] VON KROGH, G., SEBASTIAN SPAETH, AND KARIM R LAKHANI. Community, joining, and specialization in open source software innovation: a case study. Research Policy 32, 7 (2003), 1217–1241.
- [382] WAKKARY, R., DESJARDINS, A., HAUSER, S., AND MAESTRI, L. A sustainable design fiction: Green practices. ACM Transactions on Computer-Human Interaction 20, 4 (Sept. 2013), 23:1–23:34.
- [383] WANG, X., WAKKARY, R., NEUSTAEDTER, C., AND DESJARDINS, A. Information sharing, scheduling, and awareness in community gardening collaboration. Proceedings of the 7th International Conference on Communities and Technologies (June 2015), 79–88. Publisher: ACM.
- [384] WARDE, A. Consumption and Theories of Practice. Journal of Consumer Culture 5, 2 (July 2005), 131–153. Publisher: SAGE Publications.
- [385] WARDE, A. The practice of eating. John Wiley I& Sons., 2015.
- [386] WEBER, H., POEGGEL, K., EAKIN, H., FISCHER, D., LANG, D. J., WEHRDEN, H. V., AND WIEK, A. What are the ingredients for food systems change towards sustainability?—Insights from the literature.

- Environmental Research Letters 15, 11 (Oct. 2020), 113001. Publisher: IOP Publishing.
- [387] WELLMAN, B. Networks In The Global Village: Life In Contemporary Communities. Routledge, New York, June 2019.
- [388] WELLMAN, B., AND GULIA, M. Net-Surfers Don't Ride Alone: Virtual Communities as Communities. 331–366. Publisher: Routledge. 2018.
- [389] WELLMAN, B., AND WELLMAN, B. The Network Community: An Introduction. 1–47. Publisher: Routledge. 2018.
- [390] WENGER, E. Communities of practice: A brief introduction. Communities, 22(5), 57-80. 2011.
- [391] WIKIPEDIA. Pferdefleischskandal in Europa 2013. url: https://de.wikipedia.org/w/index.php?title=Pferdefleischskandal_in_Europa_2013I&oldid=189015771.
- [392] WITTMAYER, J. M., AND SCHÄPKE, N. Action, research and participation: roles of researchers in sustainability transitions. Sustainability Science 9, 4 (Oct. 2014), 483–496.
- [393] WORLD FOOD PROGRAMME. WFP Global Operational Response Plan: Update #10 – February 2024 | World Food Programme, Feb. 2024.
- [394] WULF, V., Ed. SOCIO-INFORMATICS: a practice-based perspective on the design and use of IT artifacts, first edition ed. Oxford University Press, Oxford, United Kingdom, 2018.
- [395] YAMABE-LEDOUX, A. M., SAITO, O., AND HORI, K. Exploring the Opportunities and Challenges of ICT-Mediated Food Sharing in Japan. Sustainability 15, 5 (Mar. 2023), 4584.
- [396] YATES, L. Rethinking Prefiguration: Alternatives, Micropolitics and Goals in Social Movements. Social Movement Studies 14, 1 (Jan. 2015), 1–21. Publisher: Routledge .eprint: <https://doi.org/10.1080/14742837.2013.870883>.

- [397] YATES, L. Prefigurative Politics and Social Movement Strategy: The Roles of Prefiguration in the Reproduction, Mobilisation and Coordination of Movements. *Political Studies* 69, 4 (Nov. 2021), 1033–1052. Publisher: SAGE Publications Ltd.
- [398] YU, Y., YI, S., NAN, X., LO, L. Y.-H., SHIGYO, K., XIE, L., WICAKSANA, J., CHENG, K.-T., AND QU, H. FoodWise: Food Waste Reduction and Behavior Change on Campus with Data Visualization and Gamification. In *Proceedings of the 6th ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies* (New York, NY, USA, Aug. 2023), COMPASS '23, Association for Computing Machinery, pp. 76–83.
- [399] ZAHLSEN, Ø. K., PARMIGGIANI, E., AND DAHL, Y. Challenges of Scaling Participatory Design: A Systematic Literature Review. In *Proceedings of the 34th Australian Conference on Human-Computer Interaction* (New York, NY, USA, 2022), ACM, pp. 143–159.
- [400] ZAPICO, J. L., KATZEFF, C., BOHNÉ, U., AND MILESTAD, R. Eco-feedback Visualization for Closing the Gap of Organic Food Consumption. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction* (Oct. 2016), ACM.
- [401] ZHU, J., LUO, Z., SUN, T., LI, W., ZHOU, W., WANG, X., FEI, X., TONG, H., AND YIN, K. Cradle-to-grave emissions from food loss and waste represent half of total greenhouse gas emissions from food systems. *Nature Food* 4, 3 (Mar. 2023), 247–256. Publisher: Nature Publishing Group.
- [402] ‘YOTTI’ KINGSLEY, J., AND TOWNSEND, M. ‘Dig In’ to Social Capital: Community Gardens as Mechanisms for Growing Urban Social Connectedness. *Urban Policy and Research* 24, 4 (Dec. 2006), 525–537.

Eidesstattliche Erklärung

Hiermit erkläre ich an Eides Statt, dass ich die hier vorliegende Arbeit selbstständig verfasst und keine Anderen, als die angegebenen Quellen und Hilfsmittel benutzt habe, alle Ausführungen, die anderen Schriften wörtlich oder sinngemäß entnommen wurden, kenntlich gemacht und die Arbeit in gleicher oder ähnlicher Fassung noch nicht Bestandteil einer Studien- oder Prüfungsleistung war. Der Speicherung meiner Ausarbeitung zum Zwecke der Plagiatprüfung stimme ich zu. Diejenigen Paragraphen der für mich gültigen Prüfungsordnung, welche etwaige Betrugsversuche betreffen, habe ich zur Kenntnis genommen. Zudem versichere ich, dass die elektronische Version und die gedruckte Version dieser Ausarbeitung identisch sind.

(Ort/ Datum)

Philip Engelbutzeder