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OPEN SOURCE URBANISM

A design method for cultivating Information Infrastructures in the urban commons

Sergei Zhilin

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DISSERTATION

for the purpose of obtaining the degree of doctor
at Delft University of Technology
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prof. dr. ir. T.H.J.J. van der Hagen,
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For my Mom, my first teacher and best friend. Your wisdom, love, and support navigated me through this challenging but joyful journey.

Для моей мамы, моего первого учителя и лучшего друга. Твоя мудрость, любовь и поддержка помогли мне пройти этот сложный, но радостный путь.

Contents

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Introduction

> *"I see in Open Source a DNA that resonates strongly with how people make the city theirs or urbanise what might be an individual initiative. And yet, it stays so far away from the city. I think that it will require making."*

> \- Saskia Sassen , *2011*

> *"Begin at the beginning," the King said, very gravely, "and go on till you come to the end: then stop."*

> \- Lewis Carroll, *Alice in Wonderland*

Cities play a major role in producing innovations, culture, and economic growth. More than fifty per cent of the world's population lives in cities, which will increase by 1.5 times by 2050. Rapid urbanisation and population growth pose global challenges of urban transformation, i.e., making built environments more sustainable and resource-efficient while providing prosperity and well-being for citizens. There are many movements to achieve that. For instance, the "New Urban Agenda" – a vision of global urban development signed by the majority of countries – states that all individuals and communities have to be empowered to participate in the development of resilient, sustainable, and innovative cities to foster prosperity and quality of life for all (UN, 2007, 2016b,a). Yet, citizens seldom have the power to develop urban space since it is regulated in the top-down fashion of prohibitions and restrictions (Harvey, 2011). The perspective on

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the city is slowly changing towards citizen-centric and participative visions that include citizen innovation and co-creation with various city stakeholders (Baccarne et al., 2014). Future city strategies should blur segregation between urban designers and users (Calzada and Cobo, 2015) and shift attention to co-creation with citizens (Voorberg et al., 2015). Nevertheless, even most citizen-centric cities prioritise consumption and further individualisation of urban lifestyle instead of aiming at the common good and strengthening civil rights (Cardullo and Kitchin, 2018).

Open Source Urbanism (OSU) emerges as citizens self-organise to alter their urban environments by creating Do-It-Yourself (DIY) *urban prototypes* and sharing *design manuals* allowing replication of prototypes in different urban contexts. The examples of DIY urban prototypes might vary from built structures to decentralised energy designs and digital artefacts co-created by citizens for community purposes. DIY urban prototypes emerge as a natural response of citizens to perceived problems of their urban environment; they are designed, built, paid for, and implemented by self-organised citizens and not by public or private companies. Active citizens created them to tackle not a class of problems but particular problems in their specific local contexts. OSU challenges the *status quo* of top-down urban design practices, as it facilitates the co-creation of *the urban commons*, i.e., places collectively created and maintained by self-organised citizens. Such initiatives aim to solve pressing issues of local urban environments, otherwise not solved by the public or private sector. OSU unites bottom-up citizen interventions and the open source movement: the urban commons focus on collective management of resources in the urban context, for instance, community gardens and housing cooperatives, while open source communities create digital commons, such as open source software or Wikipedia. In OSU projects, active citizens create urban prototypes along with open source design manuals covering their creation's design process. OSU projects are built around IT artefacts that facilitate all transformation steps of tacit DIY knowledge into open source manuals shared on the internet.

The cornerstone concept of this dissertation is **the commons**. In the research field of the commons, "the same word is used for both the singular and plural forms." (Ostrom and Hess, 2007, p. 21). As Ostrom and Hess (2007) put it: "Commons is an awkward word in the English language" (ibid.). Inheriting the tradition of the field, throughout this dissertation,

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we apply the same orthography, i.e., *the commons* and *a commons*. For instance, we discuss *the urban commons* as a phenomenon and *an urban commons* pointing to a specific citizen initiative.

This research adheres to the Design Science paradigm and focuses on synthesising a design method for OSU. Widely accepted Design Science Research methodology is conducted predominantly in the laboratory setting and produces artefacts firmly rooted in prior knowledge. Unfortunately, this approach is unsuitable for our study, as the knowledge base lacks. Moreover, the urban commons is not explored by scholars of Information Systems (IS), thus, we lack knowledge of the design process in such an idiosyncratic setting. To overcome these barriers, we combine Design Science with ethnographic methods. Specifically, we combine the Action Design Research (ADR) methodology elaborated by (Sein et al., 2011) with ethnographic fieldwork methods. ADR implies a collaboration of the researchers with practitioners in situ that aim at solving a real-life problem of the chosen organisation while generating design knowledge for a class of problems. As a tool for fieldwork, we adopt ethnography, that is "an anthropological research method that relies on first-hand observations made by a researcher immersed over an extended period of time in a culture, with which he/she is unfamiliar" (Schultze, 2000, p. 7). The resulting Action Design Ethnography Research (ADER) approach enables us to conduct design science research combined with fieldwork *in situ*. This methodology is a contribution to design science that enables researchers to conduct ADR within self-organised communities.

Equipped with ADER, we immerse in the everyday life of an urban commons community to explore this 'uncharted territory' and investigate how OSU infrastructures can be co-created. Moving further, we synthesise a generalised design method that guides the cultivation of OSU. A *design method* can be defined as "a set of steps (an algorithm or guideline) used to perform a task" (Offermann et al., 2010, p. 78). Frequently, methods define deliverables achieved by applying provided guidelines, along with roles that support the application of these (ibid.). This dissertation offers the following contributions to science: an interdisciplinary research domain for OSU; a research methodology combining ethnography and ADR; ethnographic accounts of the urban commons and design interventions; and a design method for OSU.

The following sections provide an overview of this study. The first sec-

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tion briefly explains the phenomenon of Open Source Urbanism. The second section introduces the research gap, namely the lack of knowledge on IIs for the idiosyncratic domain of OSU. The third section introduces the objective of this study along with research questions. The fourth section provides the outline of this dissertation.

1.1 Open Source Urbanism

OSU is a new phenomenon that is hardly studied so far. As we began this PhD research, we were able to find only two papers that conceptualise OSU, namely Bradley (2015) and Jiménez (2014). These papers argue that OSU unites bottom-up citizen interventions and the open source movement and can be defined as open source production of urban commons. The urban commons focus on collective management of resources in the urban context, for instance, community gardens and housing cooperatives, while open source communities create digital commons, such as open source software or Wikipedia. OSU projects operate as decentralised peer-to-peer networks in which distinctions between producers and consumers of resources are blurred. Such networks create physical entities along with open source manuals and blueprints that cover the design process of creating prototypes (Bradley, 2015; Jiménez, 2014).

Generally, the shared interest of citizens is an improvement in the quality of life (Jacobs, 1993). If some aspect of urban life does not meet citizens' expectations, active citizens can self-organise around a particular issue and run initiatives to solve it outside of a government authority (Boonstra and Boelens, 2011). OSU emerge as citizens self-organise to tackle the issues of their urban environment by creating Do-It-Yourself (DIY) *urban prototypes* and sharing them as open source design manuals. DIY prototypes emerge as a natural response of citizens to perceived problems of their urban environment; they are designed, paid for, and implemented by self-organised citizens and not by public or private companies (Finn, 2014). Conversely, urban designs created by professionals are thoroughly tested and standardised to comply with all possible federal and municipal regulations. In contrast, prototypes are incomplete, as they embody the ongoing experimentation of citizens with their urban environments (Jiménez, 2014). They are hand-crafted to tackle not a class of problems but particular problems (as perceived by their designers) in specific local contexts.

OSU practices appear as a grassroots response to top-down urban devel-

opment, as citizen initiatives aimed at solving pressing issues of local urban environments, otherwise not solved by the public or private sector (Bradley, 2015). OSU projects challenge the *status quo* of top-down urban design practice as they populate urban environments with new material and digital entities created and maintained by citizens. OSU communities cannot simply claim self-governance over their designs because these should be institutionalised (Petrescu et al., 2016). In public administration literature, this is known under the notion of co-production (Osborne et al., 2016), i.e., a relationship between organisations and self-organised citizens that requires a direct and active contribution from these citizens to the work of the organisation. Hence, to last, urban prototypes should be *co-produced* with city officials.

The literature provides no clear-cut definition of OSU. For the purpose of this research, we define Open Source Urbanism as **peer production of urban prototypes and open source manuals for their replication in urban commons**. Based on the literature review, we identify three aspects that characterise OSU: (1) OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment; (2) OSU initiatives produce *the commons*, urban places and digital artefacts that are collectively created and managed by self-organised citizens; (3) to last, DIY alterations of the urban environment should be accepted by or *co-produced* with the authorities. The following section discusses the gap identified in the literature, namely the lack of design knowledge for OSU.

1.2 Research problem: Cultivating Information Infrastructures for Open Source Urbanism

The *knowledge gap* of this study is the lack of prescriptive knowledge on designing IT-based artefacts for OSU projects. Although design science contains a vast array of design theories supporting computer-supported cooperative work, this knowledge is developed for structured organisations having hierarchical governance based on structures with command and control mechanisms and formal agreements and regulations (i.e., private businesses and public organisations) (Malone et al., 1987; Clemons et al., 1993). This knowledge is hardly applicable to the idiosyncratic domain of OSU. We summarise the differences between OSU and command-and-

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Table 1.1: Differences between OSU and command-and-control mechanisms

	Domain	
	Command-and-control mechanisms	Open Source Urbanism
Organisation	Planned	Self-organised
Relations	Formal contracts	Informal agreements
Initiation	Top-down	Bottom-up
Structure	Hierarchy	Meritocracy and consensus
Control	Supervisors	Roles
Motivation	Clearly-stated objectives	Shared visions and ideologies

control mechanisms in Table 1.1 (this table is synthesised in section 7.1.1).

Regarding IT-based systems at the core of OSU, we perceive them as Information Infrastructures (IIs) because OSU and infrastructures exhibit the same characteristics; for example, both phenomena are claimed to be self-organised, decentralised, and evolving. We adopted the Information Infrastructures (IIs) perspective on the design that differs from the perspective accepted in Information Systems (IS). Considering fundamental differences between IS and IIs, we must address the design process of infrastructures, as it has discrepancies with the traditional design process of information systems. In section 4.1, we discuss IIs in greater detail, namely, we lay down characteristics of IIs and discuss discrepancies between the II design process from the IS design process. We relate these with OSU to show discrepancies between 'traditional' IS and OSU infrastructures. Equipped with that, we can state this dissertation's research problem and objective.

IIs can be defined as follows: **"shared resources for a community; the different components of an infrastructure are integrated through standardised interfaces; they are open in the sense that there is no strict limit between what is included in the infrastructure and what is not, and who can use it and for which purpose or function; and they are heterogeneous, consisting of different kinds of components – human as well as technological."** (Hanseth and Lundberg, 2001, p. 349) We adopt this perspective on the IIs because it clearly delineates IIs from traditional IS: the former has no specific purpose but rather a generic idea of supporting the community of practice with information-related services, while the latter, such as decision support systems or accounting systems, clearly state their purpose and supported tasks (Hanseth and Lyyti-

nen, 2004). For the purpose of this research, we define OSU infrastructures as **a commons-based information infrastructure that facilitates the co-production of urban prototypes and open source design manuals**. This research focuses on developing a design method with a set of design principles that guides the cultivation of an OSU infrastructure.

Furthermore, the perspective on OSU as IIs supports the socio-technical perspective (Bostrom and Heinen, 1977) adopted for this study. We perceive the social and technical layers of Information Infrastructures as interdependent, thus, an analysis and design interventions in IIs should be taken considering the complexity of socio-technical interactions. The combination of Action Design Research and ethnography fits this perspective well as it considers the socio-technical complexity of the design within the organisational context.

Nevertheless, there is a difference between IIs and OSU, as IIs are often governed by contracts between decentralised parties, whereas for OSU, there is often no formal governance. We perceive IT-based artefacts for OSU projects as IIs, as this perspective suits the idiosyncratic domain of OSU. Although existing design theories (e.g., II design theory Hanseth and Lyytinen, 2004) can serve as the theoretical background, they are not entirely suitable for the OSU domain; therefore, the cultivation of IIs for OSU requires a new set of design guidelines which takes the nature of OSU into account. Moreover, OSU studies lack prescriptive knowledge on constructing OSU infrastructures. Furthermore, the idiosyncratic nature of urban commons is not explored by scholars of IS, thus, we lack knowledge of the design process in such a peculiar setting. An extrapolation of design knowledge from other domains might be problematic due to the differences in the domain of urban commons and, consequently, OSU. OSU differs from formal organisations in various ways. The lack of resources, clear hierarchies, and control are typical differences (see Table 1.1).

As we started this PhD research, studies on OSU infrastructures were absent. The IIs research field is established in the 90s, also there are studies on the cultivation, evolution and dynamics of infrastructures (e.g., Star and Ruhleder (1996); Edwards et al. (2007); Hanseth and Aanestad (2003)) as well as a design theory for IIs (Hanseth and Lyytinen, 2004). Some scholars conducted studies of 'infrastructuring' of commons (e.g., urban commons Seravalli (2018), cultural commons Marttila and Botero (2017)). Nevertheless, these studies consider socio-technical arrangements that are conducted in

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a top-down manner, i.e., research teams with predefined research goals and allocated resources. We found no studies on growing infrastructures in self-organised communities with limited resources outside market/state mechanisms.

The literature provides no design methods for cultivating OSU infrastructures. Moreover, OSU lacks the literature and is not shaped as a field of study. The existing literature on OSU, namely (Bradley, 2015; Jiménez, 2014; Baibarac and Petrescu, 2017; Sassen, 2011), gave us an impetus to the development of the field of OSU. From these papers, we understand that OSU is an overarching term that links Do-It-Yourself (DIY) culture and citizen-driven urban commons with the open source movement. We can move further with this study by using the 'snowballing' technique from the initial concept. In this sense, design is not a 'hard' blueprint of systems components and features; it requires the development of design principles (heuristics) that are" rules of thumb that provide a plausible aid in structuring the problem at hand or in searching for a satisficing artefact design" (Gregory and Muntermann, 2014, p. 639). Design principles allow embracing this diversity while providing flexibility in developing case-specific system designs. As Gregor et al. (2020) argues: "The characteristic that distinguishes design science knowledge from other forms of knowledge is that it includes design principles: prescriptive statements that indicate how to do something to achieve a goal." (p. 1622). Design principles steer the implementation process of an artefact (Walls et al., 1992); however, they are not offered as 'blueprints for strict adherence' but rather serve as inputs for case-specific design decisions (Clegg, 2000).

This research focuses on developing a design method that guides infrastructure cultivation in the inception stage, i.e., how to initialise an OSU infrastructure that is stable yet flexible to allow further evolution. The inception phase of IIs cultivation is related to two problems of information infrastructure design: *bootstrap and adaptability problems* (Hanseth and Lyytinen, 2004). Bootstrap problem is required to address the needs of first users before finishing the design to convince them to adopt the emerging II (Hanseth and Lyytinen, 2016). The adaptability problem can be described as follows: "when the II starts to expand by benefitting from the network effects, it will switch to a period of rapid growth. During this growth, designers need to heed for unforeseen and diverse demands and produce designs that cope technically and socially with these increasingly

varying needs. This demands infrastructural flexibility in that the II adapts technically and socially." (ibid., p. 106). By addressing the inception phase of an OSU infrastructure, this research addresses its bootstrapping, i.e., "a design process taking as its starting point the challenge of enrolling the first users and then drawing upon the existing base of users and technology as a resource to extend the network." (Hanseth and Aanestad, 2003, p. 386). We focus on the bootstrapping of OSU infrastructures due to the limited time of PhD research. An II cultivation can take years; II studies cover a period of infrastructure evolution up to 10-15 years (e.g., (Grisot et al., 2014)). We focus on developing a design method that guides the inception phase of an OSU infrastructure that is flexible to allow further evolution. Challenges related to adaptability, such as adoption, growing user base, and network effect, are outside the scope of this dissertation. To conclude, the knowledge gap of this dissertation is the lack of design methods for OSU, i.e., designing commons-based IIs that support sharing of DIY knowledge gained in the urban commons.

1.3 Research objective and questions

Design knowledge of OSU infrastructures is lacking. Specifically, the literature provides no methods or guidelines for practitioners co-designing such infrastructures in the urban commons setting. Taking this into consideration, we state the objective of this dissertation as follows:

The objective of this research is to develop a design method for cultivating OSU infrastructures.

We address the research objective with the design science paradigm (Simon, 1969) that is used in many disciplines, such as architecture, engineering, and computer science (March and Smith, 1995). In Information Systems (IS) studies, Design Science Research (DSR) seeks to develop prescriptive knowledge through designing and evaluating innovative IT artefacts intended to solve an identified class of problems (Hevner et al., 2004), however, shortcomings of DSR methodology make it not directly applicable for our study. Firstly, this approach fails to reflect changes in the social world caused by the introduction of an artefact due to the limited evaluation stage, typically carried out only in the final step of the design research cycle. Additionally, a laboratory approach in design science does not recognise the necessity of artefact emergence in interaction with its users and environment. The common way to overcome these limitations is to com-

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bine design science with action research, i.e., a combination of "generation of theory with changing the social system through the researcher acting on or in the social system" (Susman and Evered, 1978, p. 586). For this reason, we adopted an *Action Design Research (ADR) methodology* (Sein et al., 2011) that combines design science research and action research. This approach implies a collaboration of the researchers with practitioners *in situ* that aim at solving a real-life problem of the chosen organisation while generating design knowledge for a class of problems. ADR process model provides explicit guidelines for a research process that combines the rigour of design science research methodology and the intervention-based nature of action research.

Although this study was initially planned to be conducted in a multi-actor setting, we were unable to gain access to external actors, such as civil servants, contractor organisations, and other citizen initiatives. It might be caused by the lack of the researcher's experience in negotiation and vague objectives at the beginning of this study. The factor that this study promised no immediate benefit to these actors also played its role. Due to this limitation, we adopted the 'community perspective' on the problem at hand.

ADR methodology does not specify concrete methods of fieldwork. We adopted ethnography to conduct fieldwork inquiries within a community. We conducted the ethnography of an existing case of the urban commons, in Amsterdam, the Netherlands, from July 2018 to September 2019. Ethnography is "an anthropological research method that relies on first-hand observations made by a researcher immersed over an extended period of time in a culture, with which he/she is unfamiliar" (Schultze, 2000, p. 7). Ethnography is 'one of the most in-depth research methods possible' (Baskerville and Myers, 2015, p. 40) because it provides tools to observe interactions and practices of people directly. Observing phenomena 'in the wild', the ethnographer 'becomes a student of other people's culture' (Myers, 1999, p. 114). Apart from observations, our research approach implies design interventions, i.e., researchers' activities within organisations that aim to solve their practical problems. The researcher becomes involved in a real-world situation as both participant and researcher and conducts design interventions in collaboration with practitioners. In our case, we conducted four design interventions that focused on the co-creation of an OSU infrastructure with an Amsterdam-based urban commons community. Ethnography

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is criticised as having the risk of researcher bias. We argue that the immersion of a researcher in everyday life and identification with its members hardly leave space for neutrality. We stay on the position that completely eradicating researcher's bias from ethnography is impossible; however, we take actions to mitigate researchers' bias (see discussion in section 8.3.1).

Real-life examples of OSU are rare. The best-known, successful and documented by academic studies case of OSU is Parklets (see Examples in Chapter 3). We use this example in our interdisciplinary research domain to show different aspects of the multi-faceted phenomenon of OSU. However, the secondary data on this OSU case is insufficient to synthesise a design method for cultivating OSU infrastructures. For this reason, we conduct the ethnography of an existing case of the urban commons combined with design interventions to investigate how OSU can grow on the fertile ground of the urban commons. Important to highlight that we gained no access to the urban stakeholders that are external to the urban commons community(e.g., the municipality, the urban development company, and private contractors); thus, this study covers only the urban community perspective. The resulting research approach consists of three phases, namely (1) Problem formulation, (2) Design interventions, and (3) Design method synthesis. The phases are adapted from the ADR methodology of Sein et al. (2011). We discuss the design research phases in detail in section 2.3.2. The first phase - Problem formulation - adopts a literature review as a research method. This phase is separated into two parts.

First, we investigate RQIa *"What is Open Source Urbanism?"*to construct a domain for this research. Although the notion is mentioned in the literature (e.g., (Bradley, 2015; Jiménez, 2014)), it lacks a thorough conceptualisation that can inform the next research steps. We fill this void by outlining related concepts and laying down definitions that are used in the following research stages. We discuss Open Source Urbanism as a notion that bridges the urban commons and digital commons defining it as citizen-driven commons-based co-production of open source urban prototypes that aim at urban transformation. Moving further with the literature review, we pose the research question RQIb *"What are reference theories for a design method for OSU infrastructures?"*. By answering this research question, we provide reference theories for a design method, i.e., descriptive theories and concepts outside the Information Systems discipline. We draw on three bodies of knowledge, combining the theories on IIs, Com-

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munities of Practice (CoP), and urban places. We employed the resulting reference theories as theoretical lenses for further ethnographic inquiries in real-life urban commons, as well as for informing a design method for OSU infrastructures.

The second phase – Design interventions – adopts ethnographic and co-design methods and is separated into two parts. The ethnographic study answers the second research question: RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. Literature shows that urban commons are idiosyncratic, as they emerge in response to specific local problems and are shaped by interplay with local urban actors and settings. Ethnographic study suits well in understanding the 'messy' social reality. We conducted an ethnographic study of an urban commons in Amsterdam, the Netherlands (July 2018 to September 2019), to investigate what elements can be used as the installed base for cultivating an OSU infrastructure. Design interventions address the third research question: RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*and reports about an ethnographic co-design study focused on cultivating an OSU infrastructure in the real-life setting of urban commons. We conduct design interventions in cooperation with the same Amsterdam-based urban commons. The researcher and the community's shared goal is to co-design an OSU infrastructure with open source urban designs guiding the construction of an urban commons. Importantly, the researcher initiated this study, while the practitioners initially expressed no interest in it and had other priorities. The research objective of this study is to gain insight into the cultivation of OSU infrastructures in practice. The collected data is used to synthesise a design method for OSU.

Insights from theoretical and empirical studies allow us to answer the question RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*. We offer a design method for OSU infrastructures that consists of a set of *Constructs*, five *roles* of community members required for OSU cultivation, and eight design principles guiding the inception of an infrastructure. Constructs, i.e., analytical categories that help understand the social reality of an urban commons. A role is a set of activities and responsibilities expected from a community member by their peers. We provide the set of roles to show specific actions and required attributes of members of urban commons regarding establishing OSU infrastructures. The offered design principles can be used as an ap-

proach for the co-design process. According to that, principles are applied step by step, i.e., higher-level principles should be adhered to before moving to the subsequent principles. The resulting method serves as a toolset that guides self-organised communities in cultivating OSU infrastructures that support the co-creation and sharing of open source design manuals from tacit DIY knowledge.

1.4 Dissertation outline

Figure 1.1 depicts the relations between chapters of this dissertation, methods, and research questions. In *Chapter 2*, we describe a research approach of this study that combines the action design research methodology with ethnography. In *Chapter 3*, we build an interdisciplinary research domain for this dissertation that define crucial concepts of OSU, namely Do-It-Yourself urban design, the commons, and co-production. The chapter answers on RQIa *"What is Open Source Urbanism?"*. In *Chapter 4*, we select bodies of knowledge as reference theories for our design method. The chapter answers RQIb *"What are reference theories for a design method for OSU infrastructures?"*. In *Chapter 5*, we report an ethnographic study of the real-life example of an urban commons answering research question RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. Moving further, we report design interventions in *Chapter 6*. The chapter answers RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*. In *Chapter 7*, we offer a design method for cultivating OSU infrastructures answering on RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*. In *Chapter 8*, we draw conclusions from this research and communicate contributions to academic knowledge, limitations, and further research directions.

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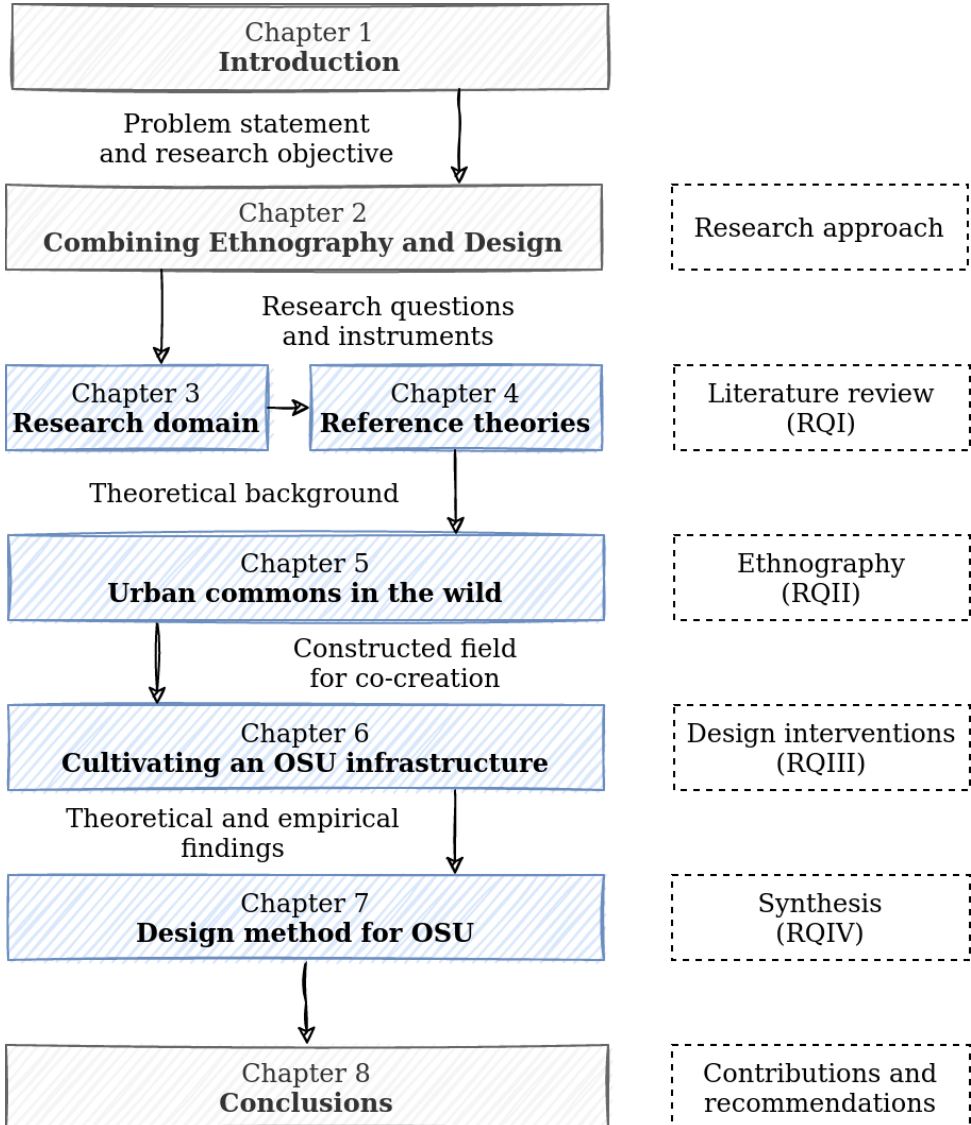
Figure 1.1: Dissertation chapters

2

Research approach: Action Design Ethnographic Research

The engineer, and more generally the designer, is concerned with how things ought to be — how they ought to be in order to attain goals, and to function.

- Herbert Simon, *The Sciences of the Artificial, 1969*

"Where should I go?" - Alice. "That depends on where you want to end up." - The Cheshire Cat

- Lewis Carroll, *Alice in Wonderland*

In the introductory chapter, we discussed the research drivers and objective of this dissertation, i.e., to build a design method that guides the cultivation of OSU infrastructures in the urban commons. We address the research objective with the Design Science approach (Simon, 1969). The Design Science approach is used in many disciplines, such as architecture, engineering, and computer science (March and Smith, 1995). In Information Systems (IS) studies, Design Science Research (DSR) seeks to develop prescriptive knowledge through designing and evaluating innovative IT artefacts intended to solve an identified class of problems (Hevner et al., 2004). Unlike IT artefacts within the IS discipline, Information Infrastructures (IIs) have no specific purpose but rather a generic idea of supporting the community of practice with information-related services (Hanseth and

Lyytinen, 2004). This dissertation focuses on building a design method for cultivating IIs in the urban commons. Specifically, we focus on OSU infrastructures: IIs not covered in the prior literature and have idiosyncratic characteristics, making current design approaches unsuitable.

Design science can be used in a laboratory or real-life setting (Iivari, 2015). Both approaches have their advantages and disadvantages. In the wide-accepted laboratory approach of DSR, prescriptive knowledge is synthesised in the laboratory conditions and then evaluated, for instance, with prototyping, whereas in a real-life setting, the conditions cannot be controlled. The laboratory approach cannot be used for this study due to lacking the prior literature. Moreover, the laboratory approach does not recognise the necessity of artefact emergence in interaction with its users and the environment, which is crucial for this research due to the idiosyncratic nature of the urban commons.

To overcome the limitations of the laboratory approach, we adopt the Action Design Research (ADR) methodology, which supports design knowledge generation in a real-life setting, and combine it with ethnography to conduct fieldwork inquiries within a community. Ethnography is 'one of the most in-depth research methods possible' because it provides tools to observe interactions and practices of people directly (Baskerville and Myers, 2015, p. 40). In our approach, we conduct ethnographic observations of an urban commons community. Based on findings from these, we conduct design interventions, i.e., researchers' activities within organisations that aim to solve their practical problems (Checkland and Holwell, 1998; Avison et al., 2001). In this study, the researcher became involved in a real-world situation as both participant and researcher and conducted design interventions in collaboration with practitioners. This involvement was required due to the lack of literature on cultivating OSU infrastructures. Moreover, in this research, we adopt a socio-technical perspective (Bostrom and Heinen, 1977) and argue that the social and technical layers of IIs are interdependent, thus, an analysis and design interventions in IIs should be taken considering the complexity of socio-technical interactions. ADR fits the adopted socio-technical perspective well as it considers the socio-technical complexity of the design within the organisational context.

The chapter is organised as follows. The first section explains the research philosophy. The second section discusses design science. The third section combines Action Design Research with ethnography, resulting in

a research process model for this dissertation. The fourth section lists the methods and research questions of this study. The fifth section provides an overview of the chapter.

2

2.1 Research philosophy

Research philosophy is, simply speaking, a scientist's worldview (Gibbs, 2005). In social sciences, researchers deal with their subjects through a set of "explicit or implicit assumptions about the nature of the social world and the way in which it may be investigated" (Burrell and Morgan, 1979, "p. 1"). A research philosophy comprises a researcher's ontological, epistemological, and axiological assumptions. Ontological assumptions deal with the nature of reality; for instance, either the observable 'reality' is an outcome of the researcher's consciousness or external to it. Epistemological assumptions relate to the nature of knowledge (i.e., subjective or objective), its scope, and the perception of 'truth'. Axiological assumptions concern individual or group values. Ontological, epistemological, and axiological assumptions, although foundational for one pursuing any intellectual labour, often stay implicit (Gregg et al., 2001; Vaishnavi and Kuechler, 2008). In scientific research, however, these concepts are fundamental and should be stated explicitly in the form of research philosophy, as it guides the selection and application of relevant research strategy and methods (Easterby-Smith et al., 2002). Due to that, we should select a research philosophy and justify the choice.

2.1.1 Positivism

Two research philosophies dominate in social sciences, namely positivism and interpretivism (Gibbs, 2005). In the same manner, research in information systems applies either one of these two paradigms (Cash and Lawrence, 1989; Walsham, 1995). The positivist paradigm claim that 'reality' is probabilistic while 'truth' is universal and objectively observable (Vaishnavi and Kuechler, 2008). In this paradigm, researchers often play the role of a passive, neutral observer that does not interfere with phenomena under investigation (Dubé et al., 2003). To check whether the study is trustworthy and meaningful, positivists apply the concept of validity. Internal validity focuses on the strength of links between cause and effect, i.e., states to what extent the cause-and-effect relationship is trustworthy (Straub and

Gefen, 2004). External validity focuses on the generalisability of the study results, i.e., the applicability of findings to other settings (Shanks, 2002). Research in information systems belongs to the positivist paradigm if it is characterised by "evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population" (Orlikowski and Baroudi, 1991, p. 5). The positivist approach has received criticism for the negligence of the complexity of information systems since it rejects free-will (Chen and Hirschheim, 2004).

2.1.2 Interpretivism

Due to the growing recognition of the complexity of information systems, researchers in this field adopted the interpretive research paradigm along with its relativistic ontology (Gregg et al., 2001). Interpretivism stays on the position that 'reality' is a social construct created by human actors, and, consequently, there is no single objective reality but rather multiple realities created in the minds of different individuals (Walsham, 1995; Vaishnavi and Kuechler, 2008). An interpretive philosophy assumes that researchers acquire knowledge of reality by means of social constructs, such as language, documents, and other artefacts. Unlike positivist research, interpretive research "does not predefine dependent and independent variables, but focuses on the complexity of human sense-making as the situation emerges" (Klein and Myers, 1999, p. 69). Methods applied by interpretivism researchers are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993, p. 4). Importantly, interpretivism research recognises that researchers subjectively interpret observations with regard to their interests and constraints (Vaast and Walsham, 2009). Mitigation mechanisms are required to avoid the researcher's bias. We discuss the mitigation mechanisms of this dissertation in section 8.2, 'Limitations of this study').

In this research, we perceive information systems as complex sociotechnical systems comprising technological components, such as software, and human actors, in which human behaviour is interwoven with and inseparable from technology. We focus on self-organised urban commons communities. Human interactions play a paramount role in this process, while chosen technology is rather derivative. Values, motivations, and vi-

sions of actors shape the functionality and use of such systems, along with the local urban context of urban commons communities. Additionally, this research has an exploratory nature since the literature on the subject was lacking at the beginning of this research.

This research cannot be positioned in the positivist paradigm, as we do not claim the results of this study as impeccable universal truth. We adopt interpretivism as a research philosophy of this dissertation, as it provides an understanding of the complexity of OSU and can guide us in selecting suitable research instruments. Since this research adopts an interpretivism philosophy, it adopts the ontological assumption that a researcher and reality are inseparable (Weber, 2004). Our epistemological assumption is that knowledge of the world is constructed by the researcher's live experience (Weber, 2004), and axiological assumptions are based on a situational and descriptive understanding of a given phenomenon (Vaishnavi and Kuechler, 2008).

2.2 Design science

The notion of design science, initially introduced in the 1960s by Buckminster Fuller, refers to 'a combination of science, technology, and rationalism' (Gregor et al., 2020, p. 1624). Design science focus on creating innovative artefacts to extend individual and organisational capabilities (Hevner et al., 2004). Design science activities are essential in applied sciences, such as Information Systems and Computer Science. Applied sciences generate 'know how', i.e., prescriptive knowledge, unlike fundamental science producing 'know what', i.e., descriptive knowledge (Niiniluoto, 1993). Nevertheless, design science differs from design practice, as the former focuses on contributions to the knowledge base, while the latter applies existing design knowledge to solve specific problems of the real world utilising information systems (Hevner et al., 2004).

Design Science Research (DSR) generates innovative artefacts, i.e., artificial objects that are, unlike natural objects, constructed by humans (Simon, 1969). DSR seeks to develop prescriptive knowledge by designing and evaluating innovative IT artefacts intended to solve an identified class of problems. Constructed artefacts, however, are rarely mature information systems that are ready for use in practice (Hevner et al., 2004). The rationale of this research is to bring a knowledge contribution by means of an IT-based artefact and not to design a solution ready for use in a real-life

setting. This dissertation seeks to solve the class of problems that can be defined as follows: **the lack of IT-based solutions for co-creation of open source design manuals for Do-It-Yourself (DIY) urban designs in the urban commons**.

In the seminal book 'The Sciences of the Artificial', published in 1969, Herbert Simon (1969) declares that ideally, design science should be "[…]intellectually tough, analytic, formalisable, and teachable" (p. 112). For that, DSR should be rooted in the knowledge base that Walls et al. (1992) calls 'kernel theories' and defines as "theories from natural science, social sciences and mathematics" (p. 41). We agree with Gregor and Jones (2007) argumentation for a broader perspective on the type of knowledge that steers the DSR process that is not limited by theories only but comprises knowledge outside of the IS discipline, including 'informal knowledge from the field and the experience of practitioners' (Gregor and Hevner, 2013, p. 340). In this research, we use the term *reference theories* (Gregor and Hevner, 2013) for this type of knowledge. The reason for that is in the semantics of the two terms. In our case, we use no 'hard' theories from mathematics or economy that would comprise the core of a design method. Instead, we use these theories as reference for our analysis and synthesis of a design method. Nevertheless, as Gregor and Hevner (2013) point out, the terms kernel theory and reference theory are used interchangeably.

Through the course of the development of the DSR paradigm, some scholars insisted on the importance of IT artefacts and their relevance to the real-world problem (e.g., (Hevner et al., 2004; March and Smith, 1995)), while others claimed that its primary focus is contributions to prior knowledge (e.g., (Walls et al., 1992; Kuechler and Vaishnavi, 2008)). Currently, it seems that an agreement is found in the middle, i.e., DSR combines scientific contributions as well as design knowledge for practitioners (Gregor and Hevner, 2013; Peffers et al., 2018). In this research, we follow the latter perspective contributing to science and practice of OSU.

2.2.1 Artefacts in design science

In IS research, the notion of 'artefact' might be confusing. For instance, Hevner et al. (2004) defined artefacts as "innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of information systems can be effectively and efficiently accomplished" (p. 83) while Orlikowski and Barley (2001)

defined an IT artefact as a "bundle of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (p. 121). The former definition perceives design knowledge as an artefact, while the latter defines artefacts as instantiations of design knowledge. To differentiate IS artefacts, Gregor and Hevner (2013) argue that DSR can yield various artefacts of different abstraction depending on their maturity level: more specific and context-dependent *instantiated artefacts*, such as software, brings less mature knowledge contribution; *nascent design theories* are emerging design knowledge not yet fully developed; finally, fully-fledged *design theories* contribute well-developed design knowledge. Every class of artefacts brings a certain scientific contribution.

Gregor (2006, p. 611) describes five categories of theories that are relevant to IS discipline, namely (1) theory for analysing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting, and (5) theory for design and action. Design knowledge belongs to the fifth category, theory for design and action, as it focuses on 'how to do something', i.e., it gives practitioners explicit guidelines on designing a technology-based artefact (Gregor, 2006, p. 620). Over the last two decades, theories for design and action are gaining more influence in IS research. Initially, design theory was not always recognised as theories (Gregor and Jones, 2007); now they are widely accepted in the information systems field (e.g., (Peffers et al., 2018; Iivari, 2020)). The theory for design and action suits the objectives of this research as we focus on contributing to scientific knowledge and the societal impact. A design method for OSU is a scientific contribution, as this research is the first that prescribes how an OSU infrastructure can be cultivated within the urban commons.

In IS field, the notion of design theory is based on the research of Simon (1969) on the theory of the artificial. Walls et al. (1992) defines a design theory as "a prescriptive theory based on theoretical underpinnings which says how a design process can be carried out in a way which is both effective and feasible" (p. 37). /citetGregor2007 broadly defines design theories in information systems as "conjectures, models, frameworks, or bodies of knowledge" (p. 314) that come as a result of design science research projects. In the same manner, Peffers (2018) put that "an IS design theory (ISDT) can be understood as similar to a behavioural science theory. It enables the IS design researcher to communicate design theory, independent of the applied science, from whence it was derived" (p. 131). Expressing de-

sign knowledge in the form of a theory adds to design research rigour and legitimacy, which is often lacking in applied sciences compared with natural sciences (Gregor and Jones, 2007; Peffers et al., 2018). Additionally, design theories contribute to the design practice, as they give explicit prescriptions on how to develop an information system (Markus et al., 2002). As was argued before, we refrain from claims of synthesising a design theory. Instead, we construct a *design method* perceiving it as design knowledge rooted in the prior knowledge base and the design fieldwork, i.e., ethnography and design interventions (see section 2.2.1).

Iivari (2020) calls for rejecting the excessive use of the term 'design theory', which overwhelmed the IS discipline. He suggested discussing specific classes of IT artefacts along with related design knowledge (Iivari, 2020). In line with this criticism, instead of using the notion of design theory, we focus on constructing a specific type of design knowledge, namely a *design method*: one of eight types of IT artefacts in IS research according to Offermann et al. (2010). A design method can be defined as **"a set of steps (an algorithm or guideline) used to perform a task"** (p. 78). Frequently, methods define deliverables achieved by applying a provided set of actions, along with roles that support the application of this (Offermann et al., 2010). The following section discusses design knowledge often labelled as 'design theories' in the IS literature. The following sections discuss the key elements of our design method, namely design principles and roles that are required for implementing principles in the self-organised setting of the urban commons.

A design method for OSU should fit the class of problems, i.e., fit various kinds of urban commons initiatives. For this, a design method requires heuristics (Gregory and Muntermann, 2014): "rules of thumb that provide a plausible aid in structuring the problem at hand or in searching for a satisficing artifact design" (ibid., p. 639). Design principles allow embracing this diversity while providing flexibility in developing case-specific system designs. As Gregor et al. (2020) argues: "The characteristic that distinguishes design science knowledge from other forms of knowledge is that it includes design principles: prescriptive statements that indicate how to do something to achieve a goal." (p. 1622). Design principles steer the implementation process of an artefact (Walls et al., 1992); however, they are not offered as 'blueprints for strict adherence' but rather serve as inputs for case-specific design decisions (Clegg, 2000). The notion of design prin-

ciples has a long history in engineering and social sciences. In 1976, Albert Cherns published a seminal paper that suggested using design principles in socio-technical system design Cherns (1976). Housel et al. (1986) defines design principles as "generic prescriptions for the design and implementation of information systems" (p. 396). The Open Group Standard defines principles as "general rules and guidelines, intended to be enduring and seldom amended, that inform and support the way in which an organisation sets about fulfilling its mission" (TOGAF, 2018, 197). Gregor (2002) defines design principles as "design decisions and design knowledge that are intended to be manifested or encapsulated in an artefact, method, process or system" (p. 17). For the purpose of this dissertation, we combine these definitions into the following definition of design principles: **"generic prescriptions and guidelines that are intended to be manifested or encapsulated in the design and implementation of socio-technical systems"**. Design principles are applicable for a class of problems since they can be used not for one particular problem instance discussed in the sixth chapter but for a class of problems.

In OSU, many stakeholders have various roles. We adopt the notion of roles because this study focuses on the self-organised setting of the urban commons. In the 'command-and-control' setting of public or private organisations, design guidelines can be implemented as part of a job description or a task allocated by superiors. In the informal setting of the urban commons, roles could help implement guidelines, as the role is a set of activities and responsibilities separated from an actual person. Hence, it allows task distribution with lacking 'command-and-control' mechanisms. The notion of roles is widely adopted in sociology, organisational studies, and computer-supported cooperative work. In the latter, the notion is often used to implement access control mechanisms that grant or restrict users to data and features of an ICT system (Jahnke et al., 2005). In organisations, roles express explicitly described tasks and functions. In this manner, Biddle and Thomas (1966) defines a role as "a set of prescriptions defining what the behavior of a position member should be" (p. 29). In our design method for OSU infrastructure, the notion of roles differs from both perspectives due to the informal and fluid structure of self-organised communities. As an OSU infrastructure is a socio-technical system that heavily relies on the social component, we adopt a broader conceptualisation of roles from the sociological perspective. In sociology, roles are often referred to as a set of

certain activities performed by people during social interactions (Goffman and Others, 1959). Roles gradually emerge by "repetition of social interaction patterns of expectations." (Jahnke et al., 2005, p. 82). A combination of roles by one person is possible, i.e., a person can simultaneously execute several roles (Merton and Merton, 1968). Roles are required for the continuous execution of tasks in the non-hierarchical, contractless setting, as the constant flux of community members perform a set of roles, i.e., roles are not designed for specific persons and can be performed by different people. To summarise, for the OSU design method, we define a role as **a set of activities and responsibilities expected from a community member by their peers**.

In addition to design principles and roles, our design method includes *constructs*: **"representations of the entities of interest in the theory"** (Gregor and Jones, 2007, p. 322). Constructs are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures. However, they should not necessarily be used in practice while cultivating an OSU infrastructure. Constructs serve as an analytical category that helps to analyse the rich social reality and delineate interwoven entities and processes. Practitioners applying the offered design method need to adopt the terms of the specific community they work with to enable an understanding of the constructs. Constructs are derived from the literature review and empirical studies.

2.2.2 Laboratory and practice approaches

This dissertation focuses on elaborating a design method for OSU in the design science research paradigm. To achieve that, we have to apply suitable methods. Widely-accepted methodologies in DSR (e.g. Peffers et al. (2007); Hevner et al. (2004)) apply *laboratory approach* in which researchers aim at solving a general problem by means of creating 'conceptual artefacts' (e.g., methods, constructs, algorithms) and, optionally, their instantiations serving as means for evaluation (Goldkuhl and Sjöström, 2018). This type of design science research often derives a class of problems from the prior knowledge base and does not require researchers to collaborate with client organisations and solve case-specific problems. The alternative is a *practice approach* that requires design science researchers to engage with specific problems of organisations and collaborate with practitioners in the real-life setting to derive a generalised solution for a class of problems (ibid.). The

laboratory approach dominates in the design science community, as Iivari (2015) claims, as it is perceived to be a more rigorous approach, results of which are easier to verify and replicate. Nevertheless, design science artefacts synthesised in the laboratory setting might be remote from practice and not consider the practical setting, which includes additional complexities (ibid.). A practice approach resonates with the reflective-in-action theory developed by Donald Schön (1983), in which he argues that design practitioners reflect on problems at hand and possible solutions simultaneously with action and not disengage from the real-life setting.

Our focus is on understanding the domain of OSU and developing a design method that can be used given the characteristics of the domain, i.e., self-organised, decentralised, small-scale, and evolving nature. Therefore, this research follows a practice approach, as it allows to engage with a real-world setting of an urban commons. We seek to solve the following class of problems: the lack of IT-based solutions for co-creating open source design manuals for Do-It-Yourself (DIY) urban designs in the urban commons. For the practice approach, we adopt Action Design Research (ADR) approach, which implies fieldwork. This dissertation applies ethnography for fieldwork that allows the researcher to gain an in-depth knowledge of case-specific problems through immersion in the everyday life of an urban commons community. Since the literature on co-design with urban commons communities is lacking, ethnographic methods enable the researcher to collect data that will serve as input for the further design stages.

2.2.3 Action Design Research

There are shortcomings in DSR methodology in the context of our study due to the focus of the laboratory setting. First, this dissertation focuses on building a design method for IIs in the urban commons (i.e. OSU infrastructures). There is a lack of literature on creating OSU infrastructures, and their characteristics are distinct from other IIs, which results in the inability to use existing work directly. Moreover, we need to investigate the phenomena of OSU in its social context, i.e., an urban commons community. Due to these reasons, the wide-accepted 'laboratory approach' (Iivari, 2015) of DSR is not applicable to this study. The laboratory approach refers to synthesising prescriptive knowledge in controlled laboratory conditions and then evaluated, for instance, with prototyping. Moreover, the laboratory approach fails to reflect changes in the social world caused by the

introduction of an artefact due to the limited evaluation stage, which is carried out only in the final step of the design research cycle (Hevner et al., 2004). Finally, the laboratory approach in design science does not recognise the necessity of artefact emergence in interaction with 'organisational elements' (i.e., users and environment) (Peffers et al., 2007).

The common way to overcome these limitations is to combine design science with action research, a combination of "generation of theory with changing the social system through the researcher acting on or in the social system." (Susman and Evered, 1978, p. 586). Action research features two concepts, namely co-creation of researchers and practitioners and intervention cycles (Baskerville, 1999; Mullarkey and Hevner, 2019). Sein et al. (2011) elaborate *Action Design Research* (ADR) methodology synthesising design science research and action research. This approach implies a collaboration of the researchers with practitioners *in situ* that aim at solving a real-life problem of the chosen organisation while generating design knowledge for a class of problems. ADR process model provides explicit guidelines for a research process that combines the rigour of DSR methodology and the intervention-based nature of action research. Figure 2.1 depicts stages of the ADR process model along with seven principles of ADR (see the description of principles in section 2.3.2, Table 2.1).

The model includes four stages: (1) Problem formulation; (2) Building, Intervention, and Evaluation; (3) Reflection and learning; and (4) Formalisation of learning (Sein et al., 2011, p. 41). In the first stage, researchers formulate a practice-inspired problem. The problem can come from prior research or practitioners, however, the resulting artefacts should be based on theoretical grounding. In the second stage, researchers use inputs from the first stage to shape the initial design of the artefact that will be refined in the real-life setting in which the IT artefact and its environment influence and shape each other during BIE-cycles. Unlike the laboratory approach, researchers should not be distant from the process and accept mutual learning with other project participants. Finally, evaluation should not be separated from building and intervention since ADR artefacts emerge as an interplay between the planned design and the social context; hence, both planned and unplanned organisational changes should be evaluated. The third stage, reflection and learning, is ongoing and occurs in parallel with the previous stages, in which the researcher ensures that design knowledge gained during BIE cycles is applicable to solving a general problem and not

Figure 2.1: Action Design Research process (adapted from Sein et al., 2011)
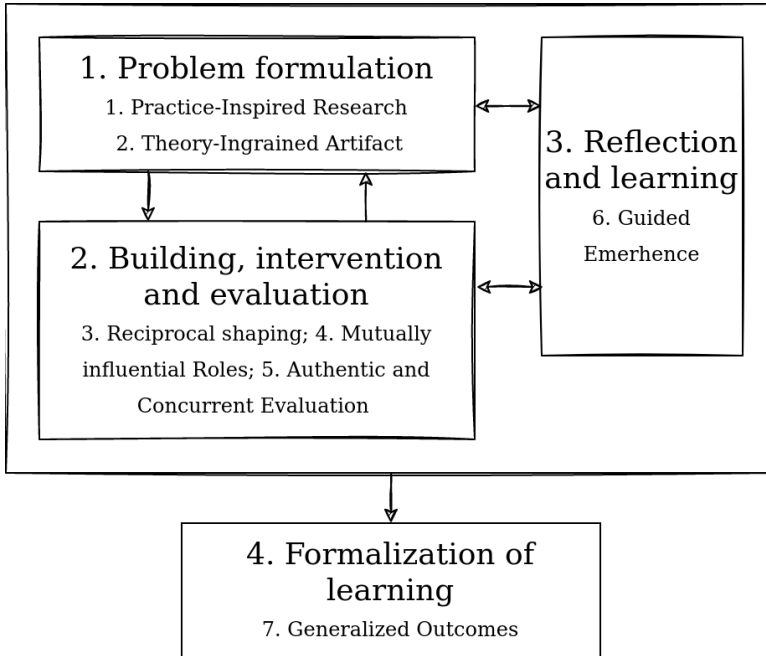
the only case-specific issue. Finally, the learning stage - formalisation - is dedicated to developing conceptual artefacts (e.g., design principles, methods), i.e. generalised solutions for the class of problems.

2.3 Combining action design research and ethnography

The ADR process model of Sein et al. (2011), discussed in the previous section, supports design knowledge generation in a real-life setting, however, it provides no specific methods of fieldwork. Hence, we adopt ethnography as a toolset for fieldwork. Combining these allows acquiring in-depth knowledge in the field and generating design knowledge while solving a particular situation.

2.3.1 Ethnography

As a tool for fieldwork, we adopt ethnography, that is "an anthropological research method that relies on first-hand observations made by a researcher

immersed over an extended period of time in a culture, with which he/she is unfamiliar" (Schultze, 2000, p. 7). Ethnography is 'one of the most in-depth research methods possible' because it gives the researcher tools to observe interactions and practices of people directly, not relying only on self-reports of their actions (Baskerville and Myers, 2015, p. 40) which is typical for other quantitative methods, such as case studies. Investigating the phenomena in its social context (Avison and Myers, 1995), the ethnographer 'becomes a student of other people's culture' (Myers, 1999, p. 114). Ethnography is "well suited to providing information systems researchers with rich insights into the human, social and organizational aspects of information systems development and application" (Harvey and Myers, 1995, p. 22).

Ethnography suits the objectives of this dissertation well, as we aim at co-creating a technology-based artefact with an urban commons community that holds values and performs practices we are not yet familiar with. In fact, immersion in the life of an urban commons is required to achieve the objective of this study, while other methods cannot provide in-depth knowledge of the community life of an urban commons. As was discussed in the introduction, the urban commons differ from the organisational settings covered in the IS field. We found no prior literature on this subject, thus, we have to immerse ourselves in community life and investigate it in depth prior to moving to design activities.

The main criticism of ethnography is that the immersion in everyday life of a community and identification with its members hardly leave the researcher space for neutrality. We stay in the position that completely eradicating the researcher's bias from ethnography is impossible. Nevertheless, we took precautions to mitigate the researcher's bias as follows. Firstly, we used various sources of information, such as various community members and documents produced inside and outside the community. We were open to criticism from our colleagues. Moreover, the community leaders were familiar with the practical objective (i.e., to construct a prototype of an OSU infrastructure); nevertheless, they were not interested in the research objective – a design method – and the process of synthesis of the method was on the researcher's side. A most important step to mitigate the researcher's bias is the following: after the ethnography and design interventions were complete, we discontinued our engagement in community life. We stopped personal relations with community members

since social interactions bring emotions that might lead to cognitive bias. Analysis, reflection and the final synthesis of the design method were conducted 'at the office'.

Another criticism addresses the theory generation from a single-case ethnography. However, in recent decades, theories generalised from a single case study have become a norm (e.g., (Yin, 1994; Walsham, 1995; Flyvbjerg, 2006)). We chose the in-depth investigation of a single case because these, as Yin (1994, p. 27) describes: "unusually revelatory, extreme exemplars, or opportunities for unusual research access". Our design method, grounded in the data from a single idiosyncratic case, fills the gap in the literature and can be perceived as a departure point for further research. Although multiple cases probably would produce a more robust theory, finding several innovative urban commons was unfeasible, taking the constraints of a PhD research.

In the traditional model of ethnography, as Myers (1999) claims, participant observation is the fundamental research tool, i.e., the ethnographer only observes but does not intervene in the community life. In contrast, Pors et al. (2002) claims that 'ethnographically inspired research inevitably intervenes in the fields studied' (p. 5) since it opens possibilities 'for interacting and engaging with [it]' (ibid, p. 4). Even if traditional ethnography gives opportunities for engaging with the field, it provides no tools to do so. Applying action design research as a research approach, we cannot bind ourselves to the position of a passive observer. (Baskerville and Myers, 2015) offers a way to integrate design science and ethnography in which the ethnographer "is no longer so tentative but rather actively engages with the people in the field" (p. 27). This concept, called *design ethnography*, fits our research approach well, as it enables an in-depth understanding of a chosen urban commons community while allowing us to intervene in it. Equipped with this approach, the researcher also becomes an adviser of the community they engaged with (Baskerville and Myers, 2015), and co-designers that conduct design interventions in the community situation.

In the design ethnography approach, suggested by Baskerville and Myers (2015), the ethnographic account of design experiences is the main contribution since it is 'a venue for learning about social and cultural practices and values' while the design artefact is a by-product of the study (Baskerville and Myers, 2015, p. 38). This approach presents observations of the design experiences of others, whereas this dissertation is looking

to understand the effects of our design interventions. Therefore, we focus on combining these two types of scientific contributions, however, we perceive a design method as the main contribution, while the conducted ethnographic studies are auxiliary to it.

2.3.2 Action Design Ethnography Research

We combine the ADR methodology with ethnography to acquire in-depth knowledge in the field and generate design knowledge. The resulting approach that we call Action Design Ethnography Research (ADER) enables us to conduct design science research combined with fieldwork *in situ*. This methodology is a contribution to design science that enables researchers to conduct Action Design Research within self-organized communities.

For the purpose of this research, we adopt the process model of Sein et al. (2011) (see figure 2.1), with several changes as follows. Firstly, we agree with (Mullarkey and Hevner, 2019) pointing out that three research activities, namely evaluation, reflection, and learning, occur at every stage of action design research. In our opinion, this research activity is singled out as a separate stage for better communication of the research methodology. In a real-life research process, this stage is a reoccurring activity that leads the researcher to produce new knowledge. Our view resonates with Donald Schon's (1983) view on design process: "inquiry, however it may initially have been conceived, turns into a frame experiment. What allows this to happen is that the inquirer is willing to step into a problematic situation, to impose a frame on it, to follow the implications of the discipline thus established, and yet to remain open to the situation's back-talk. Reflecting on the surprising consequences of his efforts to shape the situation in conformity with his initially chosen frame the inquirer frames new questions and new ends in view." (Schön, 1983, p. 269). Additionally, we prefer to use the term *Co-design ethnography* instead of the cumbersome name Building-Intervention-Evaluation suggested by Sein et al. (2011). Finally, we call the third stage *Design method synthesis*, stressing the main objective of this research. The resulting ADER process lists three phases, namely 1) Problem formulation, 2) Co-design ethnography, and 3) Design method synthesis. Figure 2.2 depicts these three phases. The phases are corroborated by seven principles of ADR that serve the role of guidelines for the research process elaborated by Sein et al. (2011) (Table 2.1). Next, we discuss the design phases of our research in relation to the principles of

ADR.

Figure 2.2: Action Design Ethnography Research process
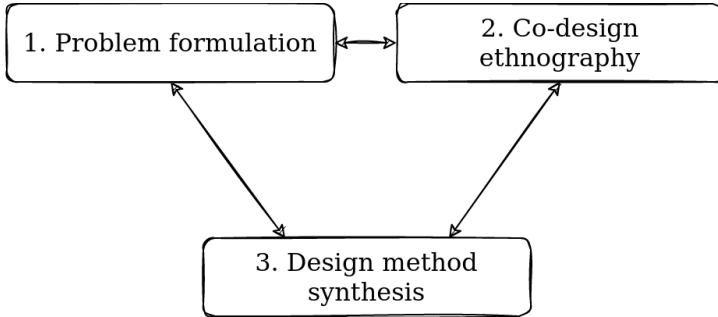
Table 2.1: Principles of action design research (source: Sein et al., 2011, pp. 40-44)

Principle	Description	Phase
1. Practice-Inspired Research	field problems as knowledge-creation opportunities	Problem formulation
2. Theory-Ingrained Artifact	the ensemble artefacts created and evaluated via ADR are informed by theories	
3. Reciprocal Shaping	the inseparable influences mutually exerted by an IT artefact and its context	Co-design ethnography
4. Mutually Influential Roles	mutual learning among the different project participants is crucial	
5. Authentic and Concurrent Evaluation	evaluation is not a separate stage of the research process that follows building	
6. Guided Emergence	the ensemble artefact will reflect ongoing shaping by organizational use, perspectives, and participants	Design method synthesis
7. Generalized Outcomes	the ensemble artefact represents a solution that addresses a problem, and both can be generalized	

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In the first phase, *Problem Formulation*, we formulated a practice-inspired problem and rooted it in prior knowledge. We defined the initial scope and problem of this research. This phase adheres to two principles of ADR: this research is inspired by a practical problem, i.e., no design method guiding the cultivation of OSU infrastructures (the first principle); the resulting method is informed by theories, i.e., the literature review of the third and fourth chapters (the second principle). Apart from defining the scope of research and theoretical background, Sein et al. (2011) suggest two tasks to be conducted in the field, namely securing long-term organisational commitment; and setting up roles and responsibilities. Although desirable, none of this is feasible for the domain of urban commons since they lack command-and-control mechanisms, thus, the researcher has to adapt to the community (e.g., current objectives, ideas, experiments) and hope to secure collaboration during the next phase.

We call the second phase *Co-design ethnography* to simplify the cumbersome name 'Building-Intervention-Evaluation' given by Sein et al. (2011). Nevertheless, building, interventions, and evaluation do indeed happen at this phase. Firstly, we conducted an ethnographic study that secures the long-term commitment of practitioners and prepares the context for further design interventions (Baskerville and Myers, 2015). Next, we conducted four design interventions focused on cultivating an OSU infrastructure with the urban commons community using reference theories as an analytical framework. This step adheres to the third principle of ADR, i.e., the emerging infrastructure and the urban commons are mutually influential. Equipped with this approach, the researcher also became an adviser of the community they engaged with while learning from community members. This dynamic corresponds with the fourth principle of ADR, i.e., mutually influential roles of the ethnographer and practitioners. In the real-life setting, the artefact and its environment influence and shape each other during the design intervention cycles. As well as the artefact shape and change each other, the researcher and practitioners are in the process of mutual learning. In the case of this research, the researcher learned the day-to-day experiences of urban commons community members, while practitioners learned the 'theoretical base' of their practical activities, such as the term 'the commons'. In these cycles, evaluation is inseparable from building and intervention. This principle imposes a challenge for researchers, as a controlled evaluation is hardly achievable 'in the field', thus, authenticity

is declared more important than a controlled setting (the fifth principle of ADR). In our case, evaluation occurred while parts of OSU were co-created.

The third phase, *Design method synthesis*, is dedicated to elaborating a design synthesis based on theoretical and empirical findings from the previous phases. According to the seventh principle of ADR, gained knowledge should lead to generalised outcomes that solve a class of problems. In the case of this research, we derive generalised knowledge (i.e., a design method for OSU infrastructures) from ethnographic studies of one urban commons community which is challenging, nevertheless, possible as with single-case studies (Yin, 1994). Moreover, the interpretivism paradigm adopted in this research enables us to do so, as we do not perceive the social reality from the logical positivism position of probabilistic truth and do not claim the resulting design method as a 'truthful theory'. Finally, we synthesised a design method based on both theoretical and empirical findings of this dissertation. The resulting design method consists of five roles of community members and eight design principles guiding the cultivation of OSU infrastructures. The design method is supported by constructs, i.e., analytical categories that help understand the social reality of an urban commons.

2.4 Research methods and questions

The research process elaborated in the previous section provides guidelines for the research process, answering how to conduct action design research. While a research process is a cyclic process of trial and error, a research report should provide a clear and coherent outcome of that process. Table 2.2 summarises research stages with related questions, methods used to address them and corresponding chapters.

2.4.1 Literature review

The review of existing scientific knowledge provides a solid basis for identifying a research problem, shaping an interdisciplinary research domain, and selecting reference theories. For the literature review, we searched peer-reviewed research journals, conference proceedings, and books using search engines and online scientific databases, namely Google.Scholar, Scopus, Science Direct, and JSTOR.

Initially, we posed research question RQIa *"What is Open Source Urban-*

Table 2.2: Research questions, methods, and chapters

Research question	Method	Chapter
RQIa *"What is Open Source Urbanism?"*	Literature review	Chapter 3
RQIb *"What are reference theories for a design method for OSU infrastructures?"*		Chapter 4
RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*	Ethnography	Chapter 5
RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*	Design interventions	Chapter 6
RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*	Synthesis	Chapter 7

ism?". The literature on this topic is very limited. At the beginning of this research, we started the literature review with several works that gave the initial impetus for this research, namely Sassen (2011); Bradley (2015); Jiménez (2014). These papers discuss the notion of Open Source Urbanism; apart from these, we cannot find papers discussing this notion. In the mentioned papers, we identified key concepts related to OSU: the commons (particularly the urban commons and the digital commons), the right to the city, Commons-Based Peer Production, and Do-It-Yourself Urbanism. Then we used a snowballing technique back and forward, i.e., we scanned the collected sources identifying citations that might be related to our research, as well as checking papers citing the collected ones. This part of the literature review was an open search to construct a description of a novel interdisciplinary domain for OSU. We address this question in the third chapter by shaping an interdisciplinary research domain for this dissertation.

Moving further, we posed research question RQIb *"What are reference theories for a design method for OSU infrastructures?"*. We had no reference theories selected prior to entering the field. During the ethnographic study, we were looking for a theoretical grounding of participant observations in relation to the literature shaping the domain. During the fieldwork,

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we observed the urban commons community, and we looked for bodies of knowledge that meet the domain criteria and serve as an analytical framework for the analysis of the ethnography. Based on the insights from the domain chapter, we select several bodies of literature as reference theories (i.e., descriptive theories and concepts outside the IS discipline). We drew on several bodies of literature, combining the literature on IIs, Communities of Practice (CoP), and urban places. These three bodies of literature were used in two ways: firstly, as an analytical framework to analyse the ethnographic study in the fifth chapter, and secondly, for reference in the design method in the seventh chapter.

2.4.2 Ethnographic study

In the previous research phase, we shaped the research domain of this study and selected the reference theories. We aim at co-creating a socio-technical artefact (i.e., an OSU infrastructure) with an urban commons community that holds values and performs practices we are not yet familiar with. Particularly, we wanted to learn what elements (e.g., activities, IT tools, habits) can comprise the *fertile ground* for cultivating an OSU infrastructure (see the discussion on the fertile ground in section 5.3). The literature did not provide knowledge on this. Therefore, we conducted a field study of urban commons. We posed the second research question as follows: RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. To answer the question, we conducted an ethnographic study immersing ourselves in everyday life of an urban commons. For that, we developed selection criteria to identify a suitable community and choose methodological tools suitable for ethnographic fieldwork. We developed case selection criteria based on the Research domain literature. We list the criteria and justify the choice of the Amsterdam-based urban commons KasKantine in section 5.1.

Ethnography was conducted in the period from July 2018 to September 2019. At the field, we spent one to three days per week for three to six hours. We participated in work shifts, community meetings, as well as socialization activities. We used the following ethnographic methods: interviews, participant observations, and immersion (Salvador et al., 1999). These methods were the cornerstone, as they allowed us to immerse in everyday life of urban commons and observation the community practice as an observing participant. During community practice, we used such meth-

ods as impromptu dialogues (in academic language, these can be called "unstructured/semi-structured in-depth interviews"). It was fairly difficult to arrange 'formal; activities, such as interviews, due to the intensive workload of community members.

Although we recorded semi-structured interviews with the initiative's co-founders and several volunteers, insightful data often popped up during the community practice. Thus, we had to fit into the schedules, routines, and activities of others. This posed a challenge for data recording. Some people were strongly reluctant to be recorded with a voice recorder. Note-taking during community practice is literally impossible since hands had to be free for physical labour, for instance, doing dishes. The only way to overcome this was to write down the insights and the observations afterwards. Some could perceive this as a methodological shortcoming; however, we expect the depth of gained knowledge to compensate for this constraint.

We collected data in notebooks and digital tools, for instance, Google.Keep. We found taking digital notes on the phone app the most beneficial technique, as it allowed us to make small notes on the go during community activities. Additionally, it allowed a crude qualitative content analysis in situ. Figure 2.3 shows analogues and digital means for data collection. Apart from that, we studied archival records, such as internal design documents and blueprints, documents for communication with the municipality, social media, and group chats.

Although during this phase, we focused on the classical ethnographic methods, such as participant observation, we must make a caveat that we do not perceive this phase as pure ethnography. Although being a participating observer, the researcher clearly stated their aim in co-design prior to starting the fieldwork because the research ethics prescribes openness and transparency. That makes this ethnographic study what Baskerville and Myers (2015) calls 'ethnography for design' that establishes the context for a future co-design process. This phase means 'a change of life for the researcher and others in the context' (Kilbourn, 2013).

Concerning the evaluation of ethnographies, three criteria are commonly applied, namely (1) authenticity, (2) plausibility, and (3) criticality (Golden-Biddle and Locke, 1993). Authenticity requires the researcher to provide evidence of the immersion in the real-life setting and convince the reader. Usually, ethnographies provide such evidence in the form of 'thick descriptions' of the time spent by the researcher in the field. Plausibility

Figure 2.3: Notebooks and Google.Keep

means that the 'shared story', i.e., an ethnographic account, addresses a scientific problem and brings new knowledge to the field (Baskerville and Myers, 2015). Criticality "suggests that the purpose of ethnography is to understand ourselves and others in new and better ways" (Schultze, 2000, p. 31). We claim that we met these three criteria in the ethnography reported in the fifth chapter. With regard to the style and language of the ethno-

graphic report, we stick to the more formal description style of IS field. For instance, we omit the 'atmospheric' description of people's actions as well as the researcher's thoughts and emotions during the fieldwork. Likewise, we do not use personal pronounce, traditionally used in ethnographies, to keep this dissertation's stylistic consistency. The reason is that we perceive this ethnographic account not as a primary scientific contribution but as a tool for investigation, the results of which will be applied to fulfil the main research objective, i.e., developing a design method.
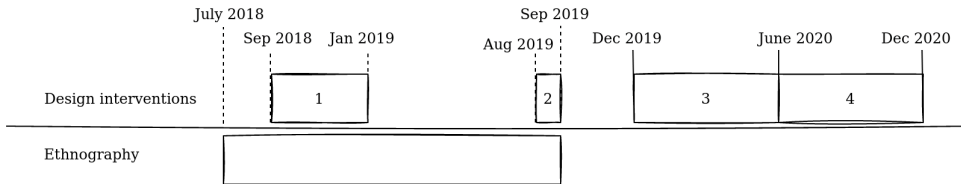
2.4.3 Design interventions

During the ethnography, we immersed ourselves in everyday life of the chosen urban commons community with the objective of identifying elements that would serve as the basis for the cultivation of an OSU infrastructure. Since the literature on OSU infrastructures is lacking, we conducted an empirical study investigating how an OSU infrastructure can be cultivated within an urban commons community. Since we co-designed IT-based artefacts with a community, we, in fact, conducted design interventions in the community. In IS research, design interventions are the researcher's activities within organisations that aim at solving their practical problems Mckay and Marshall (2001). During design interventions, the researcher is involved in real-world situations 'as both participant and researcher' (Checkland and Holwell, 1998) and conducts interventions in collaboration with practitioners (Avison et al., 2001). Design interventions lead to a socio-technical change in organisations engaged in design science research.

For this study, we apply the method called design ethnography (Baskerwille, 2015), in which the researcher is not a passive observer of the community practice but a co-designer of a socio-technical system. In the case of this research, we co-create an OSU infrastructure with the urban commons (the same initiative that is studied during the ethnography). This study answers the third research question: RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*. Figure 2.4 shows a timeline of empirical studies, i.e., the ethnography and four design interventions (rounded rectangles). The design interventions are described in detail in section 6.1, Table 6.1.

To explain the logic behind design interventions, we depart from revisiting the definition of IIs adopted for this research: **"IIs are shared**

Figure 2.4: Timeline of Design interventions and ethnography

resources for communities of practice; they facilitate information-
oriented services; they have no clear scope or purpose; they consist
of a heterogeneous and ever-changing set of technological and so-
cial components.” . We adopted this perspective on the IIs because it
clearly delineates IIs from traditional IS: the former has no specific pur-
pose but rather a generic idea of supporting the community of practice
with information-related services, while the latter, such as decision support
systems or accounting systems, clearly state their purpose and supported
tasks (Hanseth and Lyytinen, 2004). Thus, prior to design interventions, we
stated an idea (or an initial goal) for an OSU infrastructure to be cultivated
with KasKantine: co-creation and proliferation of DIY design knowl-
edge guiding the construction of an off-grid citizen initiative. The
second prerequisite for design interventions is *openness* of infrastructures.
In order to evolve and grow, infrastructures must be open, i.e., have no pre-
defined limit of elements, users, functions, and scope. Additionally, they
open in the temporal sense, i.e., with no set-in-stone deadlines, after which
they stop evolving (Karasti and Baker, 2008). Having these two factors in
mind, we designed an approach for design interventions.

The logic behind interventions is an infrastructure cultivation strategy.
Grisot et al. (2014) suggests that a cultivation strategy consists of three as-
pects: process-orientation, user mobilisation, and learning. *Process-
orientation* means that we engaged with practices and technologies that ex-
isted in the KasKantine CoP in an incremental, step-by-step manner. We
achieved that by conducting four design interventions. *User mobilisation*
entails that we found ways to motivate CoP members to use and co-design
ENA infrastructure. Ethnography helped engage in community life to un-
derstand the motivations of CoP members. *Learning* implies a reflection on
design interventions, considering whether they meet user demands or not.
In our cultivation approach, we reflected on each conducted intervention
applying learned lessons to the following interventions. The resulting OSU

infrastructure was called "Experimental Networked Autonomy" (ENA).

Considering evaluation of design interventions, Baskerville and Myers (2015) suggests six criteria for design ethnography that combine criteria of ethnographic research, namely 1) Plausibility, 2) Criticality, and 3) research rigour (discussed in the previous section), with three criteria of design science, that are 4) Shared experience in design, 5) Theoretical contribution, 6) Insight into design culture. The six chapter reports on design interventions with an urban commons community (criteria 4 and 6); insights gained during design interventions were used as input for synthesising a design method (criteria 5). To conclude, the design interventions study adheres to the evaluation criteria of design ethnography,

2.4.4 Design method synthesis

In the Action Design Research process model, researchers synthesise generalised prescriptive knowledge "from (a) the real system implementation as a specific solution to the client's problem and/or (b) the process of developing that specific solution" (Iivari, 2015, p. 111). In the case of this research, we derive generalised knowledge (i.e., a design method for cultivating OSU infrastructures) from developing an OSU infrastructure for a real-life case of the urban commons. For this purpose, we conducted the ethnography and design interventions during the previous design phase (i.e., Co-design ethnography). We used lessons learned from the co-design as input for synthesising the design method. We posed the following research question: RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*. To answer this question, we synthesised a design method for cultivating OSU infrastructures from empirical data and reference theories. A design method "consists of activities, possibly in some order, that are performed by people in order to support the system development. Methods often define results/deliverables of activities and roles." (Offermann et al., 2010, p. 84). OSU design method is focused on the process of cultivating an OSU infrastructure. Infrastructure cultivation is an organic, slow, unpredictable, and poorly controllable process. These characteristics of IIs cultivation should be embraced in advance. A set of design principles is suggested as the core of our method since principles do not prescribe specific design features but heuristics that give directions. Another aspect of this process is that it required roles, i.e., members of an urban commons CoP with relevant skills and knowledge to

perform specific functions. Finally, our method includes Constructs, i.e., concepts with definitions and specific characteristics required to give instructions for those applying the method.

Design principles. In section 2.2.1, we discussed the notion of design principles and defined them as follows: *"generic prescriptions and guidelines that are intended to be manifested or encapsulated in the design and implementation of socio-technical systems"*. We derived the principles on the basis of ethnography and design interventions.

Constructs. Constructs are defined as "representations of the entities of interest in the theory" (Gregor and Jones, 2007, p. 322). Constructs are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures. However, they should not necessarily be used in practice while cultivating an OSU infrastructure. Constructs serve as an analytical category that helps to analyse the rich social reality and delineate interwoven entities and processes. Practitioners applying the offered design method need to adopt the terms of the specific community they work with to enable an understanding of the constructs. Constructs are derived from the literature review and empirical studies.

Roles. A role can be defined as "a set of prescriptions defining what the behavior of a position member should be" (Biddle and Thomas, 1966). Roles are required for the design method because the urban commons differ from the command and control mechanisms, thus, with no tools for rigid task allocation and coercion, CoP should have alternative tools for collaboration. During the fieldwork, we noticed patterns related to CoP members' interests, knowledge and skills that can be framed as roles. As an OSU infrastructure is a socio-technical system that heavily relies on the social component, we adopt a broader conceptualisation of roles from the sociological perspective. In sociology, roles are often referred to as a set of certain activities performed by people in the course of social interactions (Goffman and Others, 1959). Roles gradually emerge by "repetition of social interaction patterns of expectations." (Jahnke et al., 2005, p. 82). For the OSU design method, we define a role as **a set of activities and responsibilities expected from a community member by their peers**. A combination of roles by one person is possible, i.e., a person can simultaneously execute several roles (Merton and Merton, 1968). The roles are derived from the participant observations during the ethnographic fieldwork.

2.5 Overview

This chapter discussed the research approach of this study. Firstly, we justified the choice of interpretivism as a research philosophy for this dissertation. Moving further, we introduced the Design Science Research along with its shortcomings concerning the domain of urban commons and OSU. To overcome them, we combined an Action Design Research methodology with ethnographic fieldwork methods. The resulting Action Design Ethnography Research (ADER) enabled us to conduct ethnography and design interventions within an urban commons community to gain insights for synthesising a design method for OSU. Finally, we listed the research questions of this study as well as the research methods adopted to address them. The following chapter constructs an interdisciplinary domain for this dissertation by combining notions from various research fields, namely Information Systems, Urban Studies, Urban sociology, and organisation studies.

3

Interdisciplinary research domain

Technology is society made durable.

- Bruno Latour, *1991*

"The time has come," the walrus said, "to talk of many things:
Of shoes and ships - and sealing wax - of cabbages and kings"

- Lewis Carroll, *Alice in Wonderland*

In the previous chapter, we presented our research approach, which is based on insights from various disciplines. This interdisciplinary study develops a design method for cultivating Open Source Urbanism (OSU) infrastructures by applying a design science approach from Information Systems (IS) field; however, the phenomena that are the focus of this dissertation are different from those often covered in IS. IS design theories adopt reference theories from such research fields as organisation studies, management, and economy, to name a few, and target practitioners from firms or public organisations. Citizen initiatives in which citizens are the designers are not the focus of IS design theories. We dedicate this chapter to building the foundations of our interdisciplinary research. We conceptualise the key phenomena constituting OSU. The chapter lays down definitions and identifies starting point for the design. Considering our research approach, this chapter is part of the first design phase, Problem formulation, and addresses research question RQIa *"What is Open Source Urbanism?"*.

We exemplify OSU with a real-life case of self-organised urban intervention that started as a Do-It-Yourself (DIY) art intervention and transformed

into a tool adopted by activists and urban authorities worldwide. That was achieved with the help of a set of design instructions made publicly available for any activist to reproduce in their local urban environment. Based on the prior academic literature, we analyse the case to show how self-organised interventions that adopt open source ethos can be perceived as OSU infrastructures. In each section, we discuss part of this case related to the subject of the section, mapping it to the definition of OSU. The real-life case was chosen to explain the complex phenomenon of OSU in the context and pinpoint its key aspects; otherwise, the discussion might seem too abstract.

The chapter is organised as follows. The first section introduces the notion of Open Source Urbanism (OSU); three aspects characterise OSU: (1) OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment; (2) OSU initiatives produce *the new commons*, urban places and digital artefacts, that are collectively created and managed by self-organised citizens; (3) to last, DIY alterations of the urban environment should be accepted by or *co-produced* with the authorities. The following sections examine these three aspects in detail. The second section examines the phenomenon of *citizen self-organisation*, particularly, Do-It-Yourself urban design interventions, discussing its opportunities and challenges. The third section discusses the co-creation of urban authorities with citizens. The fourth section defines *the commons*, and, specifically, *the urban commons* that are a form of citizen self-organisation and digital commons that are a form of self-organisation on the internet. OSU infrastructures operate across these two types of the commons. The fifth section summarises the chapter.

3.1 Open Source Urbanism (OSU)

This section investigates the core concept of this research, namely Open Source Urbanism (OSU). The notion was initially coined by Saskia Sassen (2011). In her opinion text, she argues that cities are always incomplete and imperfect, making cities open to change. This openness gives cities robustness and longevity. Infinite small-scale bottom-up interventions of various urban actors provide incompleteness to cities, unlike many top-down urban planning interventions that give citizens no room for participation and exercise of active citizenship. She claims that the Open Source movement can help strengthen grassroots initiatives, as both are based on peer-to-

peer relations and an individual initiative (Sassen, 2011). This opinion text provides no academic theorisation of Open Source Urbanism. Although academic literature on the notion is scarce, several scholars theorise it further.

OSU occurs when citizens self-organise to tackle the issues of their urban environment by creating Do-It-Yourself (DIY) designs. In urban studies literature, DIY urban designs are defined as small-scale, civic-minded design contributions that are designed and constructed by citizens (Douglas, 2014) and "represent a simple willingness to contribute perceived improvements to the local built environment on one's own terms, without permission, yet essentially in the spirit of official improvements." (Douglas, 2016, p. 118). Importantly, DIY prototypes emerge as a natural response of citizens to perceived problems of their urban environment; they are designed, paid for, and implemented by self-organised citizens and not by public or private companies (Finn, 2014). For the purpose of this research, we relax this definition by omitting one specific aspect of it, namely 'unauthorised alteration' because unauthorised DIY urban designs have two potential development trajectories: demolition or legalisation. Since this research focuses on OSU infrastructures (prolonged in time and multi-actor), we argue that dialogue with urban authorities is required to sustain it. Thus, the main aspects of DIY urban designs are (1) civic-minded ethos, (2) self-organisation (3) amateurism.

As Jiménez (2014) puts it: "In the name of [...] 'open source urbanism', citizens are wiring the landscape of their communities with the devices, networks, or architectures that they deem worthy of local attention or concern. From community urban gardens to alternative-energy microstations or Wi-Fi networks, open source hardware projects wireframe the city with new sociotechnical relations." (p. 342). The important difference between these DIY artefacts from official urban infrastructures lies in their permanent status of a *prototype* (Jiménez, 2014). Even if an object is completed and requires no further design improvements, it stays in the status of prototype being not a standardised product but an ad-hoc solution tailored for the specific local environment. Prototypes can indeed evolve into finished products for mass production, however, this is out of the scope of this research. Urban designs created by professionals are thoroughly tested, standardised, and comply with all possible federal and municipal regulations. In contrast, prototypes are incomplete, as they embody the ongoing experimentation

of citizens with their urban environments. They developed *in situ* (i.e., in specific urban contexts) and *ad hoc* (i.e., hand-crafted to tackle not a class of problems but particular problems of their designers and local communities). Like other 'branches' of the open source movement, such as software and hardware, urban prototypes are in permanent 'beta' version; they are 'pre-broken', i.e., open for reinterpretations and reassembling (Jiménez, 2014). To sum up, we define *urban prototypes* as follows: **DIY and incomplete experimental objects that emerge as a response to pressing urban issues**. We conclude that the first core aspect of OSU is its **bottom-up, DIY nature**.

Active citizens share DIY design knowledge gained during the construction of urban prototypes by means of *design manuals*. A design manual is **a written set of rules to follow to create an artefact for achieving a specific goal**. Design manuals can be of different levels of detalisation: some of them provide detailed instructions on how to do the job at hand, and any decisions taken while doing so will be in accordance with the rules in the manual. For instance, design manuals for engineering or construction dedicated to professionals contain precise design guidelines since the products must adhere to standards and regulations in that professional domain. In the context of OSU, a design manual is **a description of an urban prototype priorly created by self-organised citizens that provides the problem of the local urban environment perceived by citizens, along with a possible solution embodied in the presented urban prototype**. We highlight that the level of detalisation of a design process to replicate the prototype can be low since most urban prototypes are created for a specific local environment to solve a problem at hand, thus, they are not designed to be generalisable. The notion of open source refers to information that is freely accessible and modifiable (Benkler, 2002), which is provided by a family of open source licenses (Hansen and Howard, 2013). Thus, open source design manuals are shared on the internet to make it possible for others to use and alternate them to produce context-specific versions of urban prototypes.

In line with Sassen's argument, Bradley (2015) argues that OSU unites bottom-up citizen interventions and the open source movement; she defines OSU as open source production of urban commons. Urban commons, as well as the open source movement, are subsets of so-called 'the new commons' that are self-organised initiatives of communal management of

resources varying from urban land to information on the Internet (Baibarac and Petrescu, 2017). The urban commons focus on the collective management of resources in the urban context (e.g., community gardens, housing cooperatives), while open source communities create digital commons (e.g., open source software, Wikipedia). These two types of commons are parts of Commons-based Peer Production (CBPP) Bradley (2015). CBPP is "a process by which many individuals, whose actions are coordinated neither by managers nor by price signals in the market, contribute to a joint effort that effectively produces a unit of information or culture" (Benkler, 2003, p. 1254). In the same vein, Jiménez (2014) argues that OSU projects operate as decentralised peer-to-peer networks in which distinctions between producers and consumers of resources are blurred. Such networks create physical entities, i.e., urban prototypes and open source manuals and blueprints covering the design process of creating prototypes. Thus, the second crucial aspect of OSU is **the new commons**, i.e., in OSU infrastructures, resources are created and consumed in peer-to-peer networks that unite urban and digital commons.

3

OSU practices emerge as a grassroots response to top-down urban development, as citizen initiatives aim at solving pressing issues of local urban environments, otherwise not solved by the public or private sector (Bradley, 2015). OSU infrastructures challenge the *status quo* of top-down urban design practice as they populate urban environments with new entities, material and digital, that are created and maintained by citizens. Claims of communities for self-governance over such artefacts disrupt the traditional paradigm of governmental control and maintenance over the urban equipment (Jiménez, 2014). Thus, OSU practices aim for *urban transformation*, that is **"a process where the dominant structures, functions and identity of urban systems change fundamentally e leading to new cultural, structural and institutional configurations"** (Radywyl and Bigg, 2013, p. 160). Nevertheless, OSU communities cannot simply claim self-governance over their designs. To achieve that, DIY prototypes must be authorised, i.e., some mechanisms of collaboration with urban authorities should be in place (Petrescu et al., 2016). In public administration literature, this is known under the notion of co-production (Osborne et al., 2016). Hence, the third aspect of OSU is that urban prototypes should be **co-produced** with urban authorities.

To conclude, our analysis identifies three aspects of OSU:

1. OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment

2. OSU initiatives produce *the new commons*, urban places and digital artefacts that are collectively created and managed by self-organised citizens

3. to last, DIY alterations of the urban environment should be accepted by or *co-produced* with the authorities

Summarising the discussion above, and based on papers of Bradley (2015); Jiménez (2014), we define OSU as **citizen-driven commons-based co-production of open source urban prototypes that aim at urban transformation**. OSU is citizen-driven in the sense that citizens initiate, co-design, and implement such projects, although not necessarily all of these actions are performed by the same citizens: one group can express a demand for a DIY solution expressed in an urban prototype, while others co-design and implement it.

The following sections scrutinise three aspects main aspects of OSU. Authors do not position their academic articles, discussed in the following sections, as related to OSU, nevertheless, it covers parts of this complex phenomenon. In the following sections, we exemplify OSU with a real-life case of self-organised urban intervention that started as one DIY art intervention but, due to open source design manuals, transformed into a tool adopted by both activists and urban authorities around the world. The case was chosen as it is well-known in the academic literature on citizen self-organisation. It is important to mention that Bradley (2015) was the first to use it as an example of OSU. We analyse the case to show how self-organised interventions that adopt open source ethos can be perceived as OSU projects. In each section, we discuss part of this case related to the subject of the section, mapping it to the definition of OSU. The real-life case was chosen to explain the complex phenomenon of OSU in the context and pinpoint its key aspects; otherwise, the discussion might seem too abstract.

3.2 Citizens' right to the city and Do-It-Yourself urbanism

The notion of OSU is one of many ways for self-organised citizens to exercise their *right to the city* by creating DIY urban prototypes and open source design manuals for the former. This section investigates this aspect of OSU in greater detail, starting from the notion of the right to the city, defining citizen self-organisation, and discussing the opportunities and challenges of DIY urban design interventions. DIY urbanism is a struggle with an anachronistic planning system and is related to the right to the city, i.e., the right of citizens to be involved in changing their habitat (Douglas, 2016). Exercising this right requires citizen self-organization(Harvey, 2008). In the context of OSU, self-organised citizens exercise their right to the city by creating DIY urban designs and populating the local urban environments with them (Jiménez, 2014). In this section, we define the concepts mentioned to use as lenses for the ethnographic chapters and as constructs to describe a design method for OSU.

3.2.1 The right to the city

The notion of *the right to the city* was initially elaborated by Henry Lefebvre (1992) on the wave of the political uprisings in the late 60s in Paris and later turned into a slogan used to associate diverse movements demanding the resolution of current urban issues, such as affordable housing, education, transportation, and health. In the 80s, heated by neoliberalization, this demand was popularised worldwide, and its former political content was blurred to accommodate various ideologies, policy proposals, and demands of new urban movements in diverse contexts across the world (Purcell, 2002). Under this slogan, modern movements often demand a more equitable, democratic and environmentally sane form of urbanisation than is currently enforced by neoliberal capitalism (Brenner and Schmid, 2015).

David Harvey, the most prominent theorist of the notion, describes the right to the city as follows: "It is far more than the individual liberty to access urban resources: it is a right to change ourselves by changing the city. It is, moreover, a common rather than an individual right since this transformation inevitably depends upon the exercise of a collective power to reshape urbanisation processes. The freedom to make and remake our cities and ourselves is […] one of the most precious yet most neglected of

our human rights" (Harvey, 2008, p. 23). In other words, the right to the city implies the self-organisation of citizens that aim to improve their cities in a bottom-up manner. We define the right to the city as **the right of citizens to shape their urban environments by means of self-organisation**. We perceive OSU as a way to exercise the right to the city. To synthesise a design method for OSU, we should understand the practices of citizen self-organisation and bottom-up urban design.

3.2.2 Citizen self-organisation

In the Netherlands, the government has attempted to involve citizens in urban development since the 1960s. The recent attempt is the notion of active citizenship (Tonkes, 2006). The arguments for active citizenship are the following: first, it will increase social coherence of a fragmented and atomised society; moreover, active citizens improve the quality of local urban environments; finally, it could save public budgets, as some public services would be provided with the help of active citizens (Boonstra and Boelens, 2011). Despite the widely accepted discourse of citizen participation, current urban design practices are regularly ineffective in addressing underlying social issues in collaboration with local communities (Gunder, 2011), which is frequently caused by a 'risk-averse, conservative administrative culture' which does not perceive self-organised citizens as reliable partners (Voorberg et al., 2015, p. 1342). Besides, urban authorities are concerned about blurring boundaries between professionals and volunteers which impedes the accountability of the former (Kleinhans, 2017). This forces citizens to self-organise to change urban environments and 'fix' issues (in the perception of citizens) without professional support and, sometimes, even authority permissions (Douglas, 2014).

Boonstra and Boelens (2011) define *citizen self-organisation* as follows: "Initiatives that originate in civil society from autonomous community-based networks of citizens, who are part of the urban system but independent of government procedures" (p. 113). From this definition, we can learn that citizens build communities and act in a bottom-up manner. This definition does not shed light on the means and ends of self-organisation, i.e., why they self-organise and how they achieve their goals. For that, we adopt a more nuanced definition of citizen self-organisation of Denters (2012) as follows: **"an activity initiated by citizens as a group, where this activity is aimed at common interest and where citizens themselves decide**

**both about the aims and means of their project and actively partic-
ipate in the implementation of their project"** (p. 233). This definition
will serve as one of the selection criteria for a real-life case of self-organised
citizen initiative for the empirical part of this dissertation.

3.2.3 Do-It-Yourself Urbanism

Moving forward from the general definition of self-organisation, we dis-
cuss one particular subset of it, namely Do-It-Yourself (DIY) urbanism. Ur-
ban scholars coin this umbrella term to capture the phenomenon of self-
organised citizens experimenting with urban design, temporary usage of
spaces, small-scale art, and other interventions (Spataro, 2015). The term
DIY is used to capture its 'bottom-up and often ad hoc nature' (Pagano, 2013,
335). DIY interventions are "small-scale and creative, unauthorised yet in-
tentionally functional and civic-minded 'contributions' or 'improvements'
to urban spaces in forms inspired by official infrastructure" (Douglas, 2014,
p. 6). Some literature describes such interventions as a struggle with an
anachronistic planning system and relates DIY urbanism to the right to the
city, i.e., the right of citizens to be involved in changing their habitat (Dou-
glas, 2016; Finn, 2014; Iveson, 2013).

Due to their DIY nature, these urban prototypes are often low-cost, ele-
gant, and innovative solutions to pressing urban issues (Finn, 2014). Note-
worthy, DIY urbanism activists frequently use the same tools, theories, and
guidelines as urban professionals blurring the line between formal and in-
formal in urban design (Douglas, 2014). We refrain from claims that infor-
mal alteration of urban environments could serve as a new approach for
self-organised urban development. In fact, activists seldom focus on under-
standing the broader impact and long-term effects of their DIY alterations
due to 'the rebellious nature' of the interventions (Finn, 2014). Neverthe-
less, the considerable flow of ideas, theories, and techniques elaborated by
DIY initiatives are already being adopted by urban practitioners (see the
OSU example in section 3.4.4).

3

OSU example: part one

One of the most prominent examples of DIY urban design is a *parklet*, a temporary DIY public space created on a street parking lot. The first parklet was installed in 2005 by a collective of artists called Rebar in San Francisco. *De facto* parking lots are dedicated for parking vehicles, but *de jure*, according to municipal regulations, one can temporarily use that space with no constraints. Taking that into consideration, the artists transformed a street parking lot into a temporary public space consisting of a lawn, a bench, and a potted tree (depicted in Figure 3.1) (Pagano, 2013; Wortham-Galvin, 2013). The intervention was an art protest against the car-oriented city that is inconvenient for pedestrians and lacks green public spaces. The protest lasted only 2 hours, nevertheless, uploaded footage instantly became very popular on the internet. Dozens of enthusiastic followers quickly spread the idea and, eventually, transformed it into the global movement Park(ing) day: an annual worldwide event during which activists temporarily turn parking lots into public spaces (Pagano, 2013; Wortham-Galvin, 2013). These interventions draw the attention of public authorities and citizens to the lack of greenery, public spaces, and urban furniture in cities (Littke, 2016). This part of the practical example demonstrates the first characteristics of OSU: OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment.

To conclude, DIY urban design interventions often start as small-scale and illegal alterations of urban environments, have the potential to start the dialogue between citizens and urban professionals and can lead to urban transformation. Based on the discussion of this section, we state **the first starting point for design**: "a design method must acknowledge the non-professional nature of DIY interventions and laymen people as designers of OSU infrastructures".

Figure 3.1: The original art intervention of Rebar (source: (Davidson, 2013))

3.3 The commons

The term *the commons* originated from the medieval England legal term common land (de Moor, 2015). The roots of European commons can be traced back to the Middle Ages when Europe underwent 'the institualisation of collective action'. Instead of the traditional way of dealing with problems, i.e., in families or clans, people with similar occupations started making alliances, such as rural agricultural communities and guilds and fraternities in cities (de Moor, 2015). In the middle of the 18th century, as the challenge to provide for a rapidly increasing population arose, the institutions of the commons were considered as hampering economic growth and were abolished after centuries of satisfactory practice (Bravo and Moor, 2008).

In the 20th century, Hardin (1968) brought the commons back to the discussion claiming that individuals cannot manage common resources in a sustainable manner. In the seminal essay 'The Tragedy of the Commons', he argues that a group of people who share a commons will inevitably over-exploit it. He exemplifies it with farmers that share a common pasture. Each farmer attempts to maximise their individual benefit, not considering other farmers and a pasture capacity, hence, it will be exhausted and unable to produce the shared resource of grass. From this example, Hardin

concludes that the 'inherent logic of the commons remorselessly generates tragedy' (p. 246). The Nobel Prize winner Elinor Ostrom (1990) opposes this claim with hard data from hundreds of cases of sustainable commons demonstrating that people can cooperate without over-exploiting a commons.

In the last decades, the commons have gained renewed attention due to the emergence of the new commons (Hess, 2008). This 'renaissance of the commons' (Clippenger and Bollier, 2005) brings the question of utilising this model in the modern urbanised digital society. This section examines the development of the school of thought on commons, from the pioneering research of Ostrom to critical perspectives on commons and the development of 'new commons'. Particularly, we discuss urban commons and digital commons, as OSU projects exhibit both types. The objective of this section is to elaborate a theoretical lens on commons for this research.

3.3.1 Defining the commons

The commons is the underlying concept of OSU since the latter unites urban and digital commons. To achieve the research objective (i.e., a design method for OSU), we should specify how the commons are perceived in this study. We discuss the three perspectives on the commons to justify the perspective that suits our research objective. The three perspectives are 1) Common Pool Resources, 2) Social Practice, and 3) Social Systems.

Common Pool Resources

In her pioneering research on the commons, Ostrom (1990) coined the notion of a *Common Pool Resource* (CPR), that is" a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use" (p. 30). The evidence from anthropological and historical studies of shared use of such CPRs as fisheries, pastries, forests, and irrigation systems show that people can cooperate to use a commons without over-exploitation. Nevertheless, CPRs are subtractible, which makes them subject to rivalry and overexploitation and requires a governance scheme (Ostrom, 1990).

CPRs have two characteristics, namely excludability and subtractibility (rivalry) (Ostrom, 1996). Different types of commons vary in excludability, from non-excludable to excludable. Some CPRs are non-excludable since it is hard to control them and exclude anyone from using them, for instance,

water basins, while other CPRS, such as community gardens, are excludable, as it is possible to exclude people from using them. Some commons are subtractible and can be depleted through overuse, such as pastures, and some are non-subtractible, such as open source software, since an unlimited number of users can download the same file from the internet, not reducing the amount of the resource for others. These characteristics are closely related to rivalry, as some depletable resources become subjects to competition. For example, a crowded public park becomes a space for rivalry as a visitor using public space subtracts its benefits for others (Bollier, 2009; Foster and Iaione, 2015).

The conceptualisation of the multifaceted phenomenon of the commons as mere economic resources is limited as it does not cover social, political, and organisational issues of modern commons practices. This perspective on the commons does not shed light on the social processes in the commons communities, thus, it cannot be used for the purpose of this research since this research adopted the socio-technical perspective.

Social practice

Some scholars Euler (2015, 2018); Harvey (2014) argue that the essence of the commons is not a shared resource *per se* but also, and more importantly, the social practice of *commoning*. Linebaugh (2008) coins this term in order to describe social practices that community members use for establishing the commons and managing shared resources. Consequently, members of a group who produce and govern common resources are often referred to in the literature as commoners. Commoning is a social relation between commoners and some aspects of their environment that they perceive as paramount for their lives and well-being. Such practice should be both collective and not subject to market logic where any resource is commodified off-limits (Harvey, 2014).

A practice is a "recurrent, materiality bounded, and situated social action engaged in by members of a community" (Orlikowski, 2002, p. 256). The complex socio-technical systems of the commons comprise a plethora of practices built around managing shared resources, such as production and consumption, and peer cooperation and conflict mediation. Concerning practices of governing the commons in a sustainable manner, Elinor Ostrom (1990) offers principles that support the "long-enduring, self-organised and self-governed CPR". Briefly, the principles are the following: 1) Clearly defined boundaries; 2) Rules of appropriation and provision adequate to lo-

cal conditions; 3) Collective-choice arrangements; 4) Monitoring; 5) Graduated sanctions; 6) Mechanisms of conflict resolution; 7) Recognition by higher-level authorities; 8) Nested enterprises (in the case of larger CPRs). These principles focus on the governance of CPRs and do not explain specific social practices of commoning that constitute the everyday life of the urban commons that are required for this study.

Euler (2018) defines commoning as "voluntary and inclusively self-organised activities and mediation of peers who aim at satisfying needs." (p. 12) and derives from it four dimensions of commoning. Dimensions are (1) (re)produsage, (2) needs-satisfaction and voluntariness, (3) peers and self-organisation, and (4) inclusiveness and mediation. The first dimension refers to all activities that should be carried out for the *prod*uction and *usage* of shared resources; the term *produsage* is coined as a combination of the words production and usage). Part (re) is a shorthand for reproduction, i.e., care towards members of the community and nature, as well as maintenance of artefacts. The second dimension reflects the not-for-profit voluntary nature of commoning. People voluntarily engage in commons to satisfy their life needs, not because the government or the market forces them. The third dimension highlights non-hierarchical peer relations, i.e., the equal status of the people in the community. The fourth dimension states that mediation (e.g., conflicts, interests, needs) is essential both inside the commons and with external entities, such as the government and private companies. The perspective on the commons as a process of commoning has the same 'flaw' as it grasps only the social dimension of the phenomenon. Thus, we move to the third perspective that includes both definitions mentioned above.

Social systems

The third perspective on the commons that resonates with our view is that the commons are social systems that constantly evolve and change (Bollier and Helfrich, 2019). From the socio-technical perspective, commons can be perceived as a complex socio-technical system that consists of co-evolving social and technical dimensions. Commoners represent the former, their practices and politics, and the latter comprises commoning institutions and all kinds of techno-material artefacts that facilitate the process. From this point of view, a commons is the process of self-organisation around the shared production and consumption of a resource. This systemic view unites more narrow, discipline-related conceptualisations of commons as

practices or resources (Huron, 2017). In this vein, Dellenbaugh et al. (2015) perceive a commons as **a triad of a) common resources; b) institutions for regulating those resources, including supporting technologies; and c) communities (i.e., commoners) that design the institutions on the way of producing and reproducing shared resources**. For the purpose of this research, we adopt this three-part definition because it offers a systemic, socio-technical perspective on the complex phenomenon of the commons.

3

3.3.2 The new commons

In the last decades, the commons gained the attention of academics and urban professionals due to the emergence of the *new commons*. Charlotte Hess (2008) coins this term to indicate the emergence of a new type of commons that differs from CPRs. Such commons are labelled as 'new' because some of them are fairly new technological advances (e.g., the internet or radio) but also since all these entities became conceptualised as commons only recently, despite their already existence (e.g., air, knowledge). Thus, the new commons are not new but newly (re)discovered by scholars as such.

Hess (2008) argues that the new commons may be free or paid, rival or non-rivalrous, exhaustive or replenishable. Additionally, they may have any combination of property rights. The notion is defined as "a resource shared by a group where the resource is vulnerable to enclosure, overuse and social dilemmas. Unlike a public good, it requires management and protection in order to sustain it" (Hess, 2008, p. 37). The new commons are exemplified but not limited to digital commons (e.g., Wikipedia), urban commons (e.g., urban gardens), and cultural commons (e.g., public art).

The rising number of activists, academics, and practitioners perceive the commons discourse as a nascent movement against enclosure. The concept is crucial for a plethora of bottom-up initiatives throughout the world that struggle with ever-growing social challenges, such as commodification, corporatisation, and austerity measures, to name a few (Dyer-Witheford, 2001; Harvey, 2003; Hess, 2008). This section discusses two types of newly identified commons central to our research: urban commons and digital commons.

Urban commons

Broadly speaking, urban commons is an initiative that includes the collaborative production and consumption of resources in the urban context (Foster, 2011). Some scholars emphasise the precedence of urban commons as a resource (see section 3.3.1.1), however, acknowledging the crucial role of social and institutional aspects (Kip et al., 2015; Iaione, 2016). Critical urban theory scholars argue that urban commoning is a social practice (Bunce, 2016; Parr, 2015). They highlight the importance of urban commoning as a claim to the right to the city (see section 3.3.1.2) and accentuate ongoing urban transformation accompanying that process (Harvey, 2014; Susser, 2016). Urban transformation is **"a process where the dominant structures, functions and identity of urban systems change fundamentally e leading to new cultural, structural and institutional configurations"** (Radywyl and Bigg, 2013, p. 160). In line with that perspective, Dellenbaugh et al. (2015) note that the urban commons closely resemble Lefebvre's original interpretation of the right to the city, as he understands the city as "as an *oeuvre*, as an ongoing and collective work of art, created, used, and reshaped by its inhabitants" (Dellenbaugh et al., 2015, p. 16).

Urban commons is a multifaceted urban phenomenon, and plenty of initiatives can be placed into this category depending on chosen conceptual lenses. Examples of urban commons vary broadly from community-driven public spaces (e.g., urban gardens and parks) to local land trusts and sharing economy practices (Baibarac and Petrescu, 2017; Susser and Tonnelat, 2013; Bollier, 2009). In this research, referring to the urban commons, we focus on **spatially-rooted urban commons** only, i.e., urban commons that require the spatial dimension - a parcel of urban land – and commoning practices are organised around the management of that DIY place. Urban land has paramount importance since many challenges are related to its management and contestations over it (e.g., (Parker and Johansson, 2012; Foster, 2011; Petrescu et al., 2016)). Some scholars argue that urban commons might have a form of a public space (Radywyl and Bigg, 2013). However, these differ from public space, that is land owned by the public and open to everybody (Orum and Neal, 2009). The urban commons should not necessarily have shared ownership, i.e., regardless of the formal ownership, community members collectively manage the co-created place (Hess, 2008). This form of community self-governance and active citizenship (Baibarac and Petrescu, 2017) requires the government as the enabler (Seravalli, 2018)

or co-creation (see section 3.4); otherwise, it can be discontinued.

To conclude, in this dissertation, we focus on the spatially-rooted urban commons only, hence, the next chapter investigates the literature on urban space in relation to urban commons as a reference theory. Some urban commons studies point out that members of urban commons shape a Community of Practice (CoP) (e.g., **?**Bradley (2015); Bendt et al. (2013)). The next chapter discusses the CoP theory in detail as one of the reference theories.

Digital commons

From the 90s, scholars suggest 'information commons' or 'knowledge commons' as the new commons (Ostrom and Hess, 2007). Hess (2008) argues that most aspects of knowledge commons concern digital information since knowledge becomes commons in the digital form. (Hess, 2008). In this research, we used the term *digital commons* to stress the presence of information commons in a digital form and shared on the internet. We define digital commons as **any type of information resource collectively produced and shared by members of online Communities of Practice**. In this research, digital commons are not a subset of urban commons, as the former are intangible, thus, not spatially rooted, unlike urban commons.

The literature on digital commons provides a theoretical framework that describes the peer production of information products on the internet. Benkler (2003) captures these processes under the notion of Commons-Based Peer Production (CBPP), defining it as "a process by which many individuals, whose actions are coordinated neither by managers nor by price signals in the market, contribute to a joint effort that effectively produces a unit of information or culture" (Benkler, 2003, p. 1254). In the CBPP process, participants are equal peers that select tasks according to their skills, available time, and other personal motivations. In this framework, peers are "widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands" (Benkler and Nissenbaum, 2006, p. 60). Peers cooperate freely and bonded neither with contracts nor for the market, instead producing value for themselves and their communities (Benkler, 2017; Kostakis and Papachristou, 2014). The abundance of resources is a distinctive feature of CBPP. On the internet, means of production and "raw materials" for production are the digital commons, i.e., non-subtractive resources; hence they

are a priori 'in abundance'. The access to unlimited resources enables this mode of production (Benkler, 2002).

To be produced in commons-based peer relations, products should fulfil three main principles of CBPP, namely 1) modularity, 2) granularity, and 3) low-cost integration. Modularity means that potential objects of peer production must have a modular structure allowing peers to work asynchronously. Granularity refers to the degree to which objects are broken into smaller modules. This principle allows peers to work on modules according to their level of competence and motivation. The principle of low-cost integration refers to a mechanism by which modules produced by peers are integrated into the end product (Benkler, 2002; Benkler and Nissenbaum, 2006). Apart from the three crucial principles of CBPP, further studies identify more characteristics of CBPP (see Table 3.1).

Table 3.1: Characteristics of CBPP

Cluster	Characteristics	Description	References (per cluster)
Organization	Decentralization	a commons-based organization implies decentralized relations of individuals	Benkler and Nissenbaum (2006); Kostakis et al. (2015);
	Meritocracy and consensus	the commons-based mode of governance is based on skills and knowledge of participants and not on formal hierarchies	
	Communal shareholding	the mode of property is communal shareholding due to openness of a final product	Benkler (2017)
	Autonomy	non-contractual relationships	
	Abundance of resources	abundance of a resource facilitates commoning practices	
Product	Open product	open product via a form of open source licensing	Benkler (2002);
	Modularity	product should be dividable into smaller, relatively independent sub-projects	Benkler and Nissenbaum (2006);
	Granularity	product modules should be fine-grained and/or small in size	Bonvoisin and Boujut (2015)
	Low-cost integration	product modules should imply a mechanism of integration	
Community	Open process	open process of co-production facilitates as a mechanism of indirect coordination	Bauwens (2006);
	Self-organization	Peers organize themselves without external control	, Benkler and Nissenbaum (2006);
	Self-selection of tasks	Peers select tasks according to their motivation and skills	Bruns (2008);
	Self-motivation	Peers self-motivated to participate in the community production processes	Kostakis and Papachristou (2014);
	Sharing	Peers cooperate by sharing knowledge and ideas as opposed to market competition	Kostakis et al. (2015);
	Collaboration	Peers collaborate due to resource abundance and communal shareholding	Muller-Seitz and Reger (2010)
	Bottom-up innovation	Peers produce community-driven innovations as opposed to firm-based innovations	

Digital commons for proliferating urban commons

Digital commons have discrepancies with such tangible commons as pastures and fisheries. Due to the intangible nature of digital commons, these commons are not depletable and non-rivalrous (Ostrom and Hess, 2007). If tangible commons are scarce, digital commons are abundant, nevertheless, they are susceptible to commodification and enclosure (Boyle, 2008). The Open Source movement is a prime example of digital commons. It is a self-organised community of contributors that is freely and publicly available for use and further modifications. The primary organising principle of open source is that 'source code' remains open and free of most constraints on copying and use, and no one can have exclusive ownership of it, contrary to the proprietary software (Benkler, 2002). It is provided by families of open source licenses, such as software license GNU General Public License or the family of Creative Commons licenses (Hansen and Howard, 2013). It must be noted that open source licensing has its proponents and opponents; however, considering the focus of this study on self-organisation, this discussion is out of the scope of this dissertation.

Urban commons and digital commons are seldom studied together, while their 'rationales and ethics' are analogues (Bollier, 2009). Scholars of different scientific fields analyse them separately, while in practice, the production and struggle against enclosures of both types of commons are frequently interwoven (Bradley, 2015). The literature on digital commons provides a theoretical framework that captures peer production of information on the internet that is not limited by Open Source Software. Yochai Benkler (2003) offers the concept of Commons-Based Peer Production (CBPP), that is "a process by which many individuals, whose actions are coordinated neither by managers nor by price signals in the market, contribute to a joint effort that effectively produces a unit of information or culture" (Benkler, 2003, p. 1254). Although the CBPP theory is seldom applied to peer production in the urban space, in practice, it can be produced in peer relations, i.e., urban commoners can facilitate their practice by means of digital commons Bradley (2015), as commons-based infrastructures provide tools for knowledge sharing, connecting activists with each other, and strengthening urban commons CoPs (Radywyl and Bigg, 2013).

3

> **OSU example: part two**
> (the first part see in section 3.2.3)
> Parklets can be considered urban commons, as they are co-created and installed by self-organised citizens to fulfil their needs (e.g., raise awareness of the lack of green spaces and create a micro public space). The proliferation of parklets, which gave birth to the Park(ing) day movement, was impossible without digital commons, i.e., open source design manuals shared on the website of Park(ing) day (Bradley, 2015). Figure 3.2 depicts a page from the parklet design manual. These manuals not only guide the physical assembly of parklets but, more importantly, give recommendations on how to request permission from the urban authorities to install them in a parking lot. The Park(ing) day website with the first open source initial manuals was created by Re-bar. One component of the website was a forum that allowed activists from any country and city to self-organise and runs their parklet interventions.
>
> Moreover, activists shared their design knowledge, for instance, city-specific recommendations on how to get permission from the authorities. Together with the related social practices of activists, the website resembles an information infrastructure. Although invisible in situ, the digital commons is the crucial element of the Park(ing) day movement. The intervention exhibits the second characteristic of OSU, i.e., OSU initiatives produce *the new commons*: urban places and digital artefacts collectively created and managed by self-organised citizens.

Since OSU operates in both urban and digital domains with both types of commons, thereby, we state **the second starting point for design**: "a design method must embrace non-hierarchical, peer relations in the commons". This point acknowledges that OSU is different from other domains; thus, design approaches widely accepted in IS cannot be adopted (see the detailed discussion in section 4.1)
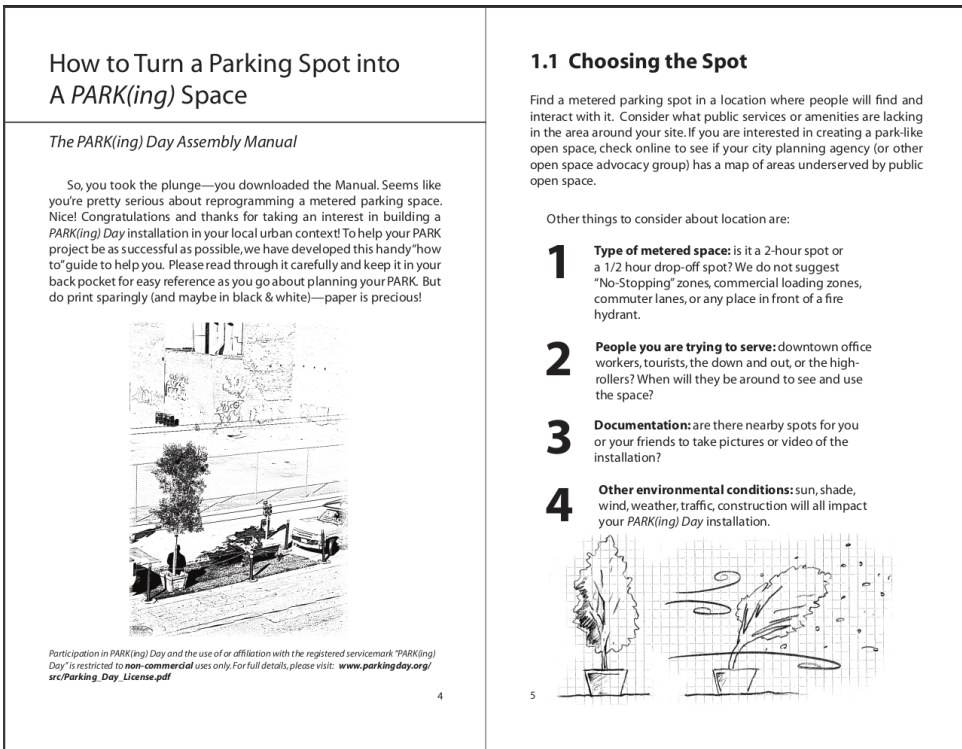
Figure 3.2: Page from open source parklet manual (accessed on 2.09.2021)

3.4 Co-production: active citizens and urban officials

Co-production is a collaboration of professionals, such as public servants and the general public. Joint efforts of urban practitioners and citizens and an acknowledgement of citizens' innovative ideas might create public value. In the current smart governance debates, co-production between citizens and public servants is getting attention due to the trend of the democratisation of governance (Bryson et al., 2014). In the context of our research, co-production is important to ensure that DIY urban designs fit the legal framework and are authorised by urban authorities. In the following sections, we discuss the nature of co-production and the perception of public administration on collaboration on citizen-driven DIY urban designs.

3.4.1 Defining co-production in OSU

In this section, we overview definitions of co-production to define what we understand as co-production in OSU projects. In the public administration literature, the term *co-production* conceptualises the collaboration of professionals (e.g. public servants) and the general public. The term is widely used in various disciplines (e.g., design, architecture, public management) to describe the collaboration of professionals and non-professionals to design artefacts (e.g., products and services) that fulfil the requirements of future users. In the public service domain, co-production refers to the involvement of citizens and communities in the process of service provision (Brandsen and Honingh, 2016). In this relationship, citizens contribute to a public sector organisation with their labour, knowledge, and ideas to receive new services or enhance existing ones (Brandsen and Honingh, 2016). The notion was initially coined by Elinor (Ostrom et al., 1978) and defined as follows: "the process through which inputs used to produce a good or service are contributed by individuals who are not 'in' the same organisation" (Ostrom, 1996, 1073). This definition refers to individual citizens only, not taking into consideration aspects of citizen self-organisation and collective action. We focus on OSU projects created collectively in a bottom-up manner; therefore, we investigate co-production further to adopt a definition that fits OSU.

Osborne et al. (2016) define co-production as "the voluntary or involuntary involvement of public service users in any of the design, management, delivery and/or evaluation of public services" (p. 640). This definition not only acknowledges coercion as co-production but also draws citizens as 'users', i.e., clients of services. As Ostrom (1996) points out: "The term 'client' is a passive term. Clients are acted upon. Co-production implies that citizens can play an active role in producing public goods and services of consequence to them." (p. 1073). Other scholars stress the voluntariness of citizen involvement. In the widely accepted definition of Parks et al. (1981), co-production is "the mix of activities that both public service agents and citizens contribute to the provision of public services. The former are involved as professionals, or 'regular producers', while 'citizen production' is based on voluntary efforts by individuals and groups to enhance the quality and/or quantity of the services they use" (paraphrased by (Pestoff, 2006, p. 506)). For instance, citizens organising a neighbourhood watch to inform the police about suspicious activities co-produce the public service of

neighbourhood safety by voluntarily self-organisation (Levine and Fisher, 1984). We share the perspective of Ostrom (1996) and Parks et al. (1981) and perceive co-production as a form of active citizenship. In this research, we focus on the voluntary form of co-production only.

With regard to the question of individual or collective co-production, Ostrom (1996) suggests only 'individuals'. Parks with colleagues (1981) highlight the civic nature of co-production, referring to 'citizens'. Nevertheless, a type (or a lack of) organisation stays unclear. Pestoff (2014) notes that "co-production is often a mix of individual and collective action" (p. 397). Individual citizens are more likely to engage in co-production spontaneously and sporadically, while collective acts concern prolonged relations of self-organised citizens and authorities to co-produce more enduring services (Pestoff, 2006). In this research, we focus only on co-production with self-organised citizens. Brandsen and Honingh (2016) revise classical definitions of Parks and Ostrom to highlight that co-production requires 'the direct input of citizens in the design or implementation of services provided for them. For the purpose of this research, we modify the definition as follows: In OSU projects, co-production can be defined as **a relationship between paid employees of an organisation and self-organised citizens that requires a direct and active contribution from these citizens to the work of the organisation**. Concerning OSU, co-production occurs as self-organised citizens collaborate with the urban officials during the process of building urban commons, e.g., getting permission for activities and making a contract for land use. Frequently, co-production is perceived as a top-down process, i.e., the request from urban officials for citizens to collaborate on already initiated projects. Nevertheless, bottom-up activities can also be perceived as co-production that citizens initiate (see discussion in section 3.4.3).

3.4.2 Governmental rationale behind citizen involvement

In previous sections, we investigated reasons for citizens to establish urban commons and create DIY urban designs. This section briefly describes the rationale of the government to co-produce public services with citizens. Governments have several reasons to integrate co-production in public service delivery. Firstly, the development of the neoliberal doctrine and the eradication of the welfare state push governments in Western Countries to reimagine public service provision mechanisms; An additional driver

is the economic crisis of 2008, which forced many of them to implement austerity measures in the public sector. To mitigate the consequences of budget cuts, governments expect citizens to self-organise to replace lacking public services and deliver (Alford, 2009; OECD, 2011). Citizen self-provisioning is cost-effective for governments since compensations for amateur co-producers are lower than for hired professionals, and voluntary contributions are not paid at all (Brandsen and Honingh, 2016).

Apart from economic reasons, co-production is claimed to have societal benefits. First of all, it has the potential to improve service quality and bring innovative, more effective public services (OECD, 2011). Additionally, it plays an empowering role in shifting power from public authorities to citizens, allowing them to participate in decision-making upon services previously provided to them (Kleinhans, 2017). Finally, voluntary participation in co-production can 'strengthen social cohesion in an increasingly fragmented and individualised society' (Brandsen and Honingh, 2016, p. 427) and foster local activism (Ostrom, 1996). Scholars claim that co-production leads to public value creation (Osborne et al., 2016). Any public service aims at public value creation because it should fulfil citizen demands, otherwise, no value is provided (Meynhardt, 2009). Public value is often referred to as the value created by the government with the help of legislative mechanisms, public services, and other tools Kelly et al. (2002), however, this perspective implies that only the government is able to create public value, not considering active citizenship.

O'Flynn (2007) takes a more radical stance to describe the notion as "a way of thinking which is post-bureaucratic and post-competitive allowing us to move beyond the narrow market versus government failure approaches" (p. 353). This claim sounds even more appealing if placed in the context of co-production, where value is co-created with the public. It blurs the roles of the government and the public as both become actors that evaluate citizens' basic needs and produce solutions to fulfil their needs. From this perspective, urban commons create public value, as a group of citizens perceive some local issues so important that they find self-organising necessary. If the officials support the bottom-up effort, a co-production project is forged. OSU infrastructures support public value creation as they are a means to create and proliferate DIY urban designs in the urban commons.

3.4.3 Types of co-production

Co-production can take various shapes that should be investigated to iden-
tify what type of co-production OSU corresponds with. Voorberg et al.
(2015) distinguish between three co-production types concerning the de-
gree of citizen involvement. In the first type, citizens act as co-implementers
helping implement services designed and established by professionals (e.g.,
waste separation). This type is the most frequently occurring, as it demands
the least effort from public authorities and citizens. In the second type, cit-
izens play the role of co-designers, therefore having the power to decide
upon the design of services. For instance, citizens can be invited to partic-
ipate in the co-design of outdoor recreation. This type of co-production is
well-known and highly accepted in the domain of urban design. The third
type implies citizens as co-initiators with the leading role, and the govern-
ment is supposed to follow their initiatives. (Voorberg et al., 2015). The
third type, citizens as co-initiators, is the least frequent in practice (Voor-
berg et al., 2015).

This research focuses on this type of co-production, i.e., **co-initiated
by citizens**, as it falls under the definition of OSU. We show how cities can
institutionalise urban prototypes co-created in OSU infrastructures on the
practical example of parklets (see below). From our perspective, cases of co-
implementation are rare due to two reasons. Firstly, the government treats
citizens as clients (Ostrom, 1996) or users (Osborne et al., 2016), i.e., pas-
sive consumers of public services. In such a view, people have little chance
to exercise their active citizenship. Instead, they can file complaints about
service quality. In such a setting, the public lost skills of self-organisation
and active citizenship and learn consumer behaviour in relation to the gov-
ernment instead (Pestoff, 2011). The second reason lies on the government
side. The government can facilitate or hinder the development of urban
commons (Seravalli, 2018). Bureaucrats are often reluctant to support cit-
izens' ideas of public services due to conservative administrative culture
and lacking trust in community initiatives (Voorberg et al., 2015). Klein-
hans (2017), in his analysis of co-production in the Netherlands, puts it
as follows: "While local professionals comply with the self-organisation
discourse, their accounts reveal ambivalent and contradictory responses
of their organisations, supporting and simultaneously resisting 'disruptive'
entrepreneurial actions from citizens." (Kleinhans, 2017, p. 1513).

3

OSU example: part three

(previous parts see in sections 3.2.3 and 3.3.2.3)

Initially, the parklets intervention was initiated by artists and gradually accepted by local authorities in several US cities. Thus, it could be considered a rare case of co-production, namely co-initiation. Supported by commons-based infrastructure, the intervention spread to many cities across the world. Several municipalities in the USA issued policies that allow citizens to transform parking spaces into semi-permanent parklets officially. This innovation supports active citizens who can now equip their neighbourhoods with additional, albeit micro and semi-permanent, nevertheless, public spaces (Pagano, 2013). Another case is from Sweden that in 2021 introduced an approach that utilises parklets as a universal street-level urban design tool and aims at redesigning every street of the country based on inputs from their dwellers (O'Sullivan, 2021).

Authorities of various cities have institutionalised and standardised the procedure of parklet installation, thus, they adopted these innovative DIY urban designs. Some enable citizens to perform as co-implementers of solutions prepared for professionals, while others allow them to co-design parklets with professional designers. As discussed, such co-production types are more common than co-initiation since standardised procedures and designs allow co-production with less effort from both citizens and urban professionals. Thus, a self-organised initiative, proliferated by means of digital commons, was adopted by urban authorities, which transformed the initially disruptive DIY intervention into a widespread tool for the co-creation of public spaces. The third characteristic of OSU, i.e., in order to last, DIY alterations of the urban environment should be accepted by or co-produced by the authorities.

To conclude, unauthorised alterations of highly-regulated urban environments should either "vanish" as considered illegal or become institutionalised (see the discussion in section 3.2.3). The latter case can be perceived as the co-production of public services initiated from the bottom-up by self-organised citizens. Consequently, OSU projects are open source designs of co-produced public services. More radical OSU projects can promote DIY

Figure 3.3: Different variants of parklets

urbanism interventions that local authorities cannot authorise due to in-compatibility with local legislation. Nevertheless, the very same projects might fit with local regulations of far remote cities, and their citizens can utilise these digital commons. Therefore OSU designs can vary highly in the degree of legality depending on local regulations since interventions welcomed in one city can be prohibited in another. Regardless of the objectives of specific urban commons that may vary considerably, OSU contributes to grassroots urban innovation. Based on the discussion of this section, we state **the third starting point for design**: "a design method must consider the co-production of OSU with the urban authorities".

3.5 Conclusions

Open Source Urbanism is different from other domains, therefore, in-depth understanding is needed and defining design starting points. This chapter provided a detailed discussion of this phenomenon by answering the research question RQIa *"What is Open Source Urbanism?"*. As no clear-cut def-

inition of OSU existed, for the purpose of this research, from Bradley (2015); Jiménez (2014); Baibarac and Petrescu (2017) we synthesised the following definition of OSU: **citizen-driven commons-based co-production of open source urban prototypes and their design manuals that aim at urban transformation**. This definition refers to several phenomena from various research fields. We examined the existing literature and learned that this term links to Do-It-Yourself (DIY) culture and citizen-driven urban interventions with the open source movement (i.e., releasing information that remains open and free of most constraints on copying and use). OSU captures the emergent urban phenomenon of active citizens who intervene in their local environments with urban prototypes, such as street furniture and share open source manuals on how others can create these.

Urban prototypes are DIY and incomplete experimental objects that emerge as a response to these pressing urban issues. These DIY designs are prototypes, as they are incomplete and embody the ongoing experimentation of active citizens with their urban environments. They developed *in situ* (i.e., in specific urban contexts) and *ad hoc* (i.e., hand-crafted to tackle not a class of problems but particular problems of their designers and local communities). OSU challenges the *status quo* of top-down urban design practices, as it transforms public spaces into *the urban commons* that are places created and maintained by citizens. Such initiatives aim to solve pressing issues of local urban environments, otherwise not solved by the public or private sector. The overarching aim of bottom-up urban innovations is *urban transformation*, that is "a process where the dominant structures, functions and identity of urban systems change fundamentally leading to new cultural, structural and institutional configurations" (Radywyl and Bigg, 2013, p. 160).

We found that three aspects can characterise OSU:

1. OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment

2. OSU initiatives produce *the new commons*, urban places and digital artefacts that are collectively created and managed by self-organised citizens

3. to last, DIY alterations of the urban environment should be accepted by or *co-created* with the authorities

From the literature, we derived three starting points for the design of a method for OSU, namely:

1. a design method must acknowledge the non-professional nature of DIY interventions and laymen people as designers of OSU infrastructures

2. a design method must embrace non-hierarchical peer relations in the commons

3. a design method must consider the co-production of OSU with the urban authorities

These starting points are different from other design methods, which often assume that the design process is conducted by professionals in contractual relationships. These starting points must be considered during the ethnographic and design phases of our research approach.

3

4

Reference theories

*A map is not the territory it represents, but, if correct, it has
a similar structure to the territory, which accounts for its useful-
ness.*

- Alfred Korzybski, *Science and Sanity*

"Why is a raven like a writing desk?"

- Lewis Carroll, *Alice in Wonderland*

In the previous chapter, we shaped the interdisciplinary research domain
of this dissertation. Particularly, we defined Open Source Urbanism (OSU)
as citizen-driven commons-based co-production of open source urban pro-
totypes that aim at urban transformation. The objective of this research
is to develop a design method for cultivating OSU infrastructures which
requires a theoretical background. In design science research, descriptive
theories and concepts outside of IS discipline can explain why the offered
design works (Walls et al., 1992). In this dissertation, we label these as *refer-
ence theories* since we refer to them analysing the ethnography in the fifth
chapter and building a design method for OSU in the seventh chapter. This
chapter answers research question RQIb *"What are reference theories for a
design method for OSU infrastructures?"*.

Based on the insights from the previous chapter, we selected several
bodies of literature as reference theories. First, we perceive IT-based arte-
facts that facilitate OSU as Information Infrastructures (IIs); therefore, we

adopt IIs as the first reference theory. Second, we needed tools for the analysis of communities that share work practices since information infrastructures function in Communities of Practice (Star and Ruhleder, 1996), in which members learn from each other by sharing tacit knowledge (e.g., anecdotes, impromptu comments and opinion exchange), as well as explicit knowledge (e.g., documents, graphics)   citePreece2004a. These practices become part of an infrastructure (e.g., (Hanseth and Lyytinen, 2004)). Thus, we adopt the theory that focuses on Communities of Practice (CoP), i.e., the CoP theory (Wenger, 1998). Third, urban commons frequently revolve around issues of urban land (see Section 6.1.2); therefore, we need to investigate the spatial aspect of the urban commons. Hence, building a design method for OSU infrastructures should be based on literature about urban space. These three bodies of literature will be used in two ways as follows. First, we utilise them as an analytical framework to analyse the ethnographic and design intervention studies in the fifth and sixth chapters. Since the fifth chapter investigates an urban commons prior to an OSU infrastructure cultivation, it does not apply IIs body of literature. Second, we apply the reference theories as theoretical background for our design method in the seventh chapter.

The chapter is organised as follows. The first section discusses IIs, their properties, and the challenges of designing. The second section introduces the CoP theory. The third section discusses the notions of urban space and urban place. In the fourth section, conclusions are drawn.

4.1 Information Infrastructures

Design science contains a vast array of design theories supporting computer-supported cooperative work. However, this knowledge is often developed for structures based on structures with command and control mechanisms (i.e., private businesses and public organisations) (Malone et al., 1987; Clemons et al., 1993). This knowledge is hardly applicable to OSU, as it exhibits a different setting in which formal contracts and hierarchy cannot be used and are not even available. Furthermore, the development of OSU is complicated due to a lack of resources, hierarchies and contractual relationships. Given the complexity, we adopted the Information Infrastructures (IIs) perspective on the design that differs from the perspective accepted in Information Systems (IS) (see Table 1.1).

4.1.1 Defining information infrastructures

Prior to discussing the design process of Information Infrastructures (IIs), we should define IIs and pinpoint their characteristics. We begin from the foundational work in the field of IIs, namely Star and Ruhleder (1996), and from this initial conceptualisation, move to a more elaborated view of IIs. Infrastructure is a fundamentally relational concept; as Star and Ruhleder (1996) put it, the question is not *what* is infrastructure but *when* is infrastructure, as it 'emerges for people in practice, connected to activities and structures' (p. 112). For instance, urban dwellers consider the water system as infrastructure that supports their everyday practices, such as cooking and cleaning, while plumbers perceive it as a subject to work with. In their seminal work on infrastructures, Star and Ruhleder (1996) outline the following eight 'dimensions' of infrastructures as follows:

1. **Embeddedness**. Infrastructures are embedded in the daily activities of users so that they are taken for granted;

2. **Transparency**.Infrastructure is transparent to use, i.e., they are not 'reinvented' for each task but invisibly supports the execution of tasks;

3. **Reach or scope**. To be called an infrastructure, a system should 'reach beyond a single event or one-site practice';

4. **Learned as part of membership**. An infrastructure, adopted as part of community practice, becomes an indispensable part of its membership, thus, new members have to learn how to work with infrastructures in the course of acquiring membership;

5. **Links with conventions of practice**. Infrastructures are shaped by conventions of communities of practice, such as norms and rules, as well as they shape these conventions over time;

6. **Embodiment of standards**. Infrastructures plug into other infrastructures in a standardised manner;

7. **Built on an installed base**. Infrastructures are built on an *installed base* of existing socio-technical systems inheriting their strengths and weaknesses;

8. **Becomes visible upon breakdown**. Infrastructures are expected to function invisibly in daily life and become visible when they break.

In our perspective, this otherwise quite thorough definition requires a crucial extension - that is not explicitly stated, but nevertheless discussed in the original study of Star and Ruhleder (1996): infrastructures are 9. **Emerging**. An infrastructure can be perceived as a complex adaptive system (Janssen et al., 2009; Hanseth and Lyytinen, 2016) i.e., "a system that emerges over time into a coherent form, and adapts and organises itself without any singular entity deliberately managing or controlling it" (Holland, 1996). Infrastructures are often designed only partially, after which they evolve over time to meet changing needs of users, i.e., their boundaries are not predefined. Functioning infrastructures are complex and layered entities that cannot be changed in a top-down manner. Changes happen gradually, as they need negotiation and adjustment of various actors. Thus, a good infrastructure should be stable but modifiable to meet various purposes of individual users and changing social needs (Hanseth and Lyytinen, 2016; Star and Bowker, 2002; Karasti and Blomberg, 2018).

To conclude, these nine dimensions emphasise the socio-technical perspective in which infrastructures are seen as a relation among people, their practices, and technologies. It fits well with this research, which adopts the socio-technical perspective as well. Additionally, it shows the importance of understanding user activities within communities of practice (the fourth and fifth dimensions). The unit of analysis is not users or groups of users but more complex entities – communities - that exhibit socio-technical relations, such as jargon, routines, and customary practices. We share this perspective in the application to OSU infrastructures; therefore, this study requires a foundation that acknowledges the importance of 'the social'.

Having discussed the characteristics of IIs, we will use these to lay down a definition of IIs. Emphasising work practices, Pipek and Wulf (2009) defined 'work infrastructures' as "the entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned to them." (p. 455). However, this definition does not highlight the unique features of infrastructures and how they differ from other ICT artefacts. Hanseth and Lundberg (2001) shed light on that, enlisting four aspects of infrastructures, defining these as follows: "Infrastructures are shared resources for a community; the different components of an infrastructure are integrated through standardised interfaces; they are open in the sense that there is no strict limit between what is included in the infrastructure and

what is not, and who can use it and for which purpose or function; and they are heterogeneous, consisting of different kinds of components – human as well as technological." (p. 349). The latter definition stresses heterogeneity and openness of infrastructures that have no specific function, evolving and changing to satisfy the user community's changing requirements.

We adopt this perspective on the IIs for this research (i.e., constructing a design method for OSU infrastructures) because it clearly delineates IIs from traditional IS: the former has no specific purpose but rather a generic idea of supporting the community of practice with information-related services, while the latter, such as decision support systems or accounting systems, clearly state their purpose and supported tasks (Hanseth and Lyytinen, 2004). Furthermore, this point of view shares the socio-technical perspective adopted for this study. For the purpose of this research, we elaborate a compact definition of IIs as follows: **IIs are shared resources for communities of practice; they facilitate information-oriented services; they have no clear scope or purpose; they consist of a heterogeneous and ever-changing set of technological and social components**. Considering fundamental differences between IS and IIs, we must address the design process of infrastructures, as it is different from the traditional design process of information systems; we can learn from the IS but cannot directly copy IS design knowledge. The following section discusses the design process of infrastructures.

4.1.2 Information Infrastructures design

IIs differ from traditional IS since the former has no specific purpose but a generic idea of supporting the community of practice with information-related services. In contrast, the latter, such as decision support systems or accounting systems, clearly state their purpose and supported tasks (Hanseth and Lyytinen, 2004). According to the design process in traditional IS, designers must define the scope of the artefact, which requires "defining what is internal (things to modify/design) and what is external (issues to consider) to a design process" (Pipek and Wulf, 2009, p. 449). OSU challenges this approach in a similar vein as with IIs, as infrastructures are open and evolving systems (Hanseth and Lyytinen, 2004), i.e., their scope and functionality cannot be predefined by designers. The noun 'design' is frequently perceived as a rigid set of predetermined features or system components to be developed. In the case of ill-structured, complex socio-tech systems,

such as OSU infrastructures, the design is soft: one cannot fully design IIs but can only facilitate the process of their emergence.

Installed base
In general, the notion of the *installed base* means 'the number of installations or products sold'. In IIs studies, however, the term has an extended meaning to encompass 'all that is there' i.e., **"existing practices, conventions, tools and systems"** (Aanestad et al., 2017, p. 28). Elements of the installed base are not limited to technology and can include the social aspects (Marttila and Botero, 2017), such as customs and community culture. The installed base has a profound impact on the development of IIs. Star and Ruhleder (1996) points out that infrastructure "does not grow de novo: it wrestles with the "inertia of the installed base" and inherits strengths and limitations from that base" (p. 113). Essential to understand the installed base as rather an analytical tool that can be of help during design interventions (Aanestad et al., 2017). For instance, in one of the first studies of IIs, citetHanseth2001 suggests that prior to the development, all users, roles, artefacts and related activities that are already in place should be meticulously mapped to grow a new II on the installed base (Hanseth and Lyytinen, 2004).

Everybody is a designer
In order to evolve and grow, infrastructures must be open, i.e., have no predefined limit of elements, users, functions, and scope. Additionally, they open in the temporal sense, i.e., with no set-in-stone deadlines, after which they stop evolving. Due to their complexity, infrastructures cannot change instantly, and parts gradually evolve. Thus, their scope and functionality cannot be predefined by designers, which requires a different approach to the design process. Additionally, the separation of design, use, and maintenance activities is blurred in information infrastructures (Karasti and Baker, 2008).

As complex systems, infrastructures are impossible to design in the traditional way, i.e., as a process guided by a comprehensive set of requirements (Hanseth and Lyytinen, 2004). This barrier is related to the distributed control of infrastructures which is an outcome of negotiations and agreements among various actors; therefore, designers cannot claim control on the subject of design (Hanseth and Lyytinen, 2016). IT professionals are often considered as the designers of information infrastructures since

they have the required expertise. Nevertheless, any user is a designer of infrastructure if they "[...] perform a deliberate, creative activity directed toward what they consider a lasting improvement." (Pipek and Wulf, 2009, p. 456). In the same vein, Hanseth and Lundberg (2001) recommend always considering users as designers because they inevitably reshape their work infrastructures, accommodating them for individual purposes and changing work practices.

This feature of IIs blurs the difference between users and designers. As Star (1999, p. 382) puts it: "Infrastructure [...] is never changed from above. Changes take time and negotiation, and adjustment with other aspects of the systems are involved. Nobody is really in charge of infrastructure". Similarly, urban commons that are the installed base for OSU infrastructures exhibit non-hierarchical relations and network governance instead of traditional 'command and control mechanisms'. At the same time, we have no knowledge of how such relations are organised in a real-life setting. Since prior design knowledge on OSU is lacking, we have to explore an urban commons 'in the wild' and investigate its installed base and co-design of OSU by its users.

Cultivation
As we learned, the development of infrastructures is dependent on the installed base and work practices of users. Due to this organic evolution within an ever-changing environment (Edwards et al., 2007), some scholars advocate for the term 'growing' or 'cultivating' infrastructures instead of 'building' or 'constructing' (Grisot et al., 2014). In this vein, Ciborra et al. (2000) suggest a cultivation approach that considers the installed base facilitating infrastructure growth gradually and incrementally. Such an approach adopts "monitoring and intervention activities over strict control and ongoing adjustments over rigid preplanning" (Aanestad et al., 2017, p. 27).

We exemplify a cultivation approach with the one offered by Grisot et al. (2014), that is characterised by three aspects, namely
1) process-orientation, 2) user mobilisation, and 3) learning. First, *process-orientation* requires "ongoing and careful step-by-step engagement with technology and existing institutionalized practices" (Grisot et al., 2014, p. 200). *User mobilisation* states that new users should be motivated to use a new infrastructure(Hanseth and Lyytinen, 2004), since designers have no control over users' behaviour. *Learning* implies a reflection on design inter-

ventions (or parts of an infrastructure) considering whether they meet user demands or not (Grisot et al., 2014). For this research, we must construct a research approach that acknowledges the challenges of the inertia of the installed base and the cultivation of infrastructures.

Bootstrapping and adaptability

The two challenges of infrastructure design concern bootstrapping and adaptability (Hanseth and Lyytinen, 2004). Bootstrapping is "a design process taking as its starting point the challenge of enrolling the first users and then drawing upon the existing base of users and technology as a resource to extend the network." (Hanseth and Aanestad, 2003, p. 386). Adaptability problem arises when an infrastructure begins an exponential growth (due to the network effects) and has to demonstrate flexibility in adapting in both technological and social aspects (Edwards et al., 2007).

To overcome these two problems, Hanseth and Lyytinen (2004) offer a design theory for designing IIs (revised in (Hanseth and Lyytinen, 2016)) consisting of five design principles derived from a theory of Complex Adaptive Systems. The principles are (1) design initially for direct usefulness; (2) build on installed bases; (3) expand installed base by persuasive enrolment tactics; (4) make the organisation of IT capabilities simple; and (5) modularise the II (Hanseth and Lyytinen, 2016). Although these are applicable for IIs of any domain and scale, we expect substantial differences in building infrastructures in the urban commons domain, as it exhibits the ethos different from the public and private companies; thus, building an OSU infrastructure demands a domain-specific design method that we cannot find in the prior literature.

4.2 Communities of Practice Theory

The notion of *Community of Practice* (CoP) was initially coined by Lave and Wenger (1991) while studying the phenomenon of apprenticeship, i.e., the process of learning in which apprentices gain knowledge and skills in the course of shared practice with their master. The study revealed that learning is the social process that takes place in communities sharing practice in a particular domain. Further studies show that the concept is applicable as an analytical framework for investigating the process of learning through practice in various domains, not limited by education but also in self-organised communities (e.g., (Bendt et al., 2013; Harper and Afonso,

2016; Krasny et al., 2015)).

   This study focuses on OSU infrastructures which, as well as any other kind of information infrastructure, is utilised in CoPs (Star and Ruhleder, 1996). We apply the CoP theory as a reference theory, thus, we have to select concepts that are suitable to refer to in further empirical studies. In the following sections, we define CoPs to delineate these from other types of communities and discuss conceptual tools suitable for empirical analysis of an urban commons, namely boundary interactions, boundary objects, and the process of learning in CoPs.

4.2.1 Defining Communities of Practice

CoPs can be defined as **"small groups of people who engage regularly in similar practices and have frequent occasions to interact with each other"** (Vaast and Walsham, 2009, p. 549). Important to understand that CoPs are different from other forms of organisation because they are self-organised entities that establish informal membership and leadership. Teams in organisations are established to reach a specific goal and managed by the command and control mechanism, while members of several teams can self-organise in a CoP to learn from each other (Wenger, 1998).

   CoPs are characterised by three elements that are the domain (shared enterprise), the community (mutual engagement), and the practice (shared repertoire). CoPs are informal groups of people bound together by an interest in a joint enterprise, such as gardening or cooking. Interest in the same domain does not automatically create a CoP. This domain of interest has to shape people's individual and collective identity as a group (the shared enterprise is closely connected to the notion of 'created/claimed space' discussed in section 4.3). Thus, membership also plays a vital role in CoPs, and a shared competence in the domain of interest distinguishes CoP members from outsiders. Mutual engagement (i.e., activities and information sharing) connects these people in a community. What differentiates CoPs from communities of interest, such as people interested in specific books or dog breeds, is that members of CoPs are practitioners. Over time a CoP develops a unique practice, a so-called shared repertoire of community resources, such as routines, jargon, and artefacts (Wenger, 1998). As Wenger (2010a) puts it, practice is "something that is produced over time by those who engage in it" (p. 180). He argues that community members collectively produce a practice that "reflects their own engagement with their

situation" (p. 181). To conclude, the CoP theory highlights the process of social learning through collective practice in a shared domain of interest. The CoP theory fits well for OSU because citizens self-organise (mutual engagement) to co-create urban commons (shared repertoire) to solve issues of their local urban environments (shared enterprise).

The CoP theory was applied for analysing urban commons initiatives (e.g., (Radywyl and Bigg, 2013; Susser and Tonnelat, 2013) and particularly community gardens (e.g., (Harper and Afonso, 2016; Krasny and Tidball, 2009; Bendt et al., 2013)), probably due to the worldwide popularity of community gardening initiatives. In the open source domain, studies show that open source communities exhibit properties of CoPs (Fang and Neufeld, 2009; Muller-Seitz and Reger, 2010; Budhathoki and Haythornthwaite, 2013). For the purpose of this research, we share this perspective on a commons as a CoP, in which members have to learn how to achieve their goals through shared practice. From this perspective, groups of citizens that co-create urban commons initiatives to tackle issues of their urban environments learn how to share responsibilities, tasks, and resources. Unlike formal organisational settings, an informal self-organised initiative makes it difficult to set up a formal structure with fixed roles and domains of responsibility. Thus, CoP members have to learn from each other and other communities along the way in their activities.

4.2.2 Interactions on the boundaries

The CoP theory claims that communities of practice have invisible and fluid boundaries, unlike visible and permeable boundaries of physical places or officially recognised boundaries of organisational units. CoPs boundaries are shaped by collective identity and membership. Through practice, one acquires their own experiences and reshapes their identity, i.e., after entering a CoP, a person over time starts identifying themselves as a community member. The socially defined competence of CoP members sets the boundary between their community and other social groups. Members of CoPs regulate membership, drawing boundaries around their social practice, i.e., those who comply with formal or unspoken rules of conduct of the community are regarded as members, thus, their collective competence and performance shape CoP boundaries (Wenger, 1998, 2000, 2010b; Nonaka and von Krogh, 2009).

The concept of CoP boundaries offers several analytical tools relevant to

our discussion, namely boundary interactions, brokering, and boundary objects. *Boundary interactions,* i.e., interactions of members of different CoPs, can take the form of boundary encounters, such as visits or joint discussions or boundary practices, i.e., 'more sustained work' of CoPs. CoPs can establish peripheral interactions providing outsiders limited access to the CoP, for instance, guided tours for those interested in becoming CoP members. *Brokers* are individuals that connect CoPs engaging in the 'export-import' of social practices. Acting as boundary spanners, they do not fully immerse in the practice of any given CoP staying on boundaries. This may bring difficulties for brokers' practice, as they are often overlooked by communities they work with and might be perceived as strangers, not members. The value they bring to communities is often not recognised (Wenger, 2000, 2010b).

4.2.3 Boundary objects

The notion of *boundary objects* was coined by Star and Griesemer (1989) to refer to "objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use and become strongly structured in individual-site use" (p. 393). Notably, 'object' can mean anything in interaction among heterogeneous groups of actors (e.g., CoPs); tangible or intangible entity, such as a car, as well as a theory as long as several groups use it. Almost anything can be a boundary object in case it is used by different social groups maintaining different meanings for every group, yet holding a shared identity that allows common action upon them (Star, 2010).

Star and Griesemer (1989) claim that boundary objects are crucial "[...] in developing and maintaining coherence across intersecting social worlds." (p. 393) because such objects stay ill-structured in-between heterogeneous social worlds while becoming more specific and adjusted to the needs of specific CoPs within any given social world. These groups' tack back-and-forth between both forms of the object'; in this manner, groups collaborate without consensus. Star and Griesemer (1989); Star (2010). For example, boundary objects were adopted in the Project Rotterdam Data movement that focuses on opening up public sector information and co-creating public services: first, citizens explained their needs through stories, and these recorded stories served as boundary objects that facilitated the communica-

tion between citizens and public servants (Mulder, 2015). We adopt boundary objects as an analytical category for this research since the urban commons emerge in the multi-actor urban environment that is 'structurally hostile' for the commons (see discussion in section 3.3.2), thus, the urban commons CoP has to collaborate with other urban actors possibly without consensus.

4.2.4 Learning and knowing in CoPs

The CoP theory shows that processes of working, learning, and innovating are inseparable (Brown and Duguid, 1991), as "practice connects 'knowing' with 'doing'" (Gherardi, 2000, p. 218). In CoPs, learning occurs when newcomers engage in community life, bringing their knowledge to the group (Lave and Wenger, 1991) and during work-related activities of community members (Brown and Duguid, 1991). As Gherardi (2000) puts it: "thinking of learning through participation in a practice enables us to focus on the fact that, in everyday practices, learning takes place in the flow of experience, with or without awareness of it" (p. 214). In line with that Orlikowski (2002) argues that "knowing is not a static embedded capability or stable disposition of actors, but rather an ongoing social accomplishment, constituted and reconstituted as actors engage the world in practice" (p. 249).

Knowing consists of two aspects, namely knowing *that* (explicit knowledge) and knowing *how* (tacit knowledge). Although complementary, these two are not substitutable: if one knows *that* (e.g., functioning of internal combustion engine design), it does not automatically provide knowing how (e.g., how to fix a car engine). The former is acquired from explicit, codified information, such as textbooks, while the latter is learned by hands-on practice Ryle (1949); Polanyi (1966); Brown and Duguid (2001). The CoP theory suggests that knowing how is the product of social learning in CoPs (Duguid, 2005; Nonaka and von Krogh, 2009). Members of CoPs exchange both types of knowledge; however, in the informal setting of a CoP, tacit knowledge exchange tends to occur naturally (e.g., impromptu comments and opinions, apprenticeship) (Preece, 2004). In CoPs, newcomers learn how to 'become a practitioner' through acquiring knowledge of the practice of the community, its specific worldview, and language (Brown and Duguid, 1991). Considering OSU infrastructures, members of such CoPs know how to design urban prototypes (i.e., tacit knowledge) through community practice, although not necessarily possess explicit knowledge of the

design process.

At the CoP boundaries, members encounter foreign competencies, which fosters learning. (Wenger, 2000). Socio-material resources of CoPs (what Wenger calls 'shared repertoire') not only facilitate learning but also might condition boundary interactions (Bendt et al., 2013). For example, one community garden allows participation only for people that joined a formal association, while another is open for volunteers. Rigid rules of the former hinder learning on boundaries, while the latter facilitates boundary interactions, as it allows outsiders to learn through practice giving them a chance to gain membership of the CoP (Bendt et al., 2013).

4.2.5 Networks of Practice

CoPs are loosely connected into *Networks of Practice* (NoPs) (Brown and Duguid, 2001) that do not coordinate practice but allow to exchange 'knowing that' which can be embedded in the local practice of CoPs, i.e., 'knowing how' (Duguid, 2005). People in an NoP are engaged in the same or similar practice, however, they may never meet each other face-to-face (Wasko and Teigland, 2004). As individuals in NoPs share practice, they are interested in sharing knowledge across CoPs (Brown and Duguid, 2001). Information Infrastructures might facilitate trans-communal knowledge exchange in NoPs (Vaast and Walsham, 2009). This dissertation focuses on cultivating OSU infrastructures for the urban commons that we perceive as CoPs. OSU infrastructures might be used to facilitate knowledge exchange among the urban commons NoPs.

As was discussed in the previous section, IIs are defined as CoPs, thus, we adopted the CoP theory as the second reference theory for this study. The CoP theory provides tools for analysing communities with a shared enterprise, namely boundaries, boundary objects, and Networks of Practice, that will be used for an ethnographic inquiry into the real-life urban commons in the next chapter and for synthesising a design theory for OSU infrastructures.

4.3 Spaces and places in the city

This section presents the literature on urban space and place as a third reference theory. This literature gives tools for analysing the spatial and material aspects of urban commons, i.e., the physical place and urban proto-

types.

4.3.1 Urban space

Space is an abstract term with many meanings in different fields, such as social science, geography, and internet studies. In this research, we understand space from the perspective of human geography as follows: space refers to a territory that has no meaning attached to it. In social sciences, spaces can refer to interactions and practices of various actors with regard to a common concern. As a French philosopher, Henry Lefebvre (1992) notes: "Space is a social product [...] it is not simply 'there', a neutral container waiting to be filled, but is a dynamic, humanly constructed means of control, and hence of domination, of power" (p. 24). For Lefebvre, 'the mathematical perspective on space' that dominates in natural sciences was an inadequate framework for analysing the social aspect of physical space (Jakobsen, 2017). Lefebvre claims that the production of space is always a subject to contestation by various urban actors that seek ways of determining urban shape and functions (Lefebvre, 1992). Policies, property rights, capital, and technologies are among the resources used in this struggle for urban space (Iveson, 2013).

Gaventa (2006) defines *social spaces* as follows: **"opportunities, moments and channels where citizens can act to potentially affect policies, discourses, decisions and relationships that affect their lives and interests."** (p. 26). For this research, we adopt this definition because it perceives space as a social construct created in a multi-actor setting. Gaventa (2006) suggests a typology of spaces for participation in relation to power, namely closed, invited, and claimed/created spaces. We are interested in the third type, claimed/created spaces, which are spaces that emerge as a response to the common concerns or identifications in which like-minded people come together for collective action (Cornwall, 2002).

Members of the urban commons operate in such created or claimed spaces that stem from common concerns (e.g., the lack of green spaces). These spaces are the shared enterprise of the CoP. Hence, these initiatives are "firmly rooted in the 'life-world' of citizens" (Denters, 2012, p. 233). By struggling for the urban land and creating spacially-rooted urban commons, active citizens claim their right to the city, i.e., their right to change the urban fabric and bring new functions and innovative solutions to perceived urban issues. OSU infrastructures reinforce this process, as open

source urban prototypes shared with other CoPs allow an exchange of DIY knowledge in urban commons Networks of Practice.

4.3.2 Urban places

In human geography, space is an abstract concept, a 'realm without meaning'. Conversely, a *place* is a meaningful location. As people put some effort into space and develop a personal attachment, they transform it into a place (Cresswell, 2004, p. 132). Place is a unique space linked to the local context, i.e., 'physical and social landscapes' (Pierce et al., 2011, p. 55). Friedmann (2016) concisely defines a place as **"a small, three-dimensional urban space that is cherished by the people who inhabit it."** (p. 154). Discussing places, Cresswell (2004) argue that place is in ongoing change over time: "[…] place is constituted through reiterative social practice — place is made and remade on a daily basis. Place provides a template for practice—an unstable stage for performance. Thinking of place as performed and practised can help us think of place in radically open and non-essentialised ways where place is constantly struggled over and reimagined in practical ways […] Place as an event is marked by openness and change rather than boundedness and permanence" (p. 39).

Agnew (1987) lists three aspects of place as a 'meaningful location', namely location, locale, and sense of place. The first aspect refers to a physical location of the place. The second aspect, locale, means a material environment for social relations. The third part refers to the symbolic dimension of place in which people create personal and collective meaning of it. Although we agree with this model of place, for the clarity of narrative, we adopt slightly different terminology for dimensions, as follows: the urban context, spatial, and symbolic. In OSU, urban places co-created by the members of urban commons play a crucial role as community life revolves around them: urban places emerge from the discontent of citizens with certain aspects of their urban environments; they contain urban prototypes that serve as the means for solving these issues; they may bring tensions with the urban officials, perceived differently by the bureaucrats and the community. For the purpose of this research, we apply these dimensions as a framework for the empirical investigation of a real-life urban place co-created by urban commons CoP; this understanding will lay a foundation for design interventions focused on the cultivation of an OSU infrastructure.

4.4 Conclusions

The previous chapter conceptualised OSU and discussed the characteristics of the phenomenon in detail. However, the literature lacks design methods for the co-creation of IIs in the urban commons setting (i.e., OSU infrastructures). To fill this void, we adopted a design science paradigm to build a design method for cultivating OSU infrastructures. According to the adopted research approach, we should select appropriate reference theories, i.e., descriptive theories and concepts outside of IS discipline explain why the offered design work (Walls et al., 1992). Crucial to select theories is the fit with the idiosyncratic nature of the urban commons. This chapter answered the research question RQIb *"What are reference theories for a design method for OSU infrastructures?"*.

We found no single theory covering all aspects of OSU infrastructure cultivation. Thus, we combined several bodies of knowledge as reference theories. We selected three relevant streams of literature that are in conformance with these assumptions, namely the literature on IIs, the Community of Practice (CoP) and urban place and space. IIs share characteristics with the urban commons: both phenomena exhibit a self-organised, decentralised, and evolving nature. IIs provides the perspective on the design as an open-ended, loosely defined process of the organic evolution of social and technological dimensions within the ever-changing environment. We take this view on design to apply it in design interventions. The CoP theory gives tools for analysing activities of community members related to the place, as well as the external urban stakeholders. The literature on urban places gives the framework for analysing the material aspect of urban commons, i.e., the physical place created by commoners and urban prototypes. These theories are used as an analytical lens for the following design steps: ethnography-based studies of real-life urban commons and co-creation of an OSU infrastructure. Apart from that, reference theories are used as theoretical background for a resulting design science artefact, i.e., a design method for OSU.

However, the literature provides no knowledge on how infrastructures can be built for the idiosyncratic domain of commons. To close the gap, the next chapter proceeds with the ethnography that adopts tools from the CoP theory and literature on urban space in order to understand what practices, tools, and conventions of a real-case urban commons can be used to cultivate an OSU infrastructure.

5

Ethnographic study: Urban commons in the wild

Ethnography is a method that originates in anthropology where it was used to think and feel like the natives

- Geertz, 1974,

When I used to read fairy tales, I fancied that kind of thing never happened, and now here I am in the middle of one!

- Lewis Carroll, *Alice in Wonderland*

In the previous chapter, we reviewed the literature to construct an interdisciplinary research domain and selected reference theories. The literature review showed that studies on OSU are lacking. Moreover, there is no design knowledge on the cultivation of OSU infrastructures. Since the prior literature on OSU is lacking, we cannot use the 'laboratory' approach that is well-accepted in DSR, i.e., to construct a design artefact based on the literature. Instead, we conduct ADR in which an existing urban commons plays the role of our laboratory. We combined this approach with ethnography, that allowed us to gain an in-depth understanding of the urban commons. Ethnography is a fieldwork study that requires the researcher's immersion in a chosen community's everyday life and activities. The ethnographic approach suits our objectives well, as it secures the long-term commitment of practitioners (Sein et al., 2011). Although this design step is not focused

on producing artefacts, 'ethnographically inspired research inevitably intervenes in the fields studied' (Pors et al., 2002, p. 5) and, in our case, it prepares the context for further design interventions (Baskerville, 2015).

This research explores how OSU infrastructures can be co-created within urban commons. In IIs studies, Star and Ruhleder (1996) argue that an infrastructure "wrestles with the inertia of the installed base and inherits strengths and limitations from that base" (p. 113). In the same manner, Hanseth and Lyytinen (2016) offers a design principle for IIs that states: "build on installed bases". The prior literature on the installed base in the urban commons domain is absent. Hence, the primary objective of the ethnographic study is to investigate which elements (e.g., artefacts, practices) of the urban commons could be used for cultivating an OSU infrastructure, as required for the next design phase. This chapter addresses the second research question RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. To answer this research question, we use reference theories from the previous chapter to understand OSU better and explain what elements of urban commons can be used to cultivate an OSU infrastructure.

Since this chapter investigates an urban commons prior to an OSU infrastructure cultivation, it does not apply the first reference theory. The second reference theory, namely the Communities of Practice (CoP) theory, is used to analyse such aspects of the urban commons community as community practice, learning through shared practice, as well as boundary interactions with external urban stakeholders. The third reference theory, the body of literature on urban space and places, is used for analysing the spatial aspect of the urban commons, i.e., the physical location co-created by the CoP. The objective of this research step is 'constructing the field': the field does not exist as a phenomenon of the real world but instead emerges as an interplay between the observed reality and the researcher interpreting it (Karasti and Blomberg, 2018). By constructing the field, the researcher inevitably intervenes in community life, and this is not a matter of choice but an inescapable condition of the ethnography (Henriksen, 2002). Importantly, in our approach, we construct the field for further design interventions (Baskerville and Myers, 2015).

We must stress that we do not perceive this phase as pure ethnography since we use ethnographic tools in this dissertation to inform our design method. Although being a participating observer, the researcher clearly

stated their aim in co-design prior to starting the fieldwork because the research ethics prescribes openness and transparency. That makes this ethnographic study what Baskerville and Myers (2015) calls 'ethnography for design' that establishes the context for a future co-design process. To fit the design science approach, we refrain from providing a 'classic' ethnographic account (i.e., an essay-style text with a thick description of communal life). Apart from that, we must admit that saving the exact quotations was not feasible during the fieldwork (discussed in detail in section 2.4.2).

The chapter is organised as follows. The first section presents case selection criteria and justifies the choice of an urban commons community. The second section analyses the chosen urban commons equipped with the theoretical lenses from the previous chapter. The third section presents findings from the analysis, i.e., the elements for cultivating an OSU infrastructure. The fourth section concludes the chapter.

5.1 Study selection

In this section, we justify a citizen initiative selected for collaboration (i.e., the ethnographic study and design interventions described in the next chapter). Firstly, we present selection criteria for an urban commons initiative suitable for the ethnographic study. Next, we discuss the limitations that were applied to the selection process. Moving further, we describe a chosen urban commons in a nutshell to justify the choice. Finally, we clarify the relationship between the researcher and the OSU community.

5.1.1 Selection criteria

The objective of the ethnographic study is to investigate which elements of the urban commons could be used for cultivating an OSU infrastructure, as required for the next design phase. To conduct ethnographic fieldwork of an urban commons, we must begin with a selection mechanism to ensure that a chosen initiative matches the objective of this study. Based on the literature review of the third chapter, we derive criteria for selecting an urban commons initiative that is suitable for this study and justifies the selected urban commons. The criteria are the following:

1. the community should be *self-organised*, i.e., initiated by citizens in a bottom-up manner, as they could not find a satisfactory solution to a

specific problem from the government authority. As a response, they self-organise in a community to solve it (Denters, 2012).

2. the community should be *commons-based*, i.e., aim at the collective production and management of resources in the urban context (Foster, 2011).

3. the community should be *spatially-rooted*, i.e., have a co-created urban place, thus, the initiative is 'firmly rooted in the 'life-world' of citizens' (Gaventa, 2006). Urban places created and owned by businesses or the government ingrain market-driven logic different from commoning; therefore, such places hinder commoning (Euler, 2018). Hence, an initiative's members should have collectively created a place that supports their commons-based practices.

4. we require the community to count at least 25 active members, as the initiative should be sufficiently complex.

5. the community should have produced a *grassroots urban innovation* i.e., unique urban designs and practices, not ready-made solutions that have been already shared on the internet.

6. community members should be *open to collaboration*, i.e., willing to accept the researcher in the community and allowed to participate in activities, observe them, and access their documents. Moreover, they should be interested in cultivating an OSU infrastructure, as required by the next phase of our research approach.

7. We limited the search area by the researcher's location, namely the Amsterdam region, the Netherlands since we planned to conduct a long-term ethnography that implies immersion in community life.

The first three criteria focus on the scope of this dissertation, i.e., self-organised urban commons that co-created urban places. We expect that our design method for OSU is generalisable to the category of bottom-up initiatives. The last criterion was set for pragmatic purposes (Yin, 1994), e.g., the researcher would not move to another country to conduct ethnography.

Equipped with the selection criteria, we scanned various information sources concerned with the topic of citizen initiatives, namely the Amsterdam municipality website (amsterdam.nl), newspapers (e.g., Amsterdam Alternative), digital platforms (e.g., amsterdamsmartcity.com), and Facebook

groups (e.g., Bewonersacademie). Additionally, we conducted a search in Google with the query 'Amsterdam' plus one of the following terms in Dutch and in English: 'maatschappelijke initiatief' (eng. social initiative), 'ruimtelijke initiatief' (eng. spatial initiative), and 'burgerinitiatief' (eng. citizens' initiative).

The difficulty of finding the appropriate initiative was manifold. Firstly, although natural resources commons are well-studied (e.g., Ostrom, 1990), the urban commons approach is a relatively new phenomenon; there was hardly any initiative of this sort (i.e., no initiatives meeting criteria 2). Another hurdle, surprisingly, was to find a self-organised initiative, i.e., one initiated by citizens and does not involve any management or funding from public or private companies. Suitable at first glance, many cases were funded or facilitated by external organisations (i.e., not meeting criteria 1). Finally, in this research phase, we wanted to address the production of grassroots urban innovation. For this reason, we excluded several initiatives that otherwise less or more matched the criteria. For instance, community gardens, as they are well-studied by both urban practitioners and researchers, and there is hardly a strong case for grassroots urban innovation.

Eventually, we found an initiative that met all the criteria – KasKantine (eng. Greenhouse cantina) – a citizen initiative that strives for "decentralised, autonomous, integrated solutions for the big challenges of our generation and the ones to follow" (retrieved from http://kaskantine.nl). The initiative was established in 2014 in Amsterdam, the Netherlands. It occupies temporarily empty construction plots and moves every 1-2 years. The initiative expands space for experiments with every version and grows its community while setting new socio-ecological objectives. The urban place, built by community members from scratch, is not connected to city infrastructures and produces energy and water autonomously. In each new version, the construction materials and technological solutions are reused. With every move, the community gains knowledge and experience and improves its designs and organisational processes. Initially conceived as an urban farm cafe that focuses on sustainable food, it gradually transformed into a community-driven off-the-grid autonomy experiment aiming to increase self-sufficiency and socio-ecological resilience on the neighbourhood level. Using the word experiment in the description, the KasKantine community stresses that they have not yet developed reliable off-grid

solutions ready for replication and perceive the initiative as ongoing development in that direction. At the moment of the inquiry, 'KasKantine' is in the third version. The ethnography took place from July 2018 to September 2019.

The initiative complies with selection criteria as follows: (1) The initiative is *self-organised* and aims at solving socio-ecological issues of the local urban environment perceived by its members; (2) the initiative features *commons-based* practices, such as distribution of food, rejected by supermarkets, among community members; (3) it is *spatially-rooted* in the form of urban place that consists of several Do-It-Yourself (DIY) structures, such as a cafe, urban farm, and workshops; (4) the community consists of more than 30 committed community members and engages approximately 150 volunteers per year; (5) community members gained sufficient DIY design knowledge in building off-grid structures and technological solutions required for the initiative; moreover, it has been reproduced twice on new land plots, therefore, community members have learned how to re-install them in different contexts. Thus, the initiative matches the *grassroots urban innovation* criteria; (6) the initiative was *open to collaboration*, as the researcher was accepted as a volunteer and an ethnographic researcher.

5.1.2 The relationship between KasKantine and the researcher

KasKantine is the complex, multifaceted urban commons that was hard to explore and understand even being immersed in the community's everyday life. This dissertation reports the investigation of the fertile ground for OSU and the cultivation of an OSU infrastructure 'Experimental Networked Autonomy' (ENA) with KasKantine community members. In fact, these activities and topics are a fraction of those the researcher attempted to engage in, such as urban agriculture, community resilience, food, biodiversity, and alienation, to name just a few. Unfortunately, most of the topics central to KasKantine did not fit the scope of this dissertation. However, a great deal of time was spent on understanding this everyday reality of community, which also became the researcher's everyday reality.

The mentioned topics are irrelevant to this dissertation and out of its scope. However, we want to stress that during ethnography is particularly hard to carve out some part of the social reality and close eyes on some phenomena as 'irrelevant'. The researchers lived the life of the KasKantine

community: that is ethnography. Total immersion was required as part of our research approach, thus, we consider this time as spent well and with success. Nevertheless, ethnography has a significant risk of researcher bias. Immersion of the researcher in the community's everyday life and identification with its members hardly leave space for neutrality.

We took precautions to mitigate the researcher's bias as follows. Firstly, we used various sources of information, such as various community members and documents produced inside and outside the community. We were open to criticism from our colleagues. Moreover, the community leaders were familiar with the practical objective (i.e., to construct a prototype of an OSU infrastructure). However, they were not interested in the research objective – a design method – and the process of synthesis of the method was on the researchers' side. A most important step to mitigate the researchers' bias is the following: after the ethnography and design interventions were done, we discontinued our engagement in community life. We stopped personal relations with community members since social interactions bring emotions that might lead to cognitive bias. We discuss the researcher's bias at length in section 8.3, 'Limitations of the study'.

Another factor that complicated this research is the self-organised nature of KasKantine.

To explain this, we need to analyse *control structures* of KasKantine. We apply three key aspects for determining control structures in Action Research projects in IS (Avison et al., 2001). The aspects are initiation, determination of authority, and degree of formalisation. The researcher initiated the collaboration with KasKantine as part of this study. Equipped with the initial literature, the researcher contacted the urban commons intending to embark on the urban commons CoP for the ethnographic study and following design interventions. Researcher-driven initiation posed a challenge, as community leaders were initially reluctant to fully engage in the co-creation of a socio-technical system for OSU.

Nevertheless, the researcher was allowed to participate in community practice, leading to growing trust in the researcher's design solutions and incremental implementation. Considering the degree of formalisation, the collaboration had an informal character. Since the researcher initiated the ADR project, community leaders were not interested in the outcome of collaboration and made no formal agreements on its means and ends. Additionally, the initiative is driven by a community of like-minded people, and

relations there are based on trust and commitment, not contractual obligations. The agreements between the researcher and the co-founders were verbal and quite vague, in the spirit of 'let us try to work together and see what happens'. Finally, the researcher had no authority for organisational actions, as any other community volunteer with no formal ties to the initiative and obligations to other stakeholders, such as the municipality and contractor organisations.

The final remark about the relationship of the researcher and the community: we began this study perceiving the urban commons as a perspective model for solving pressuring urban problems, such as atomisation, alienation, citizens as passive consumers, and clients of city services. At that moment, Kaskantine exhibited properties of the urban commons with grassroots innovation potential. In other words, the researcher began this study as a proponent of the urban commons.

5.2 Analysis

This section analyses the real-life urban commons based on the reference theories selected in the previous chapter; specifically, we analyse (1) the spatial dimension of the urban commons (i.e., the urban place); and (2) the urban commons community through the lens of the CoP theory. In the case of this dissertation, we use ethnographic tools to inform our design method. Thus, we perceive this study as instrumental in achieving the main research objective, i.e., a design method for OSU cultivation.

In our research approach, we refrain from providing a 'classic' ethnographic account (i.e., an essay-style text with thick descriptions of communal life). Although being a participating observer, the researcher clearly stated their aim in co-design prior to starting the fieldwork because the research ethics prescribes openness and transparency. That makes this ethnographic study what Baskerville and Myers (2015) calls 'ethnography for design' that establishes the context for a future co-design process. This phase means 'a change of life for the researcher and others in the context' (Kilbourn, 2013). Apart from that, recording the direct speech of participants was impossible because this would disrupt the community activities; apart from that, some members refused to be interviewed. The researcher made notes and reflections whenever possible (see full discussion in section 2.4.2). Therefore, this ethnographic account does not contain direct quotes from participants. Nevertheless, we use vernacular of the field (Schultze, 2000),

i.e., terms coined in the community, to give readers some 'flavour of the community life'. We mark vernacular expressions in italic, for example, 'off-grid experiment'.

Concerning the evaluation of ethnography, three criteria are commonly applied, namely (1) authenticity, (2) plausibility, and (3) criticality (Golden-Biddle and Locke, 1993). Authenticity requires the researcher to provide evidence of researcher's immersion in the real-life setting and convince the reader. Usually, ethnographies provide such evidence in the form of 'thick descriptions' of the time spent by the researcher in the field. Plausibility means that the 'shared story', i.e., an ethnographic account, addresses a scientific problem and brings new knowledge to the field (Baskerville and Myers, 2015). Criticality "suggests that the purpose of ethnography is to understand ourselves and others in new and better ways" (Schultze, 2000, p. 31). We met these three criteria in the ethnography reported in this chapter.

With regard to the style and language of the ethnographic report, we stick to the more formal description style of IS field. For instance, we omit the 'atmospheric' description of people's actions as well as the researcher's thoughts and emotions during the fieldwork. Likewise, we do not use personal pronounce, traditionally used in ethnographies, to keep this dissertation's stylistic consistency. The reason is that we perceive this ethnographic account as a tool for investigation, the results of which will be applied to fulfil the main research objective, i.e., developing a design method.

5.2.1 The Place

This section analyses the three dimensions of the urban place discussed in the previous chapter, namely the urban context, spatial and symbolic dimensions (Agnew, 1987). The first aspect refers to the physical location of the place. The second aspect, locale, means a material environment for social relations. The third part refers to the symbolic dimension of place in which people create personal and collective meaning of it. Our objective is to highlight the importance of both tangible and intangible aspects of place for the functioning of the urban commons.

The urban context

Before getting familiar with the urban commons, we present its urban context focusing on those developments that influenced the inception of the

initiative and, as we will see later, brought tensions with the urban officials. Particularly we discuss the perspective of the Dutch government on community initiatives, gentrification of Amsterdam, its recent shift towards more 'socially-oriented' development, and sustainable transition of the city.

Community Initiatives in the Netherlands. In the Netherlands, the first attempts at citizen involvement in spatial development processes were made in the 1960s. Currently, the multi-actor approach and interactive planning are widely accepted as a way to negotiate various interests of public, private, and civic stakeholders. However, some argue that, in practice, participatory processes are beneficial for developers while local communities and civic organisations have to deal with 'environmental burdens'. Community initiatives (CIs) are considered one of the next-generation frameworks for citizen participation aligned with the Dutch government's goals to increase self-motivation and voluntarism in society.

On the one hand, community participation improves citizen-government interaction and improves democratic legitimacy in urban development. On the other hand, CIs are perceived as one of the means to transform the Dutch welfare state into a self-provision model that fits well with the neoliberal market paradigm (Boonstra and Boelens, 2011; Denters, 2012; Hendriks and Tops, 2003). Despite promoting active citizenship and DIY-democracy in the Dutch policy debate, in practice, attempts of co-production that are started by active citizens often face resistance and 'contr-production' actions from municipality professionals. Local governments avoid co-production with communities due to a 'risk-aversive conservative administrative culture' and a lack of trust in active citizens' accountability and liability Kleinhans (2017, p. 1514).

Gentrification of Amsterdam. Due to gentrification, active citizens face the challenge of finding a parcel of urban land to establish their self-organised initiatives. In the 1990s, gentrification became a worldwide urban phenomenon due to the coupled effects of globalisation and neoliberal transformations of states (Smith, 2001). In the early 90s, the municipality of Amsterdam was using policy tools to prevent 'spatial problem concentrations'. At the same time, liberalisation of the housing market began gentrification of neighbourhoods predominantly in the city core (Uitermark and Bosker, 2014). Since then, the municipality has expanded its gentrification policy agenda to deal with the unique issue of 'too much afford-

ability' of social housing. In the 2000s, not only the city centre but also peripheral neighbourhoods were under the pressure of gentrification. That development led to the rearrangement and expulsion of local communities. Nevertheless, expulsions were diminished by the old institutional mechanisms inherited from the welfare state (Van Gent, 2013). As Uitermark and Bosker (2014) argues, after the global crisis of 2008, no more funding was left for top-down state-sponsored gentrification, which led to a shift in policy agenda towards incremental development of neighbourhoods in collaboration with local stakeholders. However, this strategy has a higher chance of succeeding in areas with more developed social and economic capital, i.e., the city core, which, consequently, might deepen the divide between more and less developed territories.

Amsterdam Municipality. Amsterdam city council, elected in 2018, has developed an implementation plan for 2018-2022 that highlights citizen participation. Among other goals, there is a plan for 'democratic renewal' that includes establishing co-creation centres in each district and emphasises community initiatives to improve community provision and social cohesion; for instance, a commons initiative pilot is suggested (Amsterdam Municipality, 2019a). In line with the transition to the new paradigm of urban development, "Environmental Law" (Omgewingswet in Dutch), Amsterdam Municipality drafted an "Initial memorandum on the Amsterdam environmental Vision-2050" (Startnoticie Omgevingsvisie Amsterdam-2050 in Dutch). The vision states that Amsterdammers should have more influence on their urban environment to cope with urban transformation in light of such challenges as city growth and climate change. Another aspect of the new vision is an ambition to develop urban environments in an integrated cross-sectoral manner, i.e., artificial and natural components of urban ecosystems, for instance, water, energy, flora and fauna, health and wellbeing, and housing should be perceived in conjunction (Amsterdam Municipality, 2019b).

Spatial dimension

KasKantine occupies temporarily empty plots of land, usually reserved for territory redevelopment, and moves every 1-2 years. With every version, the community expands space for experiments and raises its community while setting new socio-ecological objectives. Important to note that the initiatives did not start from scratch every time. First of all, all construction materials and technological solutions are always reused. Moreover,

with every move, the community gains knowledge and experience and improves its designs and organizational processes. Finally, with each version, KasKantine was increasing its ambitions and goals.

The initiative was established in 2014. It relocates every 1-2 years and occupies temporarily empty construction plots. At the moment of the inquiry, it occupies a construction site in the neighbourhood 'Westlandgracht'. According to the contract with a social housing developer company, it can occupy the land for free for a period of two years (2017-2019), in exchange for providing social services for the neighbourhood, such as a community garden, donation-based cafe, and a food bank. The place occupies an area of 0.6 hectares. It is made of two greenhouses and ten second-hand shipping containers surrounded by a fence; an urban garden and a volleyball field are located outside the fence. Figure 5.1 depicts a satellite map (source: Google Maps); numbered squares represent functional zones of the initiative, namely: KasKantine restaurant (1), back space (2), a garden (3) and a public space (4). The researcher made this division based on different access levels of zones and community members' perceptions.

Figure 5.1: Spatial configuration of KasKantine

KasKantine restaurant includes two greenhouses, with a total square of 150 m2, containing a bar counter, pizza oven, and tables for customers. Two shipping containers, transformed into a kitchen, food storage, and restrooms, adjoin them. The restaurant serves food two days a week and, on other days, hosts events and weekly classes, for instance, yoga, DJ school, and the Dutch language, among others. Clients come only for events and have access only to the cafe space. Figure 5.2 gives an impression of the restaurant.

Figure 5.2: KasKantine restaurant

The back space is dedicated to the community members only and comprises places for work, rest, and storage for tools and materials. The garden is freely accessible, and anyone who wants to work there can join the garden team. Near the garden is a public space for neighbourhood residents equipped with picnic benches and a volleyball field. Figure 5.3 depicts some parts of the back space (top two photos) and the garden and part of the public space (bottom photo).

The initiative functions off-grid, which is provided by a set of urban prototypes. Various sustainable technologies have been applied to create urban prototypes: commercial products (donated or repaired) and DIY naturebased solutions. To give a few examples: electricity is provided by solar panels; heat is produced by rocket stoves having CO_2 filters; filtered rain-

Figure 5.3: Backstage and garden

water is used for non-cooking purposes, while filtered greywater from the kitchen is reused for plant watering. Table 5.1 describes urban prototypes created by KasKantine CoP. We should highlight that a detailed description of innovative off-grid urban prototypes of KasKantine is out of the scope of this dissertation, despite the fact that the author spent a sufficient amount of time learning the functionality of these.

Table 5.1: Urban prototypes of KasKantine

	Name	Functions
1	Container greenhouse	Create protection from wind and rain; supports food production
2	Off-grid solar energy system	Produces and stores electrical energy
3	Rainwater system	Catches and purifies rainwater for
4	Greywater system	Cleans grey water for greenhouse irrigation
5	Rocket stove	Off-grid heating and cooking
6	Raised bed garden	Containers for growing plants
7	Freshwater aquaponics	Produces herbs without soil and watering based on water circulation through fish tank
8	Worm compost	Transforms food leftovers into compost
9	Food recycling station	Used to sort and redistribute 'food waste'

5

Symbolic dimension

This section analyses the symbolic dimension of KasKantine, which is closely related to the notion of 'created/claimed space' (see the discussion in section 4.3.1). We defined spaces as "opportunities, moments and channels where citizens can act to potentially affect policies, discourses, decisions and relationships that affect their lives and interests." (Gaventa, 2006, p. 26). Urban commons exist in 'claimed/created spaces', i.e., spaces that emerge as a response to the common concerns or identifications in which like-minded people come together for collective action (Cornwall, 2002). Members of urban commons operate in such created or claimed spaces that stem from a common concern; hence these initiatives are "firmly rooted in the 'lifeworld' of citizens" (Denters, 2012, p. 233).

The developing CoP gradually shaped the direction of the development of KasKantine. The factor of citizen ownership is crucial: other places with similar objectives are controlled by public or private companies, despite attempts to ensure citizen ownership of the place and knowledge, designed in a top-down manner, and citizen control of them is often decorative. Conversely, KasKantine is co-created by and for citizens, which gives the community members the feeling of ownership and control over the place. Community members report the urban place as a *place of freedom*, a *safe space*, and a *place where everybody is respected*. Because of this, innovative ideas sparkle and local knowledge is shared based on the needs of the CoP and

not imposed from the top-down.

The prevalent community visions and values are the following: community self-provisioning and self-sufficiency without external funding, based on the commoning and processing of discarded products (so-called 'urban waste'); community-driven sustainable agriculture (permaculture, bio); sustainable consumption (processing of food waste, locally-grown food); circular economy (e.g., DIY devices for off-grid energy and water production); citizen engagement (commitment, education, empowering). Although shaped predominantly by the co-founders, these visions attract new community members and help them shape their identity as *KasKantine* people or *KasKantine team.*

Urban prototypes create an aesthetically pleasing atmosphere for some but not all. Most of the visitors are not interested in the functionality of prototypes but are simply charmed by the DIY atmosphere. Most volunteers are also not interested in specific urban prototypes but in the general idea of off-grid experiments as a space of free experimentation. The place attracts active citizens who seek engagement in solving problems such as community resilience and urban food sustainability. According to the *core team members*, although the initial intention is to support people from the neighbourhood in difficult situations (e.g., low-income and asylum seekers), the non-ordinary appearance and ideas of the place attract people from the entire city of Amsterdam. As was noticed during ethnographic observations, the place became 'hip' and primarily attracts the creative class, thus, some ordinary people might feel uncomfortable.

5.2.2 The community and its practice

In this section, we analyse the KasKantine community from the perspective of the CoP theory (Wenger, 1998). As was discussed in the previous chapter, Communities of Practice (CoPs) are "small groups of people who regularly engage in similar practices and have frequent occasions to interact with each other" (Vaast and Walsham, 2009, p. 549). KasKantine community is a Community of Practice because it exhibits three elements of a CoP: 1) CoP members co-created a shared enterprise, i.e., the KasKantine urban place; 2) they regularly engage in practices and interactions; and 3) they have developed a rich shared repertoire of urban prototypes artefacts, routines, and even a place-specific jargon. This section analyses the urban commons from the perspective of CoP theory in detail.

The community

The community consists of three groups that can be divided based on responsibilities, as *core team members, active members, and volunteers*; it is a mixture of Amsterdammers and recent migrants of approximately 50 people. These people range from 20+ to 60+, although the majority are young adults. Many are either highly educated urban professionals or related to the food service industry (HoReCa: Hotel, Restaurants, and Catering). Despite the different ethnic and social backgrounds of the community members, they have shared ideas, such as *mindful consumption*, *nonconsumerism*, and *ecological justice.* These common ideas bind them together and constitute the shared community vision.

Three *core team members* are the co-founders of the initiative working as self-employed cooperators. They acquire a fixed income equal to the minimum wage defined by the government and use all surpluses to develop the place. The core team members elaborate development strategy, program events, perform everyday operations, recruit volunteers and assign tasks for them. The core team members are responsible for complying with governmental regulations (e.g., fire safety and hygienic standards) and the safety of volunteers. They founded the initiative and worked fulltime, thus knowing all processes that are important to initiative survival and development. Core members have a higher level of responsibility than volunteers, as they might have obligations to external actors, such as payments for real estate or complying with municipal safety rules. In fact, the first core member, the *founder* of KasKantine, founded it alone, thus, he has the most extensive knowledge of all the processes and relations with the urban officials. Besides, this person has a university education and management experience, as well as experience of working in ecological initiatives. Mentioned factors make him the most respectable, visible, and influential community member. Important to highlight that a non-hierarchical organisation is rather an ideal-typical situation in urban commons (Euler, 2018). Non-hierarchical relations and decision-making are hardly achievable among community members with different responsibilities and obligations.

Five *active members* of the cooperative joined the third version of KK and invested their *shares* (1 000 Euros per person) in its development. In exchange, they obtained their own workspaces, the right to freely use resources of the place, and decide upon its development along with *core team*

members. The invitation for membership was one-time action while the move to the third location was being planned. Some people acquired membership to perform entrepreneurial activities (e.g., making compost, producing juices from *food waste*), while others were interested in DIY solutions for sustainability (e.g., composting, off-grid tiny house).

Volunteers are active citizens that want to be involved in the CoP without contractual obligations and may freely leave the urban commons. Volunteers may join one of three teams: *garden, kitchen, or construction teams*, depending on their interests, skills, and motivations. *Garden team* is responsible for the urban garden, i.e., sowing, weeding, and watering plants. The harvest is used in the restaurant. *Kitchen team* is responsible for the restaurant, i.e., cooking, cleaning the space, and serving clients. *Construction team* is responsible for building and maintaining the place and its *urban prototypes*. Usually, there is a fixed schedule with *work shifts*, predefined time slots that volunteers can assign by prior arrangement with a core member responsible for the community coordination. Many volunteers are committed community members taking shifts one to two times weekly, while others volunteer occasionally. Volunteers must choose their *shifts* in advance and, if they cannot attend an assigned shift, find a replacement person themselves. This system assures that the urban commons have enough volunteers to perform required tasks.

Outsiders that visit the urban commons to use its services (e.g., restaurant) are *clients* or *consumers* of the community services. By the word consumers, core members stress that clients do not co-produce services and only consume.

Transforming consumers into community members

The volunteer base is fluid and in constant flux, as there is no official procedure for membership acquisition. Those interested in volunteering can get the information on the KasKantine website or from posters hung in the restaurant. One can come only once for a try-out day and never come back or can come again and become *part of the team*. The volunteer base primarily comprises former clients who became volunteers over time. Coming as consumers, some clients become interested in the CoP practice, become engaged as volunteers, and eventually become active members. Even if they intend to participate in urban commons, former consumers initially hardly understand the self-organised setting. Newcomer volunteers initially face difficulties fitting in the CoP even if they are aware of the values

and model of functioning of the urban commons because they have not learned the CoP practice (Wenger, 2000). For instance, absenteeism and responsible task performance were two frequent issues with new volunteers: accustomed to paid labour, newcomers supposed their volunteer contribution as a gift and felt no personal responsibility for functioning the urban commons.

As a core team member puts it (researcher's paraphrasing): "In the market economy, workers' labour is bought for money. Some might think that if you contribute as a volunteer, you do not have much responsibility because you do it for free, as a gift. With such an approach, initiative development is not sustainable; its development is hardly predictable and manageable. People see such voluntary activity as fun or fashion. Some might be excited but do not show up, which makes initiative management more problematic. The difference between volunteerism and activism is in the core values of people. If people feel that a job they do voluntarily is important for their community and society as a whole, then they're activists: they commit their time and energy to establish some activity and learn the context, regulations, and all kinds of dependencies in a given urban setting. Volunteers do not think through an issue they are helping to solve. It is crowd-based, and they execute fine-grained, clearly stated tasks.". For this reason, despite being a self-organised community, Kaskantine exhibits coordination mechanisms (see section 5.3.5). To conclude, transforming consumers into community members takes the time and effort of more experienced CoP members.

5.2.3 Documenting DIY knowledge

KasKantine provides the environment for learning DIY knowledge. New members of the CoP learn how to perform tasks by learning-by-doing. Interestingly, in KasKantine, DIY knowledge is tacit and seldom exists in explicit, codified form. Some attempts at DIY knowledge codification and digitalisation for internal use by CoP members were made but later abandoned because of three hurdles.

1. The first hurdle is lacking volunteers that are required not only for the knowledge translation but also for the maintenance of manuals and digital infrastructure in an up-to-date state.

2. The second hurdle is related to the constant flux of volunteers. Coer-

cion and controlling volunteers to read manuals would impose additional work on the core team. Additionally, such traditional organisational logic runs counter to community values as it would create tensions in the community.

3. The third hurdle is related to the embodiment of knowledge. The transfer of embodied knowledge is more effective in peer relations. Volunteers transfer knowledge to each other during work activities, i.e., learning-by-doing.

The first two hurdles are feasible to overcome, but the third one is related to the community values, and it prevents the management team from translating the tacit knowledge of the CoP into an explicit form.

When self-organised groups begin a collaboration with organisations, it demands translation of their tacit DIY knowledge into explicit form (e.g., design proposals, agreements, funding requests). The knowledge that is not an object of inter-organisational collaboration stays tacit as a part of communal practice. For instance, the community learns how to govern shared resources by trial-and-error process, and new members acquire this knowledge through engagement in community life. In the same manner, urban prototypes (e.g., aquaponics) that are developed in self-organised groups result from collective creative experimentation that does not adhere to formalised design methods accompanied by thorough documentation.

5.3 Findings

This section discusses the findings of the ethnographic study, namely the concept of *fertile ground* along with elements constituting it. The literature on IIs indicates that infrastructure should be built on the 'installed base', i.e., existing systems and practices (Aanestad et al., 2017) that are not limited to technologies and can include the social aspects of infrastructure functioning (Marttila and Botero, 2017). The installed base is an analytical tool that can help during design interventions (Aanestad et al., 2017); elements of the installed base can be mapped before the cultivation of an II begins (Hanseth and Lyytinen, 2004). In IIs literature, the installed base adheres to the market logic. For instance, a design theory for IIs (Hanseth and Lyytinen, 2016) suggests that positive network effects of a growing installed base of users lead to self-reinforcing path-dependent processes.

In the case of OSU infrastructures, we deal with small-scale IIs and significantly less amount of resources existing in the self-organised setting of the urban commons. In the case of KasKantine, we observed the emergent properties of the urban commons, i.e., the social context in which the II grows is emerging itself. We argue that for the OSU domain, this would be better captured under a different notion instead of the installed base: we label the observed phenomenon under the notion of fertile ground. We offer the term *fertile ground* for OSU infrastructures instead of the installed base widespread in IIs studies. We suggest the new notion to highlight the different mode of production in the urban commons that are self-organised, emerging communities driven by the values and visions of people. The urban commons is the fertile ground where an OSU infrastructure grows if cultivated. Organic growth is a slow, natural evolution.

We identified four elements that serve as the fertile ground for cultivating an OSU infrastructure for KasKantine, namely: 1) Community vision; 2) Urban prototypes; 3) Community activities; 4) The Commoning place. Community vision is a driver of urban commons development; Urban prototypes and Community activities are the means to achieve the vision; and the Commoning place is a physical 'container' for Community practice and prototypes. Table 5.2 provides definitions for the elements of fertile ground derived from the literature background along with ethnographic examples.

5.3.1 Community vision

Initially, the place was built to realise the vision of the *founder* of personal and communal self-sufficiency, sustainability, and freedom. With the community's growth, the vision is further shaped by new CoP members. During the ethnographic study, KasKantine functions on the commons-based economy model of abundant material resources. KasKantine is built predominantly of *urban waste*, i.e., construction resources that otherwise would be discarded. In the same fashion, the initiative restaurant cooks with *food waste*, i.e., fruit and vegetable discarded from the local shops that are still edible but either has visual flaws or expire soon. This model allows the community to share resources and deliver donation-based public services. The initiative produces public services from otherwise neglected resources. However, the bar is commercial and contributes significantly to the initiative economy. In the market realm, 'ideal-typical' commons cannot function; therefore, the urban commons is always a mix of common-

Table 5.2: Fertile ground of KasKantine

Name	Definition	In KasKantine
Community vision	The term 'vision' is "a thought, concept, or object formed by the imagination" (Merriam-Webster, 2022). Community vision is a concept of the urban commons development collectively imagined by its CoP members (Angelidou, 2015; UN, 2016a; Gil-Garcia et al., 2016).	The Community vision of Kaskantine is citizen-driven delivery of public services by reusing rejected resources, such as construction materials and food. Examples of services are free food supermarket and donation-based restaurant.
Commoning place	Physical location co-created by members of the urban commons community as a means for their shared practice. Such places emerge as a response to the common concerns in which like-minded citizens come together for collective action (Boonstra and Boelens, 2011; Denters, 2012; Agnew, 1987).	The Commoning place of KasKantine is a physical manifestation of the Community vision for citizen-driven hands-on experimentation. It is built predominantly from "urban waste", i.e., construction resources that otherwise would be discarded.
Urban prototypes	DIY and incomplete experimental objects that are developed for specific local urban contexts and hand-crafted to tackle particular problems of local communities. Prototypes embody the ongoing experimentation of citizens with their urban environments (Jiménez, 2014).	The initiative functions off-grid, which is provided by a set of urban prototypes. The full list of urban prototypes is provided in Table 5.1
Community practice	Recurrent activities that are performed as part of membership in the urban commons CoP. Such activities are either related to reproductive labour (i.e., activities focused on keeping the Commoning place running and in order) or to achieving Community vision (Krasny et al., 2015; Wenger, 2000).	In KasKantine CoP, examples of recurrent activities are watering plants, doing dishes, and cooking meals. Examples of activities to achieve the Community vision are collecting and processing food waste.

ing and commercial practices. In KasKantine, the bar and donation-based events are the main sources of income for the 'core team' cooperators and funding for initiative development.

From the fieldwork, we gained the insight that the community vision, although fluid and not materialised in a document, has paramount importance for community development. KasKantine is the urban commons, thus, it does not adhere to the market logic. The main driver that moves the CoP forward is their vision of the alternative urban future for Amsterdam, which faces such pressing urban issues as gentrification, climate adaptation, and community resilience, among many others. KasKantine CoP is concerned about these particular issues and experiments with commons-based community action. The umbrella concept of the Community vision is an off-grid initiative providing an integrated approach to neighbourhood resilience. This vision is a fluid set of ideas and directions held among the core members of the CoP. The vision changes in response to changes in the 'outer world' and is based on the values of the CoP members.

The *founder* is steering the vision due to his education, along with his ability and willingness to collaborate with urban officials and other self-organised initiatives. New members join the CoP and engage in the self-organised community practice when their values and interests match the vision. Thus the cultivation of an OSU infrastructure should revolve around this cornerstone element of the fertile ground.

5.3.2 Commoning place

The second element of the fertile ground is the Commoning place, i.e., the physical location co-created by members of the urban commons community as a means for their shared practice. The Commoning place of KasKantine is a physical manifestation of the vision for citizen-driven hands-on experimentation. The experience of KasKantine is rather not a steady development but a constant struggle for the right to exist and practise what they see as important for the city, as the policy-makers of the municipality cannot deal with innovative DIY urban prototypes. The reasons for that is the contestation for the urban land and policies that can hinder grassroots innovation. CoP members develop a relationship with the Commoning place as they shape identities around its symbolic dimension, i.e., social space in which people create personal and collective meaning of a Commoning place (Agnew, 1987). Outsiders do not share this identity and can

only grasp physical location and DIY objects with their functions while interpreting the Commoning place regarding their experience.

As we observed during ethnography, community members treat the Community place as a 'freedom' space for self-organised experimentation and activism, while the civil servants treat it depending on their personal views and professional field, for instance, as a commercial cafe, a case of circular economy initiative, or as an urban farm, to name a few. The ambiguity and fluidity of the initiative bring tensions in communication with public servants. Bureaucratic rationality collides with urban innovation, failing to fit it into existing regulatory frameworks understandable by civil servants. Specifically, the concept of the urban commons implies the third way beyond the public and private companies dichotomy, however, the legislation does not provide legal grounds for such type of citizen initiatives. Therefore, Kaskantine can be identified neither as a non-profit initiative operating on subsidies nor as a commercial company. To conclude, we argue that the Commoning place is convenient to be analysed as a boundary object. It allows communication between the CoP and external parties, such as civil servants, while maintaining different interpretations of the boundary object.

5.3.3 Urban prototypes

The third element of the fertile ground is a set of urban prototypes that make up the Commoning place. In section 3.1, we defined urban prototypes as DIY and incomplete experimental objects that emerge as a response to pressing urban issues. The important difference between these DIY artefacts from official urban infrastructures lies in their permanent status of a prototype: even if an object is completed and requires no further design improvements, it is not a standardised product but an ad-hoc solution tailored for the specific local environment. Urban designs created by professionals are thoroughly tested, standardised, and comply with all possible federal and municipal regulations. In contrast, prototypes are incomplete, as they embody the ongoing experimentation of citizens with their urban environments. They developed *in situ* (i.e., in specific urban contexts) and *ad hoc* (i.e., hand-crafted to tackle not a class of problems but particular problems of their designers and local communities) (Jiménez, 2014)

KasKantine CoP developed several urban prototypes that allow the initiative to function off-grid, such as rainwater, urine, and greywater filters

and a solar panel electricity grid. Prototypes are incomplete, as they embody ongoing experimentation of the community. They developed for specific urban contexts of Amsterdam and hand-crafted to tackle particular problems, such as reducing food waste and local production of biological vegetables and herbs, to name just a few examples. The prototypes meet the community vision and are created in response to Amsterdam challenges that KasKantine CoP focus on tackling.

5.3.4 Community practice

The fourth element of the fertile ground is a Community practice. The CoP theory states that in a CoP, practice is "something that is produced over time by those who engage in it" (Wenger, 2010a, p. 180). CoP members collectively produce a practice that "reflects their own engagement with their situation" (Wenger, 2010a, p. 181). For the purpose of this dissertation, by Community practice, we understand recurrent activities performed as part of membership in the CoP (Krasny et al., 2015; Wenger, 2000). In KasKantine CoP, examples of recurrent activities (i.e. Community practice) are watering plants, doing dishes, and cooking meals, among many other tasks, mostly related to reproductive labour. Reproductive labour is activities focused on keeping the place in order, such as cleaning the Commoning place and cooking for volunteers. Another category of activities within Commoning practice is related to achieving Community vision. Examples of such activities from the ethnographic study are collecting and processing food waste and organising events for active citizens on topics of sustainability and self-organisation. Thus, Commoning practice is the means to achieve a Community vision.

5.3.5 Roles: Ambassadors, Coordinators, and Volunteers

Apart from the elements of fertile ground, we identified certain *roles* in the CoP, performed by the CoP members with relevant skills and knowledge. A voluntarily-driven meritocratic structure that is free from contractual and market relations is crucial in the commons; nevertheless, a non-hierarchical organisation is rather an ideal-typical situation in urban commons. Non-hierarchical relations and decision-making are hardly achievable among community members with different responsibilities and obligations. Besides, leadership is important in the functioning of CoPs because community leaders coordinate community members, develop Com-

munity visions, and make alignments between the CoP and external actors (Wenger, 2000).

In KasKantine *the core members* have a higher level of responsibility than *volunteers*, as they might have obligations to external actors, such as payments for real estate or complying with municipal safety rules. From the ethnographic observations, we learned that the core team members are those who have this burden since volunteers have no contractual obligations with the initiative. We identify specific Roles in the KasKantine CoP that reflect such obligations, namely Ambassadors, Coordinators, and Volunteers.

Ambassador plays the role of boundary spanner connecting the urban commons with the external CoPs(**?**), namely civil servants and other self-organised initiatives. In Kaskantine, the *founder* predominantly plays this role, while some experienced CoP members occasionally play this role. Ambassadors gradually adjusted KasKantine to the bigger urban vision of Amsterdam, connecting it with such concepts as commoning, doughnut economy, and community resilience, despite the initial focus to make KasKantine and CoP members self-sufficient and autonomous from the 'outside world'. The Ambassadors found a language understandable for external urban stakeholders. Defining and identifying these stakeholders goes far beyond the scope of this dissertation; for instance, see Mitchell et al. (1997) and Bryson (2004). Therefore, Ambassadors are essential for the survival of the urban commons, as they align the Community vision with the needs and demands of external stakeholders.

Coordinator manages activities regarding the Commoning place, such as reproductive labour (e.g., cleaning, cooking) and volunteer management. Contrary to the Ambassador role, which connects the community with the outside world, Coordinators focus on organising community life. In KasKantine, the second co-founder acted as Coordinator of the kitchen team, while the *founder* coordinated the Construction and Gardening teams.

Volunteer performs activities (i.e., Community practice) assigned by Coordinators. In the third chapter, we learned that members of an urban commons should collaborate as peers. Peer relations, i.e., a voluntarily-driven meritocratic structure free from contractual and market relations, are the crucial principle of commons production.

5.4 Conclusions

The domain of urban commons lacks prior literature on designing OSU infrastructures. To close this gap, we engaged with a real-world urban commons called 'KasKantine'. We adopted ethnographic fieldwork methods that allow the researcher to gain an in-depth understanding of case-specific problems. During the ethnography, we immersed ourselves in everyday life of the chosen urban commons community with the objective of identifying elements of the fertile ground to cultivate an OSU infrastructure. Besides, this ethnographic study had the objective of building relationships with community members, as the next design stage implies design interventions, i.e., collaborative efforts of researchers and practitioners.

The literature on information infrastructures indicates that infrastructure should be built on the 'installed base', however, the literature provides no guidelines for identifying it in the urban commons setting. To close this gap, we study a real-life case of urban commons using selected reference theories as analytical lenses.

OSU infrastructures are small-scale infrastructures that include a modest installed base existing in the self-organised setting of the urban commons. In the case of KasKantine, we observed the emergent properties of the urban commons, i.e., the social context in which the II grows is emerging itself. We claim that the observed phenomenon would be better captured under a different notion instead of the installed base. We label it *the fertile ground.*

This chapter answers the second research question: RQII *"What elements of the urban commons can comprise the fertile ground for OSU?".* We identified four elements that serve as the fertile ground for cultivating an OSU infrastructure, namely: 1) Community vision that is the main driver of the CoP; 2) Urban prototypes that are means for community practice to implement the vision; 3) Community activities that CoP members perform to achieve the implementation of the vision; 4) The Commoning place that is a container for CoP practice and means to act towards achieving the vision.

The identified elements of the fertile ground will be used as Constructs in a design method for OSU, for instance, in the description of design principles. Apart from the fertile ground, we identified three roles that existed in the community. One role, Ambassador, is a boundary spinner between the community and the external CoPs. Another role, Coordinator, manages all activities regarding the Commoning place, such as volunteers' coordination

and management of reproductive activities. The third role, Volunteer, performs all activities required for the functioning of the Commoning place.

The objective of this dissertation is to develop a generalised design method for cultivating OSU infrastructures. Since the literature on OSU infrastructures is lacking, we should conduct an empirical study investigating how an OSU infrastructure can be cultivated within an urban commons community. Therefore, the next chapter proceeds with design interventions suggested by the researcher in order to cultivate an OSU infrastructure on this fertile ground. We build a generalised design method for OSU based on this empirical case in the seventh chapter.

5

6

Design interventions: cultivating an OSU infrastructure

Everyone who devices courses of action to turn an existing situation into a preferred one, is a designer

- Herbert Simon, *The Sciences of the Artificial*

Why it's simply impassible! Alice: Why, don't you mean impossible?Door: No, I do mean impassible. (chuckles) Nothing's impossible!

- Lewis Carroll, *Alice in Wonderland*

In the previous chapter, we provided an ethnographic account of the Amsterdam-based urban commons called 'KasKantine'. The ethnography identified the elements of the urban commons that provide the fertile ground for cultivating OSU. The was a lack of understanding of this process of cultivation of OSU infrastructures, as the literature provided little insight into a commons-based cultivation strategy. To close this gap, we posed the third research question as follows: RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*. To answer this question, we conduct design interventions, i.e., researcher's activities within organizations that aim at solving their practical problems. This chapter reports on design interventions conducted in cooperation with members of the urban commons described in the previous chapter.

The logic behind design interventions lies in the adopted perspective on IIs: they have no specific purpose but rather a generic idea of supporting the community of practice with information-related services (Hanseth and Lyytinen, 2004). Thus, prior to design interventions, we stated an initial goal with the community: to co-create an OSU infrastructure, i.e., a socio-technical artefact that facilitates the proliferation of DIY design knowledge guiding the construction of an off-grid citizen initiative. Our methodology adheres to the practice approach in design science (Iivari, 2015) and the theory of reflective practitioner (Schön, 1983), i.e., during the design interventions, we reflected on problems at hand and possible solutions simultaneously with action and did not disengage from the real-life setting. During the design interventions, the researcher became involved in a real-world situation 'as both participant and researcher' (Checkland and Holwell, 1998) and conducted design interventions in collaboration with practitioners (Avison et al., 2001). Design interventions lead to a socio-technical change in organizations engaged in this research.

This chapter equips reference theories from the fourth chapter. The previous chapter was analysed with the help of two bodies of literature: the CoP theory and the literature on urban place. This chapter uses IIs literature as a reference theory in addition to the previous two. From it, we learned that infrastructure is not designed but rather cultivated (Grisot et al., 2014; Aanestad et al., 2017). We conducted four design interventions of different scales and duration, one after the other. Each following intervention was chosen based on the reflection on the previous one.

This chapter reports the design ethnography. Its findings serve as input for synthesizing a design method for OSU infrastructures. As Baskerville and Myers (2015) claim, in design ethnography, the ethnographic account of shared design experience is the main contribution since it is 'a venue for learning about social and cultural practices and values' (p. 38); as such, the design artefact is a by-product of the study. In contrast, we use ethnographic tools in this dissertation to inform our design method. Nevertheless, this chapter contributes to understanding the ethnographically-inspired design research process. To fit the format of design science, we refrain from providing a 'classic' ethnographic account (i.e., an essay-style text with a thick description of communal life).

The chapter is organized as follows. The first section reports the design interventions that resulted in an OSU infrastructure "Experimental

Network Autonomy". The second section provides the analysis and evaluation of interventions and lessons learned from them. The third section draws the conclusions of the chapter.

6.1 Design interventions

Design interventions are the researcher's activities within organisations that aim at solving their practical problems (Checkland and Holwell, 1998; Avison et al., 2001). We take an approach similar with one developed by Donald Schön (1983), in which he argues that design practitioners reflect on problems at hand and possible solutions simultaneously with action and not disengage from the real-life setting. In our case, 'clients', i.e., the KasKantine CoP, initially expressed no problems to be solved with design interventions; thus, the researcher immersed in the community life to identify them through ethnography. The design interventions took place from September 2018 to December 2020. In total, we conducted four design interventions one after the other. Each following intervention was chosen based on the reflection on the previous one. To explain the logic behind design interventions, we depart from revisiting the definition of IIs adopted for this research: **"IIs are shared resources for communities of practice; they facilitate information-oriented services; they have no clear scope or purpose; they consist of a heterogeneous and ever-changing set of technological and social components."**. We adopted this perspective on the IIs because it clearly delineates IIs from traditional IS: the former has no specific purpose but rather a generic idea of supporting the community of practice with information-related services, while the latter, such as decision support systems or accounting systems, clearly state their purpose and supported tasks (Hanseth and Lyytinen, 2004). Thus, prior to design interventions, we stated an idea (or an initial goal) for an OSU infrastructure to be cultivated with KasKantine: **co-creation and proliferation of DIY design knowledge guiding the construction of an off-grid citizen initiative**. The second prerequisite for design interventions is *openness* of infrastructures. In order to evolve and grow, infrastructures must be open, i.e., have no predefined limit of elements, users, functions, and scope. Additionally, they open in the temporal sense, i.e., with no set-in-stone deadlines, after which they stop evolving (Karasti and Baker, 2008). Having these two factors in mind, we designed an approach for design interventions.

The logic behind interventions is an infrastructure cultivation strategy. Grisot et al. (2014) suggests that a cultivation strategy consists of three aspects: process-orientation, user mobilisation, and learning.
Process-orientation means that we engaged with practices and technologies that existed in the KasKantine CoP in an incremental, step-by-step manner. We achieved that by conducting four design interventions. *User mobilisation* entails that we found ways to motivate CoP members to use and co-design ENA infrastructure. Ethnography helped engage in community life to understand the motivations of CoP members. *Learning* implies a reflection on design interventions, considering whether they meet user demands or not. In our cultivation approach, we reflected on each conducted intervention applying learned lessons to the following interventions. The resulting OSU infrastructure was called "Experimental Networked Autonomy" (ENA). Table 6.1 gives an overview of interventions.

The first design intervention aimed at the organisational transformation that would enable the community to tighten the Network of Practice while sharing DIY design knowledge and resources with like-minded communities and citizens. The three following interventions were focused on the cultivation of the infrastructure called "Experimental Networked Autonomy" (ENA). We cultivated the II in an ad-hoc manner waiting for opportunities to intervene, i.e., moments when members have a clear motivation to cultivate the infrastructure further. We used these elements to narrow down the researcher's focus omitting all other aspects of rich (or, as some put it, 'messy') community life. The evaluation of interventions was conducted *ex post*, which is reported in the second section. The reflection instigated the finalisation of the reference theories and the synthesis of a design method for OSU infrastructures.

Notably, it was difficult to engage community members in the widespread co-design activities (e.g. co-design workshop with card sorting and diagrams) because the CoP was focused on the everyday chores, while design-related activities we often perceived as unnecessary. Due to this challenge, the researcher applied a flexible approach aligned with the daily Community practice. For instance, we initiated *impromptu* evening brainstorms and co-design discussions with CoP members while performing physical tasks. Therefore, we avoided intervening schedules of community members, preferring to weave the required co-design process into the existing activities of the CoP.

Table 6.1: Overview of interventions and artefacts

Intervention	Motivation for intervention	Artefacts
Transforming the organisational structure	A clear organisational structure would support the production and sharing of open source design manuals. The organisational transformation was conceived as the first step in cultivating an infrastructure.	-
Bridging with external stakeholders	The CoP members were motivated to communicate the public value of KasKantine with external stakeholders through a website	website describing the Community vision of KasKantine
Creating design manuals	The CoP applied for a subsidy aimed at the sustainable transformation that was partially spent on creating design manuals of off-grid prototypes	booklet with design manuals shared on a website
Building the Network of Practice	To connect with like-minded CoPs and shape a Network of Practice	digital platform with open source design manuals and collaboration features

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6.1.1 Design intervention 1: Transformation of the organisational structure

The first design intervention took place in the period from September 2018 to January 2019 and partially overlapped in time with the ethnographic study. The core team members commissioned the researcher to suggest a new organisational structure that would feature a clear distinction of activities and new directions for development. The community leaders considered a possible organisational transformation to achieve the Community vision better. Specifically, the main community activity at that time was a volunteer-driven donation-based cafe that utilised food leftovers. The vision was to attract more active citizens and support people from the neighbourhood, for instance, by providing them with cheap meals. Instead, Kaskantine restaurant attracted young hip people from the entire city, while locals were mostly reluctant to visit it. Its objective was to raise awareness of social and ecological issues (e.g., over-consumption, consumerist approach), transform consumers into active citizens, and involve them in the community (see details in section 5.2.2.1). The realisation of this vision has partly failed, as most of the cafe customers perceived the initiative as a business, not as a socio-ecological initiative. The customers were often primarily interested in cheap service and the 'funky DIY style' of the Commoning place, not necessarily sharing the community values. The rationale behind the organisational transformation was to carry out activities that bring more value to the city and neighbourhood.

The objective of the design intervention, suggested by the researcher, was stated as to transform the organisational structure of KasKantine to be able to achieve its Community vision, i.e., to raise awareness on social and ecological issues. According to the CoP theory, members of such communities are bound together by a shared interest (in our case, raising awareness on socio-ecological issues). In the course of action, a CoP develops a repertoire that facilitates collaborations. The driver for the intervention was to introduce a new tool for the KasKantine repertoire (i.e. a new organisational structure) that would stimulate the development of new tools for achieving the Community vision. We used various qualitative data collection methods: semi-structured interviews with community members, participant observation, and co-design methods, e.g., brainstorming and affinity diagramming.

The desired outcomes were: to share DIY design knowledge and re-

sources with like-minded communities and citizens and tighten the Network of Practice. The researcher suggested the following design intervention: "KasKantine transforms into a living lab as a testbed for social innovation that fulfils the needs of local communities. The living lab could include self-organised initiatives, private companies, public organisations, and knowledge institutions. The main emphasis is co-creating practical solutions for greater social and ecological resilience." (Excerpt from a presentation to oP members).

The living labs are "environments for involving users in innovation and development, and are regarded as a way of meeting the innovation challenges faced by information and communication technology (ICT) service providers" (Følstad, 2008, p. 99). This approach is well-known and widespread in Amsterdam. With such framing, forming organisational partnerships with public and private parties would be easier. The suggested approach differs because the suggested living lab was planned as citizen-driven. The suggested transformation is aligned with the community focus on decision-making autonomy, as the community of practice sets both means and ends of living lab experiments and interventions.

As a design intervention, the researcher suggested organising community practice around 'three domains of sharing', namely, sharing resources (e.g., community garden, workshops, cafe), and sharing knowledge (e.g., lectures, hands-on workshops). The organisational transformation was conceived as the first step in the cultivation of an OSU infrastructure as a more explicit organisational structure would support the production and sharing of open source design manuals. The proposed intervention did not work out. We analyse the reasons for the rejection in the Reflection section (6.3), while the next section discusses the further transformation of KasKantine along with the suggested design intervention.

6.1.2 Design intervention 2: Bridging with external stakeholders

Changed circumstances for community survival shifted their perspective towards engaging in the cultivation of an OSU infrastructure. Specifically, the CoP faced the challenge of communicating the public value of KasKantine with external stakeholders. OSU infrastructure would facilitate it by transforming the ideas and visions of the CoP into an explicit form. According to the land contract, by the end of September 2019, the initiative

had to vacate the land. After several months of negotiations with municipal authorities and private companies, only two feasible options were left by July 2019. Two vacant land parcels are in the same neighbourhood, one owned by a housing corporation and another by the municipality. Both parcels were available only for temporary renting; however possible contract conditions differed. The housing corporation was able to allow using the land free of charge with the condition that the initiative provides social services for citizens in exchange. The initiative used that scheme at previous locations.

For land, only two types of rent contracts exist in the Netherlands, either market land price for businesses or a subsidy for non-profits. Both types were undesirable for the initiative leaders, as both would lead to eradicating the urban commons. The contract for commercial organizations is unsuitable because a market price would force core team members to transform the initiative into a traditional firm leaving no room for self-organization and experimentation. The non-profit organization contract allows using the land free of charge; however, it prohibits commercial activities. Such a contract is undesirable, as it would create a dependency on subsidies and grants from the government that would diminish the initiative's autonomy as it pushes to accept the top-down perspective on the initial development.

Core team members, motivated to keep the urban commons non-profit and independent from municipality subsidies, were looking for additional tools to show the public value of KasKantine. They were convinced that an OSU infrastructure could help communicate the public value of KasKantine with external stakeholders (e.g., by sharing design manuals). The *founder* of KasKantine suggested a name for an OSU infrastructure: Experimental Networked Autonomy (ENA). The name reflects the values and the vision of the CoP: experimentation with DIY urban prototypes through a network of active citizens to achieve more autonomy in food and energy production.

The CoP theory shows that boundary objects support the collaboration of actors from different social worlds as they maintain different meanings for heterogeneous groups of actors. In the context before the second design intervention, the CoP needed a boundary object to show to civil servants that KasKantine is adjusted with the goals of the municipality (i.e., co-creation with citizens, promoting citizen initiatives), while for the CoP members, it will be the foundation of the new ENA infrastructure. The re-

searcher suggested that a simple one-page website with the Community vision would suit the purpose as the boundary object. Therefore, in the second design intervention, four community members, including the researcher, volunteered to participate in order to create a website describing the Community vision of KasKantine (i.e. artefact of this intervention). Due to the time pressure, the team decided to rapidly design and develop a simple static website with no interactive elements. Thereby, this version was developed in approximately one week in August 2019. One peer offered to design a visual appearance and elaborate its program code. The choice of technologies was delegated to that peer with regard to their skills. Although the researcher advised using ready-made FLOSS solutions to increase flexibility and future development, the volunteer chose to develop the website from scratch. Thus, the website was built with JavaScript-based frameworks Node.js and React.js.

The website consisted of the main page with a graphical menu leading to description pages (Figure 6.1). The content consisted of a swift explanation of the Commoning place, its social value for the city, and a scheme of stakeholder collaboration. Apart from that, it listed a brief description of eight urban prototypes accompanied by photos and generic models of functioning (Figure 6.2). The *founder* wrote all texts for this website. The researcher facilitated the process (e.g., tasks and time management, brainstorming).
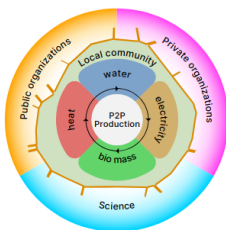
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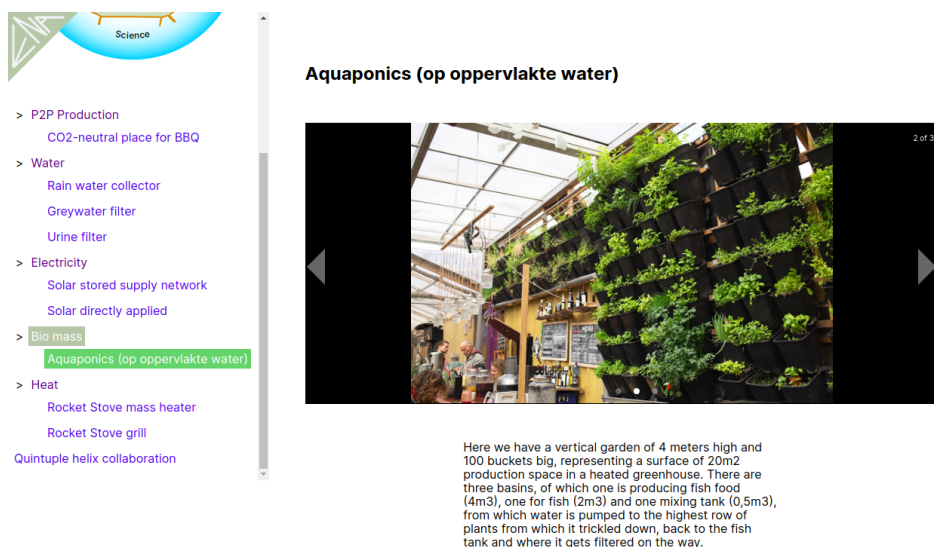Figure 6.1: Designed artefact: main page

Figure 6.2: Designed artefact: one of the inner pages

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Three community members, including the researcher, volunteered to draw models of the functioning of urban prototypes. One of them, the *founder*, was involved in constructing and maintaining the Community place from the beginning. They showed and explained the functioning of each urban prototype in the setting of the KasKantine Commoning place. Thereafter, the co-design team brainstormed on paper how models can convey this in a simple and generalized way. The team divided models to prepare them for the website, each using different methods of producing models depending on skills. One drew models on paper, and two others used different software apps. Importantly, models were elaborated by volunteers not skilled in engineering and graphic design. Therefore, the graphics looked inconsistent, and the overall visual quality of the models was low. Due to time pressure, delegating the task to one volunteer to achieve visual uniformity was impossible. Figures 6.3, 6.4, and 6.5 show examples of the models produced by the team.

6.1.3 Design intervention 3: Creating design manuals

In August 2019, the initiative was offered a five-year contract for creating the Commoning place on a municipal land parcel. Compared to previous
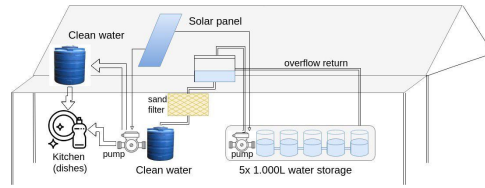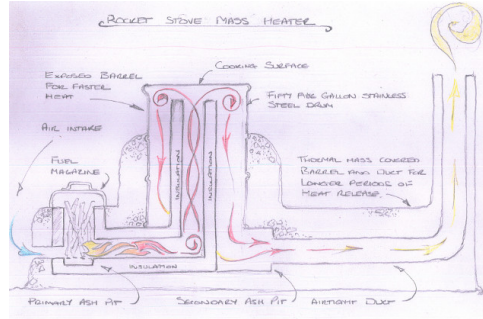
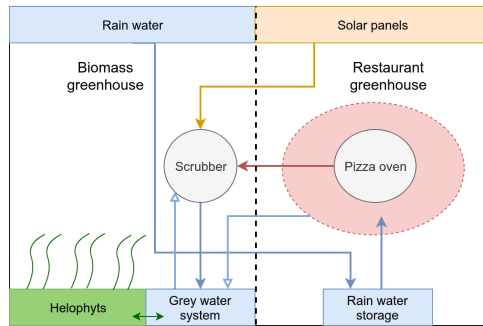Figure 6.3: Example model 1

Figure 6.4: Example model 2

Figure 6.5: Example model 3

contracts, which lasted for one or two years, this contract would provide more opportunities to fully develop the Commoning place in accordance with the Community vision. Moreover, relieved from the pressure to find a land plot, the CoP members would be more motivated to cultivate ENA infrastructure further.

Simultaneously, this contract brought an additional challenge related to the business model of the initiative. Previously, Commoning place operated on donations and profits from selling drinks, which covered expenses on the development and provided minimal wages for the community leaders

due to free-of-charge land contracts. Such a business model does not fit in the legal framework of the municipality, which recognizes either businesses competing on the market and paying the market land price or non-profits entitled to a municipal subsidy to cover the land rental costs.

The *founder* found a potential solution that could potentially eliminate or significantly diminish land rental costs while operating independently from governmental subsidies. The land price predominantly consists of providing access to city infrastructure, namely the electrical grid, water supply, and sewage. KasKantine operates off-grid, therefore, makes no use of such services. Additionally, KasKantine cannot be compared with business organizations as it aims at green transformation on the local level and creates public value. The *founder* decided to negotiate a new land contract for off-grid initiatives with the municipality. According to this proposal, non-commercial off-grid initiatives focused on socio-ecological goals could pay significantly lower land prices. This contract would benefit the city, as such initiatives occupy vacant land parcels and bring value to the city while demanding no land cost-covering subsidies from the budget. Although some public servants support and welcome the initiative's ideas, the formal procedure required for introducing a new contract demands communication of the initiative's functionality and objectives. This challenge became the primary driver of the next step in the cultivation of ENA infrastructure.

In September 2019, the initiative moved to the new land parcel. The Commoning place had to be rebuilt and could not function during the reconstruction period. During the reconstruction period, the municipality agreed to make a temporary free-of-charge contract that does not allow operations. To make their case of off-grid social enterprise stronger, the *founder* decided to upgrade the KasKantine water system to prove that rainwater and grey-water filters prevent leaks to the environment. The *founder* requested a subsidy from the municipal program called "Preparing for climate adaptation" that aimed at transforming citizen initiatives towards greater ecological resilience. The budget of € 15 000 was mainly required to cover material costs; however, the *founder* stated that € 3000 needed to be spent to create design manuals of filters that will be shared open source on a digital platform. Important to highlight that the researcher was not aware of this decision and has been notified post factum, as the subsidy was granted. The inclusion in the budget shows that community leaders recognized the potential of the digital platform and started acting proactively.

We argue that the community engaged in the co-creation process from this stage onwards as an equal partner. As the subsidy required reporting on expenses and deliverables, from this stage, the co-creation team was legally bound to develop a digital platform with design manuals.

The third design intervention took place from December 2019 to June 2020. This intervention focused on further the emergence of the ENA infrastructure. In this design intervention, the team co-designed two artefacts, namely 1) a booklet containing open source design manuals of urban prototypes; and 2) a website (landing page) communicating the Community vision and providing access to the booklet. The booklet form was chosen as it allowed us to collaborate on designs independently from the website development. Additionally, the one-file structure of the booklet allows for updating the design manuals without making changes to the website. The co-design team consisted of four members, namely the researcher, who facilitated the co-design process; the *founder*, who wrote manuals for the booklet; and two community members hired as paid contractors: a web developer and an architect. Neither the researcher nor the *founder* had material rewards for their activities.

The *core team members* offered payment for making the blueprints and the booklet layout for one of the committed community members involved in designing and constructing DIY objects as a volunteer. The task suited this person well, as they were a professional architect with experience in this job and were familiar with KasKantine designs and practices. Hired as a freelancer, they could spend more time on the project and create high-quality graphics in time for a deadline. The graphic software Adobe Illustrator was used to draw schemes and create the layout of the booklet. The choice of software was dictated by architects' skills and the fact that they already had licensed software at their disposal. For this community member interested in further urban commons development, the material reward motivation was not paramount, thus, their cooperation with other members of the co-design team was seamless. Predominantly, they collaborated with the *founder* that was able to explain the construction of urban prototypes in detail. The result was design manuals of urban prototypes. Graphics and manuals were compiled in a booklet (Figures 6.6 and 6.7).

In the previous section, we discussed the choice of web developer; consequently, the technology stack was dictated by the pressing deadline. This developer was not interested in further improving the ENA infrastructure,
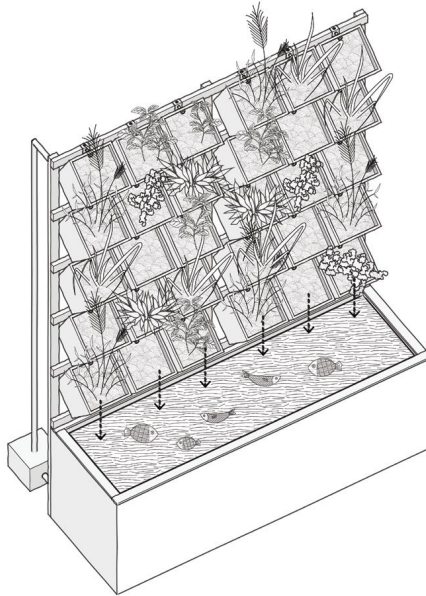
Figure 6.6: Graphics: scheme of aquaponics

forcing the co-design team to look for another software engineer. The previous version, developed in a matter of days, was not designed to be flexible and extendable. The rational choice was to develop the second version with a new technology stack. Although the website played an auxiliary role in this version, the researcher suggested considering its future development and maintenance. Open source software WordPress was chosen as one of the most popular website builders that require no designer or coding skills. Due to its popularity, it has a vast amount of plugins that allow it to implement a wide variety of design and functional features (e.g., user profiles and forums). For the role of a web developer, the core team members chose to hire someone previously involved as a volunteer for a short term. We would not consider that person a committed community member. When hired as paid professionals, they collaborated on the market logic principles, were willing to do as less work as possible and provided a website with minimal functionality. This collaboration resulted in an artefact (i.e., a website) that was hard to extend and maintain.

  The researcher suggested the website structure consisted of the follow-

Figure 6.7: Booklet pages

ing components: 1) the main page with excerpts from the booklet explaining the goals of the urban commons KasKantine, listing the design manuals of urban prototypes; 2) principles of functioning of the Commoning place; 3) brief history of KasKantine from the moment of inception; 4) a button to download the booklet in PDF format. The researcher suggested 'fence' access to the book with a contact form. Only people who left their emails and names could download the booklet. That design decision was made to contact people who have left their contact details and start building a Network of Practice (see the fourth design intervention). Considering the Open Source license, the Peer Production was chosen because scholars and practitioners from the commons domain collectively designed it.

Considering the role of community members outside the co-design team, we have to point out that most of them were not directly involved in co-designing ENA infrastructure. Everyday practices of the Commoning place include lots of physical labour such as gardening, cleaning, and cooking. Volunteers are usually interested in performing certain activities to enhance their skills or for recreation. The co-design team's goal, i.e., ENA

infrastructure cultivation, although supported and praised, was not of interest to the average volunteer. We assume that volunteers were not interested in the co-design activities (i.e., intellectual, 'office' work) because it is the everyday routine of many volunteers they want to avoid in their spare time. Nevertheless, if asked, many volunteers executed small-scale tasks. These tasks did not demand a long-term and intensive commitment. For instance, one community member being a native speaker of the English language helped to edit the booklet texts.

6.1.4 Design intervention 4: Building the Network of Practice

The results of the previous intervention motivated the design team for the fourth design intervention with the goal to transform the static website into a digital platform. A digital platform can be defined as follows: "a specific type of civic technology explicitly built for participatory, engagement and collaboration purposes that allow for user-generated content and include a range of functionalities [...] which transcend and considerably differ from social media" (Falco and Kleinhans, 2019, p. 3). The resulting artefact (i.e., a digital platform) should feature collaboration functionality, such as channels of communication and online spaces for cooperation. Since the previous artefact (i.e., the website) was developed with the open source CRM WordPress, the fit was feasible to achieve without external financial support.

The design team aimed to promote this version on the city level, using it as means to connect with like-minded citizens. The CoP theory suggests that such boundary objects facilitate the emergence of a Network of Practice (NoP). People in an NoP are engaged in the same or similar practice, however, they may never meet each other face-to-face (Wasko and Teigland, 2004). As individuals in NoPs share practice, they are interested in sharing knowledge across CoPs (Brown and Duguid, 2001). Information Infrastructures might facilitate trans-communal knowledge exchange in NoPs (Vaast and Walsham, 2009). Another reason for this design intervention was a requirement to manage the content by non-professionals. In the previous version, updates of designs in the booklet required licensed proprietary software Adobe Illustrator and skilled individuals to perform the task. Similarly, the previous website version was designed so that only individuals with web-development skills could modify it (e.g., add a new

page or change the text on the main page).

The fourth design intervention took place from June 2020 to December 2020. At this design stage, the co-design team consisted of the researcher, two co-founders, and community members occasionally performing small-grained tasks. At this stage, the second co-founder, who previously showed no interest in the project, joined the co-design team. The collaboration with the previous web developer failed, as they provided low-quality work as a paid professional and had no interest in continuing the collaboration as a volunteer. Due to this, the researcher took on the additional web development task, apart from facilitating the project.

The main page of the ENA digital platform gives an overview of the Community vision and urban prototypes (Figure 6.8).

To transform the website (i.e., artefact from the third intervention) into a digital platform, the web-developer implemented three new design features as follows. The features are a) the user interface separated from the content management, b) management of design manuals, and c) communication channels. Considering the first feature, we implemented the separation of content and the interface by introducing three user roles. Users with the Administrator role can perform all operations with the CRM, the Editors can modify the content but cannot change the website's functionality, and Subscribers have no access to content management. This feature allowed community members without web-development skills to modify the website content.

The second implemented feature regarded a website structure allowing one to add, edit, or delete design manuals. We coined the term 'module' for prototypes, as they can function individually and in combinations. Each module is presented on a separate page that features textual information augmented with media, such as schemes, photos, and videos. Figure 6.9 presents the list of modules and a module page.

The third implemented feature considered implementing channels of communication for users of the platform. We implemented this feature by means of the forum functions available as a WordPress plugin. Registered users can discuss specific modules on a module page, as well as start new discussions in the forum (Figure 6.10).

KasKantine already had a collaboration tool for the entire CoP, not only for ENA cultivation. This tool is the proprietary collaboration platform called Notion. On the platform, community members get updates on the

KasKantine development, schedules, and tasks. They suggested organising activities of the co-design team on that platform, namely tasks, meetings schedules and minutes. Online cooperative work on the design manuals was organised there as well, namely discussions on new design manuals and co-editing texts. The entire CoP adopted this collaborative space in the community practice. Thus, this collaboration platform also became a part of the ENA infrastructure. **This intervention took place during the pandemic. Due to this, the collaboration occurred predominantly online.** ENA infrastructure at this stage was cultivated to the level allowing a comfortable collaboration online.

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Figure 6.8: ENA platform. The main page
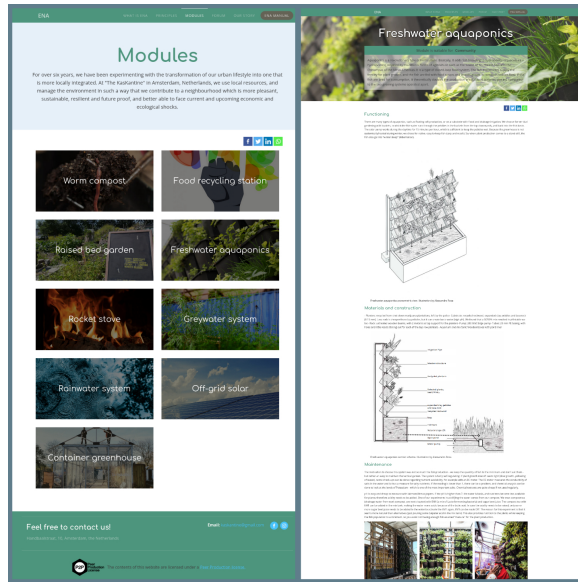
Figure 6.9: Left: list of modules; Right: Module page

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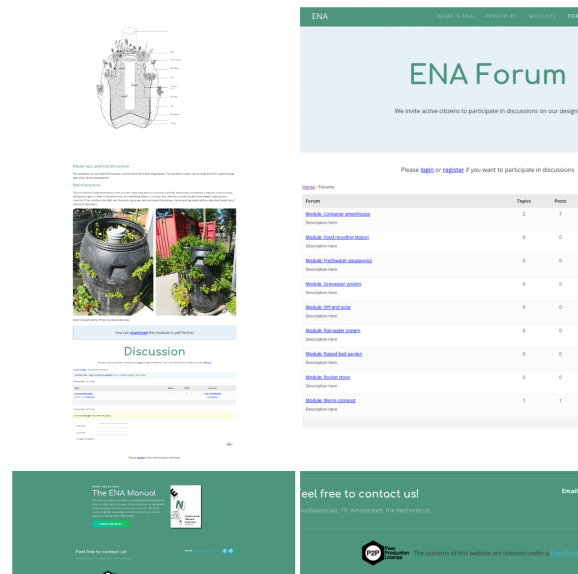
Figure 6.10: Left: Discussion on the module page; Right: Forum main page

6.2 Analysis and evaluation of design interventions

We conducted four design interventions of different scales and duration, one after the other. Each following design intervention was based on the lessons learned from the previous interventions. Table 6.2 provides an overview of design interventions. The rest of the section analyses each design intervention and reports lessons learned from them.

Table 6.2: Overview of design interventions

#	Intervention	Artefact
1	Transforming the organisational structure	New organisational structure that would feature clear distinction of activities and new directions for the initiative development
2	Bridging with external stakeholders	Simple website with brief descriptions of Urban prototypes to communicate the Community vision with other urban stakeholders
3	Creating design manuals	Booklet containing a complete Community vision and design manuals of urban prototypes along with a website providing access to the booklet
4	Building the Network of Practice	Digital platform that features collaboration functionality, such as channels of communication and online spaces for cooperation

6.2.1 Intervention 1: Transforming the organisational structure

The first design intervention did not work out due to internal and external factors. The first factor is related to deficiencies in the researcher's methods of inquiry: the researcher attempted to disrupt the community too quickly while lacking knowledge of community practice. The second factor is the community members' lack of trust in the researcher. As the researcher joined the community several months before the intervention, they were still perceived as a newcomer. Moreover, the design intervention was sug-

gested in line with the entire research project (i.e., this dissertation) that was initially evaluated by *core team members* as redundant and unnecessary. Community members were not motivated to co-produce open source design manuals since they saw no benefits of this for KasKantine.

Additionally, the initial top-down design perspective of the researcher should be taken into consideration. The researcher assumed that the suggested intervention, based on the literature and scientific methods, should be accepted. By not taking into account the informal, bottom-up nature of the community that might have an aversion to 'academic' and 'bureaucratic' ethos (e.g., methods, language, communication style). In the language of IIs infrastructures, we can put it differently: the inertia of the installed base was too strong, and future infrastructure users not included in the design process were excluded from the intervention. Moreover, the researcher did not gain a sufficient understanding of the fertile ground for OSU (e.g., Community vision).

Finally, the factor unrelated to the researcher is the lack of community resources available for the intervention. Although community leaders initiated the design intervention, the community lacked the resources to perform the suggested transformation and operate in accordance with the new structure. In our case, these are mostly committed individuals that invest their free time and expertise.

With regard to external factors, we can distinguish two crucial ones influencing the trajectory of KasKantine's development. Firstly, the CoP had higher priority goals. At the time of this research stage, the community already faced the pressure of finding a new land parcel to relocate the Commoning place and continue functioning. The second external factor is no common ground for heterogeneous initiatives that were perceived as possible partners of the living lab. The collaborations that core team members attempted to establish fell apart as they had divergent goals and challenges related to external stakeholders.

In retrospect, the timing of this intervention hindered success. Especially in such a community, a lack of trust combined with a number of other issues at play can hinder a follow-up. In the urban commons, organisational change should come from the community, not external actors. The latter might be perceived as representatives of the bureaucratic mechanisms of coercion and control and cause resistance. Such intervention should be more inspirational rather than directive and trigger the commu-

nity for change from the inside. Building trust between designers and the community is paramount in these transformations. We claim that designers should be accepted as community members and understand the vision and burdens of the initiative (i.e. fertile ground).

Having the identified factors in mind, we continued the engagement as an observing participant identifying the elements of the fertile ground and gradually building trust with the community members. The later design interventions were incremental and geared towards technological change, however, assuming the same vision that was initially suggested. The researcher's technical interventions, coupled with community leaders' activities in building a network of like-minded communities, eventually led to the organisational transformation.

6.2.2 Intervention 2: Bridging with other stakeholders

The artefact, i.e. the simple website, was built to serve for bridging with an urban developer company that could potentially provide a land plot for the community. This intervention lies in line with the 'reflective practitioner' theory in which researchers embrace changes in the context and "remain open to the situation's back-talk" (Schön, 1983, p. 269). This artefact became a foundation of ENA infrastructure. The prototype showcased the Community vision and the Commoning place along with Urban prototypes with the aim to communicate the social value of the urban commons that would increase the chances of getting a new land contract. This intervention was successful because the researcher, at this moment, already gained trust with the CoP and gained a sufficient understanding of fertile ground for OSU.

Reflecting on this co-design stage, we can draw the conclusions as follows. Firstly, a task that requires professional training, if executed by a pool of non-professionals, might result in low-quality deliverables since amateurs might lack knowledge and skills to execute the task in a sufficient manner. In our case, the style of the models and overall quality were inconsistent and unprofessional. Secondly, one volunteer developed the website from scratch without making conscious choices about using technology for long-term sustainability. The choice of the technology stack, dictated by the scarce volunteer pool, led to technological lock-in and brought issues with future development and maintenance. Using ready-made Open Source Software solutions could avoid this problem. Finally, this interven-

tion shows that onboarding community members in cultivation is only possible when they are motivated and believe that a co-created artefact benefits the community.

6.2.3 Intervention 3: Creating design manuals

During this design intervention, the *founder* engaged in the co-creation process and became proactive in decision-making on finances, goal-setting, and communicating with external stakeholders. At this stage, the *founder* set a clear goal for the co-design team, i.e., to create a booklet with design manuals for urban prototypes to justify the subsidy. ENA infrastructure was cultivated further by collaboration on artefacts of this design intervention. The municipal subsidy helped to achieve the following: 1) higher accountancy of the self-organised group that has to report the results at the particular due date; 2) high-quality graphics delivered by a paid community member (on the other hand, the second paid team member delivered poor results). Material incentives are acceptable in some cases and do not deteriorate the commons (see discussion about the commons and the market in section 3.4). In our design intervention study, the digital platform was created with this 'mixed approach' when some tasks of this design intervention were completed voluntarily, while others were paid from the municipality subsidy. However, peers that participated as paid professionals were previously engaged in the same activities voluntarily.

The intervention resulted in artefacts designed to share DIY knowledge. The artefacts are a simple one-page website and a printable pdf booklet with design manuals. Based on the open source Content Management System, the website was flexible and extendable. The website was online for several months, after which it was expanded and improved, thus, we cannot reflect on its long-term impact. However, during this design intervention, we acknowledged that well-chosen FLOSS allowed us to gradually improve the website from a three-pager providing access for downloading the pdf booklet to a digital platform with a dynamic content system. From this design intervention, we learned that in a self-organised setting, the in-house CoP members' commitment to the vision plays a paramount role. If the CoP lacks peers with the required competencies, it can recruit outsiders that accomplish specific tasks; however, these joined-up members should spend a great amount of time getting familiar with the initiative.

The landing page and a pdf booklet were presented to the municipal-

ity as a part of the subsidy report. The officials showed admiration for the work done, however, they were practically not interested in the result due to two reasons. The first reason is the language barrier; bureaucrats predominantly use the Dutch language for work. The second reason is that shared DIY knowledge has no value for the officials as it does not help to reach their goals since the subsidy program is aimed at creating physical structures for greater climate resilience. Open source design manuals allowing to replicate structures by other self-organised communities were not explicitly stated in the objectives of the subsidy program. The requirement to report results was used by the co-design team rather than as a formal structure to achieve the desired goal.

6.2.4 Intervention 4: Building the Network of Practice

This design intervention resulted in a digital platform that can be maintained by the community, as it requires no special skills. The design manuals, called 'modules' on the platform, are easily modifiable, unlike the previous version, requiring professional skills and an expensive license for specialised software. Along with the website, the co-design team created a 'back-office' that allows the community to collaborate on the project's further development.

During the previous design interventions, the second co-founder was sceptical about the objectives of the research project. This person was rather a passive observer of the co-design process, occasionally giving feedback. However, during this design intervention, the second co-founder played an active role because the objective of this intervention overlapped with their motivation in the role of Coordinator. Experienced in community management, this person supported the co-design team by organising online space for cooperation and co-design meetings. As a result, the second co-founder took the role of Co-Designer during the fourth design intervention, which resulted in the collaboration tool dedicated to all CoP members. The objectives of this tool went beyond the initially envisioned objectives of ENA infrastructure. Nevertheless, the collaborative tool became an organic part of the OSU infrastructure. Moreover, it was not planned as a part of design interventions. It was an initiative of one of Coordinators, which supports a statement that every user might become a designer of infrastructures if they need additional functionality not yet provided by ENA infrastructure.

Collaboration on this design intervention occurred predominantly online due to the pandemic. ENA infrastructure, at this point, provided tools for effective and comfortable online collaboration. Forced to work online, the co-design team adopted principles of Commons-Based Peer production (Benkler, 2002) (see the detailed discussion in section 3.3.2 and Table 3.1). Specifically, the modular design of ENA and fine-grained tasks allocated via collaboration tool allowed to work in an asynchronous and geographically dispersed way. The principles of CBPP fit well with the aim of this intervention, namely creating a tool for connecting CoPs into a Network of Practice, i.e., a network of geographically dispersed CoPs loosely connected by similar practices. We have to admit that we could not test the capacities of ENA in building an NoP due to the pandemic and the limited timespan of this PhD study.

6.2.5 Lessons learned

This section summarises lessons learned from design interventions. These lessons lay a foundation for design principles. Table 6.3 provides an overview of design interventions and crucial lessons learned from them.

The following sections discuss the lessons in greater detail. First, we discuss two new roles that were identified from design interventions, namely Co-Designer and Maker. Thereafter, we discuss five important themes that emerged during the evaluation; these themes will serve as the foundation for five design principles of a design method for OSU. This chapter discusses lessons learned from design interventions without referring to the theoretical background. In the next chapter, we support our ethnographic findings with the literature.

Roles for cultivating OSU: Co-Designer and Maker

We identified five roles required for cultivating the OSU infrastructure. Three roles were identified in the CoP prior to the design interventions: *Ambassador*, *Coordinator*, and *Volunteer* (see section 5.4). Ambassadors are required to bridge the urban commons with other CoPs and to find motivation for members to cultivate OSU. Coordinators help find motivation and organise the co-creation process. Volunteers perform activities that Coordinators assign.

The two other roles identified during design interventions are *Co-Designers* and *Makers*. These two roles were required for the cultivation of ENA infrastructure. The researcher played the role of Co-Designer, facilitating the co-

Table 6.3: Lessons learned from design interventions

Design intervention	Lessons learned
1. Transforming the organisational structure	• Top-down approaches do not work. Interventions should be more inspirational rather than directive and trigger the community for the change from the inside: this requires the role of *Co-Designer* • Cultivating OSU is impossible without trust between Co-Designers and CoP members
2. Bridging with external stakeholders	• To grow infrastructure, CoP members should have personal motivation • Community vision should be exemplified by practical cases to demonstrate their applicability in the real-life context of a specific urban environment
3. Creating design manuals	• Some tasks require professional training: CoP members with the skills to perform specific tasks play the role of *Maker* • Use of open source is well-suited for developing OSU infrastructures, as it is free for use and modification
4. Building the Network of Practice	• Applying peer production principles facilitates creating a Network of Practice

6

creation of infrastructure. As we learned from the first design intervention, the top-down approach did not work out in the urban commons setting. Instead, Co-Designer should gain in-depth knowledge of community life; the crucial prerequisite for gaining this knowledge is to build trust with CoP members (discussed below). Specifically, CoDesigner identifies elements of *fertile ground*, i.e., Community vision, Commoning place, Urban prototypes, and Community practice (see section 5.3). With this knowledge, Co-Designers identify motivations to engage CoP members in the co-creation of OSU (discussed below).

As designer intervention showed, every community member can contribute to OSU infrastructure design. In this case, they play the role of Makers. Makers contribute by executing tasks according to their competence. In-house Makers, i.e., CoP members, are more effective as they are familiar with the ideas and practices of the initiative. If a community lacks peers with the required competencies, it can recruit joined-up Makers, i.e., outsiders that accomplish specific tasks. Joined-up Makers should spend a significant amount of time getting familiar with the initiative.

6

Trust for Co-Designer
The researcher actively intervenes in community life by communicating the research objective with community members. When the researcher entered the field, the community had no intention to share open source designs, therefore, it did not intend to cultivate an OSU infrastructure. Nevertheless, at this stage, the researcher initiated the cultivation of OSU infrastructure by sharing the research objective with community members. We observed that trust building plays a paramount role in this process since the researcher should become part of the CoP to be able to co-design an OSU infrastructure through shared practice and engagement in community life. During the first intervention, trust was lacking between the researcher and the CoP since the former was perceived as an outsider or, at best, a newcomer. With time spent in KasKantine, the researcher showed commitment to and an understanding of the initiative, which gradually established trust. During the second intervention, the co-founders trusted the researcher, thus, they agreed on collaboration.

Motivation of CoP members
The affinity of CoP members to the Community vision plays a paramount role in finding motivation for engaging in OSU cultivation. Members en-

gage in cultivation if the objectives of an infrastructure match their motivations to volunteer. For instance, the second co-founder engaged only during the last design intervention because that intervention would help the Coordinator in their duties. Monetary motivation might boost cultivation since individuals can spend more time on paid work than volunteerism. Moreover, we observed that obligations to report the results to the funder organisation increased the accountability of Makers. At the same time, monetary motivation might complicate the process because paid community members switch from volunteer contributions to contractual relationships.

Showcasing community vision

This artefact from the second design intervention became a foundation of ENA infrastructure. This simple website showcased the vision of the CoP. It demonstrated how the Commoning place of KasKantine, along with off-grid urban prototypes, produces eco-minded public services, such as a restaurant and a second-hand food supermarket.

Unlike professional designers, KasKantine CoP members could not produce abstract design designs that solve a class of problems and not pursue such goals. Nevertheless, the simple website showcasing urban prototypes that solve problems in a specific neighbourhood of Amsterdam was of use for the CoP as it supported a dialogue with external urban stakeholders. Thus, showcasing demonstrated a specific urban commons community with its specific practices, prototypes, and vision and laid the foundation for cultivating ENA infrastructure further.

Use of Open Source

From the second design intervention, we learned that the choice of technologies for infrastructure might create lock-ins if the CoP lacks Makers skilled in the specific technologies. Open Source Software solves this problem. The OSS Content management Platform WordPress allowed us to gradually improve the website from a three-pager providing access for downloading the pdf booklet to a digital platform with a dynamic content system. During the third and fourth design interventions, the design and development were performed by several Makers. Some of them left the community, which did not halt the development, as the chosen software is well-documented and intuitive in use.

Applying peer production principles
The pandemic forced KasKantine CoP to further cultivate ENA infrastructure via online collaboration. This eased the application of CBPP principles; namely, we applied three main principles of CBPP: modularity, granularity, and low-cost integration. The modular design of ENA infrastructure and fine-grained tasks allowed the CoP to work in an asynchronous and geographically dispersed way.

6.3 Conclusions

During the ethnographic study, we secured the collaboration with the urban commons and identified the elements of the installed base that will serve as the fertile ground for an OSU infrastructure. This chapter describes the cultivation of an OSU infrastructure with the CoP members of the urban commons. This design step required design ethnography for two reasons: firstly, the literature provides little insight into the commons-based cultivation strategy; secondly, infrastructures are co-designed by future users. Hence, we conducted design interventions that are researchers' activities within organisations that aim to solve their practical problems. Thus, we engage in a real-world situation as both participant and researcher and conduct design interventions in collaboration with the urban commons practitioners.

This chapter answers the third research question: RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?".* To address it, we conducted four design interventions with the urban commons introduced in the previous chapter to answer this question. In total, we conducted four interventions applying learnings from each of them in the next ones. The first intervention aimed at organisational transformation did not work out for two reasons. Firstly, at the moment, we lacked the understanding of community (i.e., the fertile ground). Secondly, the researcher attempted to transform the community while lacking trust in the CoP members and knowledge of its practice. Learned from the first intervention, we conducted three following interventions, gradually cultivating ENA infrastructure on the fertile ground of KasKantine in co-creation with CoP members. Design interventions resulted in an OSU infrastructure called 'Experimental Networked Autonomy'. This artefact can be regarded as an expository instantiation of the design method (see section 2.4.4). Nevertheless, the cultivation of this particular infrastructure was not the pri-

mary objective of the researcher: learnings from the design process were used to synthesise a generalised design method for OSU.

From design interventions, we learned several lessons. First, we learned that the cultivation of an OSU infrastructure requires new roles for CoP members. The two new roles that emerged during design interventions are *Co-Designer* and *Maker*. Next, we concluded that top-down design methods are ineffective due to the idiosyncratic nature of the commons and the complexity of infrastructures. One cannot proceed with cultivating an infrastructure until the fertile ground for it is identified, and trust with the community is built. Having this in mind, we continued the engagement by observing participants identifying the entities of the fertile ground for OSU and gradually building trust with the community members. Next, we learned that motivation to cultivate an infrastructure in the urban commons should come from community members. We realised that we should build it in an ad-hoc manner waiting for opportunities (i.e., moments where members have a clear motivation to grow it). Finally, we learned that open source software and peer production principles ease building OSU infrastructures.

This chapter discusses lessons learned from design interventions without referring to the theoretical background. In the next chapter, we support our ethnographic findings with the literature. The observations and evaluation of the design interventions served as input for building a generalised design method for cultivating OSU infrastructures, namely we identified two new roles (i.e., Co-Designer and Maker) and learned lessons that are foundational for five design principles (i.e., Principles (2) Trust; (3) Motivating; (5) Showcasing; (7) Open-sourcing; and (8) Peer production; see descriptions in section 7.3). The next chapter proceeds with synthesising a design method for cultivating an OSU infrastructure on the fertile ground of the urban commons.

7

Design method for Open Source Urbanism

All theories are incomplete

- Weick K.E., *1989*

"It's a poor sort of memory that only works backward"
- White Queen

- Lewis Carroll, *Alice in Wonderland*

T he previous chapters discuss how members of urban commons Communities of Practice (CoPs) might co-create open source design manuals to communicate their DIY knowledge with external urban stakeholders. We captured such practice under the notion of Open Source Urbanism (OSU) and argued that OSU infrastructures facilitate these information-oriented activities. We defined an OSU infrastructure as a commons-based information infrastructure (II) that facilitates the co-production of urban prototypes and open source design manuals. Although there are many design methods in the literature, there is a lack of design methods suitable for OSU infrastructures. To fill this void, we combined the Action Design Research approach with ethnographic methods to build a design method for OSU. The synthesis of the method is challenging due to the idiosyncratic nature of OSU: this method should acknowledge the urban commons setting that differs from the command-and-control mechanisms of public and private organisations.

This chapter builds upon findings from the literature and empirical studies to synthesise a design method for OSU. This chapter answers the fourth research question: RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*This chapter presents a design method consisting of *constructs*, *roles*, and *design principles* to address this question. The method is focused on the design process (i.e., change process) and less on the resulting design product emerging from the process (i.e., artefact building) since the resulting IT artefacts are relatively simple and, therefore, less challenging. The main contribution comes from a design method suitable for OSU, which is distinct from other domains.

The chapter is organised as follows. The first section presents the Constructs of the design method. The second section offers five roles required for cultivating OSU and shows interactions between Roles and Constructs. The third section offers eight design principles. The fourth section draws conclusions.

7.1 Constructs of the design method

This section provides *constructs* of the OSU design method. Constructs can be defined as "representations of the entities of interest in the theory" (Gregor and Jones, 2007, p. 322). Constructs are analytical categories that help understand the social reality of an urban commons and are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures. Constructs are typical conceptual elements derived from the field: we derived constructs from the ethnographic data in section 5.3. In the offered design method, Constructs are the elements of the fertile ground, namely Community vision, Commoning place, Community practice, and Urban prototypes. This section describes constructs in a context-independent way, i.e., to be applicable to different OSU projects.

7.1.1 The fertile ground

Urban commons have an idiosyncratic nature different from other domains. In the same manner, OSU infrastructures differ from IIs for public and private organisations. IIs grow on the *installed base* of technologies and social practices (Star and Ruhleder, 1996; Hanseth and Lyytinen, 2004) and this

poses constraints for the development (Star, 2010). In IIs studies, the notion of the installed base is applied to describe 'all that is there', i.e., systems and practices that, paradoxically, simultaneously facilitate the evolution of IIs and hinder it due to the 'inertia of the installed base' (Star and Ruhleder, 1996).

Based on theoretical and empirical studies of urban commons and IIs, we offer the term *fertile ground* instead of the *installed base* to stress the self-organised nature of the urban commons and, consequently, OSU. The urban commons are emergent (i.e., not planned or designed from the top-down), therefore, elements that can play the role of the fertile ground for cultivating an OSU infrastructure are a constellation of heterogeneous elements that emerged ad-hoc and evolved over time in an organic manner. We summarise differences of OSU from command-and-control mechanisms in Table 7.1 based on the literature (e.g., see Table 3.1) and ethnographic observations. This table supports the argument of the need for the notion of fertile ground.

Table 7.1: Differences between OSU and command-and-control mechanisms

	Domain	
	Command-and-control mechanisms	Open Source Urbanism
Creation	Planned	Emergent
Initiation	Top-down	Self-organised
Relations	Formal contracts	Informal agreements
Structure and control	Hierarchy, Supervisors	Meritocracy and consensus, Roles
Motivation	Clearly-stated objectives	Shared visions and ideologies

From the ethnographic study supported by reference theories, we identified four elements that constitute the fertile ground for cultivating an OSU infrastructure, namely 1) Community vision; 2) Commoning place, 3) Urban prototypes; and 4) Community practice. Table 7.2 provides the definition of each element.

These elements of the fertile ground should be taken into consideration prior to and during the design process. These four are rather general elements that point to directions for analysis and co-design. By analysing these elements in the application to a specific urban commons, Co-Designers

Table 7.2: Elements of the fertile ground

Name	Definition
Community vision	The term 'vision' should be understood not as an act of perception but as "a thought, concept, or object formed by the imagination" (Merriam-Webster, 2022). Visions are adopted for imagining the city of the future in extrapolating current social and technological developments. These visions are shaped as a tool to discuss potential developments of cities with urban stakeholders. Building on these imaginaries, decision-makers could take specific actions (Angelidou, 2015; Wenger, 2000; Gil-Garcia et al., 2016).
Commoning place	physical location co-created by members of the urban commons community as a means for their shared practice. Such places emerge as a response to the common concerns or identifications in which like-minded citizens come together for collective action (Boonstra and Boelens, 2011; Denters, 2012; Agnew, 1987).
Urban prototypes	DIY and incomplete experimental objects emerging as a response to pressing urban issues. Urban prototypes are developed for specific local urban contexts) and handcrafted to tackle not a class of problems but particular problems of designers and local communities. Prototypes embody the ongoing experimentation of citizens with their urban environments (Jiménez, 2014)
Community practice	recurrent activities that are performed as part of membership in the urban commons CoP. Such activities are either related to reproductive labour (i.e., activities focused on keeping the Commoning place running and in order) or to achieving Community vision (Krasny et al., 2015; Wenger, 2000).

understand constraints and opportunities to hook up new tools and activities parts of infrastructures (e.g., digital tools, physical activities) to existing ones.

7.1.2 Community vision

The term 'vision' should be understood not as an act of perception but as "a thought, concept, or object formed by the imagination" (Merriam-Webster, 2020). In the XX century, visions were adopted for imagining the city of the future in extrapolating current social and technological developments. These visions are shaped by urban practitioners and researchers, such as architects, urban planners, and engineers, as a tool to discuss potential developments of cities with urban stakeholders. Building on these imaginaries, decision-makers could take specific actions, such as adopting policies and establishing research consortia and development projects. Although these visions are collective imaginaries of urban practitioners, they lead to the real transformations of cities. Visions usually express opinions on the urban development of powerful actors. However, with the increasing trend of citizen participation, the public is getting involved in shaping visions.

Although any community member can bring innovative ideas or solutions, the community vision is predominantly shaped by its core members. Core members are engaged in it full-time and have a firm grasp on the goals to be achieved for the initiative's survival and development. Frequently, volunteers like to perform simple fine-grained activities (e.g., cook a salad or do the dishes) and are not necessarily interested in all aspects of the multi-faceted complex urban commons. In the ethnographic study, the co-founder plays the most prominent role in forming the community vision. A community vision is highly dependent on the leadership and personalities of co-founders. Nevertheless, we perceive the vision as communal because only those newcomers that share (some parts) of it stay in it and gain membership. We refrain from claims that each self-organised community necessarily envisions an urban future radically different from the officials. Nevertheless, active citizens self-organise because they are unsatisfied with some aspects of their local urban environments. Cultivation of an OSU infrastructure should revolve around the Community vision, as it is the primary driver of the CoP.

7.1.3 Commoning places

This research focuses on the urban commons that are spatially-rooted, i.e., community members create physical places in which they collectively produce and consume resources. Urban commons initiatives create spaces for participation, i.e., social relations aimed at solving issues of their urban environments, but this abstract category is related to and stems from a physical place that shapes the practices and interactions of community members. The urban place, co-created by the CoP, plays the paramount role in the urban commons practice and the implementation of the Community vision. We offer the term *Commoning place*, which is a physical location co-created by members of the urban commons community as a means for their shared practice. Commoning places emerge as a response to the common concerns or identifications in which like-minded people come together for collective action. We perceive Commoning places as one of the ways for citizens to exercise the right to the city, i.e., the right of citizens to shape their urban environments by means of self-organisation.

An urban commons emerge when a group of people self-organise to achieve their individual and collective goals. Volunteers co-create a Commoning place as a means of achieving them. The Commoning place is not the ultimate goal but rather a 'container' of practice and its physical manifestation of it. This container for community practice changes and evolves organically as a response to fluid objectives and practices of the self-organised community. The urban context of the Commoning places defines problems and the potential for solutions. The spatial dimension defines the *modus operandi* of the initiative, i.e., physical objects of Commoning places support activities of community members. The symbolic dimension of Commoning places is related to the individual and collective identity of urban commons community members. This dimension is what we defined as a 'created space for participation' (see discussion in section 4.3.1). OSU infrastructures grow from the Commoning place, a container for interactions that should dictate the cultivation strategy.

7.1.4 Urban prototypes

Urban prototypes are DIY and incomplete experimental objects that emerge as a response to pressing urban issues. Prototypes are, per definition, incomplete because they embody the ongoing experimentation of citizens with their urban environments. They developed *in situ* (i.e., in specific ur-

ban contexts) and *ad hoc* (i.e., hand-crafted to tackle not a class of problems but particular problems of their designers and local communities). Essential to grasping the local issues in the perception of the urban commons community, i.e., what processes of the urban environment they perceive as societal, ecological, or economic challenges. Prototypes embody the response to these issues. We advise avoiding the evaluation of prototypes' effectiveness and argue that these solutions have inherent value by the fact of their existence, as they represent active citizens' creativity and their perception of specific facets of urban life. DIY prototypes are a civic response to some aspects of their urban environment that are perceived as not tackled by official institutions and possible solutions expressed in the form of DIY creativity. However 'wrong', 'distorted', or even 'utopian' they seem to be from the perspective of urban practitioners, they are a collective effort to contribute to public prosperity.

Since prototypes emerge within this specific CoP and the urban context, they are hardly generalisable. We perceive them as a showcase, a valuable attempt at co-production from the bottom-up and an open invitation to dialogue with external urban stakeholders, such as like-minded communities, the general public, and authorities. Urban prototypes are the focus of OSU since OSU infrastructures facilitate the co-production of open source design manuals for urban prototypes. In the process of OSU infrastructure cultivation, CoP members transform tacit DIY knowledge embodied in prototypes into explicit knowledge in the form of design manuals. Prior to the ethnographic inquiry, the CoP created nine urban prototypes (see Table 5.1). With design interventions, we facilitated the cultivation of OSU infrastructure 'Experimental Networked Autonomy'; one element of ENA is a booklet with design manuals of these nine urban prototypes (section 6.1.3).

7.1.5 Community practice

By community practice, we understand recurrent activities performed as part of membership in the CoP. For instance, if an urban commons is focused on community gardening, watering plants and harvesting might be considered community practice, and getting a tan is not, as it is a personal wish that does not contribute to the community. Nevertheless, some tasks that might seem unrelated to community goals can serve as fertile ground for cultivating parts of the infrastructure. Co-designers have to decide

whether some activities are part of community practice or not, depending on the components of the infrastructure they want to cultivate. In the ethnographic study, we consider community members 'hanging out' at the Commoning place after work as a vital community practice because this is the time when people update their progress, share knowledge, and plan the next steps.

We should highlight a community practice specific to urban commons that is commoning. *Commoning* can be defined as "voluntary and inclusively self-organised activities and mediation of peers who aim at satisfying needs" (Euler, 2018, p. 12). Commoning is a social relation between commoners and some aspects of their environment that are perceived as paramount for their sustenance. Such practice is collective and performed not in the market logic. Practices of commoning related to Commoning place and achieving Community vision and reproductive activities. Examples of such activities from the ethnography include discussions with citizens, experiments on food waste processing and distribution, but also cleaning the Commoning place, and cooking for volunteers.

Members of urban commons collaborate as peers. Peer relations are the crucial principle of commons production, i.e., a voluntary-driven meritocratic structure free from contractual and market relations (Euler, 2018; Benkler, 2003). Nevertheless, a non-hierarchical organisation is rather an ideal-typical situation in urban commons. In the real-life setting, community members have different levels of responsibility and involvement that depend on the type of organisational structure (e.g., cooperative, non-profit organisation). Especially in the complex reality of cities, founders of an initiative have a higher level of responsibility than its volunteers, as they might have obligations to external actors, such as payments for real estate or complying with municipal safety rules. Apart from that, they are expected to provide continuity of the initiative and to ensure shared values are met. Non-hierarchical relations and decision-making are hardly achievable among community members with different responsibilities and obligations.

7.2 Roles for cultivating OSU infrastructures

From the literature, we learned that infrastructures exhibit various types of users (Janssen et al., 2009). The literature indicates that designers can neither predict nor control future scope, functionality or users of infrastruc-

tures(Hanseth and Lyytinen, 2004). However, as we offer a design method for initialising an OSU infrastructure, we claim that this initial impetus demands a specific set of roles. In the empirical studies, we observed that community members play specific roles in the co-creation of OSU infrastructures depending on their motivations and functions within the initiative. For the OSU design method, we defined a role as **a set of activities and responsibilities expected from a community member by their peers** (see section 2.4.4). A combination of roles by one person is possible, i.e., a person can simultaneously execute several roles (Merton and Merton, 1968).

We provide the set of roles necessary and sufficient to follow the design method regarding the co-creation of OSU infrastructures. The roles are derived from the observations during the empirical studies. We identified five roles: Ambassadors, Coordinators, Volunteers, Co-Designers and Makers. Ambassadors, Coordinators, and Volunteers are the roles that already exist in an urban commons (although they might have different labels), while Co-Designers and Makers are roles that are required specifically for the cultivation of an OSU infrastructure. Figure 7.1 depicts the roles and their interactions with the elements of the fertile ground.

7.2.1 Ambassadors

Ambassadors represent their urban commons CoPs in interactions with external urban stakeholders. Ambassadors play a crucial role in a self-organised initiative, as they envision its development pathways in interaction with other city actors. They act as boundary spanners (Wenger, 2000), sharing the community vision of the local problems and ways to tackle them. At the same time, they obtain new knowledge that is important for community survival and development from other urban stakeholders. Community members playing this role have insights into possible initial goals for an OSU infrastructure. Ambassadors communicate with external urban stakeholders and align the Community vision with their needs and demands. In the ethnographic study, the *founder* played this role. Communicating with the civil servants from the municipality and other bottom-up initiatives, the Ambassador gradually adjusted KasKantine to the bigger urban vision of Amsterdam, connecting it with such concepts as commoning, doughnut economy, and community resilience, despite the initial focus on making KasKantine self-sufficient and autonomous from the 'outside

world'.

7.2.2 Coordinators

Coordinators are community members that manage intra-communal processes and organise the community practice in the Commoning place. They are concerned with aspects of community life such as meetings and schedules, task allocation, and coordination of volunteers. The definition of urban commons highlights peer relations as a fundamental condition of the existence of urban commons. Nevertheless, the definition captures an ideal-typical situation. All community members must be highly committed to the initiative to work in a non-hierarchical structure. In urban commons, it often means that they depend on shared resources, therefore, have a higher level of responsibility. In practice, a community where all members are equally committed and responsible is hardly imaginable. Some peers would have weaker ties with the community and leave it abruptly. Coordinators allocate tasks based on volunteers' commitment, personal traits, and life situations to avoid project execution delays related to the community's flux. In the ethnographic study, the co-founders of KasKantine played this role as they were responsible for complying with governmental regulations, such as fire safety, hygienic standards, and the safety of volunteers.

7.2.3 Volunteers

Volunteers perform activities as part of Community practice, assigned by Coordinators. Members of an urban commons should collaborate as peers. Peer relations, i.e., a voluntarily-driven meritocratic structure free from contractual and market relations, are the crucial principle of commons production. Volunteers should be trustworthy since an urban commons functioning, development (and, at times, survival) depend on them. Nevertheless, in the absence of formal agreements and contracts, a way to deal with Volunteers is to manage them with the role of Coordinator, allocating fine-grained, clearly stated tasks. In the ethnographic study, absenteeism and responsible task performance were two frequent issues with new volunteers: accustomed to paid labour, newcomers supposed their volunteer contribution as a gift and felt no personal responsibility for functioning the urban commons. For this reason, despite being a self-organised community, KasKantine exhibits coordination mechanisms.

7.2.4 Co-Designers

OSU design method has no designer role because it would be against the self-organised nature of OSU. Instead, we introduce the role of the Co-Designer. This role exactly implies what is expressed in its name, i.e., co-design with the community. The Co-Designer is a facilitator of the cultivation of an OSU infrastructure since every user can contribute to the design process. Self-organised nature of infrastructures makes traditional design processes hardly achievable. Co-Designers should not steer OSU infrastructures but rather facilitate peer production of the digital infrastructure. Co-Designers choose exact methodologies and tools considering their skills and properties of the specific fertile ground. There are ready-made toolsets for co-design, for instance, Human-Centred-Design.

OSU infrastructures are ill-structured, and hardly possible to define their scope and functions. Co-Designers are interdisciplinary professionals that can grasp such complex socio-technical systems and facilitate their growth. Although not requiring formal education in urban design or computer software design, this role demands a deep understanding of the ethos and work practices of self-organised urban commons initiatives, as they are substantially different from organisations based on a hierarchical chain of command and contractual obligations (see section 7.3, design principle 1). Civil servants, urban practitioners, active citizens, researchers, or policy-makers can play this role. In the ethnographic study, the researcher played the role of Co-Designer, facilitating the cultivation of OSU infrastructure called 'Experimental Networked Autonomy' (ENA).

7.2.5 Makers

OSU infrastructures are information infrastructures that provide services related to DIY knowledge of urban commons. This knowledge, which is tacitly held among the CoP members, should be transformed into explicit form (e.g., manuals, schemes, blueprints). Makers are community members with the knowledge and skills required to perform specific domain-related tasks. For instance, peers skilled in writing describe the construction process of built structures, while peers with a background in architecture or design produce figures that illustrate it. Makers do not define the means and ends of that process but perform tasks assigned by Co-Designers. The ethnographic study showed that *In-house* Makers, i.e., CoP members, are more effective as they are familiar with the vision and practices of an urban

commons. If the CoP lacks peers with required competencies, it can recruit *joined-up* Makers, i.e., outsiders that accomplish specific tasks. Joined-up Makers should spend much time getting familiar with the initiative.

7.2.6 Interaction of Roles and Constructs

Figure 7.1 shows interactions of Roles with each other and with Constructs in a condensed and simplified manner. This figure focuses on showing emerging roles and interactions and does not aim to show all interactions existing prior to the cultivation of OSU.

7.1

Figure 7.1: Interaction of Roles and Constructs
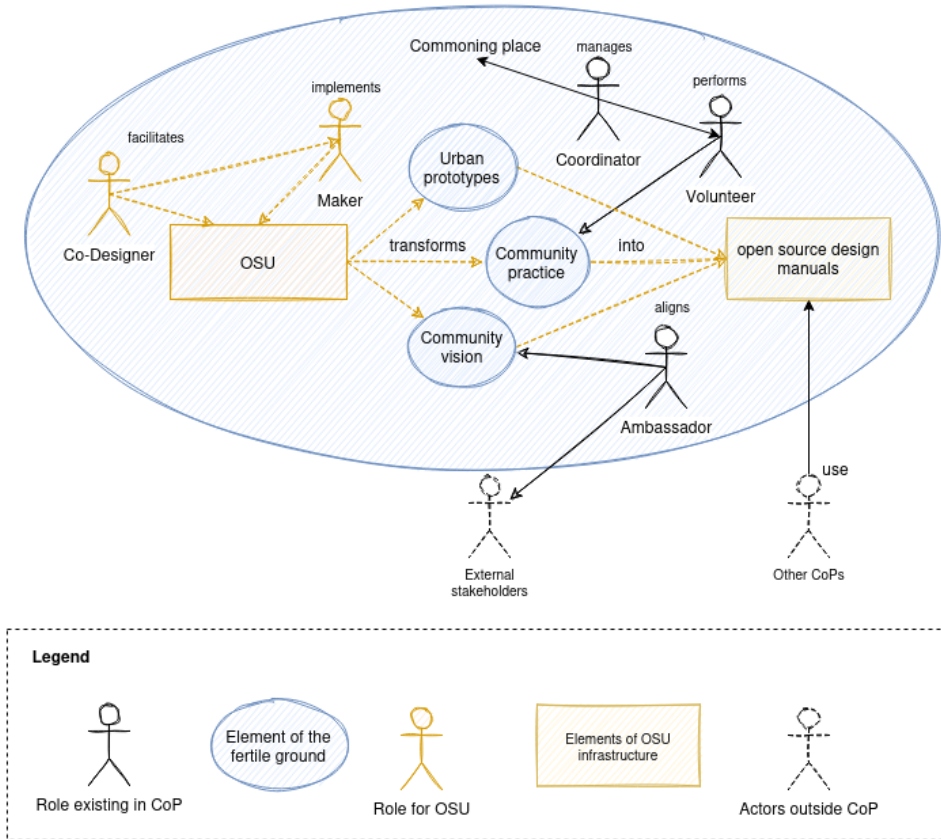
Roles and interactions that exist at the Commoning place before the cultivation of an OSU infrastructure:

- Ambassadors align Community vision with external stakeholders

- Coordinators manage Community place and Volunteers

- Volunteers perform Community practice

Roles and interactions that are required for OSU emergence:

- Co-Designers facilitate the cultivation of an OSU infrastructure on the fertile ground of an urban commons and coordinates Makers

- Makers implement features of an OSU infrastructure

- An emergent OSU infrastructure transforms tacit DIY design knowledge of the CoP (i.e., Community vision, Community Practice, design know-how to create Commoning place and Urban prototypes) into open source design manuals

- Other CoPs can freely use and modify shared design manuals to create their self-organised citizen initiatives

7.3 Design principles for cultivating OSU infrastructures

A design method for OSU should fit the class of problems, i.e., various kinds of urban commons initiatives. For this, a design method requires heuristics (Gregory and Muntermann, 2014), that are "rules of thumb that provide a plausible aid in structuring the problem at hand or in searching for a satisficing artifact design" (ibid., p. 639). Design principles allow embracing this diversity while providing flexibility in developing case-specific OSU infrastructures. Design principles steer the process of implementation of an artefact (Walls et al., 1992); however, they are not blueprints to implement but rather serve as inputs for case-specific design decisions (Clegg, 2000). In this dissertation, we define design principles as follows: *"generic prescriptions and guidelines that are intended to be manifested or encapsulated in the design and implementation of socio-technical systems"*.

The literature provides a design theory for IIs (Hanseth and Lyytinen, 2004). The IIs theory is fairly technical and applicable to command-and-control structures. The principles are immediate usefulness, utilisation of

existing installed base, expanding installed base with persuasive tactics, simplicity, and modularisation (p. 214). Our design method inherits from this theory, specifically the principle of modularisation and building on the existing installed base (instead of the installed base, we coined the notion of *fertile ground*). In comparison to IIs design theory, our design method pays attention to the social aspect of OSU infrastructures cultivation (e.g., building trust, searching for motivation and possibilities to bridge heterogeneous groups of actors) since the urban commons lack hierarchies and mechanisms of coercion. Moreover, IIs differ from OSU infrastructures in scale and resource base. We argue that the IIs design theory, although applicable to OSU, is insufficient to cultivate OSU infrastructures due to the idiosyncratic setting of the urban commons. Therefore, this dissertation offered a design method tailored to the OSU domain.

OSU infrastructures emerge and function as a loose coalition of stakeholders that might have their visions and motivations. Creating such a coalition is difficult; even if built, it is fragile and vulnerable. Therefore design principles are crucial to adhering in order to grow OSU infrastructures. The design principles in this thesis are focused on the design process and not on the resulting design product emerging from the process (i.e., artefact building).

Principles are applied step by step, i.e., higher-level principles should be adhered to before moving to the following principles. As the principles depend on each other, they are divided into four phases: Initiation, Preparation, Translation, and Proliferation. Phases are based on design interventions and lessons learned from them (however, conducted design interventions do not translate precisely into phases one-to-one). The phases are iterative and are based on mutual learning. Only partial application of phases might be useful. For instance, the outcome of the Translation phase is community knowledge translated to be accessible by external actors (e.g., a book) that has value *per se* and might be used outside the OSU infrastructure context. Stages and principles are depicted in Figure 7.2.

Table 7.3 shows an overview of the principles and literature strands and empirical studies from which they were derived. The principles were synthesised by confronting empirical case observations and literature. We refrain from claims that the literature references are exhaustive. Due to the interdisciplinary nature of the OSU domain, we integrated several research fields. Due to the space constraints of this dissertation, we cannot provide a

Figure 7.2: Phases and principles of a design method
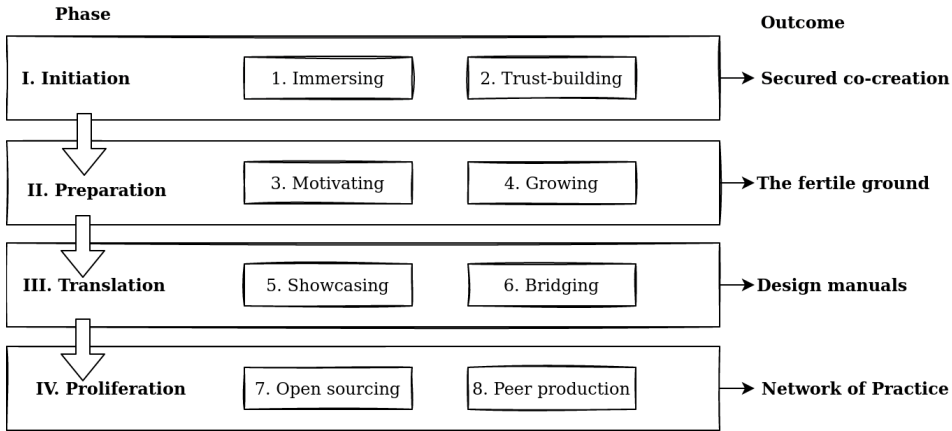
full literature review for each concept of the offered design method. Instead, we suggest pathways that can be followed by Co-Designers employing this method.

Next, we describe the design principles in greater detail. For that, we use The Open Group Standard framework for design principles (TOGAF) (TOGAF, 2018). In accordance with TOGAF, we provide a short name, statement, a rationale behind each principle using the insights from the literature review and empirical studies. Contrary to the TOGAF standard, we omit to specify the implications, as they are represented in statements. Additionally, we add examples from the ethnographic studies. The following sections elaborate on design phases and principles in greater detail.

7.3.1 Phase I: Initiation

The first phase of the OSU design method initiates a collaboration with the urban commons CoP. At this phase, the role Co-Designer is required for cultivating an OSU infrastructure. The Co-Designer facilitates the co-creation of an OSU infrastructure by applying the OSU design method. We differentiate in-house and joined Co-Designers: the former were members of the urban commons CoP, while the latter joined with the aim of establishing OSU infrastructure. In the first step of OSU cultivation, i.e., the Initiation phase, the Co-Designer should immerse in community life and become part of the community (The Immersion principle).

Consequently, the Co-Designer should gradually build trust with the

Table 7.3: Justification of design principles

Principle	Literature references	Empirical studies
Immersing	Ethnography (Schultze, 2000; Myers, 1999; Sanday, 1979; Baskerville and Myers, 2015)	Ethnography (Chapter 5)
Trust-building	Trust as organising principle (McEvily et al., 2003)	Design intervention 1 (section 6.2.1)
Motivating	Bootstraping (Hanseth and Aanestad, 2003); Cultivation (Grisot et al., 2014)	Design intervention 2 (section 6.2.2)
Showcasing	Open design (Tooze et al., 2014; Muller-Seitz and Reger, 2010)	Design intervention 3 (section 6.2.3)
Bridging	The CoP theory (e.g., (Lave and Wenger, 1991; Wenger, 1998, 2010b); Boundary objects (Star and Griesemer, 1989; Star, 2010; Wenger, 2010b)	Ethnography (section 5.2.2), Design intervention 2 (section 6.2.2)
Growing	IIs design theory ((Hanseth and Lyytinen, 2004, 2016)); The installed base (Star and Ruhleder, 1996; Pipek and Wulf, 2009; Aanestad et al., 2017); Infrastructuring of the commons (Marttila and Botero, 2017; Seravalli, 2018)	Findings from ethnography (section 5.3)
Open-sourcing	(van Wendel de Joode et al., 2003; Bradley, 2015; Jiménez, 2014)	Design intervention 3 (section 6.2.3)
Peer production	CBPP (Benkler, 2002; Benkler and Nissenbaum, 2006); IIs design theory (Hanseth and Lyytinen, 2004)	Design intervention 4 (section 6.2.4)

7

community members because trust is crucial for co-creating the urban commons (The Trust-building principle). These principles are applicable for joined Co-Designers since in-house Co-Designers, as long-term community members, have a priori fulfilled the requirements of two principles of the first phase. We derived this phase along with principles from the first design intervention: it failed because these principles were not adhered to. The implication of this phase is secured collaboration with the community.

1. Immersing: immerse in the community life to understand a community vision and practices

Co-design projects with urban commons are different from other design projects since these are self-organised, therefore, lack hierarchies and contractual relationships. During the ethnographic studies, we found that proposing a solution in a top-down fashion might be ineffective or not work and, more importantly, may cause resistance. Thus, prior to starting the design process, Co-Designers should gain a deep understanding of the fertile ground for OSU, i.e., Community vision, Community Practice, and Commoning place, along with Urban prototypes, to identify what knowledge can be shared as digital commons, and boundary interactions with other organisations. Apart from that, community members might be unaware of their innovative ideas that can be of use to others because they emerged through practice, not as a design project with explicit objectives and deliverables.

Although wide-applied data collection methods, such as case studies or focus groups, might provide a deep understanding of the initiative, these do not lay the foundation for implementing other principles, primarily Trust-building and other principles (e.g., Fitting in). The empirical studies show that ethnographic methods fit the overall project goal well (i.e., the cultivation of an OSU infrastructure). Long-term involvement in communal practices provides a live experience and deep understanding of the urban commons while not disrupting community life. Over time, the shared practice of the Co-Designer with the CoP members, paired with reflections, can lead to the understanding of community vision and practices (Schultze, 2000). The primary condition for Co-Designers to understand the functioning of the community is to keep in mind that urban commons are based on a self-organised voluntarily-driven structure. As the ethnographic study showed, CoP newcomers that are used to market relations initially have trouble adjusting to the self-organised setting.

We recommend being reluctant to identify the initiative goals from formal documents and interviewing external stakeholders because goals, habits, norms and culture of the CoP can be hidden from outsiders (Wenger, 1998) and are subject to change over time. Moreover, Ambassadors and Co-ordinators themselves might not be able to clearly formulate their common goals, as they can be expressed not explicitly but rather as a fluid and ever-changing set of ideas and intentions that depend on the changes in the local environment and community composition. Due to this, understanding the community and its history is crucial to acknowledge the evolving nature of the urban commons.

Furthermore, the motivations and actions of the initiative members can diverge from the postulated goals. Instead, Co-Designers should grasp what problems in the urban environment they attempt to tackle and what urban prototypes they co-create to support their practices. The design ethnography shows that it is crucial to identify these from the perspective of community members, as the Co-Designer's perspective may differ.

Ethnographic example. In the ethnographic study, we learned that urban authorities or researchers often initiate co-creation projects pushing self-organised groups into their agenda, such as research objectives or municipality goals. These external actors collect data and perform activities aligned with their intrinsic motivations and vanish as soon as their goal is obtained, thus, they are perceived as by-passers. Often they discontinue collaboration and do not communicate results with 'data donors'. As a result, self-organised communities gain little from such collaborations. They might develop an aversion to such joint endeavours and resist collaborating on them in the future. In the same vein, the researcher offered a design intervention after initial interviews and observations, which resulted in early designs being ignored by the community. Only after several months of engagement in community life the researcher was able to offer a design proposal that prompted the co-creation of an OSU infrastructure.

2. Trust-building: build trust with the community to secure co-creation

Trust between the Co-Designer and community members is key to securing the relationship paramount for the co-design process. Trust is "assured reliance on the character, ability, strength, or truth of someone or something" (Merriam-Webster, 22). Trust is a basic organising principle for coordinated activities: "whenever actors are simultaneously dependent on and vulner-

able to the actions and decisions of others, trust is a relevant organizing principle that warrants consideration." (McEvily et al., 2003, p. 99).

In the context of OSU infrastructures, we point out that community members must trust Co-Designers and acknowledge that their intentions are in the collective interest. Trust building is crucial for securing the overall co-creation process because if trust between Co-Designers and the community is missing, the design activities will bring little to no effect. Trust plays a paramount role in urban commons because self-organised communities operate outside the command and control relations and might resist such structures. Without contractual obligations, they collaborate as peers that cannot coerce each other to perform tasks. Thus, community members negotiate the performance of projects and tasks. Trust among community members helps to perform community practice because CoP members act voluntarily and are not constrained by official agreements. Conversely, communities that lack trust among participants face difficulties. We imply that Co-Designers start a collaboration with shaped urban commons in which trust among participants has already been built.

Work practices of public or private organisations poorly suit the co-creation with self-organised communities. The well-planned design process with set milestones and predefined deliverables, typical to those, is achieved by command and control mechanisms that conflict with the self-organised nature of urban commons. The imposition of corporate culture and a hierarchical goal-driven approach might deteriorate peer relations, block or halt the design process, or result in the superficial design of OSU infrastructure that will not function without external support. The latter is undesired as these might result in the existence of nonviable projects that become abandoned when external actors stop supporting the co-creation. Moreover, sources of legitimacy that are standard for bureaucratic structures, such as expertise or social status, are not necessarily automatically recognised in non-hierarchical communities, as in communal life, other factors play a paramount role, such as trustworthiness and commitment to the shared practice. With acquired membership, foreign competence and expertise become part of the CoP and might be accepted for developing the urban commons.

From the empirical part of this dissertation, we conclude that the main factor for the success of co-creation is trust building between the community and the Co-Designer, generally an outsider that might hold work ethos

and vocabulary quite different from those of CoP members. In order to build trust, the Co-Designer should secure long-term peer relations with the community. They must immerse in the community life equipped with an open mind, sympathy for the Community vision, and empathy for their struggles. The Co-Designer must be flexible enough to align with the world-view and ethos of the community while robust enough to keep their 'outer-world' identity. This will ensure that an elaborated OSU infrastructure design reflects the self-organised nature of the community.

Ethnographic example. Initially, we observed a tendency to accept the researcher in their role as a community member and reject collaborating in cultivating an OSU infrastructure. Since trust in the researcher by the community was lacking at the beginning of the ethnographic inquiry, the researcher was welcomed to contribute to the initiative by performing tasks dedicated to volunteers. These simple tasks, such as cleaning or dishwashing, are predefined and monitored by the community leaders and can be performed by newcomers. In case of a volunteer prove to be unreliable (i.e., absent, negligent, or careless), the overall functioning of the initiative is not fully disrupted. Conversely, if a newcomer shows commitment, they gradually build trust with other members and, over time, they will be entrusted with more complex tasks. The co-creation of an OSU infrastructure was an entirely new domain for the OSU initiative that demanded their commitment and additional resources. Consequently, the community leaders rejected design proposals as potentially disruptive and did not fit into the community practices. Nevertheless, since the researcher was allowed to participate in the community practice, it eventually led to growing trust in the researcher's intentions, which were acknowledged to be in the communal interest and by demonstrating that he understands the shared values and norms of the community. This, in turn, led to the acceptance of offered design solutions and incremental implementation thereof. The trust-building process is interwoven with another process, which is finding motivation for community members (the third principle).

7.3.2 Phase II: Preparation

The first phase prescribes Co-Designers to immerse in community life and build trust with CoP members to initiate co-creation. The implication of the first phase is secured collaboration with the community that lays the foundation for the second phase. The second phase guides the data collection

that results in understanding the fertile ground for the future OSU infrastructure. The motivation principle guides finding motivation for further collaboration. Growing principle prescribes slow cultivation of an OSU infrastructure on the fertile ground of urban commons. The implication of this phase is the initiation of OSU cultivation on the identified elements of the fertile ground.

3. Motivating: look for opportunities to motivate and involve community members

Digital tools, such as source code repositories and wikis, serve as artefacts for knowledge sharing for geographically spread participants. In the case of the urban commons, such artefacts are not necessary, as participants acquire knowledge through practice at the Commoning place (Bendt et al., 2013). Thus, members of urban commons might be unmotivated to support the development of digital tools, as they do not receive direct benefits in exchange for their time and efforts. Building an infrastructure often would take a too high toll on the community, as they are overwhelmed by the everyday activities necessary for the initiative's functioning. Hence, cocreation requires that community members grasp the future individual and communal benefits to motivate them and secure their involvement in OSU cultivation.

Defining the goals of an OSU infrastructure facilitates its development in a self-organised environment. Based on the understanding of the community vision and challenges, Co-Designers formulate goals of an OSU infrastructure, i.e., how it benefits the initiative development (Hanseth and Aanestad, 2003; Grisot et al., 2014). Ambassadors and Coordinators contribute to the goal formulation. The former envisions the initiative and interacts with other city actors; therefore, they can recognise how an OSU infrastructure might facilitate community (e.g., an outreach of community mission or negotiation of policy changes with public servants). The latter are well aware of the values and interests of community members.

Essentially, the goals of an OSU infrastructure should mirror issues of the local urban environment. This ensures that the community recognises the developed infrastructure's potential benefits and engages in its cocreation. Apart from that, community members can find individual motivations. Frequently idealism and camaraderie motivate peers to contribute. Alternatively, Ambassadors can find material incentives, for instance, external funding from public or private organisations (see the discussion on

commons and market relations in chapter three). Additionally, material incentives may increase the chance of project completion, as it demands higher accountability than voluntary work. On the other hand, it might bring the 'corporate relations' that erode peer production (Veen et al., 2016; Stewart and Gosain, 2006).

Ethnographic example. According to the land contract, by the end of September 2019, the initiative had to vacate the land, thus, getting a new land parcel became the primary goal for the initiative in order to keep functioning. The best option found was a parcel owned by the municipality. In order to negotiate rental costs, community leaders were looking for additional tools to show the social value of the initiative. The community leaders realised that an OSU infrastructure could communicate the initiative's public value to external urban stakeholders. At this stage, community members were motivated to co-create the infrastructure to prevent vanishing the initiative; apart from that, some community members were motivated to preserve gained knowledge of constructing prototypes (see the second intervention in chapter six). The initiative negotiated the new land contract and has moved to the new land parcel. To strengthen its off-grid social enterprise case, the community decided to upgrade its water system to prove that it filters rainwater and greywater, preventing leaks to the environment. The Ambassador requested a subsidy from the municipal program and partially spent it creating a booklet with design manuals (see the third intervention in chapter six).

4. Growing: grow infrastructure on the fertile ground to avoid community resistance

We coined the concept of *the fertile ground* for OSU infrastructures instead of *the installed base* well-known in IIs studies (Star and Ruhleder, 1996; Aanestad et al., 2017). We claim that this new notion fits better the idiosyncratic nature of OSU. The fertile ground highlights the different mode of production in the urban commons that are self-organised, emerging communities driven by the values and visions of people. The urban commons is the fertile ground where an OSU infrastructure grows if cultivated. Organic growth is a slow, natural evolution. Cultivating OSU is, metaphorically speaking, like growing a plant: not possible to seriously manipulate the growth of a plant; one can fertilise, weed, water, make the best sun conditions, and patiently wait until it grows. The Co-designer needs to put seeds of an OSU infrastructure (see the previous phase) and go along with

the 'community flow' – see for opportunities and motivations. If we continue the metaphor of growing a plant, we need to put seeds in the fertile ground at the right season.

In the self-organised setting with no command and control mechanisms, OSU infrastructure grows only if it organically fits the urban commons and motivation of the community. This principle prescribes investigating elements of the fertile ground (see section 7.2) in detail. For instance, which Community practices are required for the Commoning place maintenance and which are part of Community vision implementation. Equipped with these, Co-Designers can grow an OSU infrastructure by fitting new technologies, tools, and practices in the fertile ground of the urban commons. Frequently, OSU infrastructures evolve from ad hoc solutions that respond to the urban commons' urgent needs. Resistance of community members to accept a new part of OSU is a signal to change an approach or design.

Ethnographic example. Initially, the researcher attempted to organise methods well-accepted in DSR, such as design workshops. Community co-founders and volunteers had no spare time for auxiliary activities that did not necessarily yield meaningful results. Contrary, the gradual adoption of new tools and tasks based on the existing practice was accepted better by the CoP members as not breaking community routines. For instance, the practice of discussing plans for writing design manuals texts while doing physical labour, such as construction work, can serve as the foundation for creating a design manual for the urban prototype while it is being constructed. On the same day, after a shift, the discussed material can be translated into a tangible form, i.e., a piece of paper or a shared Google Document. Another example: the team adopted a proprietary web-based content management platform, Notion.io, that combines features of wikis and project management tools. We adopted it as a communication platform with regard to ENA, by this OSU fitted the digital tool already adopted by the community.

7.3.3 Phase III: Translation

The second phase initiated OSU cultivation on the identified elements of the fertile ground. The third phase focuses on translating community DIY knowledge from a tacit form held among CoP members to an explicit form stored on a medium. The Showcasing principle explains that community knowledge should be translated into an explicit form. The Bridging princi-

ple argues why this knowledge might bridge multiple social worlds. Specifically, Co-Designer should focus on translating Community vision into explicit form, along with design manuals on the Commoning place and constituting it, Urban prototypes and Community practice.

This phase required another additional role, namely Makers. Makers are community members with the knowledge and skills required to perform specific domain-related tasks. For instance, Makers skilled in writing describe the construction process of built structures, while Makers with a background in architecture or design produce figures that illustrate it. Our empirical studies show that in-house Makers, i.e., CoP members, are more effective as they are familiar with the ideas and practices of the initiative. If a community lacks peers with the required competencies, it can recruit joined-up Makers, i.e., outsiders that accomplish specific tasks. Joined-up Makers should spend a significant amount of time getting familiar with the initiative. The implication of this phase is DIY design knowledge of the CoP represented in the explicit form of design manuals.

5. Showcasing: showcase the community vision for communicating with other city actors

The Community vision is a declaration of problems in the local urban environment, as perceived by active citizens, and how the urban commons tackle them by means of the commoning place, urban prototypes, and community practice around these. The vision is the alternative urban future shaped by the collective imagination (Angelidou, 2015) of the CoP: this is not necessarily a feasible target but rather an ongoing process and a mission to move forward. Community vision could be fluid and changing due to changes in the 'outer world' (e.g., change in policies, funding programs, and like-minded communities). Nevertheless, urban commons perform community practice aiming at achieving the vision. Thus, the community vision is embodied in the Commoning place, urban prototypes, and community practice around them. The focus of an OSU infrastructure is to materialise DIY knowledge on the co-creation of these in the form of design manuals.

The manuals should be exemplified by practical cases to demonstrate their applicability in the real-life context of a specific urban environment. Unlike professional designers, active citizens are neither trained to produce designs that solve a class of problems nor to pursue such goals. Not necessarily an OSU infrastructure culminates in providing designs of a high

level of abstraction. Nevertheless, showcases of prototypes that solve problems in a specific neighbourhood or city are of great value. They show the best practices, inspire other urban commons, and support a dialogue with other city actors (see principle Bridging). Thus, showcasing demonstrates a specific urban commons community with its specific practices, prototypes, and vision (Tooze et al., 2014; Muller-Seitz and Reger, 2010).

Exemplifying the specific community vision with urban prototypes and related community practices makes shared design manuals tangible, as real-life examples are easy to grasp, unlike abstract designs. Additionally, manuals with examples shared on the internet help communicate the community vision with other city actors. Finally, it has value as it promotes active citizenship, demonstrating that self-organised citizens can solve arising local challenges outside of the standard public-private dichotomy.

Ethnographic example. The researcher found the opportunity for the second design intervention when KasKantine focused on communicating their Community vision with the other urban stakeholders. At that point, the vision was not materialised in any form, thus, communication with urban stakeholders in a consistent and clear manner was challenging. The first community vision was created in the form of a simple website with texts and pictures showing what the CoP is striving to achieve for the neighbourhood (see section 6.1.2). During the next design intervention, the CoP co-created the booklet with detailed design manuals of the most important urban prototypes created in KasKantine. For example, one of the blueprints is a greenhouse from reclaimed materials. It was constructed from materials acquired in the neighbourhood in accordance with municipal building regulations and suitable for local climate conditions. Applicable for Amsterdam, the Netherlands, this design manual can be obscure or insufficient in the context of another urban context. This DIY design was gradually shaped in the course of community practice, and the manual describes this specific showcase.

6. Bridging: connect heterogeneous groups of actors to align perspectives

Active citizens self-organise when they perceive problems in the local urban environment that are not tackled by the public or private sector. In the form of the urban commons, citizens attempt citizen-initiated co-production (see section 3.4.3). To be authorised by the urban officials, Commoning place must comply with urban environment regulations. Apart from that,

decision-makers, such as neighbourhood managers, often should give their permission. However, external stakeholders with whom urban commons collaborate might have different perspectives on the same problems and possible solutions. Therefore, the urban commons CoP envisions possible solutions to specific urban environment problems that might differ from external urban stakeholders. Broadly, external stakeholders can be defined as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 46). However, defining and identifying stakeholders goes far beyond the scope of this dissertation; for instance, see Mitchell et al. (1997) and Bryson (2004).

The different visions can bring tensions. To avoid that, the community should align their vision with that of external stakeholders; they need to find a narrative acceptable to all involved parties. To align the vision with external stakeholders, the Commoning place can be viewed as a *boundary object*, i.e., an entity that is used by different social groups maintaining different meanings for every group, yet holding a shared identity that allows joint action upon them (Star, 2010). Boundary objects facilitate collaboration among parties that have conflicting perceptions of it (Star and Griesemer, 1989). Urban stakeholders might collaborate upon the authorisation and development of the Commoning place without consensus on its meaning for the CoP and the city. Civil servants see how commoning place (and therefore community vision) fits their regulatory frameworks. Communicating the community vision with urban stakeholders is challenging: community members shape the vision through the practice and do not necessarily have it in the form of ready-made documentation, while other stakeholders do not participate in the practice. Urban officials cannot easily submerge in the reality of urban commons because their goals and background substantially differ from activism and self-organisation. Live demonstrations of the Commoning place are not necessarily effective, as they belong to different social bubbles and use various vocabularies and perspectives. Instead, decision-makers can evaluate the vision based on artefacts shared with them by the community (e.g., reports and presentations).

Bridging is required to align different perceptions and interests of stakeholders. According to the CoP theory, Ambassadors act as boundary spanners between the CoP and external stakeholders (Wenger, 2000), such as the municipality, private companies, and other citizen initiatives. Boundary spanners have to learn how to convey their vision to urban authorities,

for instance, by learning the jargon and work culture of these. They connect the Commoning place with the 'outside world' and tweak the vision and even vocabulary of the urban commons. They shape the vision influenced by city regulations and community members. To conclude, Bridging change the CoP, as the 'outside world' provoke changes in the Community vision, and this, in turn, leads to changes in the physical environment of the urban commons, i.e., the Commoning place and urban prototypes. An OSU infrastructure could facilitate the bridging process, as infrastructure can facilitate the transformation of tacit DIY knowledge into documents in explicit, codified form. Design manuals, produced by means of an OSU infrastructure, can facilitate dialogue between the CoP and other urban stakeholders.

Ethnographic example. Part of the community vision of KasKantine is experimenting with individual and community self-sufficiency in order to prevent overconsumption and, consequently, transit to more sustainable urban environments. On an official level, some civil workers sympathise with the vision, while others cannot comprehend it. Their official stance on it, however, depends on their job position. Different municipality departments see it as a citizen initiative, as an experiment in sustainability, or simply as a commercial cafe, to name a few examples. Gradually the Ambassador aligned the vision with municipal programs and visions (e.g., Commoning, Doughnut coalition, Food Vision Amsterdam), keeping their central message, i.e., off-grid citizen experiment on food production on the neighbourhood level.

7.3.4 Phase IV: Proliferation

The implication of the third phase is DIY design knowledge of the CoP represented in the explicit form of design manuals. The fourth phase is dedicated to developing processes and tools that enable inter-communal knowledge sharing and co-creation. The Open-sourcing principle advocates adopting the open source ethos for easing the development and securing community ownership. The Peer production principle recommends adopting the principles of commons-based peer production to enable the collaboration of geographically spread members of a virtual Network of Practice.

7. Open-sourcing: apply open source solutions to ease IT development and secure community ownership

From the ethnography, we can conclude that proprietary digital platforms are ill-suited for OSU infrastructures, despite these being widely used for knowledge sharing. Firstly, platforms that function as data warehouses store design manuals of various genres. Numerous urban projects shared by active citizens and communities are mixed with designs of other genres, such as craft projects and DIY electronics(Bonvoisin and Boujut, 2015). In this setup, conveying a Community vision to external stakeholders is impossible. Secondly, self-organised initiatives often lack trust in corporate-owned platforms. The latter might utilise user-generated data in a way that does not comply with the definition of digital commons; for instance, social networks use user data for commercial purposes. Thirdly, platforms based on OSS solutions are adjustable to the community's changing requirements and can better convey the community vision. Finally, OSS is created in self-organised virtual CoPs (Carillo et al., 2008) that share the ethos of the urban commons (Bradley, 2015).

Open Source Software (OSS) is well-suited for developing OSU infrastructures, as it is free for use and modification (Benkler, 2002). Notably, many OSS is well-documented, which eases the evolution of IT components of infrastructure. Self-organised communities often face the ongoing flux of members, which raises challenges of maintenance and scaling up the infrastructure. Application of OSS might increase the potential volunteer base since many well-developed OSS solutions have grown vast communities of users (Van Wendel de Joode, 2005). Co-Designers and Makers with appropriate skills might suggest OSS appropriate for the specific use-case of an urban commons CoP. Furthermore, OSU infrastructures based on open source principles prevent data misuse because the community chooses the way the design manuals are stored, managed, and shared. To share design manuals as open source, the Co-Designer suggests an open source license, such as the software license GNU General Public License or the family of Creative Commons licenses (Hansen and Howard, 2013).

Ethnographic example. The web interface of the OSU infrastructure "ENA" is built with open source website builder WordPress that requires no designer or coding skills. It was chosen as it has a vast amount of plug-ins that allow the implementation of a wide variety of design and functional features (e.g., user profiles, and forums). The design and development were

performed by several community members that played the role of Makers. Some of them left the community, which did not halt the development, as the chosen software is well-documented and rather intuitive in use. Several KasKantine CoP members contributed, as editors of the content, checking the language style and grammar. Considering the Open Source license, the Peer Production was chosen because scholars and practitioners from the commons domain collectively designed it.

8. Peer production: apply peer production principles to create a Network of Practice

CoPs are loosely connected into *Networks of Practice* (NoPs) (Brown and Duguid, 2001) that do not coordinate practice with each other but allow to exchange knowledge (Duguid, 2005). Members of an NoP may never meet each other in real life, however, as their practices are similar, they may be interested in sharing knowledge across CoPs Brown and Duguid (2001). IIs might facilitate knowledge exchange in loose groupings in which "people are not necessarily collocated but are engaged in practices that share a certain degree of similarity" (Vaast and Walsham, 2009, p. 549). This principle suggests applying principles of Commons-Based Peer Production (CBPP) (Benkler, 2002) in the physical realm (Kostakis et al., 2015) of the urban commons. The three main principles of CBPP are modularity, granularity, and low-cost integration. Modularity means that potential objects of peer production must have a modular structure allowing peers to work asynchronously. Granularity refers to the degree to which objects are broken down into smaller modules. This principle allows peers to work on modules according to their level of competence and motivation. The principle of low-cost integration refers to a mechanism by which modules produced by peers are integrated into the end product (Benkler, 2002; Benkler and Nissenbaum, 2006). Apart from the three crucial principles of CBPP, we summarised other aspects of peer production in the third chapter (see Table 3.1).

This principle of modularity suggests perceiving Commoning places in a modular way, i.e., as a set of independent prototypes and practices organised around them. According to the principle, more simple, atomic objects or built structures can be interrelated or integral parts of a more complex object or a system. In the case of urban commons, where urban prototypes are elaborated at one physical location, modularisation might seem redundant since task allocation and collaboration on them occur in a face-to-face

setting.

Nevertheless, modularisation is necessary for OSU infrastructures as a way to manage complexity (Gong, 2012). It enables task decomposition, therefore offering autonomous contributors the choice of what independent module they contribute according to their motivations and skills (Benkler, 2006). Design theory for IIs (Hanseth and Lyytinen, 2004) offers the principle of modularisation to allow the growth and evolution of IIs. The modular design of OSU infrastructures enables geographically distributed participants to contribute to developing specific infrastructure parts of their interest. The principles of CBPP fit well with creating a tool for connecting CoPs into a Network of Practice, i.e., a network of geographically dispersed CoPs loosely connected by similar practices. We must admit that this principle is more rooted in the literature than in practice since we could not fully test and evaluate this principle in the fourth design intervention.

Ethnographic example. The pandemic forced us to collaborate mostly online. We applied CBPP principles within the urban commons where appropriate. Specifically, the modular design of ENA infrastructure and fine-grained tasks allocated via the collaboration tool allowed the CoP to work in an asynchronous and geographically dispersed way. The principles of CBPP fit well with the aim of this intervention, namely creating a tool for connecting CoPs into a Network of Practice, i.e., a network of geographically dispersed CoPs loosely connected by similar practices. We have to admit that we could not test the capacities of ENA in building an NoP due to the pandemic and the limited timespan of this PhD study.

7.4 Conclusion

In the previous chapters, we shaped the interdisciplinary research domain for OSU, selected bodies of knowledge to serve as reference theories for OSU and conducted empirical co-design ethnography within a real-life case of an urban commons. This chapter utilised theoretical and empirical data from the previous chapters to synthesise a design method for cultivating OSU infrastructures. The chapter answers the fourth research question: RQIV ”*Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?*”.

We developed a method comprised of Constructs, roles, and design principles that together comprise a co-design approach for cultivating OSU infrastructures. *Constructs* are analytical categories that help understand the

social reality of an urban commons and are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures. Constructs are typical conceptual elements derived from the field: we derived constructs from the ethnographic data in section 5.3. In the offered design method, Constructs are the elements of the fertile ground, namely Community vision, Commoning place, Community practice, and Urban prototypes.

We defined a *role* as a set of activities and responsibilities expected from a community member by their peers. The set of roles is required to follow the design principles. Since the urban commons lack command-and-control structures, traditional work methods are not applicable. Instead, we provide the roles to show specific interests and affinities of community members that lead to actions regarding establishing OSU infrastructures. Roles were derived from the observations during the empirical studies. We identified five roles, namely Ambassadors, Coordinators, Co-designers and Makers. Ambassadors and Coordinators are roles that already exist in an urban commons (although they might have different labels), while Co-Designers and Makers are explicitly required for an OSU infrastructure co-creation. Co-Designer is a facilitator of design interventions, and Maker is a community member with the skills required for specific tasks (e.g., architectural drawing, language editing, web development). Our empirical studies show that in-house Makers, i.e., CoP members, are more effective as they are familiar with the ideas and practices of the initiative. If a community lacks peers with the required competencies, it can recruit joined-up Makers, i.e., outsiders that accomplish specific tasks. Joined-up Makers should spend a great amount of time getting familiar with the initiative.

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Next, we offered eight design principles divided into four phases: Initiation, Preparation, Translation, and Proliferation. Design principles are generic prescriptions and guidelines intended to be manifested or encapsulated in the design and implementation of socio-technical systems. The overview of principles is presented in Table 7.4.

Table 7.4: Design principles for OSU

Phase	Principle	Statement
I: Initiation	1. Immersing	Immerse in the community life to understand a community vision and practices
	2. Trust-building	Build trust with the community to secure co-creation
II: Preparation	3. Motivating	Look for opportunities to motivate and involve community members
	4. Growing	Grow infrastructure on the fertile ground to avoid community resistance
III: Translation	5. Showcasing	Showcase the community vision for communicating with other city actors
	6. Bridging	Connect heterogeneous groups of actors to align perspectives
IV: Proliferation	7. Open-sourcing	Apply open source solutions to ease IT development and secure community ownership
	8. Peer production	Apply peer production principles to create Network of Practice

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According to our co-design method, phases depend on each other and must be applied step by step. Before moving to the following phase, higher-level principles should be adhered to since skipping steps will not yield satisfactory results. However, only the partial application of phases might be useful for the CoP. For instance, the outcome of the Translation phase is community knowledge translated to be accessible by external actors (e.g., a book) that has value *per se* and might be used outside the OSU infrastructure context. The offered set of design principles assists Co-Designers in the cultivation of OSU infrastructures. The offered design method guides infrastructure cultivation in the inception stage, i.e., how to initialise an OSU infrastructure that is stable yet flexible to allow further evolution. The offered design method is novel because it provides the cultivation of OSU infrastructures in the setting of the urban commons.

8

Conclusions

"Everything's got a moral, if only you can find it." - Duchess

- Lewis Carroll, *Alice in Wonderland*

This dissertation is the first to offer a design method for cultivating OSU infrastructures in the urban commons setting. Although Design Science contains a vast array of design theories supporting computer-supported cooperative work, this knowledge is developed for structures having hierarchical governance and formal agreements. This knowledge is hardly applicable to OSU, as urban commons exhibit a different setting where formal contracts and hierarchy cannot be used. Furthermore, the *urban commons* development is complicated due to a lack of resources. Given the complexity of OSU, we adopted the Information Infrastructures (IIs) perspective on the design that differs from the perspective accepted in Information Systems (IS). As was discussed throughout the dissertation, our view on the design of IIs is the following. IIs, including OSU, are complex socio-technical systems that cannot be designed in a top-down manner; designers can only facilitate the process of their emergence. Moreover, any user of II can be a designer of infrastructure because, during the course of work, they reshape II accommodating them for individual purposes and changing work practices.

This research helped to understand the emerging field of OSU in detail and developed a design method for this new field. This study focuses on cultivating OSU infrastructures, i.e., infrastructures that facilitate the production of open source design manuals in the urban commons. We use the

term *cultivation* instead of development because IIs evolve within an ever-changing environment. The cultivation of OSU infrastructures implies facilitating growth gradually and incrementally. Traditional design methods are unsuitable as they do not consider the idiosyncratic nature of OSU. For this reason, the synthesised design method differs from the IIs theory (see the discussion in section 7.6). We built an interdisciplinary research domain and a research approach that adheres to this peculiar setting. It is difficult to apply more traditional 'hard' design requirements and features in such a setting. Thus, we synthesised a design method for OSU based on design principles, i.e., heuristics that direct towards possible solutions. This manner is more process-oriented than solution-oriented, which fits the idea of cultivation better than having a design as a solution to be implemented.

The societal driver of this dissertation is that the urban commons are quite rare, as self-organised citizens often lack the skills, knowledge, and resources to overcome the inception phase of an initiative. The urban commons initiatives are hard to develop and sustain as no formal organisational structure exists. OSU infrastructures facilitate the dissemination and use of DIY knowledge among urban commons. This chapter discusses scientific and societal contributions, the limitations of the study, and suggestions for further research.

8.1 Scientific and societal contributions

8.1.1 Scientific contributions

This research contributes to science in various ways. The first scientific contribution is the combination of several bodies of literature, namely Information Systems, Urban Studies, Urban sociology, and organisation studies, that resulted in an emerging research domain for OSU. The streams of literature that concern aspects of OSU are studied separately in different disciplinary domains; specifically, *digital commons* are studied in computer science and human-computer interaction. In contrast, urban commons are studied in various research fields of social sciences, such as urban sociology, human geography, and economics. We combined mentioned literature strands on the commons in urban and digital domains, bottom-up urbanism, and co-production of public services to shape the interdisciplinary research domain for this dissertation.

The second contribution provides knowledge to the IS discipline. We

elaborated a new Action Design Ethnography Research (ADER) approach suitable for the idiosyncratic setting of the urban commons. This combination of Action Design Research methodology and ethnographic fieldwork is unique. Ethnographic fieldwork (e.g., participant observations) provides detailed insights into a new domain that can be used as the basis for constructing design artefacts. Usually, a design science methodology requires a multidisciplinary team of DSR researchers and ICT practitioners; consequently, this approach is fairly expensive, time-consuming, and unsuitable for the domain of OSU. The offered combination of ethnographic and Action Design Research methodologies enabled the research team to contribute to science and practice in the idiosyncratic setting of the urban commons. We perceive ADER methodology as fruitful for the design exploration of emerging urban phenomena, as was exemplified in this study of the urban commons.

On the other hand, this method requires the researcher to practice the interdisciplinary approach and exhibit a wide range of skills (e.g., soft skills, design skills). Design interventions in organisations are challenging, but especially so in the informal setting of a self-organised initiative. Very few formal tools, such as contracts and responsible persons, are in place in such a context. Instead, researchers must be accepted in the community, understand the core values and norms, and build trust in relationships with its members.

The third contribution is a design method for the cultivation of OSU infrastructures. The method consists of the *roles* of community members and design principles guiding the cultivation of OSU infrastructures. A role is a set of activities and responsibilities expected from a community member by their peers. We provide the roles to show specific actions and required attributes of community members regarding establishing OSU infrastructures. The design method is complemented by *constructs*, i.e., analytical categories that help understand the social reality of an urban commons and are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures.

The literature on IIs provides prescriptive knowledge for constructing IIs: Hanseth and Lyytinen (2004) developed a design theory for information infrastructures based on complex adaptive systems (CAS) theory. This theory is applicable to IIs that operate in the public-private dichotomy. Derived from CAS, the IIs theory is fairly technical and applicable to command-

and-control structures. The principles are immediate usefulness, utilisation of existing installed base, expanding installed base with persuasive tactics, simplicity, and modularisation (p. 214). Our design method inherits from this theory, specifically the principles of modularisation and building on the existing installed base. However, instead of the installed base, we coined the notion of *fertile ground*. In comparison to IIs design theory, our design method pays attention to the social aspect of OSU infrastructures cultivation (e.g., building trust, searching for motivation and possibilities to bridge heterogeneous groups of actors) since the urban commons lack hierarchies and mechanisms of coercion. Moreover, IIs differ from OSU infrastructures in scale and resource base. We argue that the IIs design theory, although applicable to OSU, is insufficient to cultivate OSU infrastructures due to the idiosyncratic setting of the urban commons. Therefore, this dissertation offered a design method tailored to the OSU domain.

The IS discipline lacks studies on the urban commons, thus, our study is one of the first to provide insights into constructing a design method for the urban commons field. There was no design knowledge guiding the cultivation of OSU infrastructures. Moreover, we stress that this type of IIs (i.e., infrastructures that facilitate the production of open source urban prototypes in the urban commons) was lacking in the literature. We synthesised a set of design principles that guide urban commons CoPs in the cultivation of OSU infrastructures.

8.1.2 Societal contributions

Societal contributions are the following. The first is a design method that guides the cultivation of OSU infrastructures. This method can be used by members of the urban commons CoPs and urban practitioners (e.g., community managers and urban designers) that can apply the offered method for facilitating the cultivation of OSU infrastructures. Aside from them, the offered principles might be of interest to urban stakeholders that are not directly involved in the cultivation of OSU infrastructures but related to enabling or promoting citizen self-organisation and, specifically, the urban commons. Awareness of the offered methodology among decision-makers can contribute to the proliferation of OSU infrastructures as it lets them understand the nature of the urban commons. Besides, this method might be useful for policy-makers to raise their understanding of such initiatives.

The second contribution is paying attention to the role of Co-Designers

of OSU infrastructures. Co-Designer is a facilitator of the collective cultivation of infrastructure since every user can contribute to the design process. OSU infrastructures are ill-structured, and hardly possible to define their scope and functions. Co-designers are interdisciplinary professionals that can grasp such complex socio-technical systems and facilitate their growth. We argue that introducing this role to practice will benefit urban development. We would see a co-designer being an important part of this socio-technical system. Co-designers immersed in community life can suggest a socio-technical change that reflects issues of the local environment and solutions suggested by the initiative. Such professionals should not only have the qualification to conduct design science and ethnography but also such soft skills as empathy and open-mindedness. Heterogeneous groups that are stakeholders of the urban commons frequently have the same concerns and detect similar challenges in their cities. Nevertheless, these groups belong to different social bubbles and have different vocabularies, practices, and visions of tackling perceived urban challenges. Co-designers can act as bridges for these social realities, translators of ontologies, and creators of joint vocabularies. Urban professionals with this set of skills could construct the work field as a peculiar assemblage of different social realities to understand different CoPs and construct artefacts that facilitate the collaboration of such heterogeneous groups.

The third contribution is the perspective on treating the practice related to collecting and sharing DIY knowledge in the urban commons as an OSU infrastructure. As Star (1989) pointed out, IIs are not 'where'; they are 'when', i.e., IIs might be perceived as the perspective on information-oriented practice. If an urban commons CoP collaborates with other heterogeneous CoPs (e.g., municipal departments, NGOs, and knowledge organisations) on projects, the infrastructure emerges. It might not be visible, as infrastructures naturally 'sunk' in everyday reality. The task of urban co-designers of socio-technical systems is to find IIs, i.e., delineate them from the environment to help them grow and thrive.

The rest of the chapter is organised as follows. The first section revisits the research questions and draws conclusions of this dissertation. The conclusions are grouped with regard to the research questions posed in the second chapter. The second section discusses the limitation of this study. The third section suggests future research directions. The fourth section provides reflections on the research process.

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8.2 Findings from this study

This section reviews and answers the research questions posed in this dissertation.

8.2.1 RQIa: What is Open Source Urbanism?

We conducted a literature review in chapter three to answer the first part of the first research question: RQIa *"What is Open Source Urbanism?"*. We examined the existing literature and learned that, in general, this overarching term links Do-It-Yourself (DIY) culture and citizen-driven urban interventions with the open source movement. It captures the emergent urban phenomenon of citizens that intervene in urban environments with *urban prototypes*, i.e., DIY and incomplete experimental objects that emerge as a response to pressing urban issues. The essential difference between these DIY artefacts from official urban infrastructures lies in their permanent status of a prototype. Urban designs created by professionals are thoroughly tested, standardised, and comply with all possible federal and municipal regulations. In contrast, prototypes are incomplete, as they embody the on-going experimentation of citizens with their urban environments. They developed *in situ* (i.e., in specific urban contexts) and *ad hoc* (i.e., hand-crafted to tackle not a class of problems but particular problems of their designers and local communities). Similar to other 'branches' of the open source movement, such as software and hardware, urban prototypes are in a permanent 'beta' version. For the purpose of this research, we defined OSU as follows: citizen-driven commons-based co-production of open source urban prototypes that aim at urban transformation. We integrate various research fields, namely Information Systems, Urban Studies, Urban sociology, and organisation studies. In order to address this question in full, we summarised the literature on OSU.

Three aspects can characterise OSU: (1) OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment; (2) OSU initiatives produce *the new commons*, urban places and digital artefacts that are collectively created and managed by self-organised citizens; (3) to last, DIY alterations of the urban environment should be accepted by or *co-created* with the authorities. In the existing literature, these aspects are discussed briefly; we conducted a thorough investigation of their definitions and characteristics. From the literature, we derived three starting points for the design of a method for OSU, namely:

(1) a design method must acknowledge the non-professional nature of DIY interventions and laymen people as designers of OSU infrastructures; (2) a design method must embrace non-hierarchical, peer relations in the commons; (3) a design method must consider the co-production of OSU with the urban authorities.

8.2.2 RQIb: What are reference theories for a design method for OSU infrastructures?

We learned from the first part of the literature review that OSU initiatives are self-organised and commons-based. They exhibit social relations that differ from the command-and-control mechanisms of public and private organisations. Hence, a design method for OSU infrastructures requires reference theories that fit the peculiar nature of OSU. The second part of the literature review filled this gap in chapter four, answering the research question: RQIb *"What are reference theories for a design method for OSU infrastructures?"*. We have not found a theory that could serve as a single reference theory for OSU, thus, we utilised a multi-theory approach (i.e., combined several bodies of knowledge) for explaining the various part and arriving at design principles for OSU. Based on design assumptions derived in chapter three, we identified three bodies of literature as reference theories. Firstly, we perceive IT-based artefacts facilitating OSU as IIs; thus, the literature on IIs serves as the first reference theory. Secondly, IIs theory selected as an analytical tool requires analysis of communities that share work practices since information infrastructures function in communities in which members learn from each other by sharing tacit knowledge (e.g., anecdotes, impromptu comments and opinion exchange) as well as explicit knowledge (e.g., documents, graphics). We adopted a theory that focuses on Communities of Practice (CoP). Thirdly, we gained insight that the urban commons are frequently challenged by the scarcity of urban land; hence, building a design method for effective OSU infrastructures must include literature on urban space. While the prior literature on IIs was selected as a theoretical lens to perceive OSU practice as IIs, the CoP theory allowed analysing the urban commons community as a self-organised community shaped around a shared practice. The literature on the urban place enabled us to analyse the spatial dimension of the CoP, i.e., the physical urban space co-created by the urban commons CoP as a container for their shared practice. These three bodies of literature cover different aspects of a

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rich, multifaceted phenomenon of urban commons. We adopt the theory of IIs as a theoretical lens for analysing emerging complex socio-technical systems. The CoP theory explains the relations between community members (e.g., learning, acquiring identity and practice) and with external stakeholders (i.e., boundary interactions and objects). The literature on urban places covers the analysis of the physical realm of an urban commons.

8.2.3 RQII: What elements of the urban commons can comprise the fertile ground for OSU?

The IIs literature indicates that infrastructure grows on the *installed base*, i.e., "existing practices, conventions, tools and systems" (Aanestad et al., 2017, p. 28). OSU infrastructures grow and evolve in an organic manner, like any other type of IIs. What differentiates OSU infrastructures from other IIs, is that the social context they are cultivated in is emerging itself. Thus, there is no installed base but rather a fluid, ever-evolving socio-technical systems of common resources, institutions, and Communities of Practice, that we captured under the notion of the commons. The prior literature provides design knowledge on cultivating IIs on the installed base (e.g., IIs design theory offered by Hanseth and Lyytinen, 2004) that is unsuitable for the idiosyncratic domain of OSU. To close the gap, we conducted an ethnographic study of a real-life urban commons in Amsterdam, the Netherlands. This study answered the second research question: RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. Reference theories were applied to analyse potential elements of the installed base.

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We perceive urban commons as the *fertile ground* in which an OSU infrastructure can be cultivated. Urban commons are self-organised, emerging communities driven by the values and visions of people. We coin the notion of the fertile ground instead of the installed base to stress the self-organised nature of urban commons and, consequently, OSU. The urban commons are emergent (i.e., not planned or designed from the top-down). Therefore, elements that can play the role of the fertile ground for cultivating an OSU infrastructure are a constellation of heterogeneous elements that emerged ad-hoc and evolved over time in an organic manner. We highlight that the fertile ground is not an entity existing within the urban commons and revealed by researchers; it is a conceptual tool that is useful for researchers and designers of infrastructures (in the same manner as the

installed base).

The urban commons are self-organised and not planned or designed from the top-down; they are a constellation of heterogeneous elements that emerged ad-hoc and evolved over time. We identified elements that can serve as the fertile ground for cultivating an OSU infrastructure, namely: 1) Community vision refers to goals to be achieved, thus, the CoP shapes around the vision; 2) Urban prototypes as a means for community practice to implement the vision; 3) Community activities performed by CoP members to achieve the implementation of the vision; and 4) The Commoning place as a container for shared practice and showcase for other urban stakeholders.

Based on the ethnography, we coined the notion of the Commoning place. From the literature on urban places, we learned that place could be conceived as consisting of three dimensions: spatial, material, and symbolic. The Commoning place plays a crucial role in building the group and individual identity of the CoP and serves as a container for the CoP practice. The CoP is shaped around the Commoning place, for instance, members' roles, tasks, and responsibilities. In fact, the Commoning place is the most visible artefact of the CoP that simultaneously serves as a showcase of community vision, a container for shared practice, and a source of tensions with external urban stakeholders.

The ethos of urban commons differs from the public-private dichotomy, making them idiosyncratic to the surrounding urban environment and potentially susceptible to enclosures. Due to this discrepancy, urban commons might wish to minimize contact with the surrounding urban environment. Regardless of the commoners' wishes, the Commoning place is inevitably part of the network of urban relations (social, ecological, infrastructural). Hence, our findings suggest that the Commoning place can be analysed as a boundary object Star and Griesemer (1989), i.e., subject to actors' actions from different CoPs. The Commoning place might have diverse meanings for various stakeholders depending on their individual experience and job position. Claims and visions of urban commons should be communicated with outsiders by CoP members playing the role of boundary spanners that bridge heterogeneous social realms to secure the survival and further development of the urban commons. To conclude, we contribute the notion of fertile ground to the literature. Fertile ground is the foundation on which an OSU infrastructure grows. Fertile ground consists

of such elements of a spatially-rooted urban commons as the Community vision, Commoning place, Urban prototypes, and Community practice.

8.2.4 RQIII: Which design interventions into an urban commons cultivate an OSU infrastructure?

The following design step, aimed at cultivating an OSU infrastructure with members of the urban commons community, required design interventions for two reasons: firstly, the literature provides little insight into the commons-based cultivation strategy; secondly, information infrastructures are frequently co-designed by future users. Thus, we conducted four design interventions, i.e., researchers' activities within organizations that aim to solve their practical problems. We were involved in a real-world situation as both participant and researcher and conducted design interventions in collaboration with practitioners of the field. This design step answered the third research question: RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*.

From interventions, we learned that top-down design methods are ineffective due to the idiosyncratic nature of the commons and the complexity of infrastructures; one cannot proceed with cultivating an infrastructure until trust with the community is built, and the installed base is identified. Long-term engagement with the community is required to establish trust with its members and identify the elements that can serve as fertile ground for cultivating an OSU infrastructure. Importantly, motivation to build every part of it should come from community members. We learned that one should build infrastructure in an ad-hoc manner waiting for windows of opportunity (i.e., a moment when members have a clear motivation to grow it).

Finally, we learned that infrastructure cultivation requires different roles for community members. During the design process, we identified five roles required for growing the infrastructure. Three roles were identified in the community during the ethnography, and two roles emerged during the design interventions. The roles that existed in the CoP are Ambassador, Coordinator, and Volunteer. The emerged roles are Co-Designer and Maker. The following section proceeds by offering a design method that includes mentioned roles, along with constructs and design principles; these guide the cultivation of an OSU infrastructure on the fertile ground of urban commons.

Unlike professional designers, active citizens are neither trained to produce designs that solve a class of problems nor to pursue such goals. Not necessarily an OSU infrastructure culminates in providing designs of a high level of abstraction. For instance, the efforts of KasKantine resulted in an OSU infrastructure called 'Experimental Networked Autonomy' (ENA). As part of KasKantine CoP, the researcher played several roles (Co-Designer, Maker, Volunteer), contributing to the cultivation of ENA. At the same time, the researcher produced abstract design knowledge (i.e., a design method for OSU). We perceive no conflict here since the CoP members, although aware of the research objective, were not involved in the research process. Thus, as a community member, the researcher produced a context-dependent design (i.e., ENA infrastructure).

8.2.5 RQIV: Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?

This design step utilised insights from the empirical studies and findings from the literature to synthesise a design method for Open Source Urbanism. We refrain from claims that the literature references are exhaustive. Due to the interdisciplinary nature of the OSU domain, we integrated several research fields. Due to the space constraints of this dissertation, we cannot provide a full literature review for each concept of the offered design method. Instead, we suggest pathways that can be followed by Co-Designers employing this method.

The design method consists of constructs, roles and design principles used as a co-design approach for cultivating OSU infrastructures. Constructs are the elements of the fertile ground, namely Community vision, Commoning place, Community practice, and urban prototypes. Constructs are analytical categories that help understand the social reality of the urban commons. Constructs are required to explain design principles that guide analytic and design activities focused on cultivating OSU infrastructures. Constructs are typical conceptual elements derived from the field: we derived constructs from the ethnographic study. We offer constructs in a generalised, context-independent way to be applicable to different OSU projects.

The set of roles was identified during the ethnographic observations. We identified five roles, namely Ambassadors, Coordinators, Volunteers,

Co-Designers, and Makers. Ambassadors, Coordinators, and Volunteers are roles that already exist in an urban commons (although they might have different labels), while Co-Designers and Makers are explicitly required for an OSU infrastructure co-creation. Ambassadors are boundary spanners between the urban commons and external CoPs. Coordinators manage activities within the Commoning place, such as community management and task allocation. Volunteers perform activities, as part of Community practice, that Coordinators assign. Co-Designers are facilitators that might not possess DIY knowledge of the specific CoP; instead, they look for opportunities to cultivate an OSU infrastructure. Makers are community members who bring their competence from their professional field, such as writing texts or preparing schemes to create design manuals. Our empirical studies show that in-house Makers, i.e., CoP members, are more effective as they are familiar with the ideas and practices of the initiative. If a community lacks peers with the required competencies, it can recruit joined-up Makers, i.e., outsiders that accomplish specific tasks. Joined-up Makers should spend much time getting familiar with the initiative.

Next, we offered eight design principles divided into four phases: Initiation, Preparation, Translation, and Proliferation. Design principles are generic prescriptions and guidelines intended to be manifested or encapsulated in the design and implementation of socio-technical systems. The principles of the first phase, *Initiation*, initiate and secure the collaboration with an urban commons community. The *Immersing* principle (1) declares the importance of Co-Designers' long-term involvement in community life. The Co-Designer's immersion is significantly different from other design projects since the Co-Designer should become part of the community first. The *Trust-building* principle (2) argues why building trust with community members is crucial for co-creation with urban commons. The second phase, *Preparation*, guides the beginning of OSU cultivation on the identified elements of the fertile ground. The *Motivating* principle (3) suggests finding motivation for CoP members for further co-design. *Growing* principle (4) prescribes slow cultivation of an OSU infrastructure on the fertile ground of the urban commons. The third phase, *Translation*, focuses on translating community knowledge from a tacit form held among CoP members to an explicit form stored on a medium. The *Showcasing* principle (5) explains what community knowledge should be translated into an explicit form. The *Bridging* principle (6) argues why this knowledge might bridge multiple

social worlds. The fourth phase, *Proliferation*, is dedicated to developing processes and tools that enable inter-communal knowledge sharing and co-creation. The *Open-sourcing* principle (7) advocates adopting the open source ethos for easing development and securing community ownership. The *Peer production* principle (8) recommends adopting the principles of commons-based peer production to enable the collaboration of geographically spread members of a virtual network of practice.

8.3 Limitations of the study

This section discusses the limitations of this research, namely the researcher's bias at ethnographic work, limitations regarding the research domain, the synthesis of a design method from a single case and the scope of this study.

8.3.1 On the ethnographic fieldwork and researchers' bias

This research adopts the interpretivism paradigm that stays on the position that 'reality' is a social construct created by human actors, and, consequently, there is no single objective reality but rather multiple realities created in the minds of different individuals (Walsham, 1995; Vaishnavi and Kuechler, 2008). Methods applied by interpretivism researchers are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993, p. 4).

This research contributes to design science by offering the ADER methodology combining design science with ethnography. Considering ethnography, we agree with the school of thought that stresses empathy and identification with people under scrutiny as primary tools (or traits) of ethnographers (Sanday, 1979), as this helps to become 'like a blank slate' to understand complex social phenomena (Myers, 1999). Due to this approach, holistic ethnography has the advantage of gaining in-depth knowledge that is hardly possible to acquire with other qualitative methods.

Despite this advantage, this approach has a significant risk of researcher bias. Immersion of the researcher in the community's everyday life and identification with its members hardly leave space for neutrality. In the literature, this is called 'the risk of going native' (Monti, 1992). We received advice to "switch modes" or "change masks" during the ethnography; in a manner that, at one moment, to play a role of a volunteer and,

at the next moment, play the neutral researcher that effectively mitigates their bias'. We were unable to follow this advice. It seems impossible in our research domain because these modes are interwoven during an ethnographic design study. We take the position that the complete eradication of researchers' bias from ethnography is impossible. Only the complete disengagement helped to get back to the state of the neutral researcher. Therefore, we left the field and were fully disengaged from the social reality of KasKantine to reflect on the conducted ethnographic studies and synthesise a design method offered in this dissertation.

Although this study was initially planned to be conducted in a multi-actor setting, we were unable to gain access to external actors, such as civil servants, contractor organisations, and other citizen initiatives. It might be caused by the lack of the researcher's experience in negotiation and vague objectives at the beginning of this study. The factor that this study promised no immediate benefit to these actors also played its role. Due to this limitation, we adopted the 'community perspective' on the problem at hand. Finally, we admit that at the beginning of this study, the researcher was a proponent of citizen self-organisation and, particularly, urban commons as a specific model of it.

We took precautions to mitigate the researcher's bias as follows. Firstly, we used various sources of information, such as various community members and documents produced inside and outside the community. We were open to criticism from our colleagues. Moreover, the community leaders were familiar with the practical objective (i.e., to construct a prototype of an OSU infrastructure). Nevertheless, they were not interested in the research objective – a design method – and the process of synthesis of the method was on the researchers' side. A most important step to mitigate the researchers' bias is the following: after the ethnography and design interventions were complete, we discontinued our engagement in community life. We stopped personal relations with community members since social interactions bring emotions that might lead to cognitive bias. Analysis, reflection and the final synthesis of the design method were conducted 'at the office'.

To conclude, the ethnography of idiosyncratic urban commons coupled with the researcher's perspective (i.e., urban commons proponent) led to the synthesis of a design method as it offered in this dissertation. We admit that different communities, actors, or researchers with different personal

traits would lead to different design outcomes. The adopted interpretivism paradigm allows us to state this theory as a result of our interpretation of reality based on the long-term immersion in the everyday practice at this specific Commoning place.

8.3.2 Limitations regarding the research domain

Many IS researchers are reluctant to apply action research methods because it poses the 'double challenge' of action and research; the inability to nego-tiate 'control structures', i.e., project initiation, authority, and degree of for-malisation, frequently leads to the failure of action research projects (Avison et al., 2001) (see discussion in section 6.2). In the case of this research, we experienced the 'triple challenge', as difficulties of action research were paired with the challenge of dealing with the self-organised nature of urban commons.

Avison et al. (2001) suggests that ideally, action research projects must have 'established written agreements and contracts'. In our case, secur-ing such a formal arrangement was not possible since the community was shaped by unofficial relations (i.e., volunteerism, shared interests, and val-ues), no official control structures (i.e., contracts and funding) were in place, and this would not meet the values and norms. Therefore, we used ethno-graphic 'tools' to secure the collaboration, namely gaining membership in the CoP and fostering trust with the CoP members.

A generalisation of the offered design method is limited to the research domain constructed in the third chapter. The offered design principles are likely flexible enough to be useful for the class of problems. Moreover, the scope of this study is limited by constructing a design method that culti-vates an OSU infrastructure only to its inception phase. Further adoption by multiple communities of practice and various urban stakeholders is out of the scope of this dissertation. Due to this limitation, we had no opportu-nity to investigate the cultivation of OSU infrastructures in the multi-actor setting, for instance, such factors as conflicting interests and perspectives of different CoPs and the role of boundary objects in these. Thus, this study does not cover the evolution and growth of OSU infrastructures.

Due to the course of this research, KasKantine transformed into another type of initiative that is, although still bottom-up, independent and alterna-tive, cannot be considered the urban commons. Reflection on this change is out of the scope of this dissertation; nevertheless, we find it important to

stress that the urban commons is a fragile model of citizen self-organisation that is malleable to power dynamics and enclosures from both outside and inside the CoP.

8.3.3 Challenge of synthesising a design method from a single-case ethnography

One of the limitations of ethnography is its uration: not only the field-work is more time-consuming than other studies, but also the analysis and reporting (Myers, 1999). Due to this shortcoming, coupled with the limited time span of a PhD study, this dissertation covers only a single case of urban commons. In fact, ethnography often receives criticism for producing in-depth knowledge of a single organisation, culture, or situation while providing no breadth in comparison with other qualitative studies, such as multiple case studies; some scholars even claim that it is impossible to derive generalised knowledge based on a single ethnographic study (Myers, 1999). On the other hand, ethnography was a legitimate trade-off of time investment and gaining in-depth knowledge about the emerging phenomenon of the urban commons.

In the last decades, theories generalised from a single case study have become a norm, for instance, research of Yin (1994); Walsham (1995); Flyvbjerg (2006). The main difference between case studies and ethnography is the extent to which researchers immerse themselves in the subject under scrutiny. Primary data collection sources for case studies are interviews and documents. Ethnography gains the most from participant observation while documents and interviews supplement it (Yin, 1994). Thus, deriving theory from ethnography deals with the same challenges as a single-case study. As Myers (1999) puts it: "[t]he arguments made in favour of generalisation from case studies apply equally well to ethnographies" (p. 7).

(Eisenhardt and Graebner, 2007) argue that single case studies yield more complex theories; nevertheless, multiple case studies provide a synthesis of 'more robust, generalisable, and testable theory than single-case research." (p. 27). Although multiple cases probably would produce a more robust theory, finding several innovative urban commons was unfeasible. We chose the in-depth investigation of a single case because these, as Yin (1994, p. 27) describes: "unusually revelatory, extreme exemplars, or opportunities for unusual research access". Our design method, that is grounded in the data from a single idiosyncratic case, fills the gap in the literature

and can be perceived as a departure point for further research.

8.4 Recommendations for future research

Previous sections of this chapter highlighted the contributions of this research along with its limitations. Based on these, this section gives recommendations for future research agenda of OSU infrastructures.

8.4.1 Study OSU infrastructures in different settings

Public and private sectors might play a significant role in the development of OSU initiatives; hence, we suggest conducting a study covering OSU infrastructures in a multi-actor setting, i.e., engaging private companies, decision-makers, and civil servants in the cultivation of OSU infrastructures. Moreover, engaging several urban commons in such a study can be quite fruitful, as several communities might form a Network of Practice by means of an OSU infrastructure. As Star (1996) puts it, 'Nobody is in charge of infrastructure', and everybody can be a designer of it. This characteristic of infrastructures, coupled with tensions between urban commons and other urban actors and the self-organised nature of the former, raises questions about the cultivation of OSU infrastructures in the multi-actor setting. Especially interesting to investigate an approach that balances different, often even contradictory, interests of various urban stakeholders and maximises value for city-wide urban development while further enabling citizen-driven urban commons.

Importantly, the economic aspects of OSU are not covered by this study. If urban practitioners are interested in OSU as an approach to facilitating sustainable urban transformation, the funding and sustaining of OSU needs investigation. Possible questions include the source of money, copyright, intellectual property, and enclosure of the digital commons. Although all mentioned aspects were in our initial research ambition, at least to some extent, the reality showed it was unfeasible with the given capabilities and resources.

8.4.2 Investigate the further evolution and sustainability of OSU infrastructures

As was previously discussed, this research is limited to constructing a design method for the inception phase of OSU infrastructures, while further

8

evolution and growth of these were left outside the scope of the study. Further evolution and growth of such infrastructures can be investigated, especially the adaptability. The latter is viewed as one of the main challenges in infrastructure studies (Hanseth and Lyytinen, 2004). An overarching design theory for IIs (Hanseth and Lyytinen, 2004) might also apply to the evolution of OSU infrastructures. On the other hand, as this dissertation demonstrates, the setting of urban commons differs from public and private organisations, thus, this subject is worth studying. Furthermore, the literature on the open source movement covers topics that might be of interest with regard to OSU infrastructures. For instance, Liu et al. (2020) investigates modularity and sustainability of open source projects, pointing out that "with ordinary open source projects, sustainability can be a significant challenge as development communities grow and evolve". These challenges are also relatable to OSU infrastructures, and further research into the sustainability of OSU is recommended.

8.4.3 Further development of the Action Design Ethnographic Research

One of the main contributions of this dissertation is the Action Design Ethnographic Research (ADER) methodology. We constructed it by combining two research methodologies well-accepted by IS scholars, namely Action Design Research (Sein et al., 2011) and ethnography. Action Design Research provides a research process model that differs from the 'laboratory approach'. The main difference is the research team's involvement in the real-life problem-solving of a client. Ethnography is 'one of the most in-depth research methods possible', providing tools to observe people's interactions and practices directly (Baskerville and Myers, 2015, p. 40). This dissertation demonstrates the effectiveness of the ADER methodology that allowed gaining in-depth knowledge of the urban commons CoP and co-design complex socio-technical artefacts with future users. We recommend testing the developed method in other settings. The offered method is inductively developed; it could be put to use in other situations to test in a deductive manner and refined further. Next, we recommend eliciting the generalised research process model for ADER and applying it to other research domains that still need to be better understood. We claim that ADER contributes to design science and makes a social impact by providing researchers with another toolset for co-designing with active citizens.

Glossary

Artefact
a "bundle of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (Orlikowski and Barley, 2001, p. 121)

Citizen self-organisation
"an activity initiated by citizens as a group, where this activity is aimed at common interest and where citizens themselves decide both about the aims and means of their project and actively participate in the implementation of their project" (Denters, 2012, p. 233).

Commoning
"voluntary and inclusively self-organised activities and mediation of peers who aim at satisfying needs." (Euler, 2018, p. 12).

Commoning place
a physical location co-created by members of the urban commons community as a means for their shared practice. Such places emerge as a response to the common concerns in which like-minded citizens come together for collective action.

Commons
a triad of a) common resources; b) institutions for regulating those resources, including supporting technologies; and c) communities (i.e., commoners) that design the institutions on the way of producing and reproducing shared resources (Dellenbaugh et al., 2015).

Commons-Based Peer Production (CBPP)
"a process by which many individuals, whose actions are coordinated neither by managers nor by price signals in the market, contribute to a joint effort that effectively produces a unit of information or culture" (Benkler, 2003, p. 1254).

Community practice

recurrent activities that are performed as part of membership in the urban commons CoP. Such activities either related to reproductive labour (i.e., activities focused on keeping the Commoning place running and in order), or to achieving Community vision.

Community vision

a concept of the urban commons development collectively imagined by its CoP members.

Constructs

"representations of the entities of interest in the theory" (Gregor and Jones, 2007, p. 322).

Co-production

a relationship between paid employees of an organisation and self-organised citizens that requires a direct and active contribution from these citizens to the work of the organisation.

Design interventions

researcher's activities within organisations that aim at solving their practical problems

Design manual

a written set of rules to follow in order to create an artefact for achieving a specific goal.

Design method

. A design method can be defined as "a set of steps (an algorithm or guideline) used to perform a task" (Offermann et al., 2010, p. 78)

Design principles

"generic prescriptions and guidelines that are intended to be manifested or encapsulated in the design and implementation of socio-technical systems".

Digital commons

any type of information resource that is collectively produced and shared by members of online Communities of Practice.

Digital platform

"a specific type of civic technology explicitly built for participatory, engagement and collaboration purposes that allow for user-generated content and include a range of functionalities [...] which transcend and considerably differ from social media" (Falco and Kleinhans, 2019, p. 3).

Fertile ground

is the foundation on which an OSU infrastructure grows. Fertile ground consists of such elements of a spatially-rooted urban commons as the Community vision, Commoning place, Urban prototypes, and Community practice. We suggest the new notion to highlight the different mode of production in the urban commons that are self-organised, emerging communities driven by the values and visions of people.

Information Infrastructure (II)

IIs are shared resources for communities of practice; they facilitate information-oriented services; they have no clear scope or purpose; they consist of a heterogeneous and ever-changing set of technological and social components.

Installed base

... of an Information Infrastructure is "existing practices, conventions, tools and systems" (Aanestad et al., 2017, p. 28).

New commons

"a resource shared by a group where the resource is vulnerable to enclosure, overuse and social dilemmas. Unlike a public good, it requires management and protection in order to sustain it" (Hess, 2008, p. 37)

Open Source Urbanism (OSU)

citizen-driven commons-based co-production of open source urban prototypes that aim at urban transformation.

OSU infrastructure

a commons-based information infrastructure that facilitates the co-production of urban prototypes and open source design manuals.

Place
>   concisely defines a place as "a small, three-dimensional urban space
>   that is cherished by the people who inhabit it." (Friedmann, 2016, p.
>   154).

Reference theories
>   "theories from natural science, social sciences and mathematics" (Walls
>   et al., 1992, p. 41) including 'informal knowledge from the field and
>   the experience of practitioners' (Gregor and Hevner, 2013, p. 340).
>   In our case, we use no 'hard' theories from mathematics or economy
>   that would comprise the core of a design method, instead, we use
>   these theories as reference for our analysis and synthesis of a design
>   method.

Role
>   a set of activities and responsibilities expected from a community
>   member by their peers.

Space
>   "opportunities, moments and channels where citizens can act to po-
>   tentially affect policies, discourses, decisions and relationships that
>   affect their lives and interests." (Gaventa, 2006, p. 26).

The right to the city
>   the right of citizens to shape their urban environments by means of
>   self-organisation.

Urban commons
>   an initiative that includes the collaborative production and consump-
>   tion of resources in the urban context (Foster, 2011). In this disser-
>   tation, we focus on spatially-rooted urban commons only, i.e., urban
>   commons that require the spatial dimension - a parcel of urban land
>   – and commoning practices are organised around the management
>   of that DIY place.

Urban prototypes
>   DIY and incomplete experimental objects that emerge as a response
>   to pressing urban issues.

Urban transformation

"a process where the dominant structures, functions and identity of urban systems change fundamentally e leading to new cultural, structural and institutional configurations" (Radywyl and Bigg, 2013, p. 160).

Summary

Open Source Urbanism (OSU) emerges as citizens self-organise to alter their urban environments by creating Do-It-Yourself (DIY) *urban prototypes* and sharing their design manuals on the internet. The examples of urban prototypes might vary from built structures, such as street furniture and urban gardening equipment, to decentralised energy designs and IT artefacts. They emerge as a natural response of citizens to perceived problems in their urban environments. Urban prototypes are designed, paid for, and implemented by *self-organised* citizens instead of developed by public or private companies and bought on the market. Whereas companies' staff consist commonly of professionals, and the products are thoroughly tested and standardised to comply with all possible governmental regulations, urban prototypes are incomplete, as they embody the ongoing experimentation of citizens with their urban environments. Furthermore, amateur designers might have limited experience or background in this area.

OSU emerges in self-organised communities that this research captures under the notion of *the urban commons* that are places created and maintained by self-organised citizens. Such initiatives aim at solving pressing societal issues of local urban environments, often otherwise not solved by the public or private sector. OSU unites bottom-up citizen interventions and the open source movement: the urban commons focus on collective management of resources in the urban context, for instance, community gardens and housing cooperatives, while open source communities create *the digital commons* that are a form of self-organisation on the internet, such as open source software or Wikipedia. OSU differs from formal organisations because of the lack of resources, the absence of clear hierarchies and control structures, and voluntary contributions. OSU projects operate as decentralised peer-to-peer networks in which distinctions between producers and consumers of resources are blurred. Such networks create urban prototypes along with open source design manuals, i.e., blueprints and instructions covering their creation's design process.

Concerning IT-based systems at the core of OSU, we perceive them as Information Infrastructures (IIs) because the urban commons and IIs ex-

hibit the same characteristics: both phenomena share a self-organised, decentralised, and evolving nature. For the purpose of this research, we define OSU infrastructures as a type of IIs that facilitate urban commons in the co-creation of open source urban prototypes. IIs imply an open-ended, loosely defined design process. Due to this organic evolution within the ever-changing environment, IIs scholars advocate that IIs are cultivated and not built or constructed. Yet, OSU infrastructures differ from other types of IIs, as there are also no formal governance structures, such as hierarchies and agreements.

The driver of this research is that OSU infrastructures, like other IIs, are not designed in a top-down manner, instead, they emerge over time. This requires different approaches, and existing work does not address this. The knowledge gap is the lack of prescriptive knowledge on designing OSU infrastructures. For example, the well-accepted design theory for IIs suggested by Hanseth and Lyytinen (2004) is not suitable, as we expect substantial differences in building infrastructures in the urban commons domain (e.g., the lack of resources and hierarchies, small-scale). Thus, building an OSU infrastructure demands a domain-specific design method. Furthermore, the idiosyncratic nature of urban commons is not explored by information systems (IS) scholars. Hence, we lack knowledge of the design process of cultivating IIs for OSU in the urban commons setting. An extrapolation of design knowledge from other domains might be problematic due to the differences in the domain of urban commons and, consequently, OSU. Thus, we set the objective of this dissertation as follows:

The objective of this research is to develop a design method for cultivating OSU infrastructures

This research focused on developing a design method, i.e., an algorithm applied to achieve a stated objective. Frequently, methods define deliverables achieved by applying provided guidelines, along with roles that support the application of these. In our case, the task is to cultivate OSU infrastructures in the self-organised setting of urban commons. Particularly we focus on the inception stage of the cultivation process, i.e., how to initialise an OSU infrastructure that is stable yet flexible to allow further evolution. Thus, we focused on the bootstrapping of OSU infrastructures. Such challenges as the adoption of the artefact by other communities, growing user base and network effect were out of the scope of this dissertation. Hence,

this research focused on developing a design method that guides the inception phase of an OSU infrastructure. Another limitation of this study is a single-case ethnography.

We addressed the research objective with the design science paradigm used in many disciplines, such as architecture, engineering, and computer science. In IS studies, Design Science Research (DSR) seeks to develop prescriptive knowledge by designing and evaluating innovative IT artefacts intended to solve an identified class of problems. A 'laboratory approach' in design science would not recognise the necessity of artefact emergence in interaction with its users and environment in a real-life setting. The typical approach to overcoming this limitation is combining design science with Action Research, i.e., a combination of theory generation and social systems change. For this reason, we adopted an Action Design Research (ADR) methodology that supports design knowledge generation in a real-life setting. The ADR methodology, however, does not specify concrete fieldwork methods.

One of the main contributions of this dissertation is the Action Design Ethnographic Research (ADER) methodology. We constructed it by combining ADR and ethnography. We adopted ethnography to conduct fieldwork inquiries within a selected urban commons community. Ethnography is a research method that primarily relies on the researcher's immersion in the social life of communities or cultures for an extended period and acquiring in-depth knowledge through interactions and observations. Apart from observations, our research approach implies design interventions, i.e., researchers' activities within organisations to solve their practical problems. The researcher became involved in a real-world situation as both participant and researcher and conducted design interventions in collaboration with urban commons practitioners. In this manner, the urban commons became a laboratory for this research.

This dissertation answers the following research questions:

RQIa *"What is Open Source Urbanism?"*. Open Source Urbanism is not well covered in the prior literature, therefore, in-depth understanding is needed for defining starting points for design. Although the notion is touched upon in the literature, it lacks a thorough conceptualisation to inform the next research steps. As no clear-cut definition of OSU existed, for the purpose of this research, we synthesised the following definition of OSU: **citizen-driven commons-based co-production of open source**

urban prototypes that aim at the urban transformation. Through urban transformation, we understand making built environments more sustainable and resource-efficient while providing prosperity and well-being for citizens. This definition refers to several phenomena from various research fields, namely Information Systems, Urban Studies, Urban sociology, and organisation studies. Understanding the phenomenon of OSU requires a combination of various disciplines, thus, requires building an interdisciplinary research domain. We found that three aspects can characterise OSU: (1) OSU initiatives are initialised by citizens that claim their right to the city, i.e., the right to transform their urban environment; (2) OSU initiatives produce *the new commons*, urban places and digital artefacts, that are collectively created and managed by self-organised citizens; (3) to last, DIY alterations of the urban environment should be accepted by or *co-produced* with the authorities. Since OSU exhibits social relations that differ from the command-and-control mechanisms of public and private organisations, we cannot apply existing design knowledge. To synthesise a design method for OSU, we formulated three starting points for design, namely (1) a design method must acknowledge the non-professional nature of DIY interventions and laymen people as designers of OSU infrastructures; (2) a design method must embrace non-hierarchical, peer relations in the commons; (3) a design method must consider the co-production of OSU with the urban authorities. We must consider them during the ethnographic and design phases of this research.

RQIb *"What are reference theories for a design method for OSU infrastructures?"*. Based on the insights from the previous chapter, we selected several bodies of literature as reference theories, i.e., descriptive theories and concepts outside the Information Systems (IS) discipline. We drew on several literature bodies and combined the literature on IIs, Communities of Practice (CoP), and urban places. First, we perceive IT-based practices at the core of OSU as a kind of Information Infrastructures (IIs) because the urban commons and IIs exhibit the same characteristics: both phenomena share a self-organised, decentralised, and evolving nature. IIs imply an open-ended, loosely defined design process. Due to this organic evolution within the ever-changing environment, IIs scholars advocate that IIs are cultivated and not built or constructed. Due to the similarities, II will be used as a reference theory in this research. Second of all, we adopted tools for analysis of communities that share work practices since IIs function in

communities of practice in which members learn from each other by sharing tacit knowledge (e.g., anecdotes, impromptu comments and opinion exchange) as well as explicit knowledge (e.g., documents, graphics). These practices are part of IIs, thus, we adopt the theory of Communities of Practice (CoP). Third, we need to investigate the spatial aspect of the urban commons since urban places function as a container of community practices. Hence, building a design method for OSU infrastructures must include literature on urban space. These three bodies of literature were used in two ways: as an analytical framework for ethnographic studies and for synthesising a design method.

RQII *"What elements of the urban commons can comprise the fertile ground for OSU?"*. The literature on IIs indicates that an infrastructure grows on *the installed base* (i.e., existing systems and practices). OSU infrastructures grow and evolve in an organic manner, as any other type of IIs. What differentiates OSU infrastructures from other IIs, is that the social context they are cultivated in is emerging itself. Thus, there is no installed base but rather a fluid, ever-evolving socio-technical systems of common resources, institutions, and Communities of Practice, that we captured under the notion of the commons. The prior literature provides design knowledge on cultivating IIs on the installed base unsuitable for the urban commons' idiosyncratic domain. To close the gap, we conducted an ethnographic study of a real-life urban commons in Amsterdam, the Netherlands.

We perceive urban commons as *the fertile ground* in which an OSU infrastructure can be cultivated. We coined the notion of the fertile ground instead of the installed base to stress the self-organised nature of urban commons and, consequently, OSU. The urban commons are self-organised and not planned or designed from the top-down; they are a constellation of heterogeneous elements that emerged ad-hoc and evolved over time. We claim that fertile ground fits better the peculiar domain of OSU. We identified elements that can serve as the fertile ground for cultivating an OSU infrastructure, namely: (1) *Community vision* that refers to goals to be achieved; (2) *Urban prototypes* as a means for community practice to implement the vision; (3) Community activities performed by community members to achieve the implementation of the vision; and (4) The Commoning place as a container for shared practice and showcase for other urban stakeholders.

We gained the insight that the Community vision is the first element

to start cultivating OSU. This element of the fertile ground is essential because an urban commons want to achieve this vision; thus, cultivating an infrastructure should revolve around it. In the ethnography, we kept discussing and eliciting the Community vision, and the OSU infrastructure grew around it. The physical place is vital as a container for the community practice, hence, we coined the term Commoning place and defined it as **a physical location co-created by members of the urban commons community as a means for their shared practice**. It changes and evolves organically in response to the fluid Community vision of the community of practice. Urban prototypes are DIY and incomplete experimental objects that emerge as a response to pressing urban issues. They are developed *in situ*, i.e., in specific urban contexts and *ad hoc*, i.e., handcrafted to tackle not a class of problems but particular problems of their designers and local communities. By Community practice, we understand recurrent activities performed as part of membership in the CoP. Activities related to OSU infrastructures should grow on the existing practice.

RQIII *"Which design interventions into an urban commons cultivate an OSU infrastructure?"*. This design step required ethnographic design interventions for two reasons: firstly, the literature provides little insight into the commons-based cultivation strategy; secondly, IIs are a priori co-designed by future users. Hence, we conducted design interventions that are the researcher's activities within organisations that aim at solving their practical problems. Hence, we were involved in a real-world situation as both participant and researcher and conducted design interventions in collaboration with field practitioners. During the ethnography, we secured collaboration with the urban commons and identified the entities that can serve as the fertile ground for cultivating an OSU infrastructure.

At this design step, we conducted design interventions cooperating with the same urban commons community from July 2018 to December 2020. In total, we conducted four design interventions of different scales and duration. During the field study, the set of reference theories was incomplete, therefore, the researcher acted in an exploratory fashion, driven by the research objective, theoretical background, and the designer's intuition. The goal of design interventions was to cultivate an OSU infrastructure with open source design manuals guiding the construction of an off-grid citizen initiative. These interventions resulted in designing an OSU infrastructure named *Experimental Network Autonomy* (ENA). Part of the

infrastructure is a website that contains the Community vision and design manuals of urban prototypes. Along with the website, the co-design team created a back office that allows the community to collaborate on the further co-creation of design manuals. Altogether, the interventions resulted in an expository instantiation of an OSU infrastructure. The evaluation of interventions was conducted ex-post in the form of reflections on the interventions. The reflection instigated the finalisation of the reference theories and the synthesis of a design method for OSU infrastructures.

The first intervention suggested an organisational transformation that would enable the community to tighten the network of practice while sharing DIY design knowledge and resources with like-minded communities and citizens. The first intervention failed because the researcher attempted to transform the community too quickly while lacking an in-depth understanding of the community and the trust from its members. From this, we conclude that top-down design methods are ineffective in the urban commons setting due to the idiosyncratic nature of the commons and the complexity of infrastructures; one cannot proceed with cultivating an infrastructure until trust with the community is built. Having this in mind, we continued the engagement as observing participant identifying the entities of the fertile ground for OSU and gradually building trust with the community members. The three following interventions were focused on incremental cultivating parts of the infrastructure. To achieve that, we searched for the motivation of community members to build every part of it. We used the identified entities to narrow down the researcher's focus omitting all other aspects of rich community life. Each subsequent design intervention resulted in the growth of the infrastructure.

Our field studies conclude that the main factor contributing to the co-creation is trust-building between the community members. A Co-Designer who might hold work ethos and vocabulary quite different from CoP members likely fails. In order to build trust, Co-Designers must emerge into the community life equipped with an open mind, sympathy for the community vision, and empathy for their struggles. To build trust, the Co-Designer has to be flexible enough to align with the worldview and ethos of the community while robust enough to keep their 'outer-world' identity. Furthermore, to cultivate an infrastructure in urban commons, motivation to build every part of it should come from community members. Our findings show that we should build it in an ad-hoc manner waiting for windows of opportunity

(i.e., the moment when members have a clear motivation to grow the infrastructure). The following design phase proceeds with synthesising a design method for OSU based on insights from the literature and ethnographic studies.

RQIV *"Which design method for cultivating an OSU infrastructure can be synthesised from theories and empirical data?"*. Addressing this research question, we synthesised a design method for OSU infrastructures based on literature and ethnographic studies findings. The offered design method consists of five roles of community members and eight design principles guiding the cultivation of OSU infrastructures. The design method is supported by *constructs*, i.e., analytical categories that help understand the social reality of an urban commons; in our case, these are the elements of the fertile ground, namely Community vision, Commoning place, Community practice, and Urban prototypes. A *role* is a set of activities and responsibilities expected from a community member by their peers. We provide the roles to show community members' specific actions and required attributes regarding establishing OSU infrastructures. We define design principles as generic prescriptions and guidelines intended to be manifested or encapsulated in the design and implementation of socio-technical systems.

During the ethnography and design interventions, we learned that infrastructure cultivation requires different roles for community members. We identified five roles, namely *Ambassador, Coordinator, Volunteer, Co-Designer*, and *Maker*. The first three roles exist as part of the urban commons, although they might have different labels, and the last two emerged during the design interventions. Ambassadors are boundary spanners between the urban commons and external CoPs. Coordinators manage activities within the Commoning place, such as community management and task allocation. Volunteer performs activities, as part of Community practice, that Coordinators assign. Co-Designers are facilitators that might not possess DIY knowledge of the specific CoP; instead, they look for opportunities to cultivate an OSU infrastructure. Makers are community members who bring their competence from their professional field, such as writing texts or preparing schemes to create design manuals.

Next, we offered eight design principles divided into four phases: Initiation, Preparation, Translation, and Proliferation. According to our co-design method, phases depend on each other and must be applied step by step. Higher-level principles should be adhered to before moving to the

following since skipping steps will not yield satisfactory results. However, only the partial application of phases might be useful. The principles of the first phase, *Initiation*, initiate and secure the collaboration with an urban commons community. The *Immersing* principle (1) declares the importance of Co-Designers' long-term involvement in community life. The Co-Designer's immersion is significantly different from other design projects since the Co-Designer should become part of the community first. The *Trust-building* principle (2) argues why building trust with community members is crucial for co-creation with urban commons. The second phase, *Preparation*, guides the beginning of OSU cultivation on the identified elements of the fertile ground. The *Motivating* principle (3) suggests finding motivation for CoP members for further co-design. *Growing* principle (4) prescribes slow cultivation of an OSU infrastructure on the fertile ground of the urban commons. The third phase, *Translation*, focuses on translating community knowledge from a tacit form held among CoP members to an explicit form stored on a medium. The *Showcasing* principle (5) explains what community knowledge should be translated into an explicit form. The *Bridging* principle (6) argues why this knowledge might bridge multiple social worlds. The fourth phase, *Proliferation*, is dedicated to developing processes and tools that enable inter-communal knowledge sharing and co-creation. The *Open-sourcing* principle (7) advocates adopting the open source ethos for easing development and securing community ownership. The *Peer production* principle (8) recommends adopting the principles of commons-based peer production to enable the collaboration of geographically spread members of a virtual network of practice. The offered design method is novel because it provides the cultivation of OSU infrastructures in the setting of the urban commons.

The limitations of this research are the following. First, ethnography has a significant risk of researcher bias. Immersion of the researcher in the community's everyday life and identification with its members hardly leave space for neutrality. We took precautions to mitigate the researcher's bias as follows. We used various sources of information. We were open to criticism from our colleagues. Most important, after the ethnography and design interventions were done, we discontinued our engagement in community life and stopped personal relations with community members. Analysis, reflection, and the design method's final synthesis were conducted while completely disengaged from community life. Second, the limitations

regarding the research domain must be considered. Generalization of the offered design method is limited to the research domain constructed in the third chapter. The scope of this study is limited by constructing a design method that cultivates an OSU infrastructure only to its inception phase. The third limitation is the challenge of synthesising a design method from a single-case ethnography. One of the main limitations of ethnography is that it takes much longer than other types of studies. Due to this shortcoming, coupled with the limited time span of a PhD study, this dissertation covers only a single case of urban commons. In fact, ethnography often receives criticism for producing in-depth knowledge of a single organisation, culture, or situation while providing no breadth compared to other qualitative studies. Nevertheless, in the last decades, theories generalised from a single case study have become a norm. The main difference between case studies and ethnography is the extent to which researchers immerse themselves in the subject under scrutiny. We chose the in-depth investigation of a single case because it provided the idiosyncratic example of the urban commons that is hard to find and gain access for studies. We claim that the design principles would not have been revealed without ethnography.

Suggestions for future research are the following. The first suggestion is to conduct a study covering OSU infrastructures in a multi-actor setting, engaging private companies, decision-makers, and civil servants to cultivate OSU infrastructures. Every user of infrastructure can be its designer. This characteristic of infrastructures, coupled with tensions between urban commons and other urban stakeholders, raises questions about the cultivation of OSU infrastructures that meet the requirements of various stakeholders. Especially interesting is to investigate an approach that balances different, often even contradictory, interests of various urban stakeholders and maximises value for city-wide urban development while enabling citizen-driven urban commons. The second suggestion is to investigate the further evolution and sustainability of OSU infrastructures. This research is limited to constructing a design method for the inception phase of OSU infrastructures. Further evolution and growth of such infrastructures are of great interest, especially considering that the adaptability problem is one of the main challenges in infrastructure studies. The third suggestion is the further development of the Ethnographic Design Research approach. We constructed our methodology, Action Design Ethnographic Research (ADER), by combining two research methodologies: Action Design

Research and ethnography. This dissertation demonstrates the effectiveness of the ADER methodology that allows gaining in-depth knowledge of the urban commons CoP and co-design complex socio-technical artefacts with future users. We recommend eliciting the generalised research process model for ADER and applying it to other research domains that are not well-understood yet.

Samenvatting

Open Source Urbanism (OSU) ontstaat wanneer burgers zichzelf organiseren om hun stedelijke omgeving te veranderen door Do-It-Yourself (DIY) stedelijke prototypen te maken en hun ontwerphandleidingen op het internet te delen. De voorbeelden van stedelijke prototypen kunnen variëren van gebouwde structuren, zoals straatmeubilair en stadstuintoestellen, tot gedecentraliseerde energieontwerpen en IT-artefacten. Ze ontstaan als een natuurlijke reactie van burgers op waargenomen problemen in hun stedelijke omgeving. Stedelijke prototypen worden ontworpen, betaald en geïmplementeerd door zelfgeorganiseerde burgers in plaats van ontwikkeld door publieke of private bedrijven en gekocht op de markt. Terwijl het personeel van bedrijven meestal uit professionals bestaat en de producten grondig worden getest en gestandaardiseerd om aan alle mogelijke overheidsvoorschriften te voldoen, kunnen stedelijke prototypes onvolledig zijn, omdat ze de belichaming zijn van het voortdurende experimenteren van burgers met hun stedelijke omgeving. Bovendien hebben amateurontwerpers wellicht beperkte ervaring of achtergrond op dit gebied. Actieve burgers creëren de stedelijke prototypes om niet een klasse van problemen aan te pakken, maar specifieke problemen in hun specifieke lokale context.

OSU ontstaat in zelfgeorganiseerde gemeenschappen die in dit onderzoek worden gevat onder het concept van de urban commons, gedefinieerd als plaatsen die worden gecreëerd en onderhouden door zelfgeorganiseerde burgers. Dergelijke initiatieven zijn gericht op het oplossen van dringende maatschappelijke problemen van lokale stedelijke omgevingen, die vaak niet worden opgelost door de publieke of private sector. OSU verenigt bottom-up interventies van burgers en de open source beweging: de urban commons richten zich op collectief beheer van hulpbronnen in de stedelijke context, bijvoorbeeld gemeenschapstuinen en woningbouwcoöperaties, terwijl open source gemeenschappen digitale commons creëren, die een vorm van zelforganisatie zijn op het internet, zoals open source software of Wikipedia. OSU verschilt van formele organisaties door het gebrek aan middelen, het ontbreken van duidelijke hiërarchieën en controle, en de

vrijwillige bijdrage. OSU-projecten opereren als gedecentraliseerde peer-to-peer netwerken waarin het onderscheid tussen producenten en consumenten van middelen vervaagt. Zulke netwerken creëren stedelijke prototypes samen met open source handleidingen die het ontwerpproces van hun creatie behandelen.

Wat betreft de IT-gebaseerde systemen die de kern vormen van OSU, beschouwen wij deze als een soort informatie-infrastructuren (II's) omdat de stedelijke commons en II's dezelfde kenmerken vertonen: beide fenomenen delen het zelf-georganiseerde, gedecentraliseerde en evoluerende karakter. In het kader van dit onderzoek definiëren we OSU-infrastructuren als een soort II's die stedelijke commons faciliteren bij de co-creatie van open-source stedelijke prototypen. II's impliceren een open-einde, losjes gedefinieerd ontwerpproces. Vanwege deze organische evolutie binnen de steeds veranderende omgeving, pleiten IIs-geleerden ervoor dat IIs worden gecultiveerd en niet gebouwd of geconstrueerd. Vanwege de overeenkomsten zal II in dit onderzoek als referentietheorie worden gebruikt. Toch verschilt de OSU-infrastructuur van andere soorten II's, omdat er ook geen formele bestuursstructuren (zoals hiërarchieën en overeenkomsten) zijn zoals bij II.

De drijfveer van dit onderzoek is dat OSU-infrastructuren, net als andere II's, niet top-down worden ontworpen, maar in de loop van de tijd ontstaan. Dit vereist een andere aanpak, en het bestaande werk gaat hier niet op in. De kenniskloof is het gebrek aan prescriptieve kennis over het ontwerpen van OSU-infrastructuren. De algemeen aanvaarde ontwerptheorie voor II's van Hanseth en Lyytinen (2004) is niet geschikt, omdat we aanzienlijke verschillen verwachten bij het bouwen van infrastructuren in het domein van de stedelijke commons (bijv. het gebrek aan middelen en hiërarchieën, kleinschaligheid). Het bouwen van een OSU-infrastructuur vereist dus een domeinspecifieke ontwerpmethode. Bovendien is de idiosyncratische aard van stedelijke commons niet onderzocht door wetenschappers op het gebied van informatiesystemen (IS). Daarom ontbreekt het ons aan kennis over het ontwerpproces van het cultiveren van IIs voor OSU in de setting van stedelijke commons. Een extrapolatie van ontwerpkennis uit andere domeinen zou problematisch kunnen zijn vanwege de verschillen in het domein van stedelijke commons en, bijgevolg, OSU. Daarom hebben we de doelstelling van dit proefschrift als volgt geformuleerd:

Het doel van dit onderzoek is een ontwerpmethode te ontwikkelen

voor het cultiveren van OSU-infrastructuren

Dit onderzoek was gericht op de ontwikkeling van een ontwerpmethode, i.e., een algoritme dat wordt toegepast om een taak uit te voeren. Vaak definiëren methoden te bereiken resultaten door het toepassen van gegeven richtlijnen, samen met rollen die de toepassing van deze ondersteunen. In ons geval is de taak het cultiveren van OSU-infrastructuren in de zelfgeorganiseerde setting van stedelijke commons. We richten ons in het bijzonder op de beginfase van het kweekproces, i.e., hoe een OSU-infrastructuur te initialiseren die stabiel en toch flexibel is om verdere evolutie mogelijk te maken. We hebben ons dus geconcentreerd op het bootstrappen van OSU-infrastructuren. Door de beperkte tijdspanne van dit promotieonderzoek, vielen uitdagingen gerelateerd aan het aanpassingsprobleem, zoals de adoptie van het artefact door andere gemeenschappen, groeiende gebruikersbasis en netwerkeffect, buiten het bereik van dit proefschrift. Vandaar dat dit onderzoek zich richtte op het ontwikkelen van een ontwerpmethode die de beginfase van een OSU-infrastructuur begeleidt. Een andere beperking van dit onderzoek is de etnografie van één geval.

Wij hebben de onderzoeksdoelstelling aangepakt met het paradigma van de ontwerpwetenschap dat in vele disciplines wordt gebruikt, zoals architectuur, techniek en computerwetenschap. In IS studies zoekt Design Science Research (DSR) naar het ontwikkelen van prescriptieve kennis door het ontwerpen en evalueren van innovatieve IT artefacten bedoeld om een geïdentificeerde klasse van problemen op te lossen. Een "laboratoriumbenadering"in de ontwerpwetenschap erkent niet de noodzaak van het ontstaan van artefacten in interactie met hun gebruikers en omgeving in een real-life setting. De typische benadering om deze beperking te overwinnen is het combineren van ontwerpwetenschap met actie-onderzoek, i.e., een combinatie van theorievorming en verandering van sociale systemen. Om deze reden hebben we een Action Design Research (ADR) methodologie aangenomen die het genereren van ontwerpkennis in een real-life setting ondersteunt.

De ADR-methodologie specificeert echter geen concrete veldwerkmethoden. We hebben gekozen voor etnografie om veldwerkonderzoek uit te voeren binnen een geselecteerde stedelijke commons-gemeenschap. Etnografie is een onderzoeksmethode die in de eerste plaats berust op de onderdompeling van de onderzoeker in het sociale leven van gemeenschappen of culturen gedurende een langere periode en op het verwerven van diep-

gaande kennis via interacties en observaties. Naast observaties impliceert onze onderzoeksbenadering ontwerpinterventies, i.e., activiteiten van onderzoekers binnen organisaties om hun praktische problemen op te lossen. De onderzoeker raakte als deelnemer en onderzoeker betrokken bij een praktijksituatie en voerde ontwerpinterventies uit in samenwerking met praktijkmensen van de stedelijke commons. Op deze manier werden de stedelijke commons een laboratorium voor dit onderzoek. We concluderen dat het combineren van etnografische en actie-onderzoeksmethoden met ontwerpwetenschappelijk onderzoek de productie van prescriptieve kennis vergemakkelijkt in samenwerking met de stedelijke commons gemeenschappen.

Deze dissertatie beantwoordt de volgende onderzoeksvragen:

RQIa *"Wat is Open Source Urbanisme?"*. Open Source Urbanism lijkt te verschillen van andere domeinen, daarom is een diepgaand begrip nodig en het definiëren van ontwerpuitgangspunten. Hoewel het begrip in de literatuur wordt aangeroerd, ontbreekt het aan een grondige conceptualisering om de volgende onderzoeksstappen te informeren. Aangezien er geen eenduidige definitie van OSU bestaat, hebben we voor dit onderzoek de volgende definitie van OSU samengesteld: *door burgers aangestuurde, op commons gebaseerde coproductie van open-source stedelijke prototypen die gericht zijn op stedelijke transformatie.* Onder stedelijke transformatie verstaan we het duurzamer en hulpbronnenefficiënter maken van gebouwde omgevingen en tegelijkertijd het bieden van welvaart en welzijn aan burgers. Deze definitie verwijst naar verschillende fenomenen uit verschillende onderzoeksvelden, zoals urban studies, urban theory, en organisation studies, om er maar een paar te noemen. Om het fenomeen OSU te begrijpen is een combinatie van verschillende disciplines nodig en dus moet een interdisciplinair onderzoeksdomein worden opgebouwd. Wij hebben vastgesteld dat drie aspecten OSU kunnen karakteriseren: (1) OSU-initiatieven worden geïnitieerd door burgers die hun recht op de stad opeisen, d.w.z. het recht om hun stedelijke omgeving te transformeren; (2) om blijvend te zijn, moeten doe-het-zelf veranderingen van de stedelijke omgeving worden geaccepteerd door of in co-creatie met de autoriteiten; 3) OSU-initiatieven produceren de nieuwe commons, stedelijke plekken en digitale artefacten, die collectief worden gecreëerd en beheerd door zelf-georganiseerde burgers. OSU-initiatieven vertonen sociale relaties die verschillen van de command-and-control-mechanismen van publieke en private organisaties.

RQIb *"Wat zijn referentietheorieën voor een ontwerpmethode voor OSU-infrastructuren?"*. Op basis van de inzichten uit het vorige hoofdstuk hebben we een aantal literatuurboeken geselecteerd als referentietheorieën (i.e., beschrijvende theorieën en concepten buiten de IS discipline). We hebben ons gebaseerd op verschillende literatuur die de literatuur over IS, Communities of Practice (CoP), en stedelijke plaatsen combineert. Allereerst zien wij de op IT gebaseerde praktijken in de kern van OSU als een soort informatie-infrastructuren (II's), omdat de stedelijke commons en II's dezelfde kenmerken vertonen: beide fenomenen delen het zelf-georganiseerde, gedecentraliseerde en evoluerende karakter. II's impliceren een open-einde, losjes gedefinieerd ontwerpproces. Door deze organische evolutie binnen de steeds veranderende omgeving, pleiten IIs-geleerden ervoor dat IIs worden gecultiveerd en niet gebouwd of geconstrueerd. Omwille van de gelijkenissen zal II in dit onderzoek als referentietheorie worden gebruikt. Ten tweede hebben we instrumenten aangenomen voor de analyse van gemeenschappen die werkpraktijken delen, aangezien IIs functioneren in praktijkgemeenschappen waarin leden van elkaar leren door zowel stilzwijgende kennis (bv. anekdotes, geïmproviseerde commentaren en meningsuitwisseling) als expliciete kennis (bv. documenten, grafieken) te delen. Deze praktijken maken deel uit van II's, dus nemen we de theorie van Communities of Practice (CoP) over. Ten derde moeten we het ruimtelijke aspect van de stedelijke commons onderzoeken, aangezien stedelijke plaatsen fungeren als een container van gemeenschapspraktijken. Daarom moet bij het ontwikkelen van een ontwerpmethode voor OSU-infrastructuren ook literatuur over stedelijke ruimte worden betrokken. Deze drie literatuuropgaven zijn op twee manieren gebruikt: ten eerste als analytisch kader voor de analyse van het etnografisch onderzoek in het vijfde hoofdstuk, en ten tweede als referentie voor de ontwerpmethode in het zevende hoofdstuk.

RQII *"Welke elementen van de stedelijke commons kunnen de vruchtbare bodem vormen voor OSU?"*. De literatuur over II's geeft aan dat een infrastructuur groeit op de 'installed base' (i.e., de bestaande systemen en praktijken). Er is geen literatuur over OSU-infrastructuren. Daarom bestuderen we een real-life case van stedelijke commons om te begrijpen wat kan worden beschouwd als de 'installed base' voor OSU. We hebben gekozen voor etnografie als veldwerkmethode, omdat die goed past bij het begrip van de 'rommelige' sociale realiteit, waardoor de onderzoeker diepgaande kennis kan opdoen van casusspecifieke problemen. De onderzoeker was

gedurende meer dan een jaar (juli 2018 - augustus 2019) betrokken bij de et-
nografische studie van een Amsterdamse urban commons. De verzamelde
gegevens dienden als input voor de verdere ontwerpfasen (i.e., ontwerpin-
terventies en, bijgevolg, het synthetiseren van een ontwerpmethode voor
OSU). Als extra doelstelling richtte de etnografie zich op het opbouwen van
relaties met de gemeenschap; dit is nodig omdat de volgende ontwerpfase
gericht is op co-design.

We identificeerden vier entiteiten die kunnen dienen als de geïnstal-
leerde basis (of 'de vruchtbare grond') voor het cultiveren van een OSU-
infrastructuur, te weten: 1) Gemeenschapsvisie die het doel is dat moet
worden bereikt; de CoP draait hier dus om; 2) Stedelijke prototypen die een
middel zijn voor de gemeenschapspraktijk om de visie te implementeren; 3)
Gemeenschapspraktijk die CoP-leden uitvoeren om de implementatie van
de visie te bereiken; en 4) De gemeenschappelijke plaats die een container
is voor gedeelde praktijk en een showcase voor andere stedelijke belang-
hebbenden. We hebben entiteiten afgeleid die wijzen op richtingen voor
analyse en co-design. Door de case-specifieke inhoud van deze entiteiten
te analyseren, begrijpen co-designers de beperkingen en mogelijkheden om
nieuwe delen van infrastructuren (bv. digitale instrumenten, fysieke acti-
viteiten) aan te sluiten op bestaande infrastructuren.

We hebben het inzicht verworven dat de Gemeenschapsvisie het eerste
element is om te beginnen met het cultiveren van OSU. Dit element van de
vruchtbare grond is essentieel omdat een urban commons deze visie wil ver-
wezenlijken. Het cultiveren van een infrastructuur moet er dus om draaien.
In de etnografie bleven we hun visie bespreken en uitlokken, en de OSU-
infrastructuur groeide eromheen. De fysieke plek is van vitaal belang als
container voor de gemeenschapspraktijk, vandaar dat we de term Commo-
ning place hebben bedacht en gedefinieerd als een fysieke locatie die door
de leden van de urban commons gemeenschap gezamenlijk is gecreëerd als
middel voor hun gedeelde praktijk. Het verandert en evolueert organisch
als een reactie op de vloeiende communautaire visie van de gemeenschap
van de praktijk. Stedelijke prototypes zijn doe-het-zelf en onvolledige expe-
rimentele objecten die ontstaan als antwoord op urgente stedelijke vraag-
stukken. In het geval van onze etnografie zijn ze *in situ* (i.e., in specifieke
stedelijke contexten) en *ad hoc* ontwikkeld (i.e., met de hand gemaakt om
niet een klasse van problemen aan te pakken, maar specifieke problemen
van hun ontwerpers en lokale gemeenschappen). Onder communautaire

praktijk verstaan wij terugkerende activiteiten die worden verricht als on-
derdeel van het lidmaatschap van de CoP. Activiteiten in verband met OSU-
infrastructuren moeten op de bestaande praktijk voortbouwen.

RQIII *"Welke ontwerpinterventies in een stedelijke commons cultiveren
een OSU-infrastructuur?"*. Deze ontwerpstap vereist etnografische ontwer-
pinterventies om twee redenen: ten eerste biedt de literatuur weinig in-
zicht in de op commons gebaseerde cultiveringsstrategie; ten tweede wor-
den infrastructuren a priori mede ontworpen door toekomstige gebruikers.
Daarom voerden we ontwerpinterventies uit, welke de activiteiten van de
onderzoeker zijn, gericht op het oplossen van hun praktische problemen.
We waren dus als deelnemer en als onderzoeker betrokken bij een reële situ-
atie en voerden ontwerpinterventies uit in samenwerking met veldwerkers.
Tijdens de etnografie hebben we de samenwerking met de urban commons
veiliggesteld en de entiteiten geïdentificeerd die als vruchtbare bodem zul-
len dienen voor het cultiveren van een OSU-infrastructuur.

Bij deze ontwerpstap voerden we van september 2018 tot december
2020 ontwerpinterventies uit in samenwerking met dezelfde stedelijke commons-
gemeenschap. In totaal voerden we vier ontwerpinterventies van verschil-
lende schaal en duur uit. Tijdens het veldonderzoek was het referentie-
kader onvolledig, daarom handelde de onderzoeker op een verkennende
manier, gedreven door het onderzoeksdoel en de intuïtie van de ontwer-
per. Het gedeelde doel van de onderzoeker en de gemeenschap was het
co-design van een digitale infrastructuur met open source prototypes die
de bouw van een off-grid burgerinitiatief begeleiden. Deze interventies
resulteerden in het ontwerpen van een OSU-infrastructuur met de naam
"Experimental Network Autonomy". De infrastructuur bevat een website
die wordt onderhouden door de gemeenschap, omdat er geen speciale vaar-
digheden voor nodig zijn. De website bevatte de visie van de gemeenschap
en ontwerphandleidingen van stedelijke prototypes. Samen met de website
heeft het co-design team een back-office gecreëerd dat de gemeenschap in
staat stelt samen te werken aan de verdere co-creatie van ontwerphandlei-
dingen. Alles bij elkaar resulteerden de interventies in een expositorische
instantiëring van een OSU-infrastructuur. De evaluatie van de interventies
vond ex-post plaats in de vorm van reflecties op de interventies. De reflec-
tie heeft de aanzet gegeven tot de voltooiing van het referentiekader en de
synthese van een ontwerpmethode voor OSU-infrastructuren.

De eerste interventie stelde een organisatorische transformatie voor die

de gemeenschap in staat zou stellen het praktijknetwerk aan te scherpen en tegelijkertijd de kennis en middelen op het gebied van zelfontwerpen te delen met gelijkgestemde gemeenschappen en burgers. De interventie mislukte om twee redenen. Ten eerste ontbreekt het op dit moment aan inzicht in infrastructuren (bijv. de inertie van de geïnstalleerde basis, gebruikers als mede-ontwerpers, emergente aard). Ten tweede trachtte de onderzoeker de gemeenschap te snel om te vormen, terwijl hij het vertrouwen met de gemeenschap en de kennis van haar praktijk niet had. Hieruit concluderen we dat top-down ontwerpmethodes niet effectief zijn door de idiosyncratische aard van de commons en de complexiteit van infrastructuren; men kan niet verder gaan met het cultiveren van een infrastructuur zolang de installed base niet geïdentificeerd is en er geen vertrouwen met de gemeenschap is opgebouwd. Met dit in het achterhoofd hebben wij de betrokkenheid voortgezet als observerende deelnemer bij het identificeren van de entiteiten van de vruchtbare grond voor OSU en het geleidelijk opbouwen van vertrouwen met de leden van de gemeenschap. Drie volgende interventies waren gericht op het stapsgewijs cultiveren van delen van de infrastructuur. Om dat te bereiken zochten wij naar de motivatie van de leden van de gemeenschap om elk onderdeel ervan op te bouwen. We gebruikten de geïdentificeerde entiteiten om de focus van de onderzoeker te vernauwen door alle andere aspecten van het rijke gemeenschapsleven weg te laten. Elke volgende ontwerpinterventie resulteerde in de groei van de infrastructuur.

Onze veldstudies concluderen dat de belangrijkste factor voor het succes van co-creatie het opbouwen van vertrouwen tussen de leden van de gemeenschap is. Een Co-Designer die er een heel andere werkethos en woordenschat op nahoudt dan de leden van de CoP zal waarschijnlijk falen. Om vertrouwen op te bouwen, moeten de Co-Designers in het leven van de gemeenschap verschijnen, uitgerust met een open geest, sympathie voor de visie van de gemeenschap, en empathie voor hun moeilijkheden. Om vertrouwen op te bouwen moet de ontwerper flexibel genoeg zijn om zich aan te passen aan het wereldbeeld en ethos van de gemeenschap, terwijl hij robuust genoeg moet zijn om zijn identiteit als 'buitenwereldse' te behouden. Bovendien, om een infrastructuur in stedelijke commons te cultiveren, moet de motivatie om elk onderdeel ervan te bouwen van de leden van de gemeenschap komen. We realiseerden ons dat we het op een ad-hoc manier moesten bouwen, wachtend op vensters van opportuniteit

(d.w.z. het moment waarop de leden een duidelijke motivatie hebben om het te laten groeien). De volgende ontwerpfase gaat verder met het synthetiseren van een ontwerpmethode voor OSU gebaseerd op de inzichten uit de literatuur en etnografische studies.

RQIV *"Welke ontwerpmethode voor het cultiveren van een OSU-infrastructuur kan worden gesynthetiseerd uit theorieën en empirische gegevens?"*. De aangeboden ontwerpmethode bestaat uit vier rollen van leden van de gemeenschap en acht ontwerpprincipes die richting geven aan de ontwikkeling van OSU-infrastructuren. Een rol is een set van activiteiten en verantwoordelijkheden die van een lid van de gemeenschap verwacht worden door hun gelijken. Wij geven de rollen om de specifieke acties en vereiste attributen van de leden van de gemeenschap met betrekking tot het opzetten van OSU-infrastructuren te laten zien. Wij definiëren ontwerpprincipes als generieke voorschriften en richtlijnen die bedoeld zijn om zich te manifesteren of in te kapselen in het ontwerp en de implementatie van socio-technische systemen. Daarnaast hebben wij Constructen gedefinieerd, d.w.z. de bouwstenen waarmee de ontwerpmethode werkt en die resulteren in de beschrijving van ontwerpprincipes. We hebben een ontwerpmethode voor OSU-infrastructuren gesynthetiseerd op basis van de bevindingen van literatuur en etnografisch onderzoek.

Tijdens de etnografie en de ontwerpinterventies leerden we dat het cultiveren van infrastructuur verschillende rollen vereist voor leden van de gemeenschap. We identificeerden vier rollen, namelijk Ambassador, Cordinator, Co-Designer, en Maker. De eerste twee bestaan als onderdeel van de urban commons, en de laatste twee komen naar voren tijdens de ontwerpinterventies: Co-Designer en Maker. Ambassadors zijn de grensverleggers tussen de stedelijke commons en externe CoP's. Coordinators beheren activiteiten binnen de Commoning place, zoals community management en taakverdeling. Co-designers zijn makelaars die misschien geen doe-het-zelf-kennis hebben van de specifieke CoP; in plaats daarvan zoeken ze naar mogelijkheden om een OSU-infrastructuur te cultiveren. Bijvoorbeeld motivaties van gemeenschapsleden of samenwerkingsverbanden via grensinteracties. Makers zijn leden van de gemeenschap die hun competentie uit hun vakgebied inbrengen, zoals het schrijven van teksten of het opstellen van schema's.

De aangeboden set ontwerpprincipes met rollen kan worden gebruikt als een methode voor het cultiveren van OSU-infrastructuren. De beginse-

len moeten stapsgewijs worden toegepast, d.w.z. dat eerst beginselen van
een hoger niveau moeten worden nageleefd alvorens wordt overgegaan tot
de volgende beginselen. Aangezien de beginselen van elkaar afhangen, zijn
zij verdeeld in vier fasen: initiatie, voorbereiding, vertaling en verspreiding.
De beginselen van de eerste fase initiëren en verzekeren de samenwerking
met de gemeenschap van stedelijke commons. Het onderdompelingsprin-
cipe verklaart het belang van de langdurige betrokkenheid van de ontwer-
per bij het gemeenschapsleven. De onderdompeling van de ontwerper ver-
schilt aanzienlijk van andere ontwerpprojecten, omdat de ontwerper eerst
deel moet worden van de gemeenschap. Het principe van vertrouwen op-
bouwen beargumenteert waarom het opbouwen van vertrouwen met leden
van de gemeenschap cruciaal is voor co-creatie met stedelijke commons.
De tweede fase leidt de dataverzameling die resulteert in het begrip van
de vruchtbare grond voor de zogenaamde OSU infrastructuur. Het motiva-
tieprincipe suggereert het vinden van motivatie voor CoP-leden voor ver-
der co-design. Het groeiprincipe schrijft een langzame teelt voor van een
OSU-infrastructuur op de vruchtbare grond van de stedelijke commons. De
derde fase - Translation - richt zich op het vertalen van gemeenschapsken-
nis van een stilzwijgende vorm onder CoP-leden naar een expliciete vorm
opgeslagen op een medium. Het principe Showcasing legt uit welke ge-
meenschapskennis vertaald moet worden naar een expliciete vorm. Het
overbruggingsprincipe beargumenteert waarom deze kennis meerdere so-
ciale werelden zou kunnen overbruggen. De vierde fase is gewijd aan het
ontwikkelen van processen en instrumenten die intercommunautaire ken-
nisdeling en co-creatie mogelijk maken. Het Open-sourcing principe pleit
voor het overnemen van het open source ethos om de ontwikkeling te ver-
gemakkelijken en het eigenaarschap van de gemeenschap te verzekeren.
Het collegiale productieprincipe beveelt aan de principes van op commons
gebaseerde collegiale productie over te nemen om de samenwerking van
geografisch verspreide leden van een virtueel praktijknetwerk mogelijk te
maken.

De beperkingen van dit onderzoek zijn de vooringenomenheid van de
onderzoekers en het generaliseren op basis van het enkele etnografische
verslag. Wij hebben de volgende voorzorgsmaatregelen genomen om de
vooringenomenheid van de onderzoeker te verminderen. We hebben ver-
schillende informatiebronnen gebruikt. We stonden open voor kritiek van
onze collega's. Het belangrijkste is dat we, nadat de etnografie en de ont-

werpinterventies waren voltooid, onze betrokkenheid bij het gemeenschaps-
leven hebben beëindigd en onze persoonlijke relaties met de leden van de
gemeenschap hebben stopgezet. Analyse, reflectie en de uiteindelijke syn-
these van de ontwerpmethode werden uitgevoerd terwijl we ons volledig
onttrokken aan het gemeenschapsleven. Een andere beperking is dat dit
onderzoek slechts betrekking heeft op één enkel geval van stedelijke com-
mons. In de laatste decennia zijn theorieën die gegeneraliseerd zijn op ba-
sis van een enkele casestudy de norm geworden. Het belangrijkste ver-
schil tussen case studies en etnografie is de mate waarin onderzoekers zich
verdiepen in het onderzochte onderwerp. Wij hebben gekozen voor een
diepgaand onderzoek van één enkel geval, omdat het een idiosyncratisch
voorbeeld is van de stedelijke commons, dat moeilijk te vinden en toegan-
kelijk is voor studies. Wij beweren dat de ontwerpprincipes niet aan het
licht zouden zijn gekomen zonder etnografie.

De suggesties voor toekomstig onderzoek zijn de volgende. De eerste
suggestie is een onderzoek uit te voeren naar OSU-infrastructuren in een
multi-actor setting, waarbij particuliere bedrijven, beleidsmakers en amb-
tenaren worden betrokken om OSU-infrastructuren te cultiveren. Iedere
gebruiker van infrastructuur kan de ontwerper ervan zijn. Dit kenmerk
van infrastructuren, gekoppeld aan spanningen tussen stedelijke commons
en andere stedelijke belanghebbenden, roept vragen op over het cultive-
ren van OSU-infrastructuren die voldoen aan de eisen van verschillende
belanghebbenden. Het is vooral interessant om een aanpak te onderzoe-
ken die verschillende, vaak zelfs tegenstrijdige, belangen van verschillende
stedelijke belanghebbenden in evenwicht brengt en de waarde voor stads-
brede stedelijke ontwikkeling maximaliseert en tegelijkertijd door burgers
gestuurde stedelijke commons mogelijk maakt. Dit onderzoek beperkt zich
tot het construeren van een ontwerpmethode voor de beginfase van OSU-
infrastructuren. Verdere evolutie en groei van dergelijke infrastructuren
zijn van groot belang, vooral gezien het feit dat het aanpassingsprobleem
een van de belangrijkste uitdagingen is in infrastructuurstudies. Tenslotte
bevelen wij verdere evaluatie van de ontwerpmethode en verdere verfijning
aan.

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Curriculum Vitæ

I was born in Siberia in 1988. In 2010, I obtained a Master's Degree in Applied Informatics. After graduation, I moved to Saint Petersburg to pursue a web developer career. From 2008 to 2014, I worked as a web developer and later as a CTO of In several IT companies. Living in a big city, I became interested in urbanism, and in 2013 I enrolled on a Master's program "Design of Urban Ecosystems" at ITMO University. In 2015 I graduated (cum laude). At this program, I entered the world of interdisciplinary work and, with amusement, realised that people trained in different disciplines have different ways of working, ontologies, and worldviews. Since then, I have been learning how I can facilitate interdisciplinary collaborations. During the I became especially bottom-up urbanism and self-organised communities.

In 2016 I was admitted to a PhD program "Engineering Social Technologies for a Responsible Digital Future" at Delft University of Technology, the Netherlands. This book is the result of my PhD research. In 2017 I found a new home in Amsterdam. I strive to make this great city even better by applying skills gained during my studies. Currently, I am a postdoctoral researcher at the faculty of Industrial Design and Engineering, TU Delft. I am involved in the consortium "Designing rhythms for social resilience". In this project, I apply my skills as an IT engineer and an urbanist connecting data science with qualitative analysis methods. Apart, I do my best to bridge different social worlds by organising collaboration of computer scientists, architects, artists, and civil servants. In my free time, I make ceramics, practice yoga, and enjoy being in nature. My biggest hobby is living my life and learning to love it in all ups and downs.